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Advanced Biostatistical Evaluation of the Correlation Between Environment Factors and Human Health Outcomes

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ABSTRACT

An advanced biostatistical analysis is presented in this paper with the goal of elucidating the complex relationship between environmental influences and health outcomes in humans. Using an extensive dataset and sophisticated statistical techniques, we looked into the intricate linkages that underpin how different environmental factors affect different health indices. The study examined the relationships between several environmental elements and certain health outcomes, such as mortality rates and respiratory disorders, temperature, pollution levels, and air and water quality indices. For measuring the research study used smart PLS software and generate informative results included descriptive statistic, correlation between environment factors and human health outcomes. According to our research, there is strong evidence that some environmental variables are associated with poor health outcomes. Strict statistical procedures, such as regression modelling, correlation analysis, and confounding variable consideration, were used to guarantee the validity and reliability of the findings. In addition to finding correlations, the study clarified possible causative links, which advanced our knowledge of the complex interactions between the environment and human health. The study recognises inherent limitations, including potential biases and problems with data quality, even as it emphasises the significance of these relationships. Significant ramifications for public health exist, indicating chances for focused interventions, modified policies, and educational programmes. The findings demonstrate how evidence-based policymaking in the areas of health and the environment may have a beneficial social impact. This study adds to the expanding corpus of information on environmental health and lays the groundwork for more research and treatments in the future. The overall research founded that positive and significant correlation between environment factors and human health outcomes. The knowledge gathered from this sophisticated biostatistical review is useful for public health practitioners, academics, and policymakers as they work towards a better and more sustainable future.

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1. Introduction

The modern era that humans have been inhabiting has, no doubt, increased the ease of their art of living, but on the other hand, it has also caused many disturbances in the environment. These environmental variations have led to evaluating factors that can cause immense destruction to human health and can lower its overall quality. Therefore, the use of biostatistical data to relate human health with environmental factors is now being used in the fields of clinical laboratories and epidemiological studies. Biostatistical analysis refers to the use of statistical tools and methods to come up with the interpretation of biological and health-related data. Since environmental factors exist in correlation, statistical methods for assessing the environmental mixtures are used (Taylor et al., 2016).

By implementing this type of statistical analysis, the researchers can discover the pattern, relation, and potential effect of environmental factors like water quality, soil quality, air purity index, chemical toxins, etc. To propose a certain biostatistical method, first, a review of the literature is done on the impact of different environmental components on human health, and research data is collected. After data collection, the data type is analyzed to select a convincing statistical method that could quantify and provide a conclusion correlating with human health outcomes. From the data statistics approach applied, the confounding variable that can potentially impose a deviation on human health is identified, and finally,

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the results are interpreted, which are later subjected to publications (Braun et al., 2016). Diverse and advanced methods have been proposed for this purpose, one of the famous methods being the usage of specific biomarkers related to a specific exposure to assess and quantify different components separately in an environmental mixture. Similarly, other types of biostatistical analysis like meta and spatial analysis, time series, and correlation analysis can be implemented to quantify data related to certain environmental factors. Biostatistical analysis of water can be done by performing different statistical methods to summarize the impact of the water quality of a reservoir on human health variables (Bellavia et al., 2019; Mather et al., 2004). For instance, a multivariate analysis can be performed on a sample containing a mixture of water and components (Gyimah et al., 2021).

An air quality-related analysis can be done by applying biostatistical tools to help quantify the variables with a high toxicity ratio. For instance, a class-conscious analysis can be done for air quality assessment by correlating the health of people of different age groups and the specific quality of an area (Valavanidis et al., 2008). This quantification of data helps provide the harmful variables, which can later help in taking measures accordingly to have a lower impact and higher health-related outcomes (Li et al., 2023). Also, crossover studies are being done on air samples to study the short-term impact of air changes on a particular area. This method was first introduced to study exposures of intermittent kind. Similarly, advanced Panel studies have also been done which involve a panel of people and study continuous changes in their health by adjusting various environmental factors. Moreover, the evaluation of chemicals present in the environment can help maintain required interventions in the public health sector. Advanced statistical approaches allow monitoring chemicals in an environmental sample in one go. This not only keeps the researchers away from the hustle but also helps them in giving faster and more accurate correlative results (Taylor et al., 2016). During these quantifications and assessments, three types of main data are studied and researched to correlate two components i.e., environmental components and public health. The first type of data is termed 'hazard data' and is linked to determining regulation, standardization, and classification of sources of environmental pollutants. However, this data is only limited to a certain objective and needs to be more sufficient for analyzing a trend. The next type of data is called 'health outcome data'. It is related to the depiction of the health status of different inhabiting populations of different areas and gives a general insight into the incidence and distribution of diseases. However, the limitation surfaces when this data typefaces backlash because of discretion issues and misclassification of ailments (Mackenbach et al., 2014). The third type is called 'exposure data'.

