The Impact of Dietary Risks on Death Rates across World Regions

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ABSTRACT
We retrieved a dataset from the Global Health Data Exchange that contains information about the dietary risks' contribution to death rates across seven regions. We plotted two sets of graphs: i) Death rates across different regions, grouped by different dietary risks. ii) Death rates caused by different dietary risks grouped by different regions.

We used linear regression to model each of a region's dietary risks over a span of 25 years with the aim of using the model to extrapolate and predict the dietary risks for the year 2020. Our analysis gives us the linear coefficients for the death rates of each dietary risk in each region, which in turn allows us to predict the dietary risks for the year 2020.

Author Keywords
Dietary risks, death rates, linear regression.

INTRODUCTION
Each region in the world has their own unique food culture. For example, those in Southeast Asia will certainly have a different diet than those in the European Union. A difference in diets may result to an unintentional increase of dietary risks. Our research aims to study the trend in death rates related to certain dietary risks between different regions of the world. If a certain region in the world tends to have a substantially higher death rate for a certain dietary risk, it can be possibly attributed to their culture's diet, however this will require further research. Our work only aims to discover a relationship in death rates over time given a certain dietary risk and fit a linear regression model to predict the contribution of different dietary risks to death rates in 2020.

Data Details
Our dataset was downloaded from the Global Health Data Exchange, a data catalog created by the Institute of Health Metrics and Evaluation (IHME), an independent global health research center at the University of Washington. Using their GDB Results Tool, we selected certain features to pull from their database. For example, a row of our dataset can include the measure_name (e.g. Deaths), location_name (e.g. United States), rei_name or types of risks (e.g. Dietary risks), the metric_name (e.g. Rate), and the year (e.g. 2015). Thus this row of data will represent the rate of deaths in the United States from dietary risks in the year 2015. From their GDB Results Tool, the following data options were selected:

Context: Risk
Location: 8 regions in total
Risks: 18 in total
Age: All
Sex: All
Year: 1990, 1995, 2000, 2005, 2010, 2015
Measure: Death
Metric: Percent

The complete description and the download link for the dataset can be found at https://github.com/briluu/info370-finalproject in the file called 'Final Dataset Description.docx'.

RELATED WORK
There is current knowledge that different cultures and their different diets will result in varying health risks. For example, obesity has been observed to have increased for Latinos when they shifted away from their traditional, nutritious diet to a more fatty, Americanized diet[1]. In fact, it is known that America's obesity rate has increased over the years due to the culture of high calorie, low nutritious foods[2]. At least one third (34.9%) of American adults and about 17% of American children are obese[2]. In addition to food cultures, a culture's media portrayal of the perfect body can also lead to pressure for an individual to have an eating disorder anorexic or bulimic[2]. Something that we have not mentioned yet is the effect of income on diet, which we have not taken into consideration. The nutritional intake of those that are poor versus those that are of middle to upper income status can differ quite dramatically and will have a huge impact on one's dietary risk[3].

METHODS
There are two main parts to our research. First, we visualized the data using the Seaborn visualization library package to compare the trends. We had a few dimensions with our data and it was important for us to plot different graphs to visualize their relationships. The dimensions are death rate, time, risk and region. The first set of graphs shows how the death rates change with respect to time in different regions, given a specific dietary risk. To clarify, on each graph, we plotted death rates against years, and each line represents a region. The dietary risk is fixed. Therefore this set consists of graphs each representing a different dietary risk. We then used other dimensions of the

data. The second set of graphs shows how the death rates change with respect to time due to different dietary risks, given a specific region.

Beside the aesthetics, the Seaborn package is very useful when we tried to map colors onto our categorical data, e.g., showing different regions with different colors in the first set of graphs. Most other packages only allow numeric data type, mapping to a continuous color map (spectrum). The Seaborn `lmplot` is also very robust, giving us a linear regression on the data with a uncertainty range.

Searbon does not, however give numerical values to its regression and so we used statsmodel API `smf.ols` to fit a linear model on each death rates for six years broken down both by region and by risk factor. We then used these regression lines to predict the death rates for the year 2020.

RESULTS

We should take a look at some of the important trends. First of all, we look at the global death rate trends from the second set of graphs. From Fig. 1, we see that diet high in sodium is by far the biggest risk factor that contributes to death. It's worth noting that death rate is increasing for all risks, except for vitamin A deficiency.

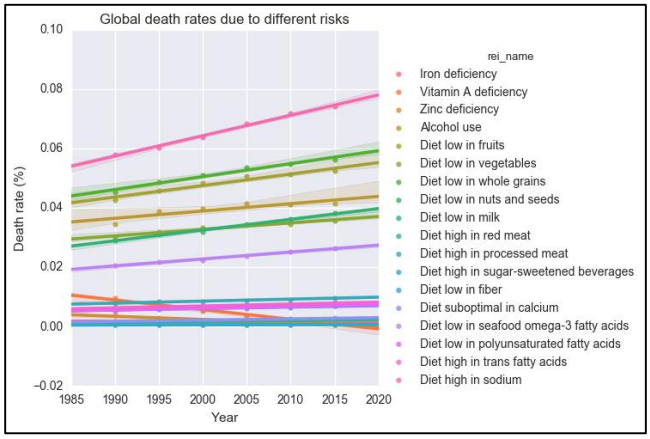

Figure 1. Global death rates due to different risk factors in different years.

