Publisher homepage: www.universepg.com, eISSN: 2707-4668

Asian Journal of Social Sciences and Legal Studies

Journal homepage: www.universepg.com/journal/ajssls

OPEN ACCESS | Research Article

Spatial Variation and Effect of Environmental Factors in the World Mortality Rate

Md. Rasel Hossain[1]*, Indi Islam[2], and Md. Owaliur Rahman Akanda[3]

[1]Department of Statistics, Noakhali Science and Technology University, Noakhali-3814, Bangladesh
[2]Department of Law, Islamic University, Kushtia-7003, Bangladesh
[3]Department of Education, Noakhali Science and Technology University, Noakhali-3814, Bangladesh

*Correspondence: rasel.stat@nstu.edu.bd (Md. Rasel Hossain, Assistant Professor, Department of Statistics, Noakhali Science and Technology University, Noakhali-3814, Bangladesh).

Received Date: 7 March 2026 Accepted Date: 8 April 2026 Published Date: 15 April 2026

Abstract

The World Health Organization reported a decrease in mortality rates from 12.6 million in 2012 to 8.7 million in 2021 due to environmental factors such as ambient temperature, low humidity, low precipitation, and increased air pressure, highlighting the importance of understanding spatial variation and association. This study analyzed data from 1981 to 2021 on the UNWPP death rate and NASA power data access viewer data, analyzing 8 independent variables across five continents. Descriptive statistics were used to analyze the distribution of environmental factors and mortality rates, and correlation coefficients were used to measure the strength and direction of the association between mortality rates and environmental variables. Regression analysis was performed for predictive modeling, using SPSS and Python software with a 5% significance level. Across all continents, higher surface pressures and colder temperatures were generally associated with lower mortality rates. In the Asian continent, wind speed significantly impacted mortality rates, as higher wind speeds were linked to lower death rates ($\beta = -0.843$, $p < 0.001$). Additionally, there was an inverse relationship between sky clarity and death rates in this area ($\beta = -15.249$, $p < 0.001$). Higher humidity and precipitation levels were also negatively associated with mortality rates, p-values of 0.02 and 0.004, respectively. On the African continent, wind speed and surface pressure were significantly negatively correlated with fatality rates. In the North American continent, there was a strong negative correlation between wind speed and death rates ($\beta = -2.864$, $p < 0.001$). In the Oceanian continent, wind speed showed a substantial negative correlation with mortality ($\beta = -2.715$, $p < 0.001$). This suggests that understanding the relationship between environmental factors and mortality is crucial for improving public health, policy, disease prevention, health equity, and sustainable development.

Keywords: Spatial variation, UNWPP, Ambient temperature, Mortality rate, and Environmental factors.

1. Introduction

The mortality rate, often known as the death rate, is a measure of the number of deaths (in general or due to a specific cause) in a given population and is related to the population's size per unit of time. Many factors influence the mortality rate, including transport

accidents, food and agriculture poisoning, communicable and non-communicable diseases, unhealthy environments, as well as health. Environmental factors have a significant impact on mortality. Temperature, food, pollution, population density, sound, light, and parasites influence all environmental influences. The bulk of research examining looking into the impact of the environment on mortality has focused on air pollutants, revealing that exposure to air pollutants is associated with an increased risk of death (M. Hossain *et al*., 2025; Krall *et al*., 2013; Tao *et al*., 2012). Several studies have also shown links between mortality and other characteristics of environmental quality (Boyles *et al*., 2021; Lopez *et al*., 2021; Rahman *et al*., 2021). According to the World Health Organization (WHO), approximately 12.6 million people died as a result of living or working in unhealthy environments in 2012 (WHO, 2012), which reduced to 8.7 million in 2021 (Our World in Data, 2021; Elhassan *et al*., 2023).

Environmental factors impact both developed and developing countries and they yet are an alarming problem and a burning issue for the present world. Environmental degradation is a worldwide concern, and all countries face major environmental risks. Moreover, it also has an impact on the social and environmental determinants of health, such as clean air, safe drinking water, enough food, and safe housing. Research conducted between 1985 and 2012 in Australia, Brazil, Canada, China, Italy, Japan, South Korea, Spain, Sweden, Taiwan, Thailand, the UK, and the USA discovered that non-optimal temperatures were responsible for increased mortality rates in the studied nations, with the highest in Thailand and lowest in China (Gasparrini *et al*., 2015; Zahangir *et al*., 2024). Chun *et al*. (2014) reported that mortality rates increased due to low atmospheric pressure and relative humidity in China (Ou *et al*., 2014). In addition to this, in China, high temperature and low relative humidity had additive interactions on mortality risk, which caused approximately 10% of deaths in 2023 with a higher burden for females and older people (Fang *et al*., 2023; Islam *et al*., 2022; Sultan *et al*., 2025).

Ambient temperature, low relative humidity, low precipitation, and increased air pressure are important public health concerns associated with mortality and diseases (Basu & Samet, 2002; Islam *et al*., 2025). A 1°C temperature rise increased cardiovascular, respiratory, cerebrovascular, diabetes mellitus, genitourinary, infectious disease, and heat-related disease mortality from 2.90% to 3.60% (Bunker *et al*., 2016).

The occurrence of traumatic disease increased in proportion to the rise in temperature and humidity, but the occurrence of non-traumatic disease increased in proportion to the rise in temperature, regardless of humidity variations (Choi *et al*., 2007; Dey *et al*., 2024a). Moreover, it has been demonstrated that an increase in relative humidity (over 85%) and atmospheric pressure (over 970 mb) results in an increase in the number of daily average instances of mortality from brain strokes (Chowdhury *et al*., n.d.; Goggins *et al*., 2012). Variability in precipitation is a key driver of infectious illnesses, which are the leading causes of morbidity and death in children globally. Additionally, according to worldwide research, abnormally wet weather increases the likelihood of cough, fever, and diarrhea symptoms in subtropical countries (Baharom *et al*., 2021; Dimitrova *et al*., 2022; Riyadh Hossain *et al*., 2025).

The effects of several environmental variables generally occur in the cycle; nevertheless, only a few studies have examined the impact of multiple exposures across environmental domains on mortality (Pearce *et al*., 2011; Rana *et al*., 2021). Most mortality studies have concentrated on the independent effect of a single variable (for example, the link between one air pressure and mortality) (Lu *et al*., 2015) or the combined effects of a few (usually two to three) factors within the same environmental domain (Mohammad Salim Zahangir *et al*., 2025; Zanobetti & Schwartz, 2009b). Despite significant research, the link between several environmental variables and mortality remains unexplored. Furthermore, mortality has also been found to vary geographically, with some variation occurring between nations. The fundamental causes of this disparity and the links between multiple exposures across environmental domains and mortality remain unclear. Since environmental features have a strong impact on the mortality rate found in previous literature, our goal was to find the spatial variation and

association between different environmental factors and mortality rates in the world.

2. Methodology

Study area

This study aimed to explore the relationship between environmental factors and mortality rates, which encompasses a comprehensive geographical scope covering different continents such as (Asia, Africa, North America, Oceania, and Europe). The data presented in the results included measurements from diverse climatic and environmental settings, ensuring a broad representation of global conditions. This allows for a broader analysis of how environmental factors such as temperature, humidity, and wind speed correlate with mortality rates across different regions.

Data collection

Mortality data (death rates per 1000 individuals) was sourced from the United Nations World Population Prospects (UNWPP) death rate from 1981 to 2021, where the United Nations Projection (UNP) was also included, which serves as the dependent variable in the statistical analyses. Data on various Environmental parameters, including surface pressure, earth skin temperature, relative humidity, wind speed, and others, were collected from the NASA Power Data Access Viewer (NASAPDAV), each of which could influence mortality rates differently. The authors of this research constructed all the figures and tables used in this study based on the 1981–2021 United Nations World Population Prospects (UNWPP) death rate and NASA power data access viewer data.

