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Original Research

Measuring the burden of disease due to climate change and developing a forecast model in South Korea

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ABSTRACT

Objectives: Climate change influences human health in various ways, and quantitative assessments of the effect of climate change on health at national level are becoming essential for environmental health management.
Study design: This study quantified the burden of disease attributable to climate change in Korea using disability-adjusted life years (DALY), and projected how this would change over time.
Methods: Diseases related to climate change in Korea were selected, and meteorological data for each risk factor of climate change were collected. Mortality was calculated, and a database of incidence and prevalence was established. After measuring the burden of each disease, the total burden of disease related to climate change was assessed by multiplying population-attributable fractions. Finally, an estimation model for the burden of disease was built based on Korean climate data.
Results: The total burden of disease related to climate change in Korea was 6.85 DALY/1000 population in 2008. Cerebrovascular diseases induced by heat waves accounted for 72.1% of the total burden of disease (hypertensive disease 1.82 DALY/1000 population, ischaemic heart disease 1.56 DALY/1000 population, cerebrovascular disease 1.56 DALY/1000 population). According to the estimation model, the total burden of disease will be 11.48 DALY/1000 population in 2100, which is twice the total burden of disease in 2008.
Conclusions: This study quantified the burden of disease caused by climate change in Korea, and provides valuable information for determining the priorities of environmental health policy in East Asian countries with similar climates.

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Introduction

Over the last century, the average global temperature has increased by 0.60–0.74 °C.[1] The third report of the Intergovernmental Panel on Climate Change (IPCC) predicted that average global temperatures would continue to rise by an additional 1.4–5.8 °C over the next century. The fourth report of the IPCC, which had higher minimum (0.4 °C) and maximum (0.6 °C) temperatures than the third report, predicted a rise of 1.8–6.4 °C. Global warming has accelerated, which has resulted in severe heat waves in recent years.[1,2] In Korea, the average temperatures of the six major cities have increased by 1.5 °C since 1900, which exceeds the increase in average global temperature over the same period.[1]

The World Health Organization (WHO) has developed a unit to quantify the environmental burden of disease, and has emphasized the importance of adaptive policy making in response to climate change.[3] Previous studies concerning the impact of climate change on human health have mainly focused on Africa, where there are underdeveloped social infrastructures and weak social capital, or major cities in the USA and Europe, which currently represent the leaders in adaptive policies to combat climate change.[4–7]

In Korea, there is increasing interest regarding the influence of climate change on human health, such as increased temperature, heat waves, extreme cold, droughts, floods and typhoons.[3] Korea is a small territory with a complex terrain and four seasons. Its climate is affected by numerous meteorological factors. National assessments of the impact of each climate factor on human health are very important for establishing environmental health policies. This study quantitatively measured the national burden of disease attributable to climate factors, and estimated the environmental burden of disease that will be caused by climate change in 2100.

Methods

The following four steps were employed to estimate the burden of disease caused by climate change. First, meteorological data were collected, and diseases related to climate change were identified. Second, mortality was calculated using computerized data obtained from the National Statistical Office of Korea regarding cause of death. In addition, a database of disease incidence and prevalence was established using claim data from the National Health Insurance Corporation of Korea for 2005–2008, and the exposure distribution rate of climate change was calculated. Third, after measuring the burden of each disease using the aforementioned estimated variables, the total burden of disease related to climate change was calculated as the sum of the products of population-attributable fractions (PAF) and the burden of each disease. Finally, a Korean burden of disease forecast model was built based on the available climate change data.