It has a role in developing links and relations with the hazard and health outcome data by giving information on exposure to an environmental hazard to the health of people on an individual level. However, the problem is faced when the individual data becomes hard to reach. Also, to deal with more than one exposure pathway, the exposure data could be more useful and can lead to misclassification of exposures being studied. All of these types of data are efficient and can do a productive correlation of environmental factors and health outcomes if there is maintained frequency of collection of data, timely reporting, precise geographic tenacity of data, and unhindered access to data is provided to the investigators (Chan et al., 2015; Mather et al., 2004).On the other hand, this type of data analysis generally helps the researchers in various ways and carries numerous advantages. The quantification of environmental factors can easily help in pinpointing the potential risk factors. This assessment of risk factors can provide the investigators with the information on adverse effects of environmental components on health outcomes.

Similarly, the environmental protective agents can use this statistical data to come up with instant decisions for health safety based on the evidence present due to statistical evaluation already being done. This reduces the investigators' effort and time and allows them to provide a more cohesive conclusion. Prediction of outcomes is another advantage of the biostatistical evaluation as the data collected can be used to predict the adversity of an environmental component and following it, preventive measures can be introduced to keep public health intact (Lazarevic et al., 2019; Pickett & Pearl, 2001). Despite the efficiencies and advantages, every approach has its own limitations, and only by overcoming these the desired objective of correlating data of environmental components and using it to manage health outcomes of the public masses can be made possible and, in turn, effectiveness for a sustainable system of the health and environmental protection sectors working around the globe can be achieved (Nguyen et al., 2023).

2. Objective of Research Study

The main objective of research is determining that correlation analysis between environmental factors and human health outcomes. Another objective is determined biostatistical analysis between dependent and independent indicator.

The research describes the Advanced Biostatistical Evaluation of the Correlation Between Environment Factors and Human Health Outcomes. The research study is divided into five specific research chapters first section represents the introduction and the second portion represents the literature review. The third portion describes research methods and presents tools and techniques. The fourth section describes the results, including descriptive statistics, correlation and smart PLS Algorithm model. the last section summarizes the overall research study and presents some recommendations.

3. Literature Review

Researchers claim that the pandemic of covid 19 was regarded as one of the causes of environmental problems that directly affected people's health. Due to changes in geographical areas, the severity of covid 19 varies in different environments. The spread of COVID-19 during the pandemic era was influenced by air pollution. Air was regarded as a modifiable feature responsible for spreading COVID-19 during the pandemic. The biostatistical analysis made on covid 19 suggests that air pollution is one of the major contributors to the spread of the SARS-COV-2 virus (Borro et al., 2020).studies explain that UPFs is a processed food that causes obesity problems in people consuming these foods. There is a deep association between the consumption of UPFs and health problems. The different types of health diseases are caused by consuming UPFs in high quantities (Chen et al., 2020). Studies predict that a lot of chemicals are produced by the manufacturing industries and released into the environment. The release of these chemicals in the environment causes air pollution. These chemicals, when inhaled through the air, pose serious health threats to humans. Effective strategies are developed to reduce the risk of health problems due to exposure to chemicals in the air. Hazardous chemicals management strategies are developed to stop the spread of hazardous chemicals into the air. also, these strategies are employed in industries that ensure that the chemicals released in the air are first assessed properly (Drakvik et al., 2020).studies elaborate that human health is badly affected by PFAS.PFAS possess toxicological properties that make them harmful to human health. Various strategies are developed to assess the toxicological properties of PFAS (Fenton et al., 2021). Studies claim that the gut microbiome causes various diverse disorders. various environmental factors influence the functioning of the gut microbiome, thereby causing health disorders(Gacesa et al., 2022).studies reveal that harmful natural algal blooms result in environmental toxicity. These blooms are a source of environmental pollution. biostatistical databases related to the algal bloom predict the abundance and diversity of harmful algal blooms in the marine ecosystem. By monitoring the diversity of algal blooms in marine environments, the pollution of harmful algal blooms can be easily identified(Hallegraeff et al., 2021).studies reveal that the increase in fluorine-containing compounds in the environment is because of the release of these compounds from the fluorinated industries. the fluorochemical industries release high amounts of fluoride ions in the atmosphere. These fluoride ions are hazardous and cause human health problems when inhaled (Han et al., 2021).

