



Expanded Orientation of Urban Public Health Policy in the Climate Change Era: Response to and Prevention of Heat Wave in Paris and Seoul: A Brief Review

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Abstract

The policies of response to and prevention of heat waves in France in 2003 and in South Korea in 2018 were compared and reviewed to see how public health policy orientation was being expanded in connection with urban and social policies. The statistics of the patients with heat illness and resulted death in France in 2003 and South Korea in 2018 were analyzed. The results and limitations of the French and Korean responses to heat waves were compared and discussed. The heat wave in France in 2003 caused an excess death of 14,802. The 2018 heat wave in South Korea resulted in 4,526 cases of heat illness and 48 deaths. France's National Heat wave Plan established in 2004 introduced the warning system and strengthened support for the vulnerable. The heat wave in South Korea in 2018 revealed the success and limitations of the national measures that have been gradually implemented since the mid-2000s. Both France and South Korea are making efforts in preventing heat illness and managing health risk through the warning systems, providing public and social support for the vulnerable, and expanding urban infrastructure. Paris puts priority on the long-term prevention of heat wave, in the wider context of climate change response, while Seoul shows a relatively strong point in immediate infrastructural expansion. In order to respond to the climate crisis and the following health risk, public health policies need to be contrived with deeper connection with urban social policies for sustainable development.

Keywords: Public health; Heat illness; Heat wave; Climate change; Urban sustainable development

Introduction

According to a Synthesis Report published in 2014 by the Intergovernmental Panel on Climate Change, human influence is the most important cause of observed global warming since the mid-20th century (1). Warming has more than doubled the probability of heat waves and increased heat-related human mortality. There are various

definitions for heat wave. According to the definition of The World Meteorological Organization, it is called heat wave when five or more consecutive days of prolonged heat occur and the daily maximum temperature is higher by 5 °C than the average temperature between 1961 and 1990 (2). French meteorologists define heat wave



as a period during which the maximum temperature exceeds 30.0°C (3). The Korea Meteorological Administration defines it as a period during which the maximum temperature of the day reaches 33°C or higher.

As the Chicago heat wave of 5 days, July 12-16, 1995, caused 739 deaths, the heat wave that occurred from the end of the last century caused considerable human loss (4). During the first two decades of the 21st century, heat waves occurred more often in wider areas of the globe than the last century. The 2003 European heat wave had a major impact on the increase of human deaths and precipitated subsequent introduction of public health policies. This was especially apparent in France, where there were nearly 15,000 excess deaths (5). The French government has been responding to the problem by the National Heat wave Plan from the following year. Paris followed the Plan at the local level in providing remedies in the public health domain. In addition, the city implemented various urban and social policies to respond to the climate crisis and achieve sustainable urban development.

In the summer of 2018, heat waves were reported in many parts of Europe, North America and Asia (6). It was especially pronounced in South Korea, where Seoul reached the highest temperature since the meteorological observations began in 1907 (7). Korea had been taking various national and local countermeasures since the mid-2000s following the global trend to overcome the climate crisis, which had been accelerated since the European experience of the heat wave in 2003. The 2018 heat wave escalated health risks and sparked discussions in Korea about the effectiveness of these responses. As a result, heat wave response and prevention efforts began to develop more systematically.

There are many studies on the heat wave and heat illness in both France and Korea. What draws our attention more are the studies related to the fields of public health – not specific studies in the fields of climatology, environmental science, or pathology – especially on crisis management and public health before and after the severe heat waves. Lagadec, critically analyzing

the French heat wave response in 2003, emphasized that the experience of this response resulted in the demand for preparations for new crises (8). Poumadère et al. analyzed how the French heat wave in 2003 was resulted from the association of natural and social factors (9). Yang & Yoon reviewed the performance and efficiency of Seoul's heat wave response policy in 2017, one year before the 2018 heat wave in Korea, based on the number of heat-disease patients and medical expenditure (10). There are also comparative studies in response to heat waves. Kovats & Kristie compared various European countries and examined the relationship between heat waves and public health focusing on the heat health warning systems (11).

Despite the major studies, a comparative analysis of the impact of the heat wave in France in 2003 and in Korea in 2018 on the development of public health policies has not yet been conducted. Therefore, this study intends to analyze the process of establishing a response and prevention system for heat-illnesses in Paris and Seoul after the major heat waves. This analysis may provide some insights for expanding the scope of urban public health in the era of climate crisis.