Construction of meteorological data

The mean daily temperature in Korea was calculated using a meteorological database from the Korea Meteorological Administration, which collects data eight times per day from 77 regional meteorological offices and observatories. This study used the lowest, highest and mean daily temperatures obtained from all 77 locations in 2008. Ozone concentration data were taken from the 2008 Annual Report of Ambient Air Quality in Korea, and the number of natural disasters was

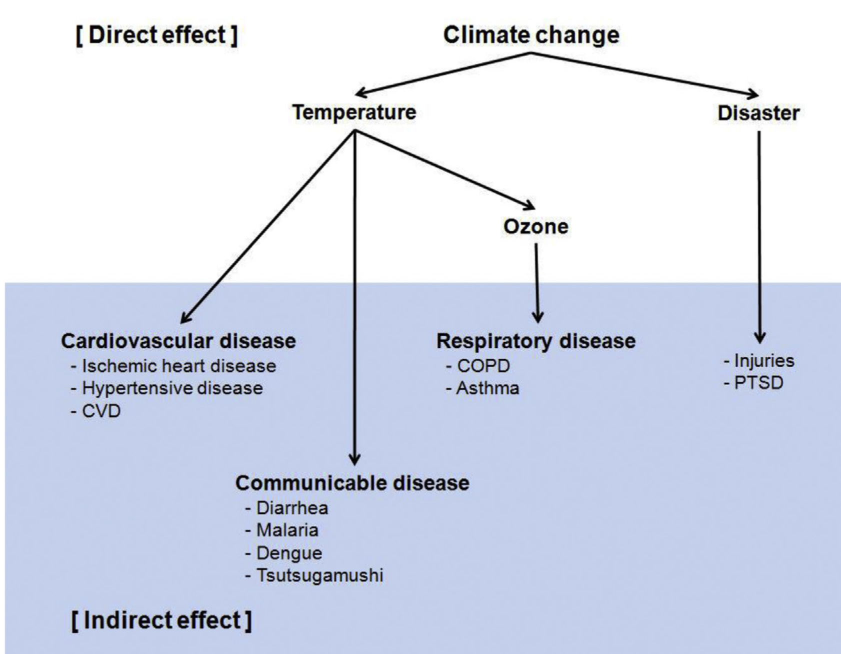

Fig. 1 – Direct and indirect effects of climate change on human health. COPD, chronic obstructive pulmonary disease; PTSD, post-traumatic stress disorder; CVD, cerebrovascular disease.

determined based on the Annual Report of Disasters in Korea.

The indicators of climate change suggested by the IPCC[1,2] include increased temperature, increased precipitation and rising sea level. Increased precipitation in Korea has an insignificant effect on the burden of disease due to sufficient drainage facilities, and the effects of rising sea level are negligible. Therefore, temperature, ozone density and natural disasters were used as indicators of climate change following the recommendations of an advisory committee (Fig. 1).

Categorization of diseases related to climate change

Increased temperature is perhaps the most characteristic effect of climate change. Specifically, heat waves affect the cardiovascular and cerebrovascular systems, and long-term exposure to high temperatures lowers the body's ability to maintain a constant temperature, leading to heatstroke, heat exhaustion, heat syncope and heat cramps.[8–10] In Korea, the incidence of cardiovascular and cerebrovascular disease increases as mean temperature increases. During heat waves, the incidence of cerebrovascular disease is twice that of cardiovascular disease. Furthermore, mortality from cerebrovascular disease, chronic lower respiratory disease and cardiovascular disease is closely related to heat waves.[11]

Temperature changes also affect infectious disease pathogens and agents, which in turn influence the duration of infection, disease distribution and disease burden.[12] These infectious diseases include malaria, dengue, diarrhoea, cholera, tsutsugamushi and leptospirosis.[10,13,14] Under a climate change scenario, it has been projected that the relative risk of diarrhoea will be 1.18 in 2050 (1.10 at present) if the mean temperature increases by 1.0–3.5 °C.[15]

The influence of ozone concentration on human health has been studied extensively along with the influence of other air pollutants (e.g. SO_2, NO_2, CO and Pb) and temperature. In addition, ozone concentration is related to an increase in mortality and morbidity.[16] Ozone is a strong oxidizing agent related to decreased lung function. It is also a risk factor for breathing deterioration, increased hospital admission, and mortality related to chronic respiratory disease.[17–21] A relationship between increased ozone concentration and asthmatic crises in children has been reported in the USA;[22] in addition, asthma and ozone are more highly correlated than asthma and SO_2, NO_2 or particulate matter.[23]