Scholars explain that exposure of humans to a natural environment free from pollutants helps improve their health. The exposure reduces the chance of cardiovascular disease onset in humans. humans who are exposed to the natural environment get proper sleep and have good mental health(Jimenez et al., 2021).studies suggest that in logistic operation, renewable energy sources are made to improve environmental sustainability. The economy's growth is related to improved environmental performance (Khan et al., 2020). Studies reveal that gaining is a process that results from changes in biological processes. aging increases, the risk of mortality. Epigenetic clocks are used to quantify biological aging. several environmental factors influence the epigenetic clocks. Certain factors accelerate the epigenetic clocks while others decelerate the epigenetic clocks(Oblak et al., 2021).scholars highlight that influenza is a disease caused by certain environmental factors. humidity is one of the factors that result in the onset of influenzas(Park et al., 2020).studies show that poor people face more serious health outcomes as compared to rich people.in many countries, these health-related disparities result in major health problems. also, the Green Space Association is related to the SES For addressing health disparities the Green Space Association holds great importance (Rigolon et al., 2021). Studies explain that IAP is one of the causes behind high mortality rates. For energy, most people worldwide use cola as a domestic energy source. The air quality gets badly affected due to the indoor burning of coals. The bad air quality then badly impacts people's health. for monitoring the IAQ the use of microcontrollers is made that provide real-time monitoring(Saini et al., 2020) Furthermore the people living in buildings are exposed to numerous indoor factors that influence their health. several multi-domain approaches are used to understand the behaviour of humans in relation to their indoor environment(Schweiker et al., 2020). Scholars provides detail about the onset of NAFLD due to certain ECs. the presence of contamination in the atmosphere results is deadly disease onset in humans. PFAS is one of the main ECs that contribute to the development of NAFLD in humans .alternation in the lipid metabolism due to the intake of harmful contaminations results in liver damage (Sen et al., 2022).

Scholars reveal that environmental degradation has increased over the past few decades due to globalization. GHG is one of the contributors that results in the degradation of the environment The help of renewable energy resources can reduce the (Usman et al., 2022).Scholars suggest that exposure to chemicals during early life results in complications later in life. People who are exposed to chemicals in childhood are more likely to become obese in adulthood. the exosome-wide approach is the widely used approach for estimating the impact of exposure to chemicals in early childhood(Vrijheid et al., 2020).Studies highlight that epidemiological data modeling is done using the ML approach.ML models help in better understating health-related interventions. By studying the epidemiological factors related to the different populations, it becomes easy to design effective intervention strategies (Wiemken & Kelley, 2020). Scholars predict that the HDI factors

are influenced by several environmental features. the energy consumption process influences the HDI development. the sustainable development of the human population is dependent on HDI(Yumashev et al., 2020). Studies of scholars show that for getting data regarding the environmental sciences field, the use of ML programs is made in the data analytics approach.ML is an algorithmic approach that is designed to reveal the hidden patterns of ESE-related fields. The process of data analysis in the ESE field becomes easy using the ML approach. the evolution in the data analysis process of ESE is made through the AI-based ML approach. Moreover ,ML provides immense applications in ESE for making the knowledge related ESE field comprehensible (Zhong et al., 2021). We already know a close relationship between environmental factors and human health. Many environmental factors affect directly or indirectly the human health in various ways. For example, air pollution can cause harm to the respiratory system of human beings and other animals, and water pollution can cause some internal damage by causing dangerous diseases such as hepatitis and cholera. Following are important applications of advanced Biostatistical Evaluation of the Correlation between Environmental Factors and Human Health Outcomes (Robertson et al., 2010).

4. Methods

The research determines that correlation between environmental factors and human health outcomes. For measuring the research used research questions because the research study based on primary data analysis. The research based on numerical research question related to the environmental factors and human health outcome for measuring the research used smart PLS software and generate informative result included descriptive statistical analysis, correlation coefficient analysis also that smart PLS Algorithm model between the dependent and independent variables. the environmental factor is independent and human health outcome consider as dependent variable.

4.1 Public Health Research

Research is the backbone of advancement and innovation. Research related to human health can play an important role in determining the effect of environmental factors on human health. In ancient times, there was less research on the environment and environmental factors because there was less environmental damage at that time. When industrialization took place, it also raised the problem of different types of pollution such as soil pollution, air pollution, and others(Checkoway et al., 2004). For example, exhaust waste from industries, vehicles, and forest fires produces harmful oxides that can form acid rain in the atmosphere and can cause damage to all kinds of living organisms on Earth. The main application of this Biostatistical Evaluation is that it can be used for public health research. Public health research gives an idea about the welfare of human health in a particular area or particular region. This biostatistical evaluation can be effectively used to conduct all research related to public health(Faragher et al., 2005).

4.2 To Make Environmental Policies

The policy can be defined as any suggestion, rule, or regulation that can work for the betterment of any organization. These policies are also necessary for protecting and conserving the environment. We can define environment as the sum of biological and physical factors that affect human health or the health of other living organisms. In the past few years, our environment has undergone drastic and pathetic changes which affected the earth's overall climate and weather pattern. This biostatistical evaluation can be used as a study for making and revising policies related to improving environmental factors(Höckel et al., 1996). For example, the protection of endangered and extinct species is necessary to maintain the natural ecosystem of the earth; thus, data that Biostatistical Evaluation obtains can be effectively used for policy-making, which would work for the betterment of the environment. For example, environmental policies also include that there should be minimal deforestation because deforestation affects human health directly or indirectly by causing even more pollution in the air. There is also an environmental policy that there should be programs for afforestation and reforestation to conserve the natural environment to minimize the environmental factors that affect human health(Siegrist, 1996).