Dependent Variables

The dependent variable is the mortality rate, measured as the "Death Rate per 1000" individuals, indicating the number of deaths per 1000 people across different geographical regions.

Explanatory Variables

This study examines the impact of eight independent variables on climate change across five continents: Asian, African, North American, Oceanian, and European. Each continent contains eight individual environmental parameters: (1) Surface pressure (kPa) represents the atmospheric pressure at the Earth's surface which can influence weather conditions and potentially affect health. (2) Earth skin temperature (°C): The temperature of the Earth's surface can affect local climatic conditions and have implications for heat-related illnesses. (3) Relative humidity at 2 meters (%): The amount of moisture in the air which can influence respiratory health and comfort levels. (4) Wind speed at 10 meters (m/s): This measures the speed of the wind, which can affect air quality and exposure to pollutants. (5) temperature at 2 meters maximum (°C): Record the highest temperatures at a standard height of 2 meters, relevant for assessing extreme temperatures. (6) Temperature at 2 meters minimum (°C): Record the lowest temperatures at a standard height of 2 meters, relevant for assessing exposure temperatures. (7) All-sky insolation clearness index: This dimensionless index measures the clarity of the sky and affects solar radiation exposure, which can impact health through vitamin D synthesis or heat exposure. (8) Precipitation corrected (mm/day): Measures daily precipitation levels affecting environmental and living conditions, such as waterborne diseases or agricultural yields.

Study Population

From 1981 to 2021, the United Nations World Population Prospects (UNWPP) death rate and NASA power data access viewer data are considered 1640 secondary data sources, which could include international health databases, weather monitoring systems, and other environmental databases. The study population appears to span five different continents, including Asian (574), African (697), North American (123), Oceanian (164), and European (82) individual datasets, suggesting a global scope. This includes various geographic and climatic regions, providing a comprehensive understanding of how different environmental conditions might affect mortality rates worldwide.

Statistical Analysis

The data for this study were extracted from the 1981 to 2021 United Nations World Population Prospects (UNWPP) death rate and NASA power data access viewer data, which considered 1640 secondary data sources. The statistical analysis revolves around the relationship between environmental factors and mortality rates across five different continents worldwide. The research began with descriptive

statistics using IBM SPSS Statistics 25 software tools, which included calculating the minimum, maximum, mean, standard deviation, skewness, and kurtosis for each variable across five different continents worldwide. This step helps summarize the central tendency, dispersion, and shape of the distribution of environmental factors and mortality rates. Before applying parametric tests, this study conducts normality tests, such as the Kolmogorov-Smirnov and Shapiro-Wilk tests, to determine if the mortality rates follow a normal distribution. This is essential because many statistical methods assume normality in data. The study employs correlation coefficients, specifically Kendall's tau_b and Spearman's rho, to measure the strength and direction of the association between mortality rates and various environmental variables. This step identifies potential predictors for more complex models. To meet the assumptions necessary for regression analysis, the study might employ transformations, such as the Box-Cox transformation, if the normality tests indicate non-normal distributions. This helps stabilize the variance and normalize the data. We then conducted a regression analysis for predictive modeling that includes (i) Model Summary: Providing R-squared values to explain the variance in mortality rates accounted for by the predictors. (ii) Analysis of Variance (ANOVA) was used to test the overall significance of the regression model, indicating whether the set of environmental factors together significantly predicted the mortality rates. (iii) Coefficients: Examining the beta coefficients of individual predictors to interpret their specific impact on mortality rates. Significance testing (using t-tests) was used to determine whether these effects were statistically reliable. (iv) Residual analysis: This involves assessing residuals (differences between observed and predicted values) to evaluate the model's accuracy and the assumption of homoscedasticity (constant variance). Finally, the statistical analysis concludes with the interpretation of significant findings, relating the statistical results to existing theories and literature, and discussing the implications of environmental conditions on public health.

Ethical statement

This study used secondary data sources and all ethical guidelines were followed by the United Nations World Population Prospects (UNWPP) death rate and NASA power data access viewer data.

3. Results

Descriptive statistics

Firstly, descriptive statistics provide quantitative summaries of the measured variables (**Table 1**). Descriptive statistics were used to analyze the relationship between environmental factors and mortality rates, covering a wide geographical area and meteorological variables for each continent between 1981 and 2021, including surface pressure, earth skin temperature, relative humidity, wind speed, temperature, sky clearness, and precipitation.

Table 1: Descriptive measures of environmental factors and mortality rates in different continents worldwide.

Continent	Env. Variables	Mean	Std. Deviation	Min.	Max.	Kewness	Kurtosis
Asian	No. of Death	8.36	2.97	5.44	36.54	2.80	17.22
	Surface Pressure (kPa)	95.93	5.50	81.28	100.97	-1.49	1.23
	Earth Skin Temp.(°C)	22.04	8.06	0.47	29.77	-1.31	0.40
	Rel. Humidity (%)	68.35	13.63	31.88	86.36	-0.88	-0.29
	Wind-Speed (m/s)	3.28	0.98	1.97	6.34	0.89	0.31
	Temperature Max.(°C)	37.06	5.46	27.32	48.81	0.11	-1.04
	Temperature Min.(°C)	6.33	14.88	-33.11	26.64	-0.84	-0.11
	Sky Clearness	72.60	0.05	0.43	0.64	-0.04	-0.38
	Precipitation(mm)	3.58	2.29	0.30	12.87	0.78	0.35
African	No. of Death	10.81	4.05	4.72	20.45	0.61	-0.58
	Surface Pressure (kPa)	95.37	5.45	81.81	101.28	-1.02	0.13
	Earth Skin Temp.(°C)	24.02	4.15	11.99	31.68	-0.72	0.59
	Rel. Humidity (%)	64.25	13.77	29.19	88.18	-0.54	-0.48
	Wind-Speed (m/s)	3.75	1.11	1.54	6.43	0.03	-0.36
	Temperature Max.(°C)	37.10	4.81	27.53	45.87	-0.28	-0.90
	Temperature Min.(°C)	10.72	7.10	-12.70	24.60	-0.35	-0.12