According to the United Nations International Strategy for Disaster Reduction (2007), the number of disasters related to climate change has increased more quickly than the number of geological disasters since the late 1970s. Moreover, the increase in large-scale disasters has outpaced that of small-scale disasters. In Korea, typhoons are responsible for most natural disaster-related diseases. While heavy rainfall occurs frequently, typhoons cause much more damage.[24] Meteorological disasters that originate due to climate change may have effects on human health, resulting in injury, death, mental disorders, malnourishment and epidemics.[25,26] As deaths due to flooding are common, many studies have been conducted on this topic.[15,27–30] According to Schmidt et al., 48% of flood victims in Missouri experienced physical injuries, including twist injuries (34%), lacerations (24%), abrasions (11%) and external injuries (11%). In addition, it is known that the associated trauma caused by floods, earthquakes and typhoons results in the development of mental disorders.[31–37] However, the occurrence and duration of serious mental disorders, such as post-traumatic stress disorder (PTSD) is disputed. In a study of residents who were victims of Hurricane Andrew or Hurricane Katrina in the USA, the number of adult PTSD patients increased by 2030% within five months to two years after the hurricanes.[38] According to a follow-up survey, the risk of PTSD among a group of tsunami survivors was relatively high [relative risk 5.16, 95% confidence interval (CI) 4.04–6.60].[39]

Table 1 – Risk factors for diseases associated with climate change in Korea.

Risk factor	Disease	ICD-10 code
Temperature	Hypertensive disease	I10–I13
	Cerebrovascular disease	I60–I69
	Ischaemic heart disease	I20–I25
	Diarrhoea	A00, A01, A03–A04,
	Cholera	A06–A09
	Salmonellosis	
	Malaria	
	Tsutsugamushi	
Ozone density	Respiratory disease	J40–J44, J45–J46
Disaster	Post-traumatic stress disorder	F43.1, F01–F99, G06–G98

ICD-10, International Classification of Diseases-10.

In this study, cerebrovascular disease related to heat waves, respiratory disease related to increased ozone concentration, and injury and mental illness related to meteorological damage were separated to facilitate measurement of the total burden of disease on the basis of International Classification of Diseases-10 (ICD-10) codes (Table 1). Increases in ozone concentration are highly related to temperature, so it is difficult to analyse the increase in ozone concentration as an independent risk factor. However, a previous WHO study analysed the burden of disease using the following risk factors: mean increase in temperature, extreme temperature and external air pollution.

For the research model, the goodness of fit was tested using three indices: Tucker–Lewis Index (TLI), Comparative Fit Index (CFI), and the Root Mean Square Error of Fit Index (RMSEA). TLI and CFI are relative goodness of fit indices, and show the level of explanation according to the worst model. RMSEA is an absolute goodness of fit index, and reveals how well the theoretical model fits the actual data. Generally, if CFI and TLI are >0.9 and RMSEA is <0.06, the fit of the model is considered to be good. The research model had CFI of 0.84, TLI

Table 2 – Confidence intervals for sensitivity.

	Mean	SD	Minimum	Maximum
Mean temperature (°C)	13.8	1.3	13.66619	13.93381
Heatwave (days)	10.2	0.8	10.11765	10.28235
Ozone density (ppm)	0.349	0.124	0.336237	0.361763
Typhoon (events)	2.4	0.149	2.384663	2.415337

SD, standard deviation; ppm, parts per million.

of 0.66 and RMSEA of 0.04; as such, the goodness of fit was a little lower than the standard, but CFI and RMSEA were very close to the criteria. Therefore, the model was considered to provide a good explanation of the risk factors.

A sensitivity analysis and CI estimations for several risk factors are shown in Table 2.