4.3 Healthcare Planning

As our environment is getting even worse day by day because of unceasing and increasing environmental pollution, we need effective and swift planning for the healthcare sector. For example, if there are emerging problems of respiration in the older population of America, there must be effective healthcare planning to cope with these alarming numbers of respiratory disorders. One of the major applications of Biostatistical Evaluation is that it can give us an idea about the effect of environmental factors on human health; thus, we can plan healthcare aspects according to this evaluation. Planning is the major key to effectively combating and treating diseases in time(Duty et al., 2004).

If there is no effective planning, there will be a high rate of disease spread for example, during the coronavirus pandemic across the world, it was evaluated by Biostatistical Evaluation that older people are more prone to get coronavirus

flu as compared to young and adult age people, then this Biostatistical Evaluation was used for prevention of flu by adopting some cautious habits in older people. Same in the case of AIDS, when it spread through some environmental factors, it was recommended by physicians to avoid such environmental contacts, which resulted in fewer cases of AIDS. It can be concluded that Biostatistical Evaluation can be easily used for planning related to the Healthcare sector which will work for the betterment of humanity (MacKinnon, 2012).

4.4 Epidemiology

This is not a new term in the medical science field. Rather, it can be explained as the study of disease patterns in an environment with the help of different factors. As we all know, we cannot deny the fact that environmental factors are responsible for causing many human health issues. So, by Biostatistical Evaluation, we can efficiently study disease patterns in human beings under the umbrella of Epidemiology. For example, hepatitis has different types and some of the types of hepatitis viruses spread by drinking polluted water, which is a result of water pollution. Biostatistical Evaluation shows that these hepatitis diseases are more common in areas without facilities for drinking pure water (Ege et al., 2011). The same is true in the case of genetic mutation. Mutation can be defined as any change in genetic material that may be due to various factors, including environmental factors. It has been seen that mutations are more common in areas where there is more risk of harmful radiations, such as Alpha radiations. This is an important application of Biostatistical Evaluation.

4.5 Risk Assessment

The most important application of biostatistical evaluation is that it can be used in a timely manner for the assessment of any risk factor in the environment(Pickett & Pearl, 2001). By biostatistical evaluation, we came to know that human health is largely affected by environmental factors. By closely observing and analysing these environmental factors, we can easily assess any risk in time and be prepared to cope with any alarming situation.

For example, by Biostatistical Evaluation, we came to know that there is a risk of more respiratory disorders in human beings by inhaling polluted air, so if there is any area of more air pollution, we can easily assess that there would be more respiratory problems in masses of population in the near future. When risk is assessed timely, the damage caused by such factors can be minimized (Pope 3rd et al., 1995).

5. Smart PLS Algorithm Model

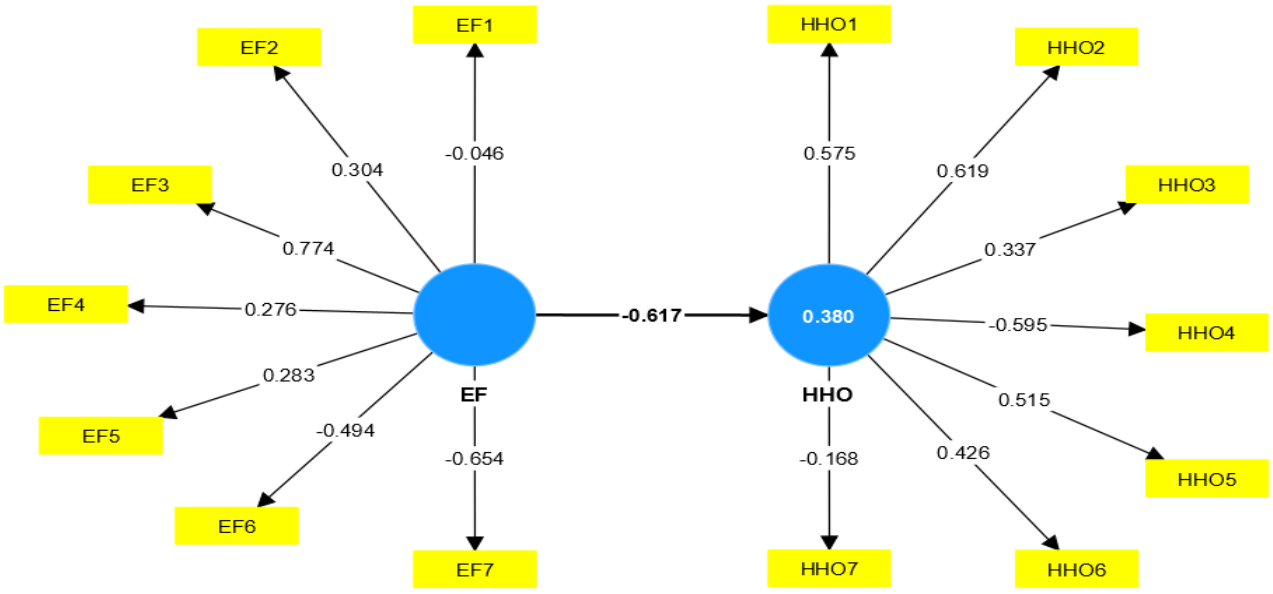

Figure 1: Smart PLS Algorithm Model

The above model of figure 1 represents the smart PLS Algorithm model between EF and HHO for Advanced Biostatistical Evaluation of the Correlation Between Environment Factors and Human Health Outcomes. The smart algorithm model presents -0.046, 0.304, 0.774, 0.276, 0.283, and -0.494. Also, -0.654 shows some positive and some negative values between them. The Ef presents those -0.617, which shows a negative link with HHO. According to the result, the

values show that 0.575, 0.619, 0.337, -0.595, 0.515, and 0.426 show positive and significant values between them.