	Sky Clearness	0.56	0.07	0.43	0.69	-0.54	-0.59
	Precipitation(mm)	2.27	1.46	0.03	7.99	0.34	-0.72
North American	No. of Death	6.66	1.80	4.44	11.49	0.85	-0.01
	Surface Pressure (kPa)	96.33	2.19	93.31	98.62	-0.46	-1.51
	Earth Skin Temp.(°C)	26.49	1.72	22.87	30.01	-0.36	-0.86
	Rel. Humidity (%)	72.06	4.89	59.79	82.25	-0.19	-0.47
	Wind-Speed (m/s)	3.51	0.88	2.23	5.12	0.13	-1.21
	Temperature Max.(°C)	36.63	1.12	33.90	39.96	0.21	0.34
	Temperature Min.(°C)	16.21	2.41	11.40	20.35	-0.20	-1.06
	Sky Clearness	0.55	0.04	0.43	0.61	-1.50	2.54
	Precipitation(mm)	2.82	1.37	0.55	7.66	0.67	0.41
Oceanian	No. of Death	7.56	2.12	4.24	12.97	0.56	-0.46
	Surface Pressure (kPa)	98.57	3.22	92.99	101.01	-1.09	-0.72
	Earth Skin Temp.(°C)	27.06	2.08	23.22	30.05	-0.58	-1.08
	Rel. Humidity (%)	81.12	2.64	74.15	86.72	0.21	-0.37
	Wind-Speed (m/s)	4.46	1.40	2.25	6.80	-0.30	-1.15
	Temperature Max.(°C)	29.82	0.80	27.63	32.31	0.43	0.45
	Temperature Min.(°C)	22.31	3.07	16.61	26.78	-0.25	-1.37
	Sky Clearness	0.54	0.05	0.43	0.66	0.14	0.21
	Precipitation(mm)	5.08	1.92	0.56	10.68	-0.31	-0.05
European	No. of Death	12.86	1.94	10.20	16.27	0.53	-1.36
	Surface Pressure (kPa)	99.84	0.24	99.43	100.20	0.00	-1.59
	Earth Skin Temp.(°C)	9.33	1.27	6.21	12.16	-0.05	-0.22
	Rel. Humidity (%)	74.65	3.52	65.87	82.93	-0.44	0.03
	Wind-Speed (m/s)	4.17	0.19	3.81	4.69	0.19	-0.42
	Temperature Max.(°C)	35.29	2.23	30.00	40.54	-0.08	-0.38
	Temperature Min.(°C)	-20.93	4.80	-31.58	-8.34	-0.08	-0.26
	Sky Clearness	0.49	0.03	0.43	0.54	-0.65	0.15
	Precipitation(mm)	1.50	0.25	0.91	2.28	0.10	0.80
Overall	No. of Death	9.42	3.70	4.24	36.54	1.21	2.17
	Surface Pressure (kPa)	96.18	5.11	81.28	101.28	-1.41	1.29
	Earth Skin Temp.(°C)	23.08	6.59	0.47	31.68	-1.50	1.52
	Rel. Humidity (%)	68.47	13.23	29.19	88.18	-0.94	0.08
	Wind-Speed (m/s)	3.66	1.11	1.54	6.80	0.35	-0.44
	Temperature Max.(°C)	36.23	5.04	27.32	48.81	0.13	-0.92
	Temperature Min.(°C)	9.17	13.10	-33.11	26.78	-1.23	1.04
	Sky Clearness	0.54	0.06	0.43	0.69	-0.12	-0.57
	Precipitation(mm)	3.01	2.04	0.03	12.87	0.89	0.72

The study of global mortality rates reveals considerable diversity, with a mean of 9.42 deaths per 1000 individuals, ranging from a minimum of 4.24 to a maximum of 36.54, and indicating considerable health consequences influenced by diverse environmental factors (**Table 1**). The data presents a right-skewed distribution (skewness = 1.21), suggesting a prevalence of lower mortality rates globally, while the high kurtosis (2.17) identifies exceptional outlier regions with exceptionally high rates. The study further indicates that environmental factors play a significant role in shaping health outcomes. Globally, the average surface pressure is 96.18 kPa, with negative skewness (-1.41), ranging from 81.28 to 101.28 kPa. The average temperature across the regions is 23.08°C, with a broad range from 0.47° to 31.68°C, predominantly higher (skewness = -1.50). The relative humidity average is 68.47%, with most regions experiencing higher humidity (skewness = -0.94), ranging from 29.19 to 88.18%. Wind speed averages 3.66 m/s, with a slight positive skew (0.35) towards higher speeds, ranging from 1.54 to 6.80 m/s. Precipitation is generally low across regions, averaging 3.01 mm/day, with a positive skew (0.89) indicating lower precipitation levels, ranging from 0.03 to 12.87 mm/day. Sky clearness and precipitation vary significantly, impacting local climates and potentially influencing health through mechanisms like solar exposure and hydration availability. In the Asian and African continents, which exhibit signific-

ant outliers in mortality rates (mean = 8.36, kurtosis = 17.22), there are variable environmental conditions, and the average mortality rates are higher (10.81 per 1000), with consistent yet harsh environmental conditions, with less variability in temperature and humidity (**Table 1**).

In North American, Oceanian, and European continents that have the lowest variability in mortality rates (mean = 6.66 per 1000), correlated with stable environmental conditions, display moderate variability in mortality rates (mean = 7.56 per 1000) and environmental factors, including relatively high humidity (81.12%) and reports stable and higher mortality rates (mean = 12.86 per 1000) with consistently more excellent environmental conditions, indicating a potential impact on health stability. This analysis underscores the critical influence of environmental factors on mortality rates across different global regions.

Table 2: Normality test of the dependent variables in different continents worldwide.

	Kolmogorov-Smirnova		Shapiro-Wilk	
Tests of Normality	**Statistic**	**p-value**	**Statistic**	**p-value**
No. of death	0.108	0.000	0.902	0.000
a Lilliefors Significance Correction				

The results of normality testing on mortality rates per 1000 population across different continents reveal substantial departures from a normal distribution. Both the Kolmogorov-Smirnov test ($D = 0.108$, $p < 0.001$) and the Shapiro-Wilk test ($W = 0.902$, $p < 0.001$) decisively reject the null hypothesis of normality. These findings indicate the existence of skewness or kurtosis, implying that certain regions have exceptionally high or low mortality rates compared to the global average. Given the non-normal distribution, it is essential to employ non-parametric methods in the analysis of these data to account for potential outliers and the asymmetrical distribution of values (**Table 2**).

Table 3: Spatial comparison of correlation between environmental factors and mortality rates in different continents worldwide.

Correlations			Surface Pressure	Earth Skin Temp	Rel. Humidity	Wind-Speed	Temper-ature Max	Temper-ature Min	Sky Clearness	Precipitation
Asian	Kendall's tau_b	No. of Death	-.298**	-.198**	-.281**	-.284**	.144**	-.263**	.063*	-.276**
		p-value (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.024	0.000
	Spearman's rho	No. of Death	-.413**	-.294**	-.444**	-.442**	.222**	-.399**	.091*	-.431**
		p-value (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.03	0.000
African	Kendall's tau_b	No. of Death	-.367**	-0.02	-0.011	-.403**	-.089**	-0.012	-.220**	.297**
		p-value (2-tailed)	0.000	0.436	0.651	0.000	0.000	0.649	0.000	0.000
	Spearman's rho	No. of Death	-.539**	-0.021	-0.021	-.598**	-.133**	-0.012	-.344**	.448**
		p-value (2-tailed)	0.000	0.582	0.586	0.000	0.000	0.757	0.000	0.000
North American	Kendall's tau_b	No. of Death	0.002	.227**	-.433**	.137*	-.128*	0.107	.313**	-.371**
		p-value (2-tailed)	0.979	0.000	0.000	0.025	0.036	0.08	0.000	0.000
	Spearman's rho	No. of Death	0.046	.322**	-.600**	.219*	-.203*	0.159	.353**	-.547**
		p-value (2-tailed)	0.617	0.000	0.000	0.015	0.024	0.078	0.000	0.000
Oceanian	Kendall's tau_b	No. of Death	-0.079	-.293**	.147**	-.344**	-.345**	-.217**	-0.017	-0.094

