**Data Visualization Final Project**

**A picture containing circle, emblem, logo, trademark

Description automatically generated**

**World Happiness Report and It’s Influencing factors (2015 – 2019)**

**By:**

**Sai Thejeswar Takkolu**

**U86302442**

**Introduction:**

**“There is no path to happiness; Happiness is the path”.**

**-Buddha**

World Happiness Index is an annual report which is published by United Nations Sustainable Development Solutions Network. My Project aims to present the World Happiness Report from 2015-2019 representing the happiness score for a total of 141 countries. According to me being happy is a choice, but there are several other factors that can contribute to deciding a country’s happiness.

In this project we will look at how several factors like GDP per capita, social support (family and societal support), healthy life expectancy, Freedom to make life choices, generosity, and perception of government corruption are involved in deciding the happiness factor.

I have blended and considered another factor into account which might be having some correlation in deciding happiness. Annual CO2 emissions in a nation can be one of the factors according to my research that has impact over happiness. Every year there are some million tones of carbon dioxide (CO2) released into the atmosphere leading to several health conditions in any country. Since pollution is a considerable catalyst in degrading health which eventually can result in lower levels of happiness.

Apart from the mentioned factors there are several other hidden factors which might affect the happiness of a nation. In this growing world it is becoming increasingly hard to find the factors having an influence over a several human emotions. According to my research there are a few more overlooked aspects that might affect happiness, which are population, meat consumption per capita, homicide rate, and infant mortality rate.

**Ambitiousness with my research questions:**

Happiness is an emotion, and it can be really hard to find the influencers. On the other hand, this in-depth research helped me formulate a few questions that include:

1. What are the happiness scores of all countries from 2015-2019?
2. Show a scatter plot for meat consumption against happiness score. Can you support the fact that meat consumption produces dopamine which indeed increases happiness?
3. Support your views for correlation between meat consumption and happiness scores by showing trends over the years. What do you infer?
4. Show a map representation for happiness score of all the countries. Do you think there is a notable trend over the years?
5. How does happiness change according to the generosity factor for all countries you considered in question 2?
6. Compare happiness score of country with most crime rate, most infant mortality rate with the happiest and least happy country in 2019. What do you infer from this?
7. Is there a correlation between CO2 emissions in a country with its happiness? Consider Switzerland, Russia, India, China, and Denmark.
8. Do you think happier countries have a higher healthy life expectancy?

**Methodology:**

I have considered the World Happiness Report data from 2015-2019. Factors which have been considered include:

* **GDP Per capita:** GDP per capita is the Gross Domestic Product divided by the number of people in the country. It measures the country’s economic output that relates to its population.
* **Social Support:** Support from family and society to a citizen is considered.
* **Healthy life expectancy:** The life expectancy is number of years an average human can live up to in a country.
* **Freedom to make life choices:** The extent of freedom available for an average human in their respective countries. Freedom to elect the leader, freedom of speech and several other fundamental rights are included.
* **Perception of government corruption:** Over the years corruption has been growing in leaps and bounds in several countries. People definitely show a waned satisfaction with a corrupted government.
* **Generosity:** Being generous is not everyone’s trait. It’s an innate thing which takes shape into better or worse over the time depending on our social and cultural influences.
* **Annual emissions of CO2 in tones:** A polluted atmosphere can be a major cause of critical health issues which eventually lead to a lower life expectancy and in turn reduced happiness.
* **Homicide rate in a country:** According to my research I have found that the countries with more crime rate much unhappier than the ones with less crime.
* **Meat consumption per capita:** I have found some interesting fact regarding the meat consumption. There is compound present in meat that increases the release of hormone called “Dopamine” which is responsible for our happy emotion. It is quite likely that when a person consumes more meat, he/she tend to me happier than the vegetarians.
* **Infant mortality rate:** Unhappy countries might have more hostile environment and that might also include more infant mortality rate, that’s the basis for me considering that factor.
* **Population:** Populous country can be really hard to control and extremely challenging to the government to control several factors. That might include more pollution, more crime, more mortality rate etc.

**Data sources:**

My main sources of data include:

* [Our World in Data](https://ourworldindata.org/)
* [Kaggle](https://www.kaggle.com/)
* [World happiness index](https://worldhappiness.report/)

**Datasets:**

There are several suppositions as to what that top factor can be that is influencing happiness. Based on my research I could come to a nebulous conclusion of those very factors. Below are the datasets which I used in my project.