6. Descriptive Statistic

Table 1: Result of Descriptive Statistic

Name	No.	Mean	Median	Scale min	Scale max	Standard deviation	Excess kurtosis	Skewness	Cramér-von Mises p value
EF1	0	1.653	1.000	1.000	4.000	0.893	0.814	1.292	0.000
EF2	1	1.510	1.000	1.000	3.000	0.610	-0.305	0.794	0.000
EF3	2	1.408	1.000	1.000	3.000	0.531	-0.509	0.803	0.000
EF4	3	1.449	1.000	1.000	3.000	0.574	-0.181	0.876	0.000
EF5	4	1.408	1.000	1.000	3.000	0.531	-0.509	0.803	0.000
EF6	5	1.449	1.000	1.000	3.000	0.537	-0.806	0.618	0.000
EF7	6	1.388	1.000	1.000	3.000	0.527	-0.315	0.902	0.000
HHO1	7	1.469	1.000	1.000	3.000	0.538	-0.915	0.530	0.000
HHO2	8	1.551	1.000	1.000	3.000	0.608	-0.484	0.641	0.000
HHO3	9	1.449	1.000	1.000	3.000	0.574	-0.181	0.876	0.000
HHO4	10	1.429	1.000	1.000	3.000	0.535	-0.671	0.709	0.000
HHO5	11	1.490	1.000	1.000	3.000	0.576	-0.453	0.703	0.000
HHO6	12	1.306	1.000	1.000	3.000	0.503	0.885	1.355	0.000
HHO7	13	1.347	1.000	1.000	3.000	0.517	0.185	1.114	0.000

The above result of table 1 represents that descriptive statistical analysis results describe each variable's mean values, median rates, minimum value, maximum value, and skewness values, including dependent and independent variables. The result describes that the probability value of each indicator EF1, 2, 3, 4, 5, 6, and 7 represents the independent variable for determining the Advanced Biostatistical Evaluation of the Correlation Between Environmental Factors and Human Health Outcomes. The mean values are 1.653, 1.510, 1.408, 1.449, 1.408, and 1.449. These show the positive average value of the mean. The standard deviation rates are 80%, 87%, 61%, and 89% deviate from mean values. According to the result, the overall minimum value is 1.000, the maximum value is 3.000, and the median rate is 1.000, respectively. According to the result, the overall probability value is 0.000, which is 100% significant. Similarly, HHo1, 2,3, 4,5, 6, and 7 are dependent variables; their mean values are 1.551, 1.449, 1.490, 1.306, 1.347, These show the positive average values of the mean. The standard deviation rates are 60%, 57%, 53%, 50%, and 51%, deviate from the mean.

7. Correlation coefficient

Table 2: Result of Correlation coefficient

	EF1	EF2	EF3	EF4	EF5	EF6	EF7	HHO1	HHO2	HHO3	HHO4	HHO5	HHO6	HHO7
EF1	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EF2	0.087	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EF3	0.040	0.050	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EF4	0.054	0.220	0.133	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EF5	0.175	0.113	0.012	0.269	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EF6	0.016	0.048	0.285	0.257	0.213	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EF7	0.026	0.171	0.419	0.099	0.128	0.110	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
HHO1	- 0.171	- 0.294	- 0.313	- 0.352	0.044	0.118	0.150	1.000	0.000	0.000	0.000	0.000	0.000	0.000
HHO2	0.389	- 0.153	- 0.254	- 0.066	0.062	0.242	0.097	0.207	1.000	0.000	0.000	0.000	0.000	0.000
HHO3	- 0.054	0.162	- 0.066	0.008	- 0.199	0.339	- 0.036	-0.022	0.227	1.000	0.000	0.000	0.000	0.000
HHO4	- 0.031	0.268	0.246	0.038	0.031	- 0.030	- 0.445	-0.274	-0.287	-0.162	1.000	0.000	0.000	0.000
HHO5	- 0.027	0.276	- 0.253	- 0.048	- 0.186	0.213	0.315	-0.017	0.103	0.261	-0.019	1.000	0.000	0.000
HHO6	- 0.082	0.090	- 0.238	- 0.123	- 0.009	0.171	0.168	-0.003	0.182	0.019	0.119	0.398	1.000	0.000
HHO7	- 0.402	0.215	- 0.070	- 0.112	0.005	0.027	- 0.044	0.148	-0.283	-0.181	0.348	-0.022	0.062	1.000