		p-value (2-tailed)	0.136	0.000	0.005	0.000	0.000	0.000	0.747	0.075
	Spearman's rho	No. of Death	-0.14	-.377**	.260**	-.517**	-.498**	-.276**	-0.067	-0.133
		p-value (2-tailed)	0.075	0.000	0.001	0.000	0.000	0.000	0.391	0.089
European	Kendall's tau_b	No. of Death	-.546**	-.224**	.318**	.283**	-0.117	-.194**	0.11	.270**
		p-value (2-tailed)	0.000	0.003	0.000	0.000	0.121	0.01	0.146	0.000
	Spearman's rho	No. of Death	-.747**	-.334**	.450**	.480**	-0.196	-.286**	0.172	.373**
		p-value (2-tailed)	0.000	0.002	0.000	0.000	0.077	0.009	0.123	0.001
Overall	Kendall's tau_b	No. of Death	-.244**	-.170**	-.158**	-.235**	.056**	-.221**	-.074**	-.076**
		p-value (2-tailed)	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
	Spearman's rho	No. of Death	-.359**	-.262**	-.245**	-.350**	.090**	-.330**	-.116**	-.134**
		p-value (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The relationships between mortality rates and environmental factors across various regions have been identified using Kendall's tau-b and Spearman's rho correlation tests, which have revealed significant correlations that shed light on the impact of the environment on public health across different continents worldwide (**Table 3**). Although most factors displayed negligible correlations with mortality rates, wind speed displayed a strong negative correlation (tau_b = -0.403, rho = -0.598), and precipitation showed a notable positive correlation (tau_b = 0.297, rho = 0.448). Additionally, relative humidity and wind speed showed a significant correlation with mortality rates, with relative humidity displaying a robust negative correlation (tau_b = -0.433, rho = -0.600) in both African and North American continents. Wind speed and maximum temperature both demonstrated strong negative correlations with mortality rates (tau_b = (-0.344 ± -0.345), rho = (-0.517 ± -0.498)), highlighting that harsher wind conditions and cooler maximum temperatures might elevate mortality rates. Furthermore, surface pressure showed the strongest negative correlation with mortality rates (tau_b = -0.546, rho = -0.747), whereas relative humidity exhibited positive correlations, indicating that higher pressure and humidity levels could be beneficial in both Oceanian and European continents (**Table 3**).

Across all continents, the correlations revealed that higher surface pressures and cooler temperatures generally correlated with lower mortality rates, while higher maximum temperatures slightly increased mortality rates. Additionally, higher wind speeds and more precipitation generally correlated with beneficial outcomes. Finally, across all continents, the correlations revealed that higher surface pressures and cooler temperatures generally correlated with lower mortality rates.

Table 4: Tests of Normality by using inverse distribution function in different continents worldwide.

Continents	Dependent Variable	Kolmogorov-Smirnova		Shapiro-Wilk	
		Statistic	p-value	Statistic	p-value
Asian	No. of Death	0.003	.200*	1	1
African	No. of Death	0.003	.200*	1	1
North American	No. of Death	0.009	.200*	0.998	1
Oceanian	No. of Death	0.008	.200*	0.999	1
European	No. of Death	0.018	.200*	0.997	1

* This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The mortality rates across five continents were analyzed using the Kolmogorov-Smirnov and Shapiro-Wilk tests to determine if the data conformed to a normal distribution (**Table 4**). From the Kolmogorov-Smirnov Test Results, both the Asian and African continents displayed a Kolmogorov-Smirnov statistic of 0.003 (p-value = 0.200), indicating that the data did not significantly deviate from a normal distribution. The North American and Oceania continents reported similar statistics (0.009 and 0.008, respectively), both with a p-value of 0.200, further supporting the normality of the mortality rates. The European continent displayed the highest statistical significance value (0.018), but it also maintained a p-value of 0.200, suggesting that the mortality rates are generally distributed despite a slightly higher deviation from the norm compared to other continents. On the other hand, from the Shapiro-Wilk Test Results, it was found that the Asian, African, North American, and Oceanian populations showed near-perfect test results, with statistics ranging from 0.998 ± 1 and p-values of 1, indicating a solid adherence to a normal distribution.

The results from both tests across all continents consistently suggest that mortality rates are normally distributed (**Table 4**). This normality across diverse geographic and demographic landscapes implies that the basic assumptions necessary for many parametric statistical analyses are met. The uniformity and non-significance of the p-values, especially highlighted by the near-perfect results of the Shapiro-Wilk test, underscore the robustness of the mortality data distribution.

Table 5: Regression coefficients of mortality rates and environmental factors by using inverse distribution function in different continents worldwide.

Continents	Variables	Unstandardized Beta	Standardized Beta	Std. Error	t-value	p-value	95.0% CI	
Asia	Intercept	28.141		3.864	7.283	0.00	20.551	35.731
	Surface Pressure (kPa)	-0.024	-0.044	0.057	-0.414	0.679	-0.136	0.088
	Earth Skin Temp.(°C)	-0.236	-0.64	0.124	-1.903	0.058	-0.48	0.008
	Rel. Humidity (%)	-0.057	-0.262	0.024	-2.341	0.02	-0.105	-0.009
	Wind-Speed (m/s)	-0.843	-0.277	0.156	-5.401	0.000	-1.15	-0.537
	Temperature Max.(°C)	0.068	0.125	0.085	0.8	0.424	-0.099	0.236
	Temperature Min.(°C)	0.133	0.663	0.066	2.006	0.045	0.003	0.262
	Sky Clearness	-15.249	-0.261	2.87	-5.313	0.000	-20.887	-9.611
	Precipitation(mm)	-0.269	-0.207	0.093	-2.888	0.004	-0.452	-0.086
Africa	Intercept	37.127		4.343	8.549	0.000	28.6	45.654
	Surface Pressure (kPa)	-0.221	-0.298	0.035	-6.308	0.000	-0.29	-0.152
	Earth Skin Temp.(°C)	1.19	1.219	0.165	7.221	0.000	0.866	1.513
	Rel. Humidity (%)	0.065	0.222	0.028	2.367	0.018	0.011	0.12
	Wind-Speed (m/s)	-1.808	-0.494	0.203	-8.905	0.000	-2.207	-1.41
	Temperature Max.(°C)	-0.464	-0.55	0.073	-6.312	0.000	-0.608	-0.319
	Temperature Min.(°C)	-0.695	-1.219	0.107	-6.489	0.000	-0.905	-0.485
	Sky Clearness	-10.866	-0.186	2.446	-4.442	0.000	-15.67	-6.063
	Precipitation(mm)	-0.211	-0.076	0.192	-1.104	0.27	-0.588	0.165
North America	Intercept	-55.966		22.182	-2.523	0.013	-99.909	-12.023
	Surface Pressure (kPa)	1.7	2.063	0.303	5.618	0.000	1.101	2.3
	Earth Skin Temp.(°C)	-0.989	-0.944	0.391	-2.527	0.013	-1.764	-0.214
	Rel. Humidity (%)	-0.491	-1.333	0.075	-6.545	0.000	-0.64	-0.343
	Wind-Speed (m/s)	-2.864	-1.398	0.458	-6.258	0.000	-3.77	-1.957
	Temperature Max.(°C)	-0.492	-0.306	0.122	-4.017	0.000	-0.734	-0.249
	Temperature Min.(°C)	-0.061	-0.082	0.11	-0.555	0.58	-0.28	0.157
	Sky Clearness	-19.076	-0.457	2.368	-8.057	0.000	-23.766	-14.385
	Precipitation(mm)	-0.019	-0.014	0.167	-0.112	0.911	-0.349	0.311
Oceanian	Intercept	-63.053		28.082	-2.245	0.026	-118.53	-7.581
	Surface Pressure (kPa)	1.44	2.185	0.253	5.686	0.000	0.94	1.94
	Earth Skin Temp.(°C)	-1.726	-1.69	0.439	-3.93	0.000	-2.593	-0.858