**Dataset 1 - Happiness scores from 2015-2019:**

This is our main dataset that includes the happiness score of several nations. We have many factors in this dataset which are mentioned in the table below:

|  |  |
| --- | --- |
| Variable | Description |
| Country | Country which is being measured for happiness |
| Rank | Ranking based on the happiness score |
| Score | Happiness score which is calculated based on other considered factors |
| GDP per capita | GDP is gross domestic product which is a measure of a country’s economy |
| Social Support | This is the support received by an individual by family and society. |
| Healthy Life expectancy | The average life expectancy of a person in a country |
| Freedom to make life choices | This factor includes the freedom of several aspects in a nation, like freedom to choose leaders, fundamental rights etc. |
| Perception of corruption | A corrupted government and society which impacts day to day life |
| Generosity | How generous a society is when it comes to any individual. |
| Year | The year (2015-2019) for which all the factors are being measured |

**Dataset 2 – Annual CO2 emission from 2015-2019:**

Our second dataset is the one that provides the information about the annual CO2 emission in several countries. The CO2 emission has been measured in millions of tonnes over years. It is quite surprising to know that it is not the most populous country which produces the most CO2.

|  |  |
| --- | --- |
| Variable | Description |
| Entity | Country which is being measured for CO2 emission |
| Code | This is the country code which is three lettered. |
| Year | Year for which the CO2 emission is measured. |
| Annual CO2 emissions | This is the amount of carbon dioxide (CO2) released measured in tonnes. |

**Dataset 3 – Population and demography from 2015-2019:**

Population plays a major role in several areas. The number of resources available, the population density, pollution, crime rate and several other areas that can be controlled by population control alone. This is our third dataset representing the population of all the countries from 2015 – 2019.

|  |  |
| --- | --- |
| Variable | Description |
| Country name | Country whose population is being measured. |
| Year | Year for which the CO2 emission is measured. |
| Population | The population of a country. |

**Note: There are several other columns based on the demographics, but we considered only the total population column.**

**Dataset 4 – Infant mortality rate from 2015-2019:**

Infant mortality rate is serious concern in many nations. According to my research I have found a correlation between the infant mortality rate and the happiness of a country.

|  |  |
| --- | --- |
| Variable | Description |
| Entity | Country which is being measured for Infant mortality rate. |
| Code | This is the country code which is three lettered. |
| Year | Year for which the Infant mortality rate is being measured. |
| Deaths - All causes - Sex: Both - Age: <1 year (Rate) | The infant mortality rate measured for both the genders. |

**Dataset 5 – Homicide rate from 2015-2019:**

It is quite evident to say that happiness and crime rate are inversely proportional to each other. Based on my research I can say that the countries with lower crime rate (Homicide rate) are much happier than the ones with more crime rate.

|  |  |
| --- | --- |
| Variable | Description |
| Entity | Country which is being measured for Homicide rate. |
| Code | This is the country code which is three lettered. |
| Year | Year for which the homicide rate is being measured. |
| Deaths - Interpersonal violence - Sex: Both - Age: All Ages (Rate) | The homicide rate measured for both the genders. |

**Dataset 6 – Daily meat consumption per person from 2015-2019:**

Through my thorough research I found an interesting fact about meat. Meat contains a compound that increases the production of the happy hormone called “Dopamine”. More the dopamine more the happiness.

|  |  |
| --- | --- |
| Variable | Description |
| Entity | Country which is being measured for meat consumption. |
| Code | This is the country code which is three lettered. |
| Year | Year for which the meat consumption is being measured. |
| Meat, total | 00002943 || Food available for consumption | 0645pc || kilograms per year per capita | Total amount to meat consumed in kilograms per year per capita. |

**Data cleaning and pre-processing:**

Data cleaning and pre-processing is a major step before we could proceed with the visualization. There were many null values present in all my datasets, I used Microsoft excel in filtering and cleaning the unwanted rows and columns. The null values were present in the columns like happiness score, country, annual CO2 emission and the infant mortality rate. Excess of empty rows creates irregularities in the visualizations.

