

Global HDI and Happiness

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Exploratory Data Analysis

Satisfying FAIR Principles - Human Development Index (HDI) Data Set

Findable - The data is collected from the United Nations. Because of this, the data is very reliable. Also, the original table contains all of the descriptions for certain terminology. Especially what's considered "High HDI", "Medium HDI", and "Low HDI", all have their definitions listed at the bottom.

Accessible - It's freely accessible and available in the Excel format. The report from the year is also posted in a link that leads to the pdf in the same webpage.

Interoperable - At the end of the provided report, it contains all of the survey questions that were used in the interviews that took place for the countries. However, the country names themselves are not the "standardized" ones and therefore, it would be difficult to use other data tables with that of the HDI table.

Reusable - All of the other columns in the data table are used to calculate the HDI and from there the HDI rank. Therefore, the attributes listed are all important to the argument.

Conclusion - The HDI data set from the UN, overall does meet the requirements of the FAIR standards. However, the "I" or "Interoperable" is not sufficiently met compared to the others.

Satisfying CARE Principles - HDI Dataset

Collective Benefit - The UN aims to use this data to uniformly and properly track the development of each country in the world. Some territories are also included. The UN uses this data to compare countries data from the HDI standpoint but also from other attributes like mean schooling years or gross national income (GNI). This helps the UN to best figure out what each country or region needs or is affected by the most and the UN can help with suggesting policy changes or even providing aid.

Authority to Control - The data is collected by the United Nations. They had people who were sent out to all or nearly all 195 countries during a specific time period and they collected answers to the survey questions. For countries that had little internet or wifi access, surveys were conducted in-person. While the data and subsequent graphs are available to the public. The countries themselves are unable to determine how their data is used within the report.

Responsibility - The UN analyzed the data they collected themselves and released their findings in the UN report which is a booklet written in English. There is no way to have it translated to a different language. There are no other language options which greatly minimizes who is reached especially given that nearly all 195 countries have data that has been recorded.

Ethics - Data is only summarized by country and therefore nothing confidential has been released in either the report or the raw table. It ethically obtained its data with the consent of its participants.

Conclusion - Because the HDI dataset is sufficient in most of the criteria it mostly passes the CARE principles. It's only weak on the "Responsibility" aspect of how the information is released to the public.

Sustainable FAIR Principles - World Happiness Report (WHR)

Findable - The World Happiness Report collected the data and made the booklet with analysis and figures and tables at the end. Any other sites that contain this data merely copied it from this report.

Accessible - It is widely available and free to access and download.

Interoperable - The questions were based on survey questions that interviewers asked participants to rate certain ideas on a scale from 1-10 and from there they averaged out the response across the respective country. However, it does assume some terminology to be already understood and is not found near the table but instead in the report.

Reusable - It is reusable since it clearly states the survey questions that had been asked and how they took the survey for nearly all 195 countries.

Conclusion - The FAIR requirements were met, although it could do a better job in the Interoperable area specifically clearly defining terminology.

Sustainable CARE Principles - World Happiness Report (WHR)

Collective Benefit - It's intended to help guide public policies and inform world leaders what exactly is impacting their citizens happiness in their day-to-day lives.

Authority to Control - Similar to the HDI data, this is done by a private organization and therefore the local communities don't have access to their own data rather just the summarized and processed data that is released with every other country, when the report is published.

Responsibility - There are cultural biases with answers. For example what one culture considers important may not be the same to another. It's important to analyze the data in the context it's meant to be analyzed and to be aware of the cultural differences between nations.

Ethics - It is entirely confidential and no single participant's response is released. Rather all responses are averaged and then entered into their country's entry. This makes all participants viewed as a member of their respective country rather than individuals.

Conclusion - It meets certain CARE principles. However, there could be a way to allow countries to access their own raw data even if it's not released to the public per se. The countries should be able to see their own specific data to make better judgments for their policies.