	Rel. Humidity (%)	0.005	0.007	0.105	0.052	0.959	-0.203	0.214
	Wind-Speed (m/s)	-2.715	-1.785	0.297	-9.147	0.000	-3.301	-2.128
	Temperature Max.(°C)	-0.476	-0.18	0.232	-2.051	0.042	-0.934	-0.017
	Temperature Min.(°C)	0.301	0.436	0.197	1.527	0.129	-0.088	0.691
	Sky Clearness	-5.77	-0.149	2.396	-2.408	0.017	-10.502	-1.037
	Precipitation(mm)	-0.468	-0.424	0.083	-5.648	0.000	-0.632	-0.304
European	Intercept	549.105		101.96	5.386	0.000	345.91	752.305
	Surface Pressure (kPa)	-5.634	-0.693	0.955	-5.902	0.000	-7.537	-3.732
	Earth Skin Temp.(°C)	0.103	0.067	0.227	0.451	0.653	-0.35	0.556
	Rel. Humidity (%)	0.109	0.198	0.088	1.237	0.22	-0.067	0.285
	Wind-Speed (m/s)	0.97	0.095	1.105	0.878	0.383	-1.233	3.173
	Temperature Max.(°C)	-0.06	-0.069	0.096	-0.63	0.53	-0.252	0.131
	Temperature Min.(°C)	0.001	0.003	0.037	0.036	0.972	-0.072	0.075
	Sky Clearness	32.473	0.45	5.977	5.433	0.000	20.561	44.385
	Precipitation(mm)	-0.359	-0.046	0.793	-0.453	0.652	-1.94	1.222
Overall	Intercept	39.441		2.462	16.02	0.000	34.612	44.27
	Surface Pressure (kPa)	-0.142	-0.197	0.027	-5.271	0.000	-0.195	-0.089
	Earth Skin Temp.(°C)	0.478	0.853	0.075	6.393	0.000	0.332	0.625
	Rel. Humidity (%)	-0.033	-0.118	0.015	-2.141	0.032	-0.063	-0.003
	Wind-Speed (m/s)	-0.993	-0.299	0.105	-9.468	0.000	-1.199	-0.787
	Temperature Max.(°C)	-0.302	-0.411	0.044	-6.874	0.000	-0.388	-0.216
	Temperature Min.(°C)	-0.242	-0.859	0.037	-6.527	0.000	-0.315	-0.169
	Sky Clearness	-12.981	-0.216	1.773	-7.323	0.000	-16.458	-9.504
	Precipitation(mm)	-0.425	-0.234	0.061	-6.95	0.000	-0.546	-0.305
a. Dependent Variable: Death Rate Per 1000: b. Significance. codes: 0 ‘***’ .001 ‘**’ .01 ‘*’ .05 ‘’. .1 ‘’ 1								

The environmental indicators' diverse characteristics are crucial for examining the connection between environmental factors and mortality rates across various continents of the world. This study identified key meteorological indicators that significantly influenced both environmental factors and mortality rates. The outcomes are presented in (**Table 5**), revealing that regression analyses can be employed to quantify the impact of environmental variables on mortality rates across different continents. In the Asian continent, wind speed demonstrated a substantial negative impact on mortality rates (β = -0.843, $p < 0.001$), suggesting that higher wind speeds are connected with lower mortality rates. Sky clearness also had a significant negative effect ($\beta = -15.249$, $p < 0.001$), indicating that clearer skies contribute to higher mortality rates in this region. Relative humidity and precipitation were negatively associated with mortality rates, with p-values of 0.02 and 0.004, respectively, showing that higher humidity and precipitation levels correlate with lower mortality. In the African continent, wind speed had a profound negative association with mortality rates ($\beta = -1.808$, $p < 0.001$). Both the surface pressure and temperature max demonstrated substantial negative impacts ($\beta = -0.221$ and $\beta = -0.464$, respectively, both $p < 0.001$), suggesting that higher pressures and lower maximum temperatures are beneficial, as shown in Table 5. In the North American continent, wind speed again showed a significant negative correlation with mortality rates (β = -2.864, $p < 0.001$). Relative humidity displayed a robust negative relationship (β = -0.491, $p < 0.001$), indicating that drier conditions are associated with higher mortality rates. In the Oceanian continent, wind speed was negatively correlated with mortality (β = -2.715, $p < 0.001$). Earth-skin temperature had a significant negative impact (β = -1.726, p = 0.00), indicating that cooler skin temperatures may reduce mortality rates. In the European continent, sky clearness showed a positive impact on reducing mortality rates (β = 32.473, p = 0.00), in contrast with findings from other continents. Surface pressure had a significant negative impact (β = -5.634, p = 0.00), aligning with the trend that higher atmospheric pressure correlates with lower mortality rates.

Numerous environmental factors have a substantial impact on death rates across continents, including wind speed, sky clarity, and surface pressure. The complicated interaction between climatic conditions

and public health is reflected in the variability of these impacts. Because wind speed and relative humidity have such a large impact, programs meant to improve the environment should concentrate on these variables. The powerful correlations shown by statistically significant results underscore the necessity for locally customized environmental policies and health interventions, which should be incorporated into global public health plans.

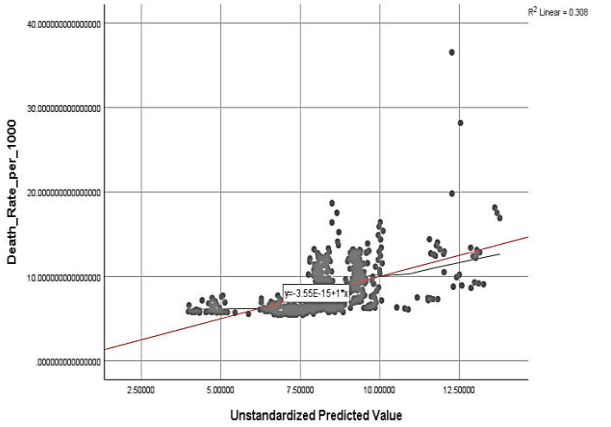

Fig. 1: Regression line for the Asian Continent.

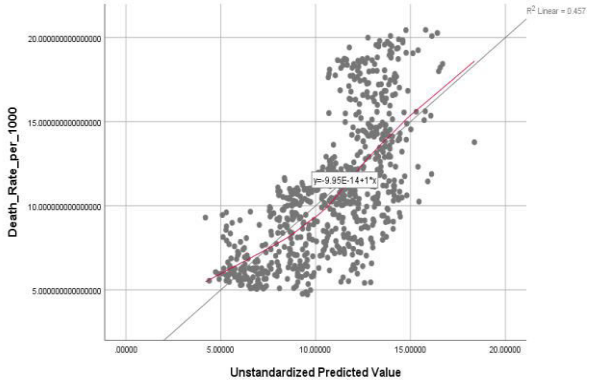

Fig. 2: Regression line for the African Continent.

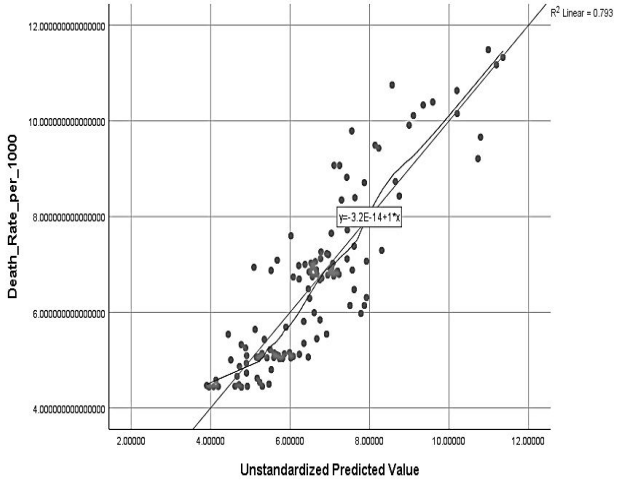

Fig. 3: Regression line for the North American Continent.

