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Communicable Disease Rates

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Effects on Global, Communicable Disease Rates

Which factors are crucial to understanding what causes death by communicable disease?

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Abstract: *This paper discusses the effect of Global health expenditure, carbon dioxide emissions, and percentage of population under stress on communicable disease rates worldwide. By analyzing the latest data taken from 148 different countries in years 2010 and 2015, I have determined that the population under stress* **is** *significant to communicable disease rates; while health expenditure and c02 emissions are insignificant.*

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I. Introduction

At the mention of communicable diseases, it is not uncommon for people to instantly think of some of the more well known, deadly versions. AIDS, tuberculosis, and pneumonia are some of the scariest and most fatal diseases on the planet. The assumption that these diseases are most prevalent in third world countries is a common one. Speaking in generalities, the assumption seems to hold. However, my interest in the topic is what is behind that assumption. The question I set out to answer is: "What causes countries to have such high percentages of deaths due to communicable diseases?" Is it the fact that the government just doesn't spend money on public health? Having more clinics and hospitals for the ill to visit sounds like a suitable way to combat communicable disease rates. Presumably, the quicker the treatment – the less deaths occur from the disease. Perhaps, people in heavily polluted countries have poor lung functionality – due to smog or high carbon dioxide emissions. Poor lung functionality can lead to a number of different diseases, including tuberculosis and pneumonia. It is entirely possible that countries who are emitting high amounts of carbon dioxide, methane, or other harmful gasses are harming the population and increasing the amount airborne symptoms causing communicable diseases. Another scenario excludes man-made effects altogether. It is entirely possible that geographic location and weather patterns play a drastic part in passing on diseases from person to person. This may include drought, famine, high temperatures, or floods. This paper examines whether or not the aforementioned scenarios significantly effect death by communicable disease rates and offers a recommendation for a possible solution.

II. Literature Review

A. *Impacts of Climate Change Extend to Human Health* - A Scientific American article, written by Lauren Morello, discusses how increasing global temperature plays a role in disease migration. As we have seen with the H1N1 and Zika viruses, diseases do not have international boundaries. Changing temperatures causes the virus to adapt to climates that are suitable for the reproduction and growth of the disease. Diseases that appear in developing nations are not simply staying put in their country of origin. They are rapidly expanding and reacclimating themselves to climates that suit their needs. What can we do about this? A study at the National Institute of Health Sciences suggests that reducing the use of fossil fuels will reduce not just emissions of greenhouse gases, which drive warming, but also particulate matter and other pollutants that factor in many conditions that are among the leading causes of death in the United States, including heart and lung illnesses and cancer.

B. In Curtis Petzoldt and Abby Seaman's paper, *Climate Change Effects on Insects and Pathogens*, "temperature is probably the single most important factor influencing insect behavior, distribution, development, survival, and reproduction." It only makes sense that increasing these factors would cause the insect population to skyrocket. This includes many disease-carrying insects – such as mosquitos. This poses a huge potential risk – especially in less developed nations. With increases in insect population comes increases in communicable disease likes malaria, west Nile, and Zika. In countries who are unable to treat such diseases effectively, this could severely impact health conditions across the globe.

C. In Dr. Christopher Murray and Dr. Alan D Lopez's paper *Global Mortality, Disability, and the Contribution of Risk Factors: Global Burden of Disease Study,* they claim that "Prevention and control of disease and injury require information about the leading medical causes of illness and exposers." Murray and Lopez call for a deeper look into more common methods to investigate the overall, worldwide burden. They concluded that developed regions around the world account for 11.6% of the worldwide burden caused by death and disability. These same countries also account for over 90% of health expenditure worldwide.

D. *The Double Burden of Communicable and Non-Communicable Diseases in Developing Nations* – a study conducted by Abdesslam Boutayeb concludes that despite the successes of vaccines, "communicable diseases like AIDS, tuberculosis, malaria, and dengue are still out of control in many regions of the globe. Boutayeb's paper gives a global view of main diseases and their impact on population living in low – and middle – income nations."

III. Empirical Methodology

The models that are considered in this study are based on the functional equation:

$$Pdeath = f\,(Hex,\ c02,\ stress)$$

Where Pdeath is the percentage total deaths in a given country caused by communicable diseases. Hex is the Heath Expenditure by country. C02 is the amount of carbon dioxide produced by country (kT). Lastly, stress is the percentage of a countries total population effected by either floods, extreme temperature, or drought.

IV. Data Description

The data used for this study was obtained through the World Bank Data Collection Website. I have taken the data from 2010 and 2015 (the two most recent years available) for four different variables and 148 different countries. These variables include the percentage of total deaths caused by communicable diseases, heath expenditure by country, c02 emissions by country (kT), and percent of total population under stress.

A. Dependent Variable: Percentage of Total Deaths Caused by Communicable Disease

The dependent variable is at the crux of the regression analysis. The reasoning behind this study is to discover which variables have some sort of measurable effect on the Pdeath variable. The description of Pdeath is very straightforward. It measures the amount of people in a specific country that die from communicable diseases as a percentage of total deaths.

B. Independent Variable 1: Heath Expenditure

Per World Bank, Heath Expenditure measures "the amount spent by nations on health care and/or its various components. These amounts may or may not be equivalent to the actual costs and may or may not be shared among the patient, insurers, and/or employers."