Methods

First, the level of heat waves in Paris and Seoul for those years was confirmed through meteorological data from France in 2003 and South Korea in 2018, respectively, and official statistics on heat illness patients and excess deaths were reviewed. Next, the results and limitations of the French and Korean governments in response to heat waves were compared and reviewed through public documents. In addition, the strengthening and expansion of public health domain for the prevention of heat-related illness was analyzed in relation with the efforts to respond to the climate crisis. The comparative methodology may confirm the universality of the problem as well as the contextual awareness of individuality. Comparative analysis of the cases of response to and prevention of heat waves and heat illnesses in Paris

in 2003 and Seoul in 2018 may deepen the contextual and universal understanding of the expansion of public health policy orientation in the era of climate change.

Results and Discussion

According to an analysis by Météo France, Paris has experienced in August 2003 a period of unprecedented heat wave since the beginning of the collection of weather data in 1873. The highest minimum (night) temperature record was reached on the 11th and the 12th, August 2003, of 25.5 °C. In addition, the 2003 heat wave was characterized by nine consecutive days of maximum temperature above 35°C, while in 1911, the previous highest record, there were no more than five consecutive days exceeding 35°C. From August 1st to the 5th, 2003, the temperature gradually increased from 24.8°C to 37°C, then maintained at 36-37°C from the 5th to the 13th, and thereafter, the temperature rapidly decreased to 28°C on the 16th of August (12, 13).

This heat wave was accompanied by a high excess mortality. During the 20 days from August 1st, 2003, when the death rate began to increase, to the 20th, when the average temperature of the preceding years was recovered, the number of deaths was 41,621. The average number of deaths during the same period in the three preceding years was 26,819, so the excess death numbered 14,802. Ile-de-France, including Paris, recorded the highest number of deaths among the 20 re-

gions of France, with 8,506 deaths and 4,866.9 excess deaths, 32.9% of the total excess deaths. In Paris, the death toll was 1,910 and the number of excess deaths was 1,066.9, 7.2% of the total excess deaths. The first report submitted to the Minister of Health on September 25th, 2003, focused on quantifying this excess mortality and identified its main characteristics: the excess mortality observed from the age of 45 was significant, increasing with age: +20% among people of the age of 45-54, +40% in people of the age of 55-74, +70% in the elderly people of the age of 75-94, and +120% in people aged 95 yr and over (5). As Table 1 shows, in addition to the causes directly related to heat, very pronounced excess mortality and a steep rise (+80 to +100%) are observed for diseases of the respiratory system, nervous system, mental disorders, and infectious disease. Periods of heat wave are conducive to the occurrence of heat-related pathologies (14). Because of the environmental and personal factors and living and working conditions as listed in the following, some people are more at risk of developing these pathologies: old age, loss of autonomy (people confined to bed or armchair) and the person's inability to adapt their behavior to the heat, Parkinson's disease, dementia, cardiovascular diseases and sequelae of cerebrovascular accident, obesity, malnutrition, taking certain medications, habitat particularly poorly adapted to heat, in particular the housing on the top floor, the absence of accessible cool or air-conditioned place, and the absence of habitat itself.

Table 1: Main Medical Causes of Death during the 2003 Heat wave in France

<i>Medical cause</i>	<i>Death (1~20 Aug 2003)</i>	<i>Death average (former 3 years)</i>
Dehydration, heatstroke, hyperthermia	3468	163
Cardiovascular illnesses	10790	7786
Cancer	8959	8026
Diseases of the respiratory system	2834	1469
Diseases of the nervous system	2042	1042
Mental disorders	1650	902
Diseases of the Digestive System	1546	1246
Endocrine and nutritional diseases	1470	850
Infectious diseases	1017	534

According to the World Meteorological Organization, during the summer of 2018, heat waves affected Northern Europe, Middle East, North Africa, Australia and East Asia. South Korea was also seriously affected breaking both the overall national record (41.0 °C), and the city record for Seoul (39.6 °C) (6). According to the data from Korea Meteorological Administration, 31.4 days of heat wave was recorded in Korea in 2018. Tropical nights, nights from 6pm to 9am next morning that reach 25°C or above, counted 17.7. From 2011 the Korea Centers for Disease Control and Prevention (KCDC) operated the heat-related illness surveillance system to monitor heat stroke, heat exhaustion, heat cramps, heat syncope, and heat oedema due to the heat wave in 521 hospitals. According to the KCDC Annual Reports produced based on individual hospital reports, as shown in Fig. 1, 4,526 heat disease patients, among which 48 died, were reported between the 20th, May and the 10th, September 2018 (7).