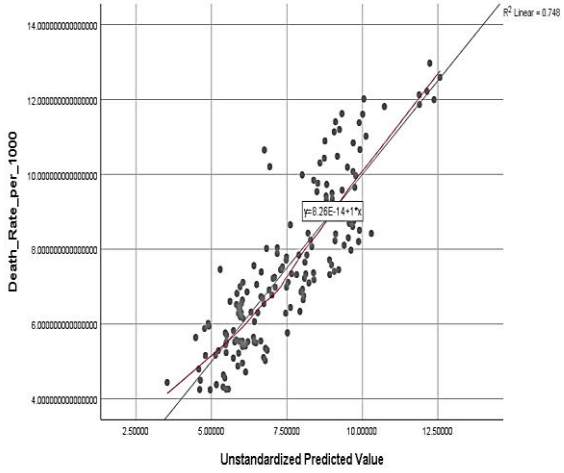

Fig. 4: Regression line for the Oceanian Continent.

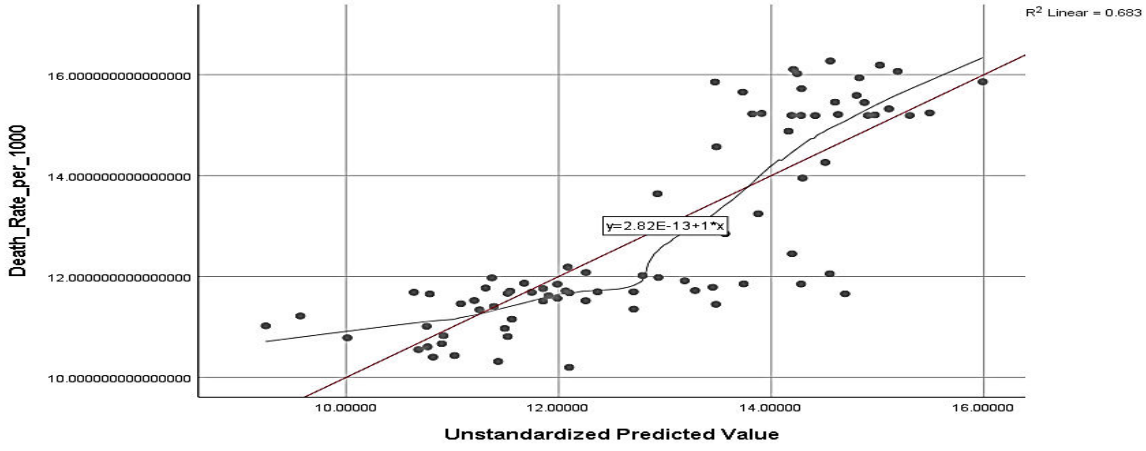

Fig. 5: Regression line for the European Continent.

The relationship between wind speed and mortality rates reveals a significant negative correlation (β = -0.843, $p < 0.001$), indicating that increased wind speeds may be advantageous, possibly due to improved air quality (as shown in **Fig. 1**). The impact of sky clearness is substantially negative (β = -15.249, $p < 0.001$), indicating that clearer skies correspond to higher mortality rates, potentially because of increased UV exposure. In **Fig. 2**, the negative correlation between wind speed and mortality is again apparent (β = -1.808, $p < 0.001$). Both surface pressure and maximum temperature display protective effects against mortality, with very significant p-values ($p < 0.001$). A decline in wind speed is significantly associated with decreased mortality (β = -2.864, $p < 0.001$) (as shown in **Fig. 3**). Moreover, relative humidity exhibits a negative correlation (β = -0.491, $p < 0.001$), suggesting that lower humidity levels are connected to increased mortality rates. The figure below illustrates the negative slopes for both variables, accompanied by annotations highlighting the significant p-values, emphasizing their impact on mortality. Both variables are negatively correlated with mortality, with wind speed (β = -2.715, $p < 0.001$) and earth skin temperature (β = -1.726, $p < 0.001$), indicating that better conditions and increased wind speeds are advantageous (as depicted in **Fig. 4**). This figure depicts the negative slopes for both variables, along with p-values indicating statistical significance. In Europe, sky clearness has a positive impact on mortality reduction (β = 32.473, $p < 0.001$) (as shown in **Fig. 5**). High surface pressure is correlated with lower mortality rates (β = -5.634, $p < 0.001$). This figure displays a positive slope for sky clearness and a negative slope for surface pressure, each with statistically significant p-values.

4. Discussion

In our analyses, we primarily identified positive correlations between environmental factors and mortality rates, which encompass a comprehensive geographical scope, covering different continents such as (Asian, African, North American, Oceanian, and European). This study showed that the global mortality rates show considerable variability, with a global mean of 9.42 deaths per 1000, ranging widely from. This reflects significant differences in health outcomes influenced by varying environmental conditions. Our findings align with prior research indicating significant correlations between air pollutants and mortality (L. Dai, A. Zanobetti, P. Koutrakis, 2014). Asian and African continents show significant outliers in mortality rates with variable environmental conditions and exhibit higher average mortality rates and consistent yet harsh environmental conditions, with less variability in temperature and humidity.

In North American, Oceanian, and European, continents that have the lowest variability in mortality rates correlated with stable environmental conditions display moderate variability in mortality rates and environmental factors, including relatively high humidity, and reported stable and higher mortality rates with consistently more excellent environmental conditions, indicating a potential impact on health stability. While most factors showed negligible correlations with mortality rates, wind speed displayed a strong negative correlation, precipitation showed a notable positive correlation, relative humidity, and wind speed showed significant correlations with mortality rates, with relative humidity showing a robust negative correlation in both African and North American continents. It also shows that wind speed and maximum temperature both demonstrated strong negative correlations with mortality rates, highlighting that harsher wind conditions and cooler maximum temperatures might elevate mortality rates. A prior analysis also found that the correlations between fine particulate matter and mortality were more pronounced in regions characterized by arid climates than in other areas (Zanobetti & Schwartz, 2009a). Therefore, it is conceivable that the convergence of arid climate zones and environmental quality imposed a significant environmental burden on mortality; the underlying mechanisms warrant further investigation (Genowska *et al*., 2015; Patel *et al*., 2018).

These adverse associations indicate counterintuitive findings, implying that poorer environmental quality correlates with reduced mortality rates. The surface pressure showed the strongest negative correlation with mortality rates, while relative humidity exhibited positive correlations, indicating that higher pressure and humidity levels could be beneficial in both

Oceanian and European continents. Conversely, higher maximum temperatures slightly increase mortality rates, while higher wind speeds and more precipitation generally correlate with beneficial outcomes.

Finally, across all continents, the correlations revealed that higher surface pressures and cooler temperatures generally correlated with lower mortality rates(Saikat *et al*., 2020). This study reveals that regression analyses were conducted to quantify the impact of environmental variables on mortality rates across different continents. In the Asian continent, wind speed has shown a substantial negative impact on mortality rates, indicating that higher wind speeds are associated with lower mortality rates(Parvej *et al*., 2020). Sky clearness also had a significant negative effect, suggesting that clearer skies contributed to higher mortality rates in this region. Relative humidity and precipitation were negatively associated with mortality rates, respectively, indicating that higher humidity and precipitation levels were correlated with lower mortality (M. R. Hossain *et al*., 2020). In Africa, wind speed has a profound negative association with mortality rates. Surface pressure and maximum temperature both demonstrated substantial negative impacts, indicating that higher pressures and lower maximum temperatures are beneficial (M. Hossain *et al*., 2025).

In the North American continent, wind speed again showed a significant negative correlation with mortality rates. Relative humidity displayed a robust negative relationship, suggesting that drier conditions are associated with higher mortality rates(Dey *et al*., 2024b). In the Oceania continent, wind speed was significantly negatively correlated with mortality. Earth's skin temperature had a significant negative impact, indicating that cooler skin temperatures may reduce mortality rates. In the European continent, sky clearness had shown a positive impact on reducing mortality rates, in contrast with findings from other continents. Surface pressure had a significant negative impact, aligning with the trend that higher atmospheric pressure correlates with lower mortality rates. The results of the current study on the Asian continent indicate that higher wind speeds are linked to reduced mortality rates, as wind speed had a significant negative impact on mortality rates ($\beta = -0.843$, $p < 0.001$). Air was shown to have the strongest correlations with mortality from all causes, heart disease, and cancer, whereas the sociodemographic index showed the most correlation with mortality from stroke (Demiessie *et al*., 2021). There was no discernible gradient trend throughout the urbanicity gradient. Larger connections were typically reported in dry areas for both the overall EQI and domain indices. The associations varied between climate regions, ranging from 2.29% (95% CI: 1.87%, 2.72%) to 5.30% (95% CI: 4.30%, 6.30%) for the overall EQI (Mohammad Omar Faruk *et al*., 2025; States, 2017).