**Analysis:**

**Data source:**

There are a total of six datasets which I have used as mentioned above. I have connected all the tables with common columns which are “Country name” and “Year”. The screenshot of the data source has been provided below:

A screenshot of a computer

Description automatically generated

The connection has been highlighted with a circle below:

A screenshot of a computer

Description automatically generated

**Visualizations:**

There are several insights I fetched through my research. According to my research question I have made pertaining visualizations. Please find them below:

**Visualization 1: Happiness ranking for countries from 2015-2019**

The below visualization shows us the ranking of the countries based on Happiness score from 2015 – 2019. This helps us answer the question: **What are happiness rankings of countries from 2015 - 2019?**

A screenshot of a computer

Description automatically generated with medium confidence

From the above visualization we can see that the countries have been ranked based on the Happiness score for all the years from 2015 – 2019. The scroll bar below can show us the rankings for all the years along with happiness scores.

The top ranked countries for the years are:

1. 2015 – Switzerland
2. 2016 – Denmark
3. 2017 – Norway
4. 2018 – Finland
5. 2019 - Finland

**Visualization 2: Happiness trends for a few countries with low, medium, and high happiness scores from 2015 – 2019 with trail.**

The visualization below shows us the trends in happiness scores for the countries, Afghanistan, Finland, India, Italy, Pakistan, Switzerland, Syria, United States, and Yemen. The reason for choosing the following is because they had scores which are low, medium, and high for all the taken years.

**A screenshot of a computer

Description automatically generated with medium confidence**

* From the above visualization we can see that trends of the mentioned countries are observed along with a trail. We can see that from the countries taken Finland overtook Switzerland to become the happiest country in 2019.
* Afghanistan is the least happy amongst the group in 2019. There are trails present showing the respective country rankings for each year.

**(Note: There is also a drill down in the year upon clicking which we can see the sparse trends for individual country.)**

**Visualization 3: Meat consumption for a few countries with low, medium, and high happiness scores from 2015 – 2019 with trail.**

The visualization below shows us the meat consumption trends for the countries, Afghanistan, Finland, India, Italy, Pakistan, Switzerland, Syria, United States, and Yemen. According to my research I found that meat consumption increase “Dopamine” release which is a happiness hormone. Therefore, I chose the same countries I chose in visualization 2 to know if the facts are indeed true.

**(Note: I considered these countries since it is combined group with low, medium, and high happiness score, hence they show better trends over time)**

**A screenshot of a computer

Description automatically generated with medium confidence**

* From the above visualization we can see the meat consumption trends shown along with trails for the mentioned countries. We can see that Unites States has the highest meat consumption per capita for all the years from 2015 – 2019.
* India stands the lowest in meat consumption per capita, which is shown with a green line.
* Just above India we can see Afghanistan standing second from the bottom.
* Syria’s meat consumption plunged from 2018 to 2019.
* In the coming visualizations we will see if there is any relationship between meat consumption and happiness score. Are the facts really true?

**Visualization 4: Relation between meat consumption and happiness over time.**

I have decided to plot a scatter plot for meat consumption per capita against happiness score for the countries, Afghanistan, Finland, India, Italy, Pakistan, Switzerland, Syria, United States, and Yemen. This visualization answers our question: **Show a scatter plot for meat consumption against happiness score. Can you say that meat consumption increases happiness?**

**A screenshot of a computer

Description automatically generated**

* From the above scatter plot, we can see that meat consumption per capita has been plotted against happiness score for the above-mentioned countries.
* Upon clicking the play button, we can see how the changes in meat consumption has actually caused a change in happiness scores.
* United states, Switzerland, Finland, and Italy have score above 6 which is considered good enough. It is also surprising to see that their meat consumption is also very high when compared to Syria, Afghanistan, India, and Pakistan which stands low in happiness amongst the taken countries.
* This plot gives us some proof to get much closer in believing our fact that “meat consumption increases happiness”.
* Let’s see how what the trend says about this fact in the next dashboard.