In 2018, heat disease patients increased by four times and death by 4.5 times than the average of preceding 7 years. Patients numbered 4,526 in total: heat exhaustion 2,502 (55.3%), heat stroke 1,050 (23.2%), heat cramps 518 (11.4%), heat syncope 314 (6.9%), others 142 (3.1%). All deaths were caused by heat stroke. 34 elderly aged 65 years and above died and reached 70.8% of the total deaths. The number of patients in their 50s was the highest counting 986 (21.6%), followed by the 60s, 718 (15.9%), 40s, 702 (15.5%), 70s, 589 (13.0%), over 80, 507 (11.2%), 30s, 502 (11.0%), 20s, 371 (8.19%), and under 20 151 (3.33%). Spatially, among 17 regions (comprising 8 metropolitan cities) in Korea, Gyeonggi-do, surrounding region of Seoul, recorded the highest number of patients, counting 937 (20.70%), followed by Seoul, 616 (13.61%). Number of deaths in Gyeonggi-do and Seoul were 5 and 4, respectively.

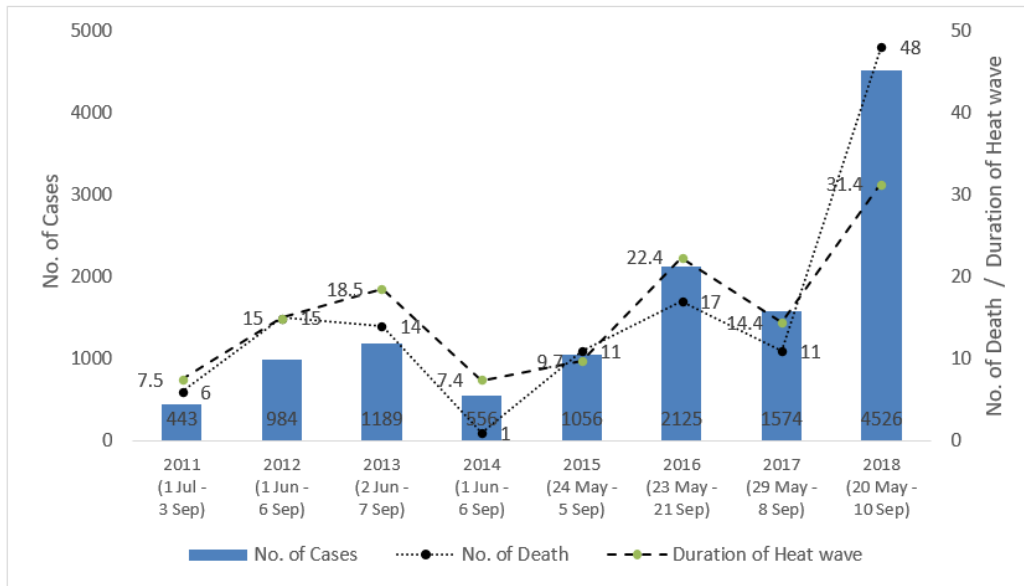


Fig. 1: Heat illness cases by year in South Korea

The experience of catastrophic heat waves suggested that it is necessary to strengthen strategies and policies to prevent the negative health impacts of the heat waves. The report submitted to

the National Assembly in France on September 24th, 2003, introduced 35 lessons learned from the health and social crisis triggered by the heat wave (12). The main points are the following: to

better understand environmental health risks having a view to climate change; to develop the research in relation between climate and public health; to consider the specificities of vulnerable populations in public health programs; to conduct regular information campaigns preventive of the consequences of high heat in order to prevent, anticipate, alert and inform health crises; to develop and disseminate protocols for the care of the elderly; to set up a weather warning system; to conduct revisions on the administrative organization; to institute local solidarity plans; and for the elderly to introduce the home help services, enlarge the financial support, and provide cooling system in residential facilities in terms of improving the medical-social sector. The report showed that the health crisis caused by heat wave was not simply a pathological problem but a problem that was closely related to the socioeconomic vulnerability.

The French government introduced the National Heat Wave Plan in May 2004. The Plan specified the national environmental and health surveillance system, the national organization plan for the alert, standard information messages for the different populations at risk. The Plan presented measures to reduce the risks of heat wave: informing the various populations at risk, training the professionals in charge of them and improving the organization and equipment in retirement homes and health establishments to provide sufficient staff and means of cooling. This plan was a systematic response to the three requirements (Identifying isolated people at risk, Responsibility for the alert, and Solidarity) that were raised after the heat wave experience in 2003. The Plan included four progressive levels of action. Vigilance (level 1) June 1st – September 30th; Alert (level 2): mobilization of health and social services; Intervention (level 3): implementation of health and social measures; Requisition (level 4): taking of the crisis beyond the health and social field. There also followed the establishment of an interministerial heat wave committee, measures to improve geriatric care, and measures for homeless people (14).