C. Independent Variable 2: Carbon Dioxide Emissions (kT)

The c02 variable details the amount of carbon dioxide each country emits into the atmosphere in kilotons. This metric attempts to account for both natural and human sources of carbon dioxide emissions. Natural sources may include decomposition and respiration; While human sources are processes like burning fossil fuels or deforestation.

D. Independent Variable 3: The Stress variable accounts for the number of people effected by flood, extreme temperature, or drought, as a percentage of the total population of the given country. Stress may account for inadequate living conditions or extreme poverty, both commonly associated with the spread of disease.

V. Results

The type of regression I chose to run accounted for my data being of the fixed, panel variety. The research included 4 different variables, from two different years, among 149 different countries (298 overall). This made it necessary to use the fixed, panel method because it would then account for changes in variables over time, but not by country, and vise a versa. These results can be seen in Table II. Table II represents how changing each X (independent) variable would affect the result of the Y (dependent) variable. Since none of my data was serially correlated, I did not have to run the "White Test" or check for Heteroskedasticity.

Effect of Heath Expenditure and c02 Emissions

To my surprise, neither of these two variables proved to be significant in determining Pdeath. The belief that countries who spend more money on health expenditure have less deaths caused by communicable diseases cannot be proven by the model I chose to run. Based on the Test-Statistic and probability, Heath Expenditure has no significance to Pdeath. Similarly, c02 emissions are not significant in determining Pdeath either. Just because I country is heavily pollution (and likely negatively effecting people's lungs) does not mean that it is correlated with Pdeath.

Effect of Population under Stressful Conditions

Based on the results of the Test-Statistic and the probability, the percentage of people living under stress is significant to the Pdeath at a 1% significance level. However, this was to be expected. It makes sense that people who experience floods, droughts, or extreme whether may be exposed to difficult living conditions which are conducive to communicable diseases. High temperatures often provide comfortable habitats for things like insects and bacteria which are often closely associated with communicable diseases.

VI. Conclusion

After running my regression, I have concluded that population of a given country under stress is significant to Pdeath at a 1% significance level. For a 1% change in the population under stress, there is a 20% change in population killed by communicable disease. Countries with high percentages of people under stress such as Malawi, Swaziland, and Cambodia, may want to evaluate this particular statistic in an attempt to combat death by communicable disease in the future. By doing so, they can effectively address an issue that effects the probability of death by communicable disease at a 1% significance level – most likely generating a substantial impact. Unfortunately, my model was unable to show any significance between health expenditure and Pdeath. Nor was it able to show any significance between c02 emissions and Pdeath. This is not to say that these variables have absolutely no relevance to Pdeath, however they were not significant in the model.

Appendix

Table I

Summary of Statistics

Variable Name	Observations	Mean	Std. Dev.	Max	Min
Percentage of Deaths caused by Communicated Disease	296	23.54	21.25	70.40	1.40
Heath Expenditures as a % of GDP	296	6.83	2.52	17.14	1.92
C02 Emissions (kT	296	208,702.2	921,838.5	10,291,927	62.34
Percentage of Population under stress	296	1.19	2.013	9.23	0.00

Appendix (continued)

Table II

Main Results

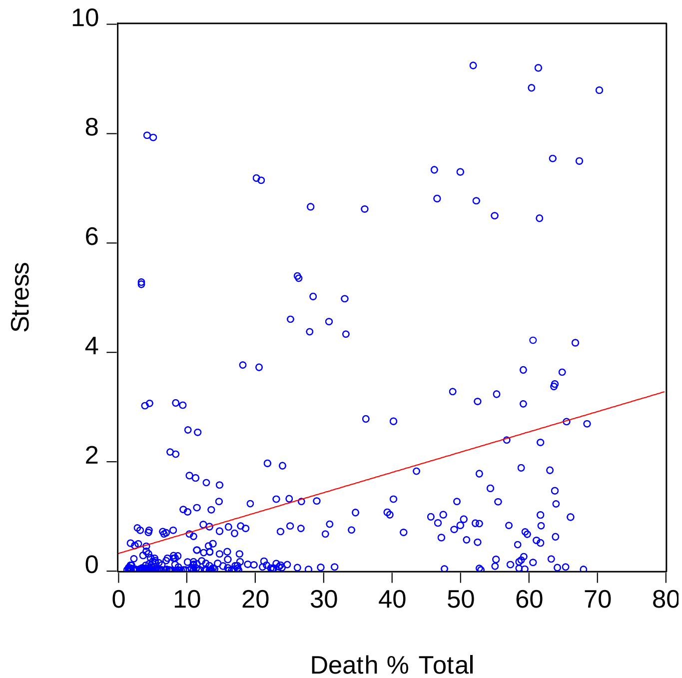
Variables	**Original Models**			
Y = Pdeath	Model I	Model II	Model III	
X1 = hex	.130 (.542)	.133 (.550)	.054 (.225)	
X2 = C02		-3.86E-07 (-.188)	-1.01E-08 (-.005)	
X3 = Stress			20.94 (-2.58) ***	
Obs	296	296	296	
Adj R^2	0.988	0.988	0.988	
F-stat (p-value)	162.91 (0.000)	160.75 (0.000)	165.92 (0.000)	
Serial Correlation Test (DW Stat)	2.05	2.05	2.06	

Notes: t-stat in parenthesis. *** indicates significant at 1% level.

Table III

Variable Name	**Beta Sign**	**Significance**
Health Expenditure	Positive	Insignificant
C02 Emissions	Negative	Insignificant
Pop. Under Stress	Positive	Significant***

Appendix (Graphs)



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