**Dashboard 1: Dashboard showing trends in Happiness score and meat consumption (visualization 3 and visualization 4)**

I have created a dashboard that shows visualization 3 and 4. This shows how the meat consumption is related to the happiness score for the countries, Afghanistan, Finland, India, Italy, Pakistan, Switzerland, Syria, United States, and Yemen. This answers the question: **Support your views for the correlation between meat consumption and happiness score by showing trends over the years. What do you infer?**

**A screenshot of a computer

Description automatically generated with medium confidence**

* As per the dashboard we can see a little linear relationship between meat consumption and happiness scores for the taken countries.
* United states, Italy, Switzerland, and Finland have higher meat consumption and their happiness scores are also higher.
* India, Syria, Afghanistan, and Yemen have lower meat consumption and hence, lower happiness score.
* I can say that there is certain correlation between meat consumption and happiness from the above dashboard.

**Visualization 5: Map representation of happiness scores over time (2015-2019)**

To have a more appealing look I have created an animated map representing the happiness score for all the 141 countries. This answers the question: **Show an animated map representation for happiness score of all the countries by year. Do you think there is notable trend over the years?**

**A screenshot of a computer

Description automatically generated with medium confidence**

* From the above visualization we can see that there is an animated map representing the happiness scores.
* The colour intensity gradually increases according to the happiness.
* Dark colour represents higher happiness while lighter colours are less happier countries.
* From the animation I can say that there are little or no notable changes in happiness score over the years.
* Change requires time and I’m certain that there can be some heavy positive results over future years. Changing mindset, economy, and combined effort of every factor will certainly increase happiness.

**Visualization 6: Generosity by Happiness score for over the years countries used in question 2.**

I have created a scatter plot showing the relationship between generosity in a country by happiness country. For this visualization I have considered the same countries I considered in question 2 and 3. This visualization helps me answer the question: **Plot a scatter plot for generosity against happiness score for all the years for the countries in question 2. Is there a correlation between the two?**

A screenshot of a computer

Description automatically generated

* The above scatter plot shows how the generosity factor varies in the considered countries.
* We can see that Syria ranks has a higher generosity while Yemen has the least amongst the taken countries.
* Though Syria ranks high in generosity it is not the happiest country. Finland still ranks the top in happiness.
* Afghanistan is the least happy even though Yemen has the least generosity.
* Finland, Switzerland, Unites States, and Italy stands in top 4 even though none of them are top in generosity.
* From this visualization I can infer that generosity cannot be an explicit factor affecting the happiness score of a country.

**Visualization 7: Homicide rates of countries in 2019**

Fear can take a hit on happiness of a person. From my research I found that crime rates can lead to fear, eventually lower levels of happiness. Below visualization shows the homicide rate for all the countries in 2019.

A screenshot of a computer

Description automatically generated with medium confidence

* From the above bubble chart, we can see that “El Salvador” has the highest deaths of 48.71 from homicide.
* Let’s see if homicide rate has any influence over happiness.

**Visualization 8: Infant mortality rates of countries in 2019**

Infant mortality rate is something concerning the society over the years. There can be a subtle relationship of Infant mortality rate with the happiness. The below visualization shows the infant mortality rates of all the countries in 2019.

A screenshot of a computer

Description automatically generated with medium confidence

* From the above bubble chart, we can see that “Mali” has the highest Infant mortality rate of 7.367.
* Let’s see if Infant mortality rate has any influence over happiness in further visualizations.

**Visualization 9: Comparison of homicide rate, Infant mortality rate, and happiness score for extreme countries in 2019**

In the below visualization I have compared the homicide rate, Infant mortality rate, and happiest score of the extreme countries in 2019. By extreme countries I mean the happiest country, least happy country, country with most homicide rate, and country with most infant mortality rate in the year 2019. This visualization answers our question: **Compare happiness score of all the countries with homicide rate and infant mortality rate in the year 2019. What do you infer from this? Infer from the country with highest homicide rate and highest infant mortality rate.**

**A screenshot of a computer

Description automatically generated with medium confidence**

* From the above visualization we can see that “Mali” has the highest Infant mortality rate and has a low happiness index. “El Salvador” has the highest homicide rate with a happiness index a little less than “Finland”.
* Though “Afghanistan” is the least happy country it is not highest in either homicide rate or the infant mortality rate.
* Finland is the happiest country and there is very low crime rate and infant mortality rate. I can say to some extent that the countries with less crime and infant mortality rate are happier.
* I can also say that more crime and more infant mortality rate contribute to a lower happiness index.
* Overall, I can say that homicide rate and infant mortality rate may not be direct influencers of happiness.