This calls for a further analysis into the diet high in sodium and vitamin deficiency graphs in the first set. From Fig. 2, we see that in East Asia and Pacific, the high sodium intake is a significant cause for the death rates and it is rising very sharply. This raises concerns in the food consumption in East Asia and Pacific region. A high sodium intake is also associated with high salt intake. On the other side, Fig. 3 shows that vitamin A deficiency related deaths have decreased significantly over the years in Sub-Saharan Africa, virtually eliminated as a risk factor. Note that in Europe and North America, the death rate caused by vitamin A deficiency has always been 0%.

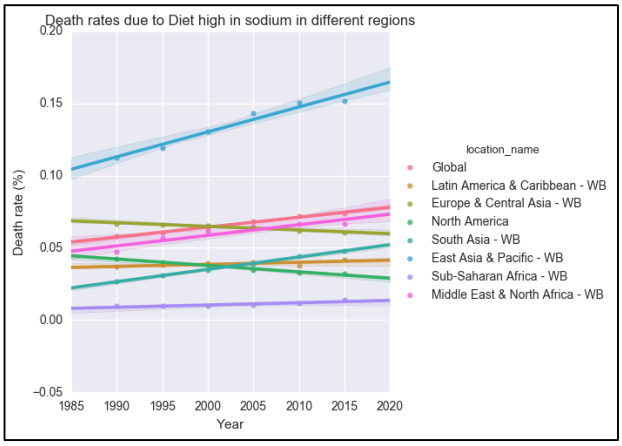

Figure 2. Death rates due to high sodium intake in different regions.

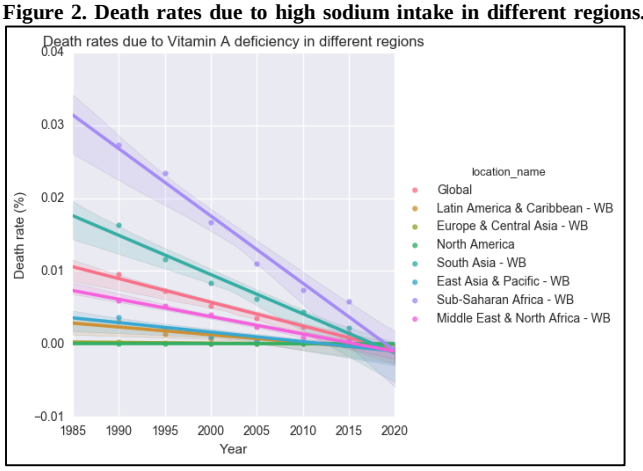

Figure 3. Death rates due to vitamin A deficiency intake in different regions.

Our linear regression analysis gave us predicted values for the year 2020. These values are our predictions and can be compared to the real values once 2020 comes. In addition, our graphs give us insight into how dietary risks can influence the death rate for certain regions at certain points in time. Therefore we hope that our work can allow certain regions to better manage their resources to target specific dietary risks that are prevalent in their region.

DISCUSSION AND FUTURE WORK

The goal of this research was to explore a trend in death rates related to dietary risks across different regions in the world. Having discovered that some countries are simply more at risk than others for certain dietary risks, public policy and public health officials should be taking this research into consideration when developing their health policies, as this might help them focus their time and resources into tackling and reducing a specific dietary risk prevalent in their community. The purpose of using graphs and visual elements is aimed to help people explore our discoveries and bring awareness to the dietary risks that they or their family will be at risk for.

Our study was also limited in that we only looked at death rates in relation to dietary risks, when in fact there are countless variables that can influence the death rate for a certain region. We took a macroscopic approach to observing this relationship and we want to acknowledge the limitations to this approach.

There are many pieces of work that study the effect of diet on health. However, there seems to be less work done on exploring and analyzing the death rates in dietary risks between countries. We hope that our work builds a foundation for others to begin more in-depth research on this topic.

CONCLUSION

In conclusion our research explores the trend in death rates between countries of certain dietary risks over the years 1990 and 2015. We plotted these points and performed a linear regression analysis on them. Next, our code allows people to explore the results of the linear regression analysis, viewing each dietary risks' linear coefficients and R^2 value. Finally, with our code we are able to generate a set of predicted dietary risk rates for the year 2020 for each region. Hopefully by 2020 we will be able to look back at these results and compare them once the real, true values come in.

A key finding is that people in East Asia and Pacific region are consuming too much salt, a main income of sodium. Governments and relevant institutions will have to encourage the public to practice healthier diets by reducing salt intake. This can lower blood pressure, since a high sodium intake is often found in persons with pre-diabetes or diabetes[3].

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