# What Relates to Life Expectancy

## A PROPOSAL TO IDENTIFY ELEMENTS RELATED TO LIFE EXPECTANCY FROM THE GLOBAL PERSPECTIVE

H Karen Tam
February 10, 2018

# Content

- Problems
  - Inequality on life expectancy
- Dataset
  - Gapminder
- Data Wrangling
- Exploratory Analysis
  - Density plots
  - Descriptive statistics
- In-depth Analysis
  - Pearson Correlation Coefficient
  - Multiple Linear Regression
- Recommendations
- Potential Improvements

# Problems

Do poor people have shorter life spans?

All people have the basic right to survive.

# Problems

- Who is interested?
  - Government agencies
  - Public health research organizations
  - Community nonprofits
  - Healthcare facilities
- Motivation
  - Improve equality in life expectancy.
  - Seek answers to close the disparity gap in life spans of the rich and the poor.

# Dataset

- Data are from Gapminder.org
- A final dataset was created by combining datasets for the following variables:
  - Life Expectancy
  - Income
  - Total Health Spending
  - Government Health Spending
  - Improved Drinking Water Source
  - Food Supply
  - Various Cancer Deaths

# Dataset

- This project evaluates the following variables:

| Variables | Years | Number of Countries/ Territories |
|---|---|---|
| Life Expectancy | 1960 - 2016 | 209 |
| Income | 1960 - 2011 | 200 |
| Total Health Spending | 1995 - 2010 | 189 |
| Government Health Spending | 1995 - 2010 | 191 |
| Improved Drinking Water Source | 1990 - 2010 | 201 |
| Food Supply | 1961 - 2007 | 176 |
| Cancer Death | 1995 - 2002 | 149 |

# Data Wrangling

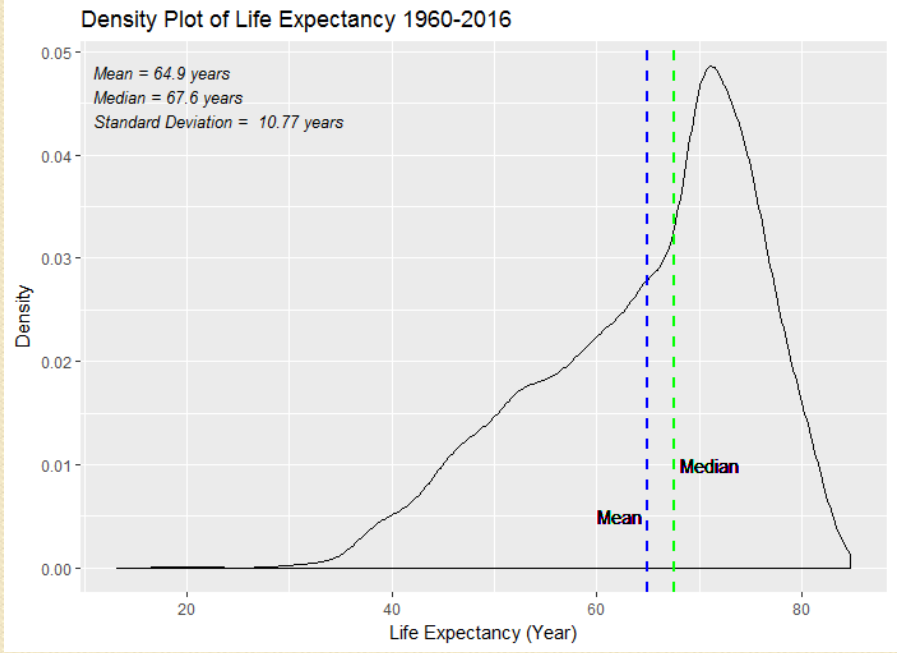
- Data Wrangling
  - Reshape the data for plots and statistical analysis
  - Remove missing value and join the data from different variable datasets
  - Examine outliers