Graphs, Tables and Analysis

A country's human development index is the metric used by the United Nations to compare and assess levels of human development of countries globally. The factors that make the Human Development Index are Life Expectancy (at birth), Education (mean years and expected years of schooling) and the Gross National Income per capita, the metric for Standard of living. The metric tries to capture exactly how well people thrive in a country. The Happiness score is the measure of well-being reported through the World Happiness Report. It is typically collected through survey. We want to see if there is any correlation between how well a country is doing, and how happy its' population claims.

Figure 1: A scatter plot of Countries' Human Development Index and Happiness Score for the year 2022.

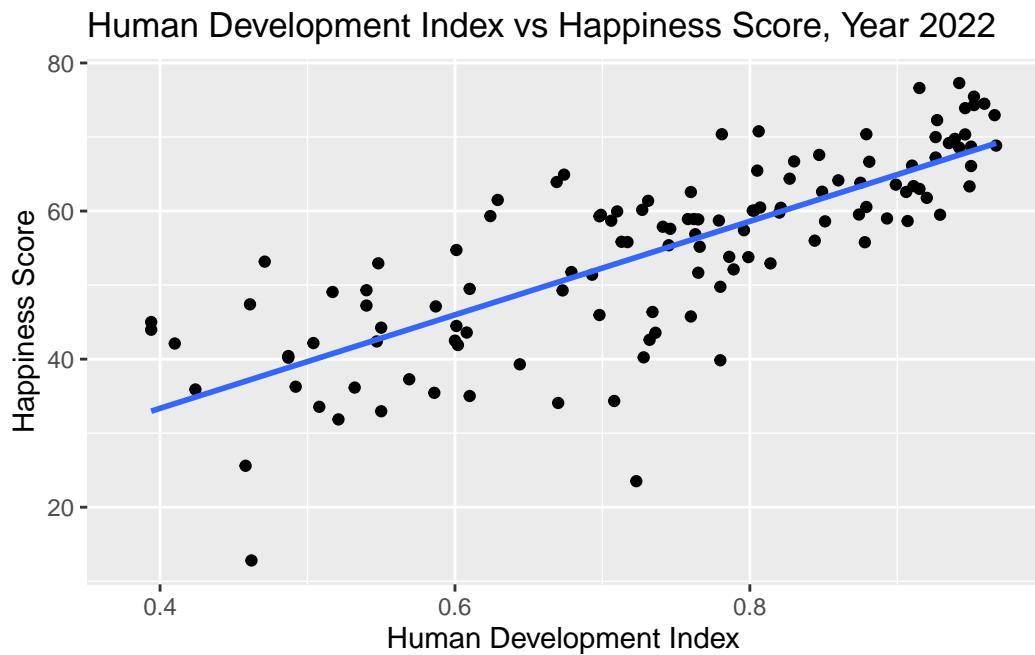
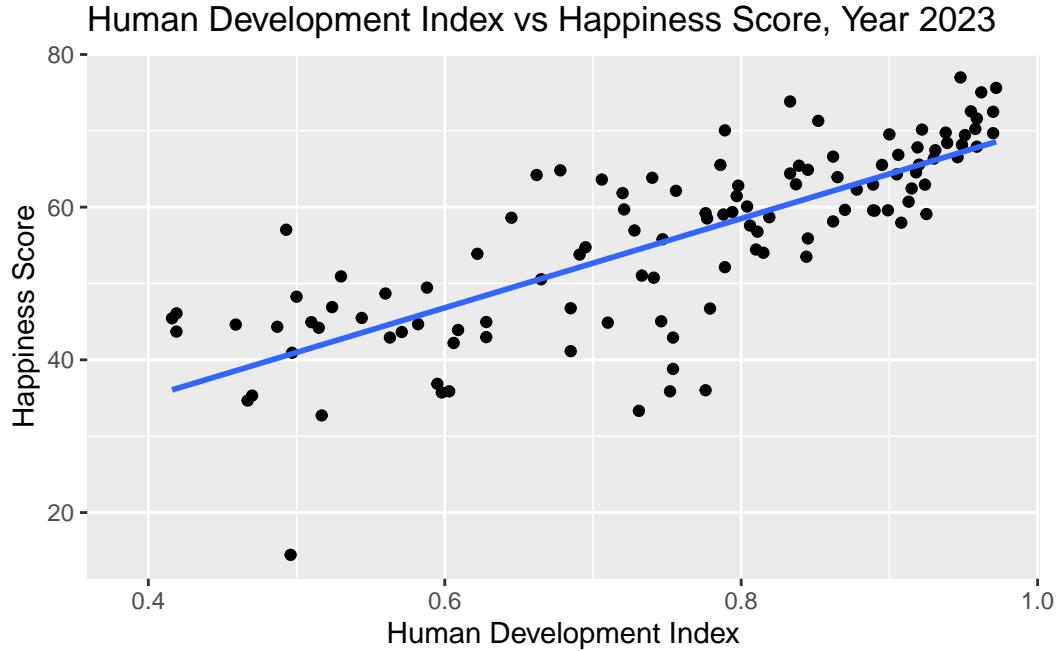