The above result of table 2 describes that correlation coefficient analysis result presents that -0.031, -0.027, -0.082, and -0.402 these all show a negative correlation coefficient between them. According to the results, there are some negative

and some positive correlations between the dependent and independent to determine the Advanced Biostatistical Evaluation of the Correlation Between Environmental Factors and Human Health Outcomes. Human health impacts of climate change are being more thoroughly investigated and measured. The frequency and intensity of heat waves, wildfires, droughts, floods, landslides, hurricanes, and other natural disasters are increasing due to rising temperatures and altered weather patterns. Extreme weather conditions and heat waves significantly influence health directly and indirectly. Extended and high temperatures can directly cause disease, lower labour capability for outdoor workers, and fatality from heat-related causes. The biosphere is altered by climate change, extreme weather events, and their direct effects. Certain areas may see an upsurge in vector-borne diseases and infections sensitive to the climate. Temperature variations foster an environment conducive to watery infections like diarrhoea and mosquito-borne diseases like dengue fever. In the future, climate change will affect the areas where infectious diseases can spread. Numerous infectious diseases will expand to new regions where people have never been exposed to them before or have not become immune to them. Changing temperatures can lead to lower yields for specific crops and geographical areas, which raises food prices and increases food insecurity and undernutrition. Another issue is the scarcity of water. Poverty rates are rising, along with migration, displacement, violent conflict, and detrimental consequences on mental health. The global public health policy community is becoming more concerned about the health implications of climate change. The article "Climate change is the biggest global health threat of the 21st century" was published in the general medical magazine The Lancet in 2009. In 2015, the World Health Organisation reaffirmed. In 2019, the climate change emergency was publicly proclaimed by the Australian Medical Association.

8. Conclusion

Studies reveal that medical experts worldwide concur that climate change is an actual phenomenon stemming from human activity and leading to a rise in health issues within their communities. Research indicates that addressing climate change via action enhances public health. Health professionals may take action by educating the public about health risks and solutions, advocating for legislative changes, and decarbonizing their own residences and places of employment. According to studies, public engagement with climate change messages is higher when the topic is framed as a health issue rather than an environmental one. The sophisticated biostatistical analysis conducted to investigate the relationship between environmental elements and human health outcomes has produced insightful findings. Our research examined the intricate relationship between environmental factors and several health markers, using rigorous statistical techniques to examine a large dataset. Our research shows a strong correlation between a few environmental elements and human health results. Robust statistical methods, a wide range of datasets, and cautious evaluation of possible confounding variables helped the study. To offer a fair assessment of the findings, it is necessary to note certain limitations, such as any restrictions, problems with data quality, or biases in the selection process. For measuring the research used smart PLS software and generate result included descriptive statistic, correlation and smart PLS Algorithm model between them. overall research concluded that positive and significant correlate environmental factors and human health outcomes. There are significant implications for public health. Knowing these correlations can help build evidence-based health plans and direct focused treatments, especially for vulnerable groups. Subsequent research endeavours may augment our comprehension of the intricate correlations between environmental exposures and health consequences. Based on our study, we have recommended several actionable policies, including specific policy suggestions you have drawn from your research. Adopting evidence-based modifications to environmental laws or actions can benefit public health outcomes and enhance community well-being in general. Since public awareness is important, educational program are essential. It is important to think about ways to educate and empower people about the connections between the environment and health that have been found. This biostatistical analysis concludes by highlighting the complex relationships between environmental elements and human health. Using these data, we may influence therapies, legislation, and educational initiatives that can result in better health outcomes and a more sustainable environment. A dedication to evidence-based decision-making, continuous research, and teamwork are all necessary steps on the path to a healthy society. With this study's help, we learned that Biostatistical Evaluation can help study the effect of environmental factors on human health. This evaluation has many applications for protecting and conserving the environment to minimize its effect on human health.

9. References

Bellavia, A., James-Todd, T., & Williams, P. L. (2019). Approaches for incorporating environmental mixtures as mediators in mediation analysis. *Environment International*, *123*, 368-374.

Borro, M., Di Girolamo, P., Gentile, G., De Luca, O., Preissner, R., Marcolongo, A., Ferracuti, S., & Simmaco, M. (2020).

Evidence-based considerations exploring relations between SARS-CoV-2 pandemic and air pollution: involvement of PM2. 5-mediated up-regulation of the viral receptor ACE-2. *International journal of environmental research and public health*, *17*(15), 5573.

Braun, J. M., Gennings, C., Hauser, R., & Webster, T. F. (2016). What can epidemiological studies tell us about the impact of chemical mixtures on human health? *Environmental health perspectives*, *124*(1), A6-A9.

Chan, E., Serrano, J., Chen, L., Stieb, D. M., Jerrett, M., & Osornio-Vargas, A. (2015). Development of a Canadian socioeconomic status index for the study of health outcomes related to environmental pollution. *BMC public health*, *15*(1), 1-8.