**Visualization 10: Total CO2 emission proportion for Switzerland, Russia, and India for 5 years**

It is more likely that countries with more population have more annual CO2 emission. I chose India, China, Russia as they are three of the most populated countries and Switzerland and Denmark since they stand on top in happiness index.

A screenshot of a computer

Description automatically generated with low confidence

* From the above visualization we can see that China has the highest CO2 emission for a total of 5 years.
* The reason could be because China is one of the most populated countries.
* India stands next in CO2 emission, followed by Russia, Switzerland, and Denmark stands the fifth amongst the five considered countries.
* Let’s see how this data helps us in out inferences in further visualizations.

**Visualization 11: Total Happiness score for Switzerland, Russia, India, China, and Denmark for 5 years**

The below visualization shows the total happiness score for 5 years from 2015-2019 for Switzerland, Russia, and India.

A screenshot of a computer

Description automatically generated with low confidence

* From the above visualization we can see the following happiness scores:

1. Switzerland – 37.56
2. India – 21.49
3. Russia – 28.99
4. China – 26.09
5. Denmark – 37.73

* All the scores are out of 50 since for each country. Switzerland stands on top while India has the lowest total.
* Let’s see how out above to visualization draw us to another inference in the next dashboard.

**Dashboard 2: Comparison of total CO2 emission and the happiness score for Switzerland, India, and Russia (visualization 10 and visualization 11)**

I have decided to look at how correlated the CO2 emissions would go hand in hand with the happiness of a nation. Below I have made a dashboard representing the pie charts for total CO2 emissions and happiness scores. This helps answer my question: **Is there a correlation between CO2 emissions in a country with its happiness?**

**A screenshot of a computer

Description automatically generated with medium confidence**

* From the above visualization we can see that India emits highest CO2 with 12 billion tonnes, Russia with 8 billion tonnes, Switzerland with 189 million tonnes, China with 50 billion tonnes, and Denmark with 172 million tonnes.
* India stands the lowest with a total happiness score of 21.49 while Switzerland has the highest with 37.56, Russia has a score of 28.99, China with 26.09, and Denmark with 37.73 happiness score.
* I can see that the more the emission of CO2 less is the happiness.
* I observe an inverse relation between the two factors. Therefore, I can infer to some extent that countries with less CO2 emissions are a little happier that ones with more CO2 emissions.

**Visualization 12: Healthy life expectancy vs Happiness for each country from 2015-2019**

A healthy life would have positive benefits for life. I considered life expectancy to against the happiness. I visualized how a nation with healthy life expectancy would have an impact over happiness. This visualization answers my question: **Do you think happier countries have a higher healthy life expectancy?**

**A screenshot of a computer

Description automatically generated with medium confidence**

* The above visualization is an animated one showing changes in life expectancy and happiness from 2015-2019 for all the countries.
* According to my observation I can see that for most of the countries as the life expectancy increased the happiness also increased.
* I considered horizontal bars to visualize since it is easy to look at the varying changes and draw an inference.
* As the happiness increases the bars get darker and the colour fades as it decreases.
* Though life expectancy is not the only determining factor, it does seem to have a good positive impact on happiness. As they say, **“A healthy life is a happy life, a happy life is a healthy life”.** It holds visually true.

**Conclusions:**

I would like to throw some light on the conclusions and the inferences I have made related to my research questions in this section. Below are my research questions along with relevant justifications:

1. **What are happiness rankings of countries from 2015 - 2019?**

According to visualization 1 I have visualized all the countries based on their respective happiness scores and rankings.

The top ranked countries for the years are:

1. 2015 – Switzerland
2. 2016 – Denmark
3. 2017 – Norway
4. 2018 – Finland
5. 2019 – Finland
6. **Is there a relationship between happiness score and meat consumption? Show trends considering few countries.**

Visualizations 2 and 3 answers this question. I have created two separate visualizations showing happiness and meat consumption. According to the visual data I can say that there is some correlation between the two factors to some extent. For this question I have considered the countries, Afghanistan, Finland, India, Italy, Pakistan, Switzerland, Syria, United States, and Yemen. These countries are considered to show a changing trend among low, medium and high happiness score countries.