Figure 2: A scatter plot of Countries' Human Development Index and Happiness Score for the year 2023.



In regards to the graphs separately, both Figure 1 and Figure 2 have strong positive correlations between Human Development Index and Happiness Score. For the both the plots the each black dot represents a country. The blue trend line represents shows that the countries with higher human development index, which also means better education, income and life expectancy, tend to report higher happiness levels. This shows that human development could be a significant factor in shaping the well being of nations' populations. Although overall, both graphs show a strong positive correlation, the two plots differ in subtle shifts in point distribution, definitely due to changes in global dynamics like economics and public health.

Table 1: Five Number Summary for Global Human Development Index

Countries	Minimum	Quartile 1	Median	Quartile 3	Maximum	Mean	Standard Deviation	Year
207	0.380	0.602	0.740	0.847	0.967	0.7237409	0.1551773	2022
193	0.388	0.622	0.762	0.862	0.972	0.7407979	0.1516078	2023

Table 2: Five Number Summary for Global Happiness Score

Countries	Minimum	Quartile 1	Median	Quartile 3	Maximum	Mean	Standard Deviation	Year
207	12.81	45.9600	57.880	63.5700	77.29	54.87562	12.35355	2022
193	14.46	45.4775	58.645	64.8375	76.99	55.94750	11.80071	2023

In addition to the graphs, the five number summaries help quantification to the overall distribution. For Table 1, the table shows the distribution of human development index for both 2022 and 2023.

For 2022, the values ranged from minimum of 0.380 to a maximum of 0.967, and had a median of 0.740. In comparison to 2023, the minimum increased to 0.388 and the mean increased to 0.762. This shows overall improvement in human development in countries. For Table 2, in 2022 scores ranged from 12.81 to 77.29, with a median of 57.88. In 2023, the minimum score increase to 14.46 and the median increased to 58.645, showing upward shift in global happiness. The interquartile range also widened, reflecting overall improvements in well-being for nations over all. Over all, both human development index and happiness score shows upward movement in all the summary statistics. Adding the overall positive relationship between the two variables.

Author Contribution

Ahalya worked on the wrangling of the Human Development Index data set, and created the Quarto document, as well as wrote the Exploratory Analysis. Ian wrote the entire README file, as well as the plan document, and worked on the graph for HDI vs Happiness Score, year 2022. Ankita wrangled the Happiness Score data, created the plot for HDI vs Happiness Score, year 2023, created the five number summary tables for the attributed and wrote the graph and table analysis, as well as this contribution.

Works Cited

- Nations, United. “Human Development Index.” *Human Development Reports*, 7 Nov. 2025, hdr.undp.org/data-center/human-development-index#/indicies/HDI.
- “Happiness Score (WHR).” Gapminder, www.gapminder.org/data/. Accessed 17 Dec. 2025.
- United Nations. “Human Development Ranking 2022.” Countryeconomy, countryeconomy.com/hdi. Accessed 17 Dec. 2025.