The four levels were revised for better efficiency in 2013 as the following: level 1 – seasonal watch (green vigilance card), level 2 – heat warning (yellow vigilance card), level 3 – heat wave alert (orange vigilance card), level 4 – maximum mobilization (red vigilance card) (15). Heat wave as strong as the one in 2003 did not occur since the National Heat Wave Plan was introduced, but there were many cases of heat waves in the duration of the 2010s, and the heat wave in 2015 brought significant health consequences and an excess mortality of 3,300.

Therefore, a long-term response to the climate crisis was required as much as the social attenuation of hazards. In 2005, Paris signed the Charter of European Sustainable Cities and Towns towards Sustainability, and in 2007, the Council of Paris adopted the Paris Climate Plan. It manifested the will of the city to provide a direct response to the problem through the development of a fully-fledged policy. This Plan aimed to reduce greenhouse gas emissions in the Parisian territory by 75% in 2050 than 2004. The action plan concerned housing, urban planning, resource management, etc. In chapter 6 of the Plan (‘strategy for adapting the territory of Paris to climate change’) Heat Wave Plan was included (16). The 2018 version of the Paris Climate Plan took as the initiative a carbon neutral and 100% renewable energy city, a resilient city that ensures the quality of its living environment, and a city designed as an ecosystem. Together with energy, building, urbanism, air purification, biodiversity, by 2030, at least 300 cooling islands and routes were to be created or made accessible to the public in Paris in preparation to the heat wave (17).

In Korea, the National Emergency Management Agency first established a heat wave countermeasure plan in 2005, and since 2006, the Ministry of the Interior and Safety has implemented comprehensive heat wave measures every year. Since 2008, special weather alert measures for heat waves have been implemented, and text messages of heat wave warnings and action tips have been sent to the public through the mobile phone emergency text message service. The heat wave forecast consisted of four levels of warning:

attention, caution, alert, and severe. Since 2011, the heat-related illness surveillance system has been operated based on the heat wave prevention rules jointly established by the KCDC and Prevention and the Korean Society of Emergency Medicine. The number of sun shelters on sidewalks and public cooling centers, first installed in Seoul in 2013, also gradually increased in number. This series of measures to counter the heat wave produced positive results in preventing heat-related illnesses in areas with a high proportion of elderly and low-income populations in Seoul.

The comprehensive measures for heat waves prepared in May 2018 suggested 15 implementation directions in the following four areas: establishing a pan-government response system for heat waves; creating a safe living environment from heat waves; preventing damage to facilities and properties; improving public awareness and building infrastructure. This included expansion and strengthened management of the cooling centers – after the action, 45,284 were in operation including 3,234 in Seoul, which is a 5.5% increase from the year before. Public health personnel, senior caregivers, social workers, and civil servants were active adding up to 145,384 people (18). Comprehensive measures from the government and the Seoul city contributed to reducing the number of heat-related diseases and deaths in South Korea in the summer of 2018. Nevertheless, the health crisis and the loss of life was large compared to the previous ones, so the limits of response to the heat wave were reconsidered. Unlike previous reports that focused on the occurrence of heat waves and direct damage to people and material, reports that recognized heat waves as environmental and social disasters and articles emphasizing the need to establish more systematic heat wave response governance appeared frequently in the media.

The Seoul Institute released a policy report evaluating Seoul's heat wave measures at the end of August. Here, the inefficiency of the cooling center in both operation and management and the difficulty in establishing cooperative governance among the government, local governments, medical community, and civil society were pointed

out as critical problems. In addition, the result of the opinion poll, the first heat wave response policy that Seoul citizens wish to improve was introduced: lowering electricity rates for sufficient use of air-cooling devices (54.9%); expanding outdoor shade spaces and shade screens (47.7%); improving cooling centers (41.9%); expanded support for the vulnerable (37.5%), etc. (19).