Incidence estimation

To estimate incidence, individuals who had medical records in the National Health Insurance Corporation claim database in 2008 were identified, and a second database was built using this information after verifying their diagnoses and the visit records of the medical institutions where they were treated. As this study was interested in subjects who became ill in 2008, people who had the same diagnosis between 2005 and 2007 were excluded. In addition, outpatient records were examined to investigate the incidence rates of asthma, chronic obstructive pulmonary disease and diarrhoea, which are generally examined in the outpatient setting. In the analyses of outpatient records, incident cases of chronic illnesses were considered to be those that involved more than three outpatient visits with the same diagnosis in 2008, without the same diagnosis between 2005 and 2007. For short-term illnesses, cases were included when there were more than three outpatient visits with the same diagnosis. Once the incidence rates of the diseases were calculated, they were categorized by five-year age groups and sex. The 2008 mid-year population was used as the standard population.

Calculation of disability-adjusted life years

Estimates of population and deaths were developed by age group and sex to estimate years of life lost (YLL) due to premature death in 2008. Mortality was stratified by five-year age group and sex from the National Statistical Offices according to ICD-10 codes. The 2008 mid-year population was used as the standard population. Age-group-specific YLL due to premature death were estimated using standard expected YLL, and the final burden of disease due to premature death was estimated by applying the YLL due to premature death function, as suggested by the Global Burden of Disease study group.[40,41]

Incidence rate, prevalence parameters and case fatality rate were used to estimate years lived with disability (YLD). The DISMOD II method developed by the Global Burden of Disease researchers was used to estimate the expected duration of disability and the average age at onset.[41] The computer model called 'DISMOD II' was developed to ensure internal consistency and to model the associations between incidence, remission, fatality and prevalence. Under the DISMOD II model, it is assumed that any individual or group that is susceptible to a specific disease at a certain point in time will trigger the incidence of the disease as they become infected. The model further explains that YLD equals the burden of disease obtained by excluding remission rate, deaths from general mortality, and cause-specific death rate or case fatality rate from incidence rate. The final burden of disease due to disability caused by climate change was estimated using the YLD function supplied by the Global Burden of Disease study group.[42]

Using YLL due to premature death and YLD results, the DALY values of the disease due to climate change in Korea were calculated:

$$DALY = \sum_a \sum_s \sum_i YLL_{a,s,i} + \sum_a \sum_s \sum_i YLD_{a,s,i}$$

$$YLD = D\left\{\frac{KCe^{\gamma a}}{(\gamma+\beta)^2}\left[e^{-(\gamma+\beta)(L+a)}[-(\gamma+\beta)(L+a)-1]\right.\right.$$
$$\left.\left.-e^{-(\gamma+\beta)a}[-(\gamma+\beta)a-1]\right]+\frac{1-K}{\gamma}\left(1-e^{-\gamma L}\right)\right\}$$

where r is discount rate, β is age-adjusted parameter (=0.04), K is 1 or 0 (modulation factor), C is constant (=0.1658), a is age at disease onset, L is averaged duration, and D is disability weight.

$$YLL = \left\{\frac{KCe^{\gamma a}}{(\gamma\beta)^2}\left[e^{-(\gamma+\beta)(L+a)}[-(\gamma+\beta)(L+a)-1]\right.\right.$$
$$\left.\left.-e^{-(\gamma+\beta)a}[-(\gamma+\beta)a-1]\right]+\frac{1-K}{\gamma}\left(1-e^{-\gamma L}\right)\right\}$$

where r is discount rate, β is age-adjusted parameter (=0.04), K is 1 or 0 (modulation factor), C is constant (=0.1658), a is age at death, and L is standardized expected life year at death.

Estimation of population-attributable fractions

Three parameters should be considered to estimate PAF due to climate change: the number of deaths, the relative risk of climate risk factors for different climate fractions, and the

Table 3 – Systematic review of relationships between risk factors and diseases.