Code Appendix

```
#Tidyverse style was followed throughout.
# Wrangling/Scraping and Cleaning of HDI and Happiness Score data 2022 -----
# Primary Author: Ankita, Reviewed by Ahalya
library(tidyverse)
library(rvest)

#scraping raw HDI 2022 Data
HDI_2022_raw <- read_html("https://countryeconomy.com/hdi") %>%
  html_elements(css = "table") %>%
  html_table()

HDI_2022 <- (HDI_2022_raw[[1]])

HDI_2022_clean <- HDI_2022 %>%
  select(-c(3:5)) %>%
```

```

separate_wider_delim(
  cols = Countries,
  delim = " [",
  names = c("Country", "junk")
) %>%
select(-c(,2)) %>%
rename()

happiRaw <- read.csv("hapiscore_whr.csv") # read in csv file

happiClean_2022 <- happiRaw %>%
  select(-c(geo, X2005:X2021, X2023)) %>% # removing unneeded columns
  rename(
    Happiness_Score_2022 = X2022, #rename to a more appropriate name
    Country = name
  )

# HDI and Happiness Score 2022 Plot -----
# Primary Author: Ian, Reviewed by Ankita
# creating the combined data
HDI_HappiScore_2022 <- full_join(
  x = HDI_2022_clean,
  y = happiClean_2022,
  by = join_by(Country == Country)
)

#creating visualization HDI vs HappiScore 2022
ggplot(
  data = HDI_HappiScore_2022, # data set
  mapping = aes(
    x = HDI, # x variable
    y = Happiness_Score_2022 # y variable
  )
) + geom_point() + labs(
  title = "Human Development Index vs Happiness Score, Year 2022", # title
  x = xlab("Human Development Index"), # x-axis label
  y = ylab("Happiness Score") # y-axis label
) + geom_smooth( # line of best fit
  method = "lm", # linear model
  se = FALSE
)
# Wrangling and Cleaning of HDI and Happiness Score data 2023 -----
#Primary Author: Ahalya, Reviewed by Ian and Ankita
HDI_raw <- read_csv("HDR25_Statistical_Annex_HDI_Table(Table 1.csv)")

HDI_clean <- HDI_raw %>%
  select(-c(1, 4:16)) %>%

```

```

slice(-c(1:7, 82, 133, 177, 204:278)) %>%
  rename("Country" = `Table 1. Human Development Index and its components`,
         "HDI" = `...3`) %>%
  mutate(
    HDI = as.numeric(HDI)
  )

happiRaw <- read.csv("hapiscore_whr.csv") # read in csv file

# cleaning the data
happiClean <- happiRaw %>%
  select(-c(geo, X2005:X2022)) %>% # removing unneeded columns
  rename(
    Happiness_Score_2023 = X2023, #rename to a more appropriate name
    Country = name
  )

happiClean_2022 <- happiRaw %>%
  select(-c(geo, X2005:X2021, X2023)) %>% # removing unneeded columns
  rename(
    Happiness_Score_2022 = X2022, #rename to a more appropriate name
    Country = name
  )

# HDI and Happiness Score 2023 Plot-----
# Primary Author: Ankita, Reviewed by Ahalya

library(tidyverse)
library(ggplot2)

# creates full data set
HDI_Happiscore_clean <- left_join(
  x = HDI_clean,
  y = happiClean,
  by = join_by(Country == Country)
)

# HDI vs Happiness Score (2023)
ggplot(
  data = HDI_Happiscore_clean,
  mapping = aes(
    x = HDI, # x variable
    y = Happiness_Score_2023 # y variable
  )
) + geom_point() + labs(
  title = "Human Development Index vs Happiness Score, Year 2023", # title