A limitation of the analysis was its ecological design and cross-sectional approach. In this investigation, we examined the relationship between environmental factors from 1981 to 2021 and mortality rates observed during the same timeframe. We consider this emphasis on cross-sectional associations to be appropriate, given the short-term correlations between environmental quality and mortality documented in numerous previous studies, particularly those examining air quality (Ayana *et al*., 2016; Md. Rasel Hossain *et al*., 2025; Sayeed *et al*., 2021). Furthermore, if the overall environmental quality at the continental level remained relatively stable, such that the environmental factors from 1981 to 2021 also represented the continent's environmental conditions in preceding years, the associations identified in this study may be extrapolated to the health effects of environmental quality beyond the observed period. An assessment incorporating present environmental conditions and delayed mortality rates may uncover the long-term impacts.

Therefore, despite its limitations, we considered this approach to be the most suitable for this exploratory analysis. A significant asset of this study was the utilization of environmental factors to depict overall environmental quality. Compared with prior studies that used single exposures, incorporating environmental factors was more effective at capturing the health effects attributable to cumulative environmental exposure. These continents also offer a framework for comparing the health effects associated with various facets of environmental quality. To the best of our

knowledge, this represents the initial investigation into the cumulative environmental impacts on mortality. Compared to studies limited to a smaller spatial scale and those conducted at the national level without accounting for spatial heterogeneity, this study has the potential to reveal variations in environmental impacts on mortality, thereby providing valuable insights for prioritizing efforts to address environmental issues.

5. Conclusion

Mortality rates are greatly impacted by environmental factors. Developing and executing public health initiatives targeted at lowering these risks is made easier by a better understanding of how environmental factors affect mortality. It is essential to research the relationship between environmental factors and mortality to improve public health, inform policy, prevent disease, advance health equity, and guarantee sustainable development. With the backdrop of a changing environment, it offers the essential knowledge to preserve human health. This research will facilitate international collaboration and global health programs to effectively tackle these issues.

6. Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

7. Author Contributions

M.R.H.: participated in this study through the design phase and in data acquisition, cleaning, and analysis. M.R.H.; M.O.R.A.: participated in the analysis and interpretation of data, as well as in the drafting and revision of the manuscript. M.R.H.: participated in the oversight of the final manuscript. All authors have reviewed and approved the final manuscript.

8. Acknowledgment

We are very much grateful to the United Nations World Population Prospects (UNWPP), United Nations Projection (UNP) and NASA Power Data Access Viewer (NASAPDAV) Program for providing their data.

9. Conflicts of interest

The authors declared that they have no conflict of interest regarding this paper.

10. References

Ahmad T, Uddin ME, and Hossain I. (2018). Evaluation of Microbial and Physiochemical Properties of Three Selected Lakes Water in Dhaka City, Bangladesh. *Scholars Academic J. of Biosciences*, **6**(2), 230-238. https://doi.org/10.21276/sajb.2018.6.2.17

Ayana, E., Ceccato, P., & Defries, R. (2016). Examining the relationship between environmental factors and conflict in pastoralist areas of East Africa. *Science of The Total Environment*, 557–558, 601–611. https://doi.org/10.1016/j.scitotenv.2016.03.102

Baharom, M., Ahmad, N., & Tangang, F. (2021). The impact of meteorological factors on communicable disease incidence and its projection: A systematic review. In *Inter J. of Environmental Research and Public Health*. https://doi.org/10.3390/ijerph182111117

Basu, R., & Samet, J. M. (2002). Relation between elevated ambient temperature and mortality: A review of the epidemiologic evidence. In *Epidemiologic Reviews*. https://doi.org/10.1093/epirev/mxf007

Boyles, A. L., Beverly, B. E., & Chandler, K. J. (2021). Environmental Factors Involved in Maternal Morbidity and Mortality. *J. of Women's Health*. https://doi.org/10.1089/jwh.2020.8855

Bunker, A., Wildenhain, J., & Sauerborn, R. (2016). Effects of Air Temperature on Climate-Sensitive Mortality and Morbidity Outcomes in the Elderly; a Systematic Review and Meta-analysis of Epidemiological Evidence. *EBioMedicine*. https://doi.org/10.1016/j.ebiom.2016.02.034

Choi, S. H., Lee, S. W., & Kim, N. H. (2007). Effects of atmospheric temperature and humidity on outbreak of diseases. *EMA - Emergency Medicine Australasia*. https://doi.org/10.1111/j.1742-6723.2007.01000.x

Chowdhury, M. I., Hossain, M. R., & Arefin, M. S. (n.d.). An Assessment on the Prospect of Gig Economy to Create Employment Opportunity.

Demiessie, H. G., Hossain, M. R., & Shirin, S. (2021). The gateway to well-being and happiness: Re-

defining individualism, voluntary simplicity and civilization. *Asian J. Soc. Sci. Leg. Stud*, **3**(3), 59–74.

Dey, S., Zahangir, M. S., & Hossain, Md. R. (2024a). Prevalence and determinants of malnutrition among women of reproductive age in Bangladesh. *J. of Medicine, Surgery, and Public Health*, **2**, 100096. https://doi.org/10.1016/j.glmedi.2024.100096

Dey, S., Zahangir, M. S., Faruk, M. O., & Hossain, Md. R. (2024b). Prevalence and determinants of malnutrition among women of reproductive age in Bangladesh. *Journal of Medicine, Surgery, and Public Health*, **2**, 100096. https://doi.org/10.1016/j.glmedi.2024.100096

Dimitrova, A., McElroy, S., & Benmarhnia, T. (2022). Precipitation variability and risk of infectious disease in children under 5 years for 32 countries: A global analysis using Demographic and Health Survey data. *The Lancet Planetary Health*. https://doi.org/10.1016/S2542-5196(21)00325-9

Elhassan S, Miskeen E, & Umbelle T. (2023). Maternal mortality review, an open window on the experience of safe motherhood in low-resource countries, *Eur. J. Med. Health Sci*., **5**(3), 39-46. https://doi.org/10.34104/ejmhs.023.039046

Fang, W., Li, Z., & Ma, W. (2023). The joint and interaction effect of high temperature and humidity on mortality in China. *Environment International*, **171**(1), 107669. https://doi.org/10.1016/j.envint.2022.107669

Gasparrini, A., Guo, Y., & Armstrong, B. (2015). Mortality risk attributable to high and low ambient temperature: A multicountry observational study. *The Lancet*. https://doi.org/10.1016/S0140-6736(14)62114-0

Genowska, A., Jamiołkowski, J., & Pająk, A. (2015). Environmental and socio-economic determinants of infant mortality in Poland: An ecological study. *Environmental Health*, **14**(1), 61. https://doi.org/10.1186/s12940-015-0048-1

Goggins, W. B., Chan, E. Y. Y., & Chen, L. (2012). Effect modification of the association between short-term meteorological factors and mortality by urban heat islands in Hong Kong. *PLoS ONE*. https://doi.org/10.1371/journal.pone.0038551