Risk factor	Disease	RR (or OR)	Reference
Temperature	Cardiovascular disease	OR: 3.19	Bretin et al., 2004[48]
		OR: 2.48	Bouchama et al., 2007[49]
		RR: 1.84	Wallace et al., 2007[52]
		RR: 1.01	Knowlton et al., 2009[53]
	Hypertensive disease	OR: 1.46	Bretin et al., 2004[48]
	Cerebrovascular disease	RR: 0.98	Knowlton et al., 2009[53]
		RR: 1.71	Wallace et al., 2007[52]
	Ischaemic heart disease	RR: 2.23	Wallace et al., 2007[52]
	Diarrhoea	OR: 1.03	Singh et al., 2001[13]
	Cholera	RR: 1.05	Luque Fernández et al., 2008[50]
	Malaria	RR: 4.85	Loevinsohn, 1994[51]
Ozone density	Asthma	RR: 1.03	Wong et al., 1999[54]
	Chronic obstructive pulmonary disease	RR: 1.03	Wong et al., 1999[54]
Disaster	Post-traumatic stress disorder	RR: 5.16	Hansley and Varela, 2008[55]

RR, relative risk; OR, odds ratio.

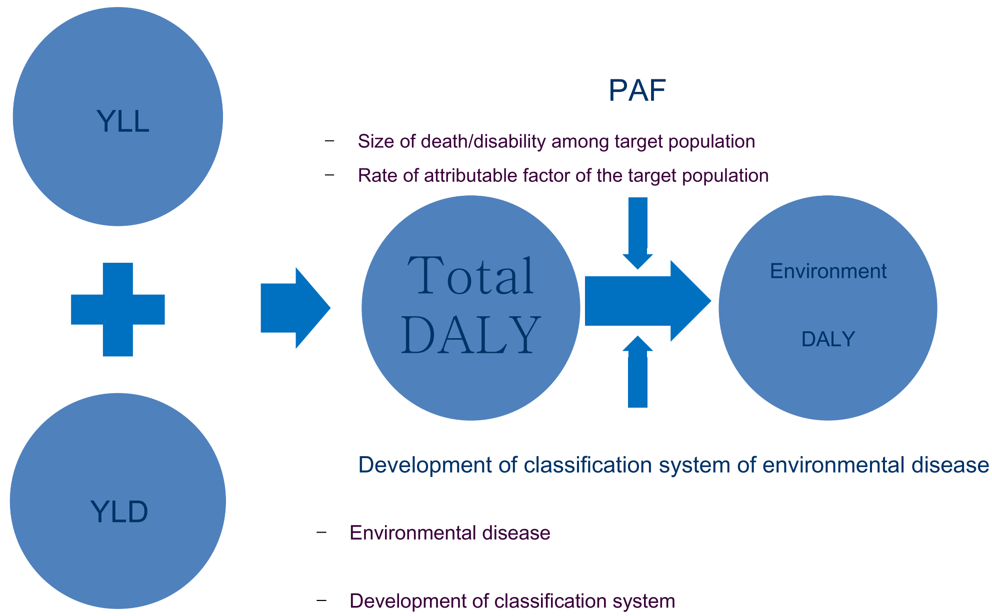

Fig. 2 – Research model of environmental burden of diseases. YLL, years of life lost; YLD, years lived with disability; PAF, population-attributable fractions; DALY, disability-adjusted life years.

exposure distribution. The number of deaths classified by age, sex and cause is published in the annual report of the National Statistical Office. To estimate the relative risk for each risk factor related to climate change, a systematic review was performed to identify relative risks or odds ratios for countries with climates similar to Korea (Table 3). Meanwhile, for injuries caused by natural disasters, such as typhoons, floods and earthquakes, reports including mortality and incidence were used.[43] The exposure distribution refers to the number of people exposed to the risk factor when the observed meteorological values for each risk factor exceed the threshold of relative risk. It is a function of the number of people and relative risk for each risk factor. Finally, PAF of DALY due to climate change were calculated by multiplying PAF by DALY. Hence, if the burden of disease among Koreans in 2008 was the baseline of the burden of climate change-related diseases, the proportion assessed by PAF became the burden of disease due to climate change (Fig. 2).

$$\mathrm{PAF} = \frac{\sum_{i-1}^{n} P_i RR_i - \sum_{i-1}^{n} P_i' RR_i}{\sum_{i-1}^{n} P_i RR_i}$$

where P_i is proportion of population at exposure level i, current exposure; P_i' is proportion of population at exposure level i, counterfactual or ideal level of exposure; RR_i is relative risk at exposure level i; and n is number of exposure levels.