Happier countries have a better meat consumption per capita than not so happier countries.

My Dashboard 1 shows the trends along with trail. This provides a slight proof to my conclusion.

1. **Show a scatter plot for meat consumption against happiness score. Can you support the fact that meat consumption produces dopamine which indeed increases happiness?**

In visualization 4 I can see that happiness is high and increasing in more meat consuming countries like Switzerland, USA, Finland, and Italy. India stands lowest with meat consumption and hence a less happy country.

Through my observations yes, I can support the fact that meat consumption produces “Dopamine” which in-turn increases happiness.

1. **Show a map representation for happiness score of all the countries.**

I have made a map representation of happiness scores for all the countries in visualization 5. This is an animated chart showing changing happiness scores from 2015 – 2019.

1. **How does happiness change according to the generosity factor for all countries you considered in question 2?**

Visualization 6 shows the changing happiness score according to the generosity factor in the considered countries. I found that generosity cannot be an explicit factor affecting the happiness of a country. They both are not linearly related.

1. **Compare happiness score of all the countries with homicide rate and infant mortality rate in the year 2019. What do you infer from this? Infer from the country with highest homicide rate and highest infant mortality rate.**

From visualizations 7 and 8 I found that “El Salvador” and “Mali” are the countries with highest homicide rate and infant mortality rate respectively. Then I considered “Finland” and “Afghanistan” which are the happiest and the least happy countries in 2019 respectively.

From the line graph in visualization 9 I could infer that homicide rate and infant mortality rate indeed affect happiness score of a country. More the crime less the happiness. Also, I can say that they are not the ultimate deciding factor. Though Afghanistan has lesser crime and infant mortality rate it still ranks least in happiness score. But a lesser crime and infant mortality rate does improve happiness to some extent.

1. **Is there a correlation between CO2 emissions in a country with its happiness? Consider Switzerland, Russia, India, China, and Denmark.**

In my visualization 10 and 11 I have considered Switzerland, Russia, and India to show total CO2 emissions and total happiness scores respectively. I chose a pie chart since it would be a better option to show the proportion of CO2 emission and happiness score for all the five years.

From dashboard 2 (combination of visualization 10 and 11) I can say that when countries with more CO2 emission are less happy than the ones with less CO2 emission. India is least happy amongst the considered countries since it has the highest total CO2 emission while Switzerland is the happiest with least CO2 emission. Russia stands in between. There is strong correlation between CO2 emission and happiness score.

1. **Do you think happier countries have a higher healthy life expectancy?**

In visualization 12 I took a side-by-side horizontal bar chart comparing healthy life expectancy and happiness scores of all the countries from 2015-2019.

I can see that happier countries do have a healthier life expectancy than the unhappy ones. The darker the bar the higher the life expectancy and higher the happiness. I have made an animation and through observation I’m sure that life expectancy does have a high correlation with the happiness score of a country.

**Additional research questions:**

I feel that there could have been more questions and insights to draw from the data. I felt the above questions are much more important to address to make some healthy inferences. My additional questions would be:

* Is population of a country affecting its happiness?
* What kind of government prevails in happier countries? Do you think there is a correlation between the kind of government and happiness?
* Can you say that alcohol consumption leads to a lower happiness? (If alcohol considered)

**References:**

* [**https://ourworldindata.org/co2-emissions**](https://ourworldindata.org/co2-emissions)
* [**https://ourworldindata.org/grapher/infant-mortality-rate?tab=table&time=2015..2019**](https://ourworldindata.org/grapher/infant-mortality-rate?tab=table&time=2015..2019)
* [**https://www.kaggle.com/datasets/mathurinache/world-happiness-report**](https://www.kaggle.com/datasets/mathurinache/world-happiness-report)
* [**https://ourworldindata.org/explorers/population-and-demography**](https://ourworldindata.org/explorers/population-and-demography)
* [**https://ourworldindata.org/grapher/homicide-rate**](https://ourworldindata.org/grapher/homicide-rate)
* [**https://ourworldindata.org/grapher/daily-meat-consumption-per-person**](https://ourworldindata.org/grapher/daily-meat-consumption-per-person)
* [**https://worldhappiness.report/**](https://worldhappiness.report/)