Checkoway, H., Pearce, N., & Kriebel, D. (2004). *Research methods in occupational epidemiology* (Vol. 34). Monographs in Epidemiology and.

Chen, X., Zhang, Z., Yang, H., Qiu, P., Wang, H., Wang, F., Zhao, Q., Fang, J., & Nie, J. (2020). Consumption of ultra-processed foods and health outcomes: a systematic review of epidemiological studies. *Nutrition journal*, *19*(1), 1-10.

Drakvik, E., Altenburger, R., Aoki, Y., Backhaus, T., Bahadori, T., Barouki, R., Brack, W., Cronin, M. T., Demeneix, B., & Bennekou, S. H. (2020). Statement on advancing the assessment of chemical mixtures and their risks for human health and the environment. *Environment International*, *134*, 105267.

Duty, S. M., Calafat, A. M., Silva, M. J., Brock, J. W., Ryan, L., Chen, Z., Overstreet, J., & Hauser, R. (2004). The relationship between environmental exposure to phthalates and computer-aided sperm analysis motion parameters. *Journal of andrology*, *25*(2), 293-302.

Ege, M. J., Mayer, M., Normand, A.-C., Genuneit, J., Cookson, W. O., Braun-Fahrländer, C., Heederik, D., Piarroux, R., & von Mutius, E. (2011). Exposure to environmental microorganisms and childhood asthma. *New England Journal of Medicine*, *364*(8), 701-709.

Faragher, E. B., Cass, M., & Cooper, C. L. (2005). The relationship between job satisfaction and health: a meta-analysis. *Occupational and environmental medicine*, *62*(2), 105-112.

Fenton, S. E., Ducatman, A., Boobis, A., DeWitt, J. C., Lau, C., Ng, C., Smith, J. S., & Roberts, S. M. (2021). Per-and polyfluoroalkyl substance toxicity and human health review: Current state of knowledge and strategies for informing future research. *Environmental Toxicology and Chemistry*, *40*(3), 606-630.

Gacesa, R., Kurilshikov, A., Vich Vila, A., Sinha, T., Klaassen, M. A., Bolte, L. A., Andreu-Sánchez, S., Chen, L., Collij, V., & Hu, S. (2022). Environmental factors shaping the gut microbiome in a Dutch population. *Nature*, *604*(7907), 732-739.

Gyimah, R. A. A., Gyamfi, C., Anornu, G. K., Karikari, A. Y., & Tsyawo, F. W. (2021). Multivariate statistical analysis of water quality of the Densu River, Ghana. *International Journal of River Basin Management*, *19*(2), 189-199.

Hallegraeff, G. M., Anderson, D. M., Belin, C., Bottein, M.-Y. D., Bresnan, E., Chinain, M., Enevoldsen, H., Iwataki, M., Karlson, B., & McKenzie, C. H. (2021). Perceived global increase in algal blooms is attributable to intensified monitoring and emerging bloom impacts. *Communications Earth & Environment*, *2*(1), 117.

Han, J., Kiss, L., Mei, H., Remete, A. M., Ponikvar-Svet, M., Sedgwick, D. M., Roman, R., Fustero, S., Moriwaki, H., & Soloshonok, V. A. (2021). Chemical aspects of human and environmental overload with fluorine. *Chemical Reviews*, *121*(8), 4678-4742.

Höckel, M., Schlenger, K., Aral, B., Mitze, M., Schäffer, U., & Vaupel, P. (1996). Association between tumor hypoxia and malignant progression in advanced cancer of the uterine cervix. *Cancer research*, *56*(19), 4509-4515.

Jimenez, M. P., DeVille, N. V., Elliott, E. G., Schiff, J. E., Wilt, G. E., Hart, J. E., & James, P. (2021). Associations between nature exposure and health: a review of the evidence. *International journal of environmental research and public health*, *18*(9), 4790.

Khan, S. A. R., Zhang, Y., Kumar, A., Zavadskas, E., & Streimikiene, D. (2020). Measuring the impact of renewable energy, public health expenditure, logistics, and environmental performance on sustainable economic growth. *Sustainable development*, *28*(4), 833-843.

Lazarevic, N., Barnett, A. G., Sly, P. D., & Knibbs, L. D. (2019). Statistical methodology in studies of prenatal exposure to mixtures of endocrine-disrupting chemicals: a review of existing approaches and new alternatives. *Environmental health perspectives*, *127*(2), 026001.

Li, D., Lee, C., Park, A. H., Lee, H., & Ding, Y. (2023). Contextual and environmental factors that influence health: A within-subjects field experiment protocol. *Frontiers in public health*, *11*, 1019885.

Mackenbach, J. D., Rutter, H., Compernolle, S., Glonti, K., Oppert, J.-M., Charreire, H., De Bourdeaudhuij, I., Brug, J., Nijpels, G., & Lakerveld, J. (2014). Obesogenic environments: a systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project. *BMC public health*, *14*(1), 1-15.

MacKinnon, D. (2012). *Introduction to statistical mediation analysis*. Routledge.