Model for estimating burden of disease due to climate change

Annual mean temperatures until 2100 were estimated on the basis of a regression coefficient that was derived from analyses of alternation trends of the annual mean temperatures from 1971 to 2007 in the seven largest cities in Korea.[25] The number of days of heat waves until 2100 was also estimated by setting 10.2 days as the baseline, in accordance with meteorological data from 2008, and substituting this value into a linear regression equation. According to an IPCC report, an A1B scenario model was accepted. According to the model, the temperature would increase by 2.8 °C and sea level would rise by approximately 21–48 cm if there were no interventions.[1]

According to previous research, ozone concentrations are expected to increase proportionally to the annual mean temperature.[43] Ozone concentration was estimated and is summarized in Table 3 using 0.3499 ppm, parts per million (ppm) as the reference ozone concentration, which is the mid-value of the maximum values of daily mean ozone concentrations

Table 4 – Climate change scenario in Korea.

	2008	2020	2030	2040	2050	2060	2070	2080	2090	2100
Mean temperature (°C)	13.80	14.27	14.66	15.05	15.44	15.83	16.22	16.61	17.00	17.39
Heatwave (days)	10.2	10.7	11.2	11.7	12.2	12.7	13.2	13.7	14.2	14.7
Ozone density (ppm)	0.349	0.356	0.363	0.374	0.381	0.388	0.395	0.402	0.409	0.416
Typhoon (events)	2.40	2.64	2.90	3.19	3.51	3.86	4.25	4.67	5.14	5.65

ppm, parts per million.

Table 5 – Burden of disease by sex in disability-adjusted life years/1000 population.

Risk factor	Disease	Sex		Total	
		Male	Female		
Heatwave	Rheumatic heart disease	0.04	0.10	0.07	5.17
	Hypertensive heart disease	1.83	1.81	1.82	
	Ischaemic heart disease	1.85	1.27	1.56	
	Cerebrovascular disease	1.59	1.52	1.56	
	Inflammatory disease	0.21	0.15	0.18	
Temperature	Diarrhoea	0.04	0.04	0.00	0.06
	Malaria	0.01	0.00	0.01	
	Dengue	0.00	0.00	0.00	
	Tsutsugamushi	0.04	0.05	0.05	
Ozone density	Chronic obstructive pulmonary disease	1.17	1.14	1.15	1.59
	Asthma	0.36	0.52	0.44	
Disaster	Post-traumatic stress disorder	0.00	0.00	0.00	0.03
	Injury	0.02	0.01	0.03	
Total		7.16	6.58	6.85	

(0.314–0.383 ppm) during an 8 hour interval (9:00–17:00) during the summer seasons between 2000 and 2008.[44]

For natural disasters, the number of typhoons was extrapolated from a mean number of 2.4 natural disasters in 2008 using a linear model.[45] The linear model was derived from analyses of the increment trends of natural disasters, and revealed that the number of natural disasters in 2007 was 1.4 times greater than that in 1997 according to the data obtained from the NatCatSERVICE Weather Phenomena Information Database (Table 4).

Results

This study calculated the burden of disease due to risk factors associated with climate change and estimated future changes. According to the results, hypertensive heart disease due to heat waves represented the greatest burden of disease associated with climate change in Korea. DALY due to heat waves was 1.82/1000 population, and this number represented more than 30% of the total DALY, which was 6.85/1000 population (Table 5). Mortality increases rapidly with an increase in temperature,[46] and the present results were concordant with results from previous studies. Furthermore, the incidence of cerebrovascular disease due to heat waves increased; as a result, the burden of disease also increased.