# Exploratory Analysis

## Income


Mean: US$6,616
Median: US$1,896
Standard Deviation: US$10,671

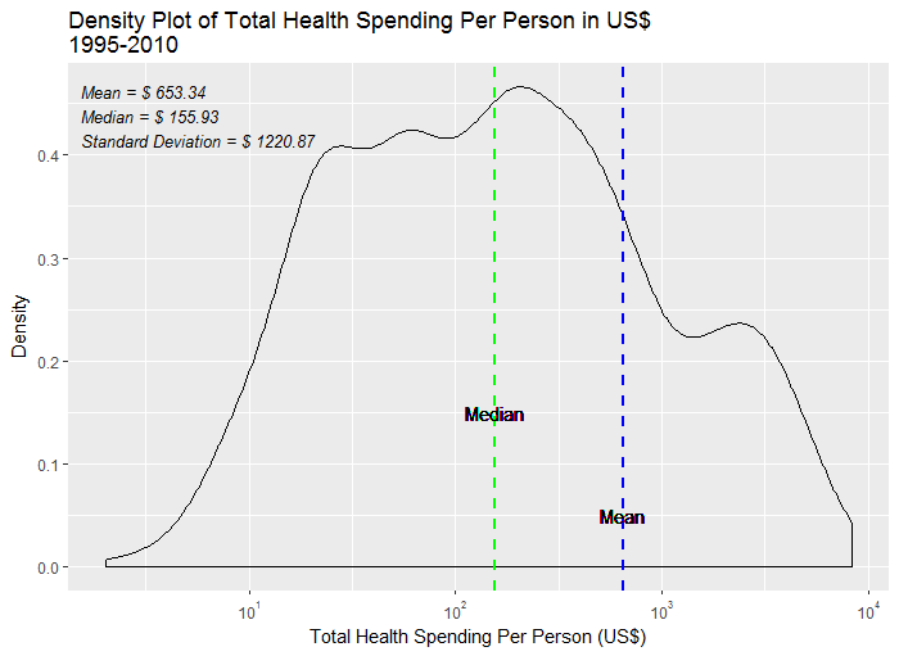
## Life Expectancy




Mean: 65 years
Median: 68 years
Standard Deviation: 11 years

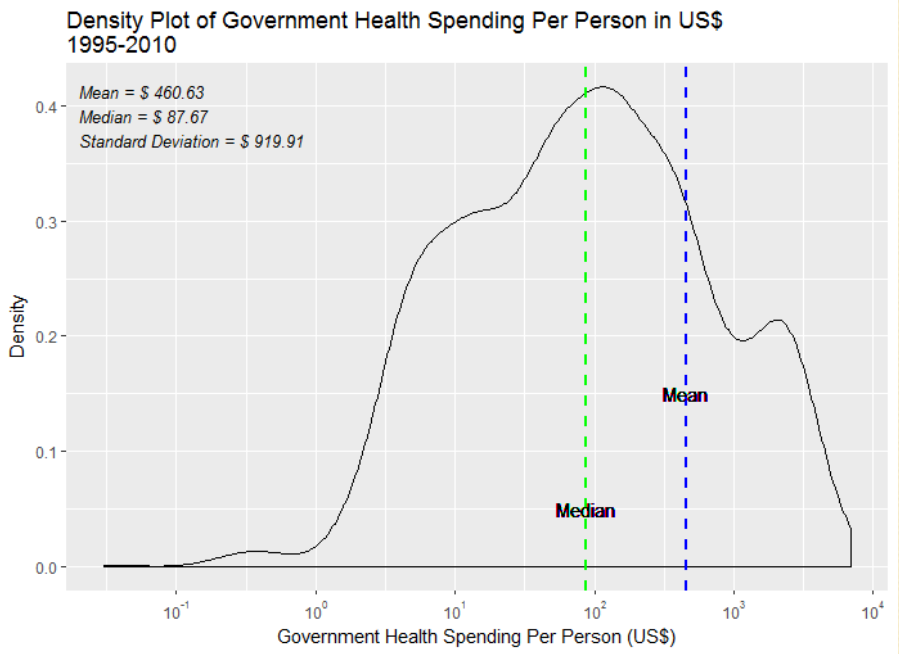
# Exploratory Analysis

## Total Health Spending




Mean: US$653
Median: US$156