The Seoul city established a five-year climate change plan (2017-2022) in 2017 with the vision of a 'climate safe city with low carbon'. Here, climate change adaptation activities were specified, and responses to heat waves included expansion of cooling centers, expansion of cooling fog facilities, strengthening of health management for the underprivileged, and strengthening the protection and support for flop house dwellers and homeless people (20). The emphasis was placed on supporting the socially and economically disadvantaged class whose daily life will become more difficult due to the climate crisis. From a long-term perspective, however, linking the city's sustainability policies to respond to the climate crisis and responses to heat waves was somewhat insufficient.

Conclusion

The capitals of France and South Korea, located on the opposite sides of the Eurasian continent, have been responding to public health risks caused by heat waves since the mid-2000s. This response was further systematized after experiencing severe heat waves in France in 2003 and in South Korea in 2018. Comparing the responses, it is possible to conclude that the weather warning system, solidarity, and support activities for the vulnerable are very similar, but Seoul is observed to be better organized than Paris in the operation and management of cooling centers and sun shelters on the streets. Paris is active in responding to the public health risks posed by heat waves by linking them to a more comprehensive and long-term climate crisis. Heat waves are expected to increase further in the course of this century due to climate change. The direction

of public health in the era of climate crisis is expected to become more diverse and closely related to sustainable development by synthesizing medical, socioeconomic and environmental aspects.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

References

1. IPCC (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds)]. Geneva, IPCC.
2. Frich P, Alexander LV, Della-Marta P, et al (2002). Observed coherent changes in climatic extremes during the second half of the twentieth century. *Climate Research*, 19: 193–212.
3. Besancenot JP (2002). Vagues de chaleur et mortalité dans les grandes agglomérations urbaines. *Environnement, Risques et Santé*, 4-1: 229-240. [Article in French].
4. Klinenberg E (2002). *Heat wave: A Social Autopsy of Disaster in Chicago*. Chicago, Chicago University Press.
5. Hémon D, Jouglé E (2003). Surmortalité liée à la canicule d'août 2003. Rapport d'étape. Estimation de la Surmortalité et Principales Caractéristiques épidémiologiques. Paris, Inserm. [Document in French].
6. World Meteorological Organization (2019). WMO Statement on the state of the global climate in 2018. https://library.wmo.int/doc_num.php?explnum_id=5789
7. Korea Centers for Disease Control and Prevention (2019). Annual Report on the Notified Patients with Heat-related illness in Korea. [Document in Korean].
8. Lagadec P (2004). Understanding the French 2003 Heat Wave Experience: Beyond the heat, a Multi-Layered Challenge. *Journal of Contingencies and Crisis Management*, 12-4: 160-169.
9. Poumadère M, Mays C, Le Mer S, Blong R (2005). The 2003 Heat Wave in France: Dangerous Climate Change Here and Now. *Risk Analysis*, 25-6: 1483-1494.
10. Yang HJ, Yoon HY (2019). Measuring the Efficiency of Heat-wave Action Programs in Urban Environments: Using Heat-related Illness Data in Seoul, South Korea. *Journal of the Korean Urban Management Association*, 32-1: 31-45. [Article in Korean].
11. Kovats RS, Kristie LE (2006). Heat waves and public health in Europe. *Eur J Public Health*, 16-6: 592-599.
12. Assemblée Nationale. Jacquat D (2003). Rapport d'information sur la crise sanitaire et sociale déclenchée par la canicule. [Document in French].
13. Hémon D, Jouglé E (2004). Surmortalité liée à la canicule d'août 2003. Rapport remis au Ministre de la Santé et de la Protection Sociale. Paris, Inserm. [Document in French].
14. Ministère de la santé et de la protection sociale, Ministre déléguée aux personnes âgées (May 2004). Plan National Canicule(PNC). Actions nationales et locales à mettre en oeuvre par les pouvoirs public afin de prévenir et réduire les conséquences sanitaires d'une canicule (version du 31 mai 2004). [Document in French].
15. Ministère des affaires sociales et de la Santé (2013). Plan National Canicule 2013. [Document in French].

16. Mairie de Paris (2007). Plan Climat de Paris. Plan de lutte contre le réchauffement climatique. [Document in French].
17. Ville de Paris (2018). Plan Climat de Paris. Vers une ville neutre en carbone, 100% énergies renouvelables, résiliente, juste et inclusive. [Document in French].
18. Related Ministries Joint (2018). Comprehensive measures for the heat wave in 2018. [Document in Korean].
19. Cho HM, Lee YH (2018). Measures to improve Seoul's ability to respond to heat waves. The Seoul Institute Policy Report 257. [Document in Korean].
20. Seoul Metropolitan Government (2017). Seoul Comprehensive Plan for Response to Climate Change (2017~2021). [Document in Korean].