Kim raised concerns regarding a greater risk for cerebrovascular disease than cardiovascular disease during heat waves;[11] however, in this study, the burdens of hypertensive heart disease (1.82 DALY/1000 population) and ischaemic heart disease (1.56 DALY/1000 population) were greater than the burden of cerebrovascular disease (1.56 DALY/1000

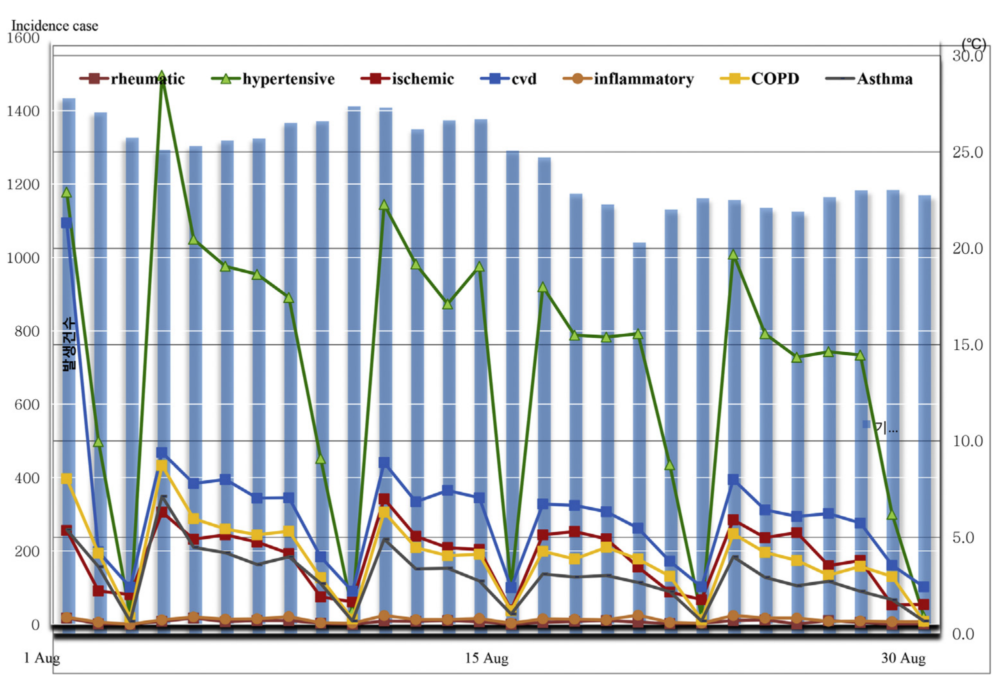

Fig. 3 – Incidence of chronic diseases by temperature in August (hottest month of the year) among people aged ≥65 years. COPD, chronic obstructive pulmonary disease; CVD, cerebrovascular disease.

Table 6 – Burden of disease by age group in disability-adjusted life years/1000 population.

Risk factor	<15 years	15–64 years	≥65 years
Heatwave	0.37	9.25	34.84
Temperature	0.34	0.65	0.26
Ozone density	3.65	2.14	10.45
Disaster	0.00	0.03	0.01

population). These results were inconsistent with the results from previous studies. However, when focusing on people aged ≥65 years, chronic diseases increased with increased temperature (Fig. 3). In addition, the burden of disease was greatest among senior citizens (≥65 years). In particular, heat waves and ozone density were the most dangerous risk factors among older individuals. When focusing on people aged ≥65 years, cerebrovascular disease represented the greatest disease burden (women: 6.54 DALY/1000 population; men: 7.11 DALY/1000 population) (Table 6).

According to the estimation model used in this study, the burden of disease due to climate change was 6.88 DALY/1000 population in 2008, and this is expected to double to 11.48 DALY/1000 population by 2100 (Table 7). However, these numbers were calculated without considering interventions or prevention policies, such as population increases and greenhouse gas reduction policies. In reality, as the population ages, the burden of disease due to climate change will increase rapidly. Therefore, political prevention strategies and related activities are necessary.