Hossain, M., Hossain, K., & Shuvo, T. A. (2025). Factors Associated with Domestic Violence Among Jordanian Women: Evidence from a Cross-Sectional Study in 2023. https://doi.org/10.34104/ajssls.025.04120433

Hossain, M. R., Haque, A., & Rana, M. S. (2020). Measuring Co-Movement of Real Interest Rate and Inflation Rate: Using VEC Approach. *Management Research*, **7**(6), 66–76. https://www.academia.edu/download/63733479/06_IJETMR20_A05_210420200624-18259-44g8sw.pdf

Islam MM, Noor FN, and Hasan MR. (2022). Risk factors for under-five child mortality: evidence from Bangladesh multiple indicator cluster survey (MICS) 2019. *Eur. J. Med. Health Sci*., **4**(3), 79-90. https://doi.org/10.34104/ejmhs.022.079090

Islam, M. S., Rony, M. A. T., & El-Shafai, W. (2025). Zero-BertXGB: A Novel Technique for Abstract Classification in Systematic Reviews. *IEEE Access*. https://ieeexplore.ieee.org/abstract/document/10845770/

Krall, J. R., Brooke Anderson, G., & Peng, R. D. (2013). Short-term exposure to particulate matter constituents and mortality in a national study of U.S. urban communities. *Environmental Health Perspectives*. https://doi.org/10.1289/ehp.1206185

L. Dai, A. Zanobetti, P. Koutrakis, and J. S. (2014). "Associations of Fine Particulate Matter Species with Mortality in the United States: A Multicity Time-Series Analysis," . *Environ. Health Perspect*, **122**. https://doi.org/10.1289/ehp.1307568

Lopez, P. D., Cativo-Calderon, E. H., & Rosendorff, C. (2021). The Impact of Environmental Factors on the Mortality of Patients With Chronic Heart Failure. *American Journal of Cardiology*. https://doi.org/10.1016/j.amjcard.2021.01.019

Lu, F., Zhou, L., & Zheng, X. (2015). Short-term effects of air pollution on daily mortality and years of life lost in Nanjing, China. *Science of the Total Environment*. https://doi.org/10.1016/j.scitotenv.2015.07.048

Md. Rasel Hossain, Susmita Begum, & Humayra Afnan. (2025). Parental Socioeconomic, Demographic, and Neonatal Factors Influencing Infants' Low Birth Weight: A Cross-Sectional Study in Bangladesh - Hossain - 2025- Health Science Reports - Wiley Online Library. https://onlinelibrary.wiley.com/doi/full/10.1002/hsr2.71146

Mohammad Omar Faruk, Mohammad Anwar Hosen, & Faisal M Rahman. (2025). Multiclass Semantic Segmentation of Satellite Imagery Using Convolutional Neural Networks | Springer Link. https://link.springer.com/chapter/10.1007/978-981-96-7036-9_20

Mohammad Salim Zahangir, Fariha Khanam Lisa & Kabir Hossain. (2025). Cultural, socio-economic, and demographic factors contributing to child mortality: Evidence from Sierra Leone demographic and health survey 2019 | *BMC Public Health*. https://link.springer.com/article/10.1186/s12889-025-22191-8

Ou, C. Q., Yang, J., & Guo, Y. M. (2014). The impact of relative humidity and atmospheric pressure on mortality in Guangzhou, China. Biomedical and Environmental Sciences. https://doi.org/10.3967/bes2014.132

Our World in Data. (2021). Data Review: How many people die from air pollution?

Parvej, M. I., Tabassum, M., & Hossain, M. R. (2020). Sexual harassment experience among the female population in Bangladesh. *Science, Technology & Public Policy*, **4**(1), 22–26. https://www.academia.edu/download/86424225/10.11648.j.stpp.20200401.14.pdf

Patel, A. P., Jagai, J. S., & Lobdell, D. T. (2018). Associations between environmental quality and infant mortality in the United States, 2000-2005. *Archives of Public Health*, **76**(1), 1–11. https://doi.org/10.1186/s13690-018-0306-0

Pearce, J. R., Richardson, E. A., & Shortt, N. K. (2011). Environmental justice and health: A study of multiple environmental deprivation and geographical inequalities in health in New Zealand. *Social Science and Medicine*. https://doi.org/10.1016/j.socscimed.2011.05.039

Rahman, M., Islam, M., & Chowdhury, T. (2021). A global analysis on the effect of temperature, socio-economic and environmental factors on the spread and mortality rate of the COVID-19 pandemic. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-020-01028-x

Rana, M. S., Hossain, M. R., & Alam, B. (2021). Comparative Study on Caesarian and Normal Delivery Childbirth in Bangladesh. *Open Journal of Statistics*, **11**(4), 524–538. https://www.scirp.org/journal/paperinformation.aspx?paperid=111357

Riyadh Hossain, Tahmina Akter, & Md. Rasel Hossain. (2025). Impact of environmental factors on the spread of dengue fever in the United States of America (USA): *Inter J. of Environmental Health Research:* **0**(0). https://www.tandfonline.com/doi/abs/10.1080/09603123.2025.2534420

Saikat, A. S. M., Mahmud, S., & Uddin, M. E. (2020). Anticipation of Natural Honey in Fighting Against Novel Corona Virus: Pharmacologic and Therapeutically Study. *Journal of Natural Remedies*, **21**(8 (1)), 142–149. https://www.academia.edu/download/86408564/544-Article_Text-800-1-10-20201219.pdf

Sayeed, M. A., Rasel, M. S. R., & Hossain, M. M. (2021). Prevalence and underlying factors of mobile game addiction among university students in Bangladesh. *Global Mental Health*, **8**, e35.

States, C. U. (2017). Associations between Environmental Quality and Mortality in the Contiguous United States, 2000–2005. **125**(3), 2000–2005.

Sultan, T., Sarker, M. M. H., & Njima, C. B. (2025). ViTDeBERTaNews: A Comparative Study of Single-modal, Multimodal, and LLM Techniques for Detecting Fake News. *2025*

International Conference on Control, Automation and Diagnosis (ICCAD), 1–6. https://doi.org/10.1109/ICCAD64771.2025.11099172

Tao, Y., Huang, W., & Zhu, T. (2012). Estimated acute effects of ambient ozone and nitrogen dioxide on mortality in the Pearl River Delta of southern China. *Environmental Health Perspectives*. https://doi.org/10.1289/ehp.1103715

WHO, (2012). Deaths Due to Environmental factors. https://www.who.int/news/item/15-03-2016-an-estimated-12-6-million-deaths-each-year-are-attributable-to-unhealthy-environments

Zahangir, M. S., Zahed, Md. A., , & Hassan Chowdhury, M. M. (2024). Socio-Economic, Behavioral, and Dietary Characteristics of Street Children in an Urban Area of Bangladesh. *Child & Youth Services*, 1–17. https://doi.org/10.1080/0145935X.2024.2429652

Zanobetti, A., & Schwartz, J. (2009a). The effect of fine and coarse particulate air pollution on mortality: A national analysis. *Environmental Health Perspectives*, **117**(6), 898–903. https://doi.org/10.1289/ehp.0800108

Zanobetti, A., & Schwartz, J. (2009b). The effect of fine and coarse particulate air pollution on mortality: A national analysis. *Environmental Health Perspectives*. https://doi.org/10.1289/ehp.0800108

Citation: Hossain MR, Islam I, and Akanda MOR. (2026). Spatial variation and effect of environmental factors in the world mortality rate, *Asian J. Soc. Sci. Leg. Stud*., **8**(2), 563-578. https://doi.org/10.34104/ajssls.026.05630578

Copyright: © The Author(s), 2026. Published by the UniversePG. This is an **Open Access** article, distributed under the terms of the Creative Commons Attribution 4.0 License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution and reproduction in any medium, and provided the original work is properly cited.