Standard Deviation: US$1,221

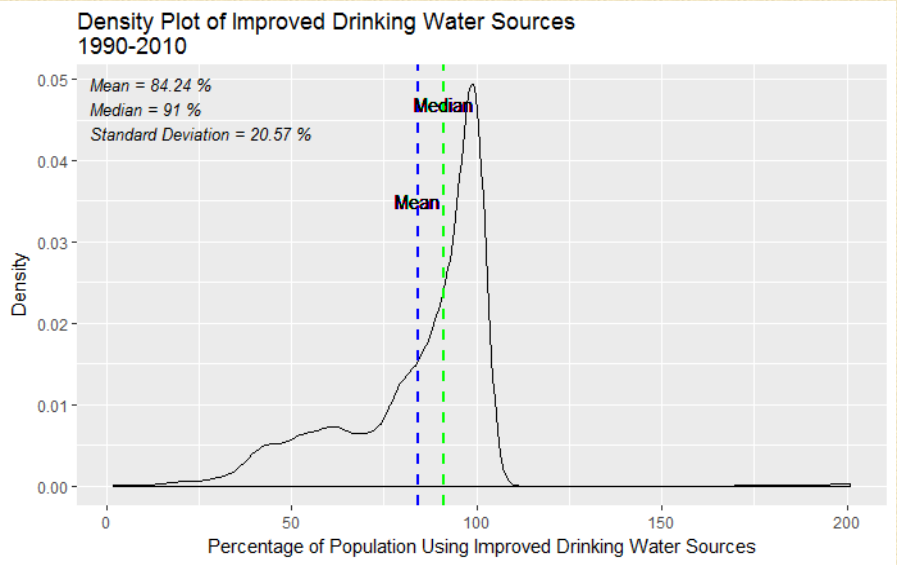
## Government Health Spending




Mean: US$461
Median: US$88
Standard Deviation: US$920

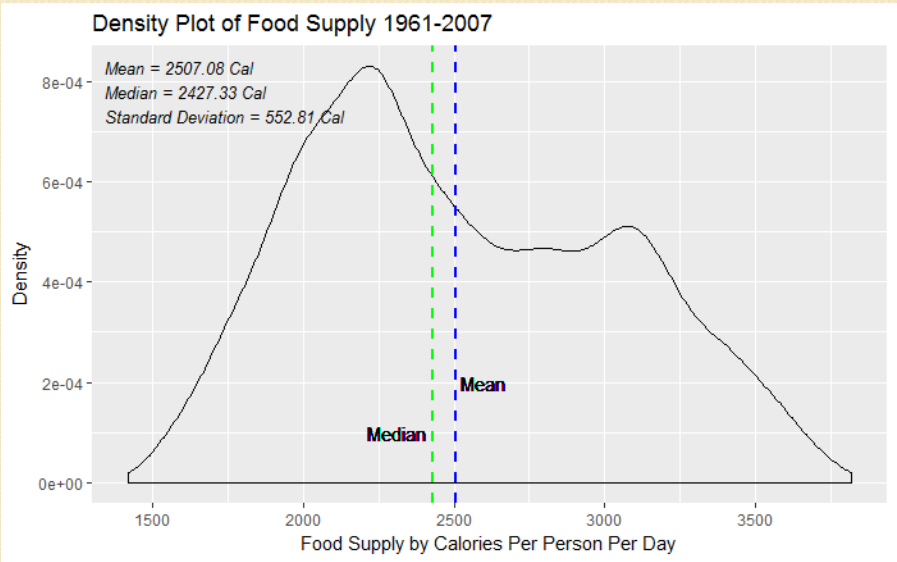
# Exploratory Analysis

## Drinking Water




Mean: 84 %
Median: 91%
Standard Deviation: 21%

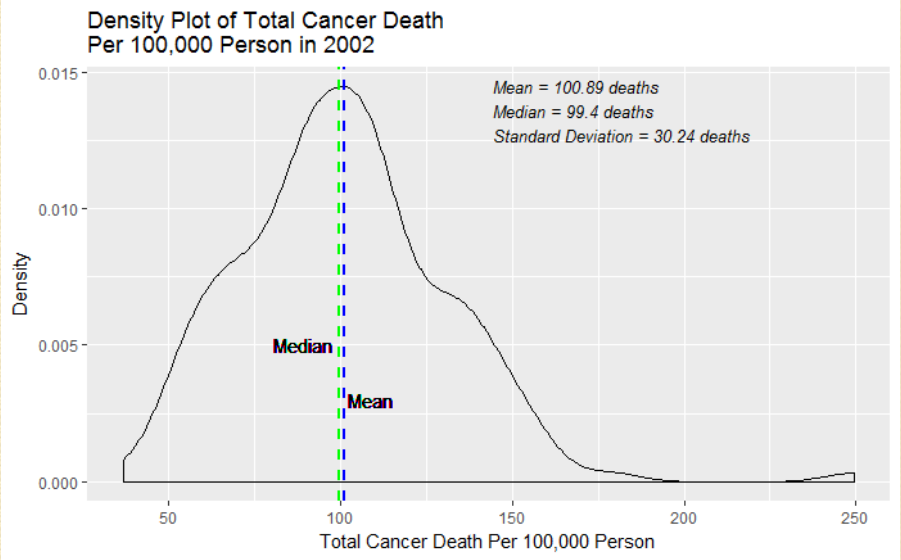
## Food Supply




Mean: 2,507 Cal
Median: 2,427 Cal
Standard Deviation: 553 Cal

# Exploratory Analysis

## Cancer Death




Mean: 101 deaths
Median: 99 deaths
Standard Deviation: 30 deaths

# In-depth Analysis

## Pearson Correlation Coefficient

- Strength and direction of linear relationships between life expectancy and 6 independent variables