Discussion

This study calculated the burden of disease due to climate change, and estimated the future burden of disease due to climate change in Korea. The findings are amenable for use in policy making. Specifically, using data for Korea, climate change was found to be responsible for 6.85 DALY/1000 population in 2008. On the basis of these data, it is predicted that climate change will lead to 11.48 DALY/1000 population in 2100.

Among the total burden of disease due to climate change, the main factors were hypertensive heart disease (1.82 DALY/1000 population), ischaemic heart disease (1.56 DALY/1000 population) and cerebrovascular disease (1.56 DALY/1000 population). Mortality increases rapidly with increasing temperature.[46] Furthermore, the incidence of cerebrovascular disease due to heat waves increased, so the burden of disease increased.[11]

Primary and secondary preventive interventions are essential to prevent increases in the incidence rates of these diseases in the future. In particular, there is a need for alerts regarding heat waves and properly structured emergency intervention systems.

A larger DALY/1000 population was observed in people aged ≥65 years (45.57 DALY/1000 population) compared with people aged 16–64 years (12.07 DALY/1000 population). The Korean population is aging; therefore, the total burden of disease due to climate change will increase and effective interventions must be implemented.

This study had several limitations. First, it was assumed that respiratory diseases due to increased temperature were caused by ozone density, so only ozone-related diseases were considered. As such, diseases related to suspended solids or contaminated air were not included. Additionally, the study focused on respiratory disease without consideration of atopic diseases. Also, due to the lack of a causal relationship between temperature and antigens, related diseases were excluded.

Second, mortality due to heat waves was not included when calculating the burden of disease. This study considered specific diseases, and it was difficult to attribute death from a specific disease to heat waves. In addition, it was not possible to consider heatstroke patients separately, as insufficient reports of heatstroke patients were reported through injury surveillance.

Third, due to a lack of related studies, data derived from studies conducted in other countries were used for relative risks. There is little research regarding climate change in Korea, and a lack of internationally peer-reviewed studies. The relative risks of various populations differ,[47] and there are no standards. In the present study, no adjustment was made for age, sex or other population characteristics. The findings may have been more meaningful and precise if it had been possible to adjust for these variables.

In spite of these limitations, this study quantified the burden of disease due to climate change and estimated the future burden of disease due to climate change in Korea, providing meaningful implications for the study of environmental public health. Due to the complicated nature of the data, this topic had limited accessibility until now. This study presents evidence that has relevance for environment policy.

As the Korean population ages, there will be increases in common diseases such as hypertensive heart disease, ischaemic heart disease and cerebrovascular disease. There is a need to conduct further research, and to obtain more detailed models for estimating the health effects of climate change.

Conclusions

Behavioural changes are needed to decrease the burden of disease due to climate change. The degree of climate change is increasing progressively. This means that behavioural changes could change the progression of climate change. In particular, it is essential to reduce the use of fossil fuels.

Table 7 – Predicted burden of disease by climate change scenario in disability-adjusted life years/1000 population.

	2008	2020	2030	2040	2050	2060	2070	2080	2090	2100
Heatwave	5.19	5.19	6.29	6.29	7.27	7.27	8.35	8.35	9.53	9.53
Temperature	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.09	0.09	0.09
Ozone density	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.80	1.80	1.80
Disaster	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.06	0.07

The findings presented in this study have some limitations. First, it was not possible to use real data as much as the authors would have liked. Second, the fourth assessment from the IPCC is seriously flawed; the estimates of rises in sea level are grossly underestimated and the projections for increases in global temperatures are also likely to be underestimated. An improved Special Report on Emission Scenarios is also available. Future studies will use the new report.

In conclusion, despite the limitations of the data used in this study, these results are helpful for determining the priorities for future public health policies related to climate change. Moreover, the present study provided specific quantitative data to establish an evidence-based health policy.

Author statements

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Ethical approval

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Competing interests

None declared.

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