```

```

y = ylab("Happiness Score"), # x axis
x = xlab("Human Development Index") # y axis
) + geom_smooth(
  method = "lm", # creates best fit line
  se = FALSE # removes shaded part
)

# Creating Summary Statistics for each attribute-----
# Primary Author: Ankita, Reviewed by Ahalya and Ian

library(tidyverse)
library(rvest)
library(kableExtra)

#generating five number statisitics for each attribute
HDI2022_stats <- HDI_HappiScore_2022 %>%
  summarize(
    Countries = n(),
    Minimum = min(HDI, na.rm = TRUE),
    `Quartile 1` = quantile(HDI, probs = 0.25, na.rm = TRUE),
    Median = median(HDI, na.rm = TRUE),
    `Quartile 3` = quantile(HDI, probs = 0.75, na.rm = TRUE),
    Maximum = max(HDI, na.rm = TRUE),
    Mean = mean(HDI, na.rm = TRUE),
    `Standard Deviation` = sd(HDI, na.rm = TRUE),
  ) %>%
  mutate(
    Year = "2022"
  )

Happi2022_stats <- HDI_HappiScore_2022 %>%
  summarize(
    Countries = n(),
    Minimum = min(Happiness_Score_2022, na.rm = TRUE),
    `Quartile 1` = quantile(Happiness_Score_2022, probs = 0.25, na.rm = TRUE),
    Median = median(Happiness_Score_2022, na.rm = TRUE),
    `Quartile 3` = quantile(Happiness_Score_2022, probs = 0.75, na.rm = TRUE),
    Maximum = max(Happiness_Score_2022, na.rm = TRUE),
    Mean = mean(Happiness_Score_2022, na.rm = TRUE),
    `Standard Deviation` = sd(Happiness_Score_2022, na.rm = TRUE)
  ) %>%
  mutate(
    Year = "2022"
  )

HDI2023_stats <- HDI_Happiscore_clean %>%

```

```

summarize(
  Countries = n(),
  Minimum = min(HDI, na.rm = TRUE),
  `Quartile 1` = quantile(HDI, probs = 0.25, na.rm = TRUE),
  Median = median(HDI, na.rm = TRUE),
  `Quartile 3` = quantile(HDI, probs = 0.75, na.rm = TRUE),
  Maximum = max(HDI, na.rm = TRUE),
  Mean = mean(HDI, na.rm = TRUE),
  `Standard Deviation` = sd(HDI, na.rm = TRUE),
) %>%
mutate(
  Year = "2023"
)

Happi2023_stats <- HDI_Happiscore_clean %>%
  summarize(
    Countries = n(),
    Minimum = min(Happiness_Score_2023, na.rm = TRUE),
    `Quartile 1` = quantile(Happiness_Score_2023, probs = 0.25, na.rm = TRUE),
    Median = median(Happiness_Score_2023, na.rm = TRUE),
    `Quartile 3` = quantile(Happiness_Score_2023, probs = 0.75, na.rm = TRUE),
    Maximum = max(Happiness_Score_2023, na.rm = TRUE),
    Mean = mean(Happiness_Score_2023, na.rm = TRUE),
    `Standard Deviation` = sd(Happiness_Score_2023, na.rm = TRUE)
) %>%
mutate(
  Year = "2023"
)

#Combining into data sets
HDI_stats <- bind_rows(HDI2022_stats, HDI2023_stats)
Happi_stats <- bind_rows(Happi2022_stats, Happi2023_stats)

# Summary Statistics for Global Human Development Table -----
# Primary Author: Ankita, Reviewed by Ahalya and Ian

#rendering the table
HDI_stats %>%
  kable(
    caption = "Five Number Summary for Global Human Development Index", # title of table
    booktabs = TRUE,
    align = c("l", rep("c",6)),
    format.args = list(big.mark = ',')) # adds separators to the number totals
) %>%
  kableExtra::kable_styling(
    bootstrap_options = c("striped","condensed"),
    font_size = 10,

```

```
    stripe_color = "gray!10" # adds back stripes
  )

# Summary Statistics for Global Happiness Score Table -----
# Primary Author: Ankita, Reviewed by Ahalya and Ian

#rendering the table
Happi_stats %>%
  kable(
  caption = "Five Number Summary for Global Happiness Score", # title of table
  booktabs = TRUE,
  align = c("l", rep("c",6)),
  format.args = list(big.mark = ',')) # adds separators to the number totals
) %>%
  kableExtra::kable_styling(
  bootstrap_options = c("striped","condensed"),
  font_size = 10,
  stripe_color = "gray!10" # adds back stripes
)
```