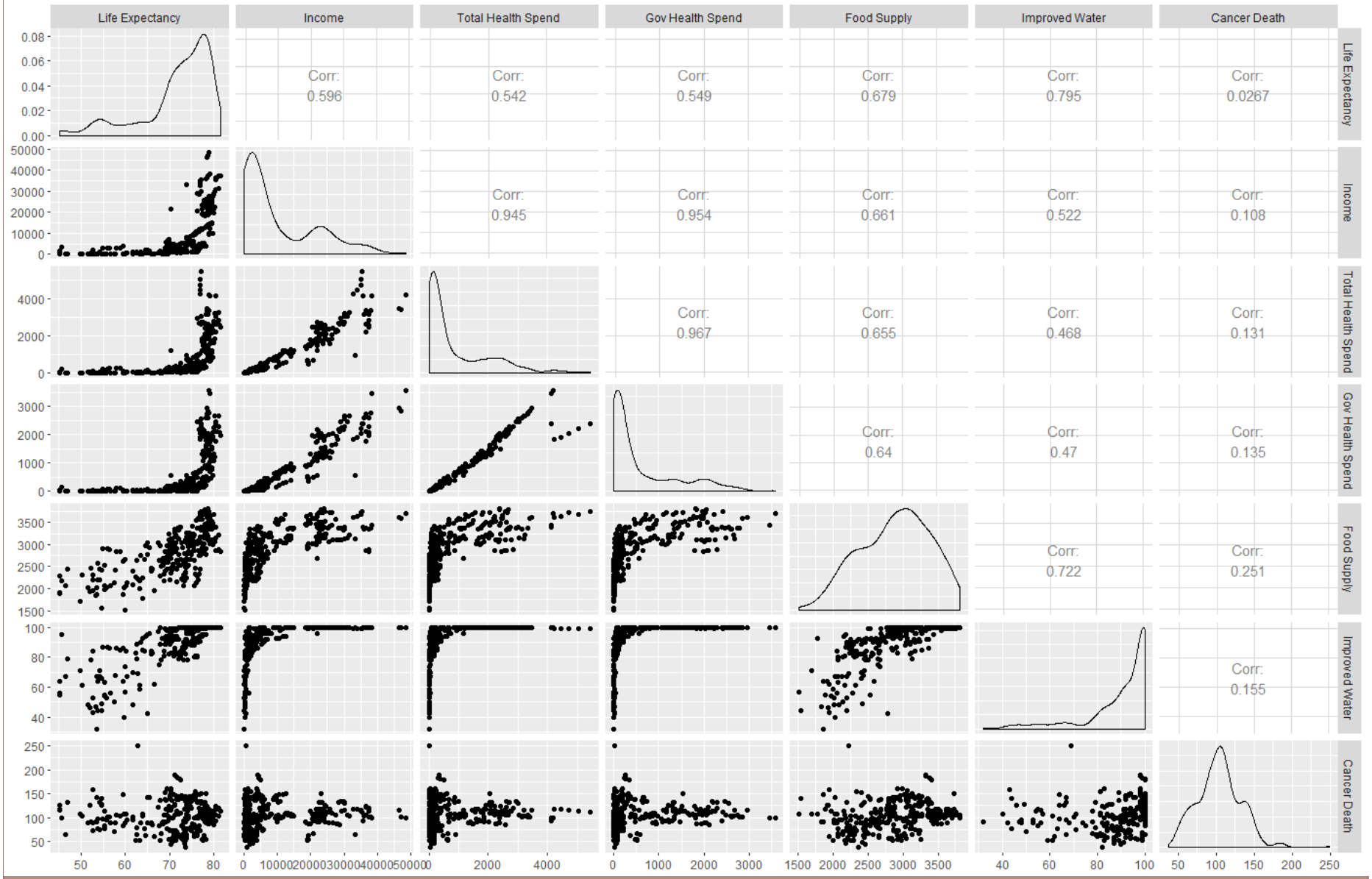
## Multiple Linear Regression

- Model the relationship between life expectancy and 6 independent variables by fitting a linear equation to observed data
- Variable Selection
  - Best Subsets Regression
  - Stepwise Forward Regression
  - Random Forest
- 10-fold Cross-Validation

# Pearson Correlation Coefficient
# Correlation with Life Expectancy

| Independent Variable | r | Significantly Correlated | Strength | Direction |
|---|---|---|---|---|
| Income | 0.60 | Yes | Moderate | Positive |
| Total Health Spending | 0.54 | Yes | Moderate | Positive |
| Government Health Spending | 0.55 | Yes | Moderate | Positive |
| Improved Drinking Water Source | 0.80 | Yes | Strong | Positive |
| Food Supply | 0.68 | Yes | Strong | Positive |
| Cancer Death | -0.03 | No | Weak | Negative |

# Pairwise Comparison



# Multiple Linear Regression

| Variable | Amount Needed to Increase 1 Year of Life |
|---|---|
| Income | An Increase of US$7,003 in GDP Per Capita |
| Improved Drinking Water Source | An increase in 3% of country's population with an access to clean drinking water sources |
| Food Supply | An increase in 453 calories intake per person per day* |
| Cancer Death | A decrease in 29 cases of cancer death per 100,000 person per year |

* If people faces food shortage due to extreme poverty or wars

# Recommendations

- To close the inequality gap in life expectancy

| Stakeholders | Recommended Actions |
| --- | --- |
| All Stakeholders | Identify life expectancy related problems in underprivileged communities |
| Governments | Develop policies and implement them effectively |
| Community Organizations and Health Facilities | Provide services to reduce life expectancy related problems in underprivileged communities |

# Potential Improvements

- More independent variables that are associated with life expectancy should be identified.
- Updated data should be used when available.