Mather, F. J., White, L. E., Langlois, E. C., Shorter, C. F., Swalm, C. M., Shaffer, J. G., & Hartley, W. R. (2004). Statistical methods for linking health, exposure, and hazards. *Environmental health perspectives*, *112*(14), 1440-1445.

Nguyen, T. N., Hadush, K. T., Visintin, L., Goessens, T., De Saeger, S., Lachat, C., & De Boevre, M. (2023). Associating multiple mycotoxin exposure and health outcomes: current statistical approaches and challenges. *World Mycotoxin Journal*, *16*(1), 25-32.

Oblak, L., van der Zaag, J., Higgins-Chen, A. T., Levine, M. E., & Boks, M. P. (2021). A systematic review of biological, social and environmental factors associated with epigenetic clock acceleration. *Ageing research reviews*, *69*, 101348.

Park, J. E., Son, W. S., Ryu, Y., Choi, S. B., Kwon, O., & Ahn, I. (2020). Effects of temperature, humidity, and diurnal temperature range on influenza incidence in a temperate region. *Influenza and other respiratory viruses*, *14*(1), 11-18.

Pickett, K. E., & Pearl, M. (2001). Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *Journal of Epidemiology & Community Health*, *55*(2), 111-122.

Pope 3rd, C., Bates, D. V., & Raizenne, M. E. (1995). Health effects of particulate air pollution: time for reassessment? *Environmental health perspectives*, *103*(5), 472-480.

Rigolon, A., Browning, M. H., McAnirlin, O., & Yoon, H. (2021). Green space and health equity: a systematic review on the potential of green space to reduce health disparities. *International journal of environmental research and public health*, *18*(5), 2563.

Robertson, C., Nelson, T. A., MacNab, Y. C., & Lawson, A. B. (2010). Review of methods for space–time disease surveillance. *Spatial and spatio-temporal epidemiology*, *1*(2-3), 105-116.

Saini, J., Dutta, M., & Marques, G. (2020). A comprehensive review on indoor air quality monitoring systems for enhanced public health. *Sustainable environment research*, *30*(1), 1-12.

Schweiker, M., Ampatzi, E., Andargie, M. S., Andersen, R. K., Azar, E., Barthelmes, V. M., Berger, C., Bourikas, L., Carlucci, S., & Chinazzo, G. (2020). Review of multi-domain approaches to indoor environmental perception and behaviour. *Building and Environment*, *176*, 106804.

Sen, P., Qadri, S., Luukkonen, P. K., Ragnarsdottir, O., McGlinchey, A., Jäntti, S., Juuti, A., Arola, J., Schlezinger, J. J., & Webster, T. F. (2022). Exposure to environmental contaminants is associated with altered hepatic lipid metabolism in non-alcoholic fatty liver disease. *J Hepatol*, *76*(2), 283-293.

Siegrist, J. (1996). Adverse health effects of high-effort/low-reward conditions. *Journal of occupational health psychology*, *1*(1), 27.

Taylor, K. W., Joubert, B. R., Braun, J. M., Dilworth, C., Gennings, C., Hauser, R., Heindel, J. J., Rider, C. V., Webster, T. F., & Carlin, D. J. (2016). Statistical approaches for assessing health effects of environmental chemical mixtures in epidemiology: lessons from an innovative workshop. *Environmental health perspectives*, *124*(12), A227-A229.

Usman, M., Jahanger, A., Makhdum, M. S. A., Balsalobre-Lorente, D., & Bashir, A. (2022). How do financial development, energy consumption, natural resources, and globalization affect Arctic countries' economic growth and environmental quality? An advanced panel data simulation. *Energy*, *241*, 122515.

Valavanidis, A., Fiotakis, K., & Vlachogianni, T. (2008). Airborne particulate matter and human health: toxicological assessment and importance of size and composition of particles for oxidative damage and carcinogenic mechanisms. *Journal of Environmental Science and Health, Part C*, *26*(4), 339-362.

Vrijheid, M., Fossati, S., Maitre, L., Márquez, S., Roumeliotaki, T., Agier, L., Andrusaityte, S., Cadiou, S., Casas, M., & de Castro, M. (2020). Early-life environmental exposures and childhood obesity: an exposome-wide approach.

Environmental health perspectives, *128*(6), 067009.

Wiemken, T. L., & Kelley, R. R. (2020). Machine learning in epidemiology and health outcomes research. *Annu Rev Public Health*, *41*(1), 21-36.

Yumashev, A., Ślusarczyk, B., Kondrashev, S., & Mikhaylov, A. (2020). Global indicators of sustainable development: Evaluation of the influence of the human development index on consumption and quality of energy. *Energies*, *13*(11), 2768.

Zhong, S., Zhang, K., Bagheri, M., Burken, J. G., Gu, A., Li, B., Ma, X., Marrone, B. L., Ren, Z. J., & Schrier, J. (2021). Machine learning: new ideas and tools in environmental science and engineering. *Environmental Science & Technology*, *55*(19), 12741-12754.