ECO SCIENCE JOURNALS
We care for Health & Nature

MULTIDISCIPLINARY
SCIENCE JOURNAL

VOLUME - 3

WWW.ECOSCIENCEJOURNALS.COM

Crossref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER UNITED STATES
ISSN:3067-1221; CODEN: USA

ECO SCIENCE JOURNALS

Top eighteen countries with the highest life expectancy in relation to adult mortality rate and infant death rate (2010-2015)

Jeevan Reddy Gurrala [1*], Adrian Mora [2]

1, 2. GVSU College of Computing- Health Informatics and Bioinformatics, M.S Grand Valley State University, Grand Rapids, MI, USA, 49504

Article Info: Received: 08 May 2026, Accepted: 08 Jun 2026, Published: 10 Jun 2026

ABSTRACT:

We live in a society of big data that spans anywhere from social media, social networks, IoT devices, machine learning, and health information. For example, according to Forbes, there are 2.5 quintillion bytes of data created each day[1]. The ability to capture and interpret this data is crucial. Therefore, we decided to use health data for the top eighteen life expectancy countries from 2010 to 2015 to determine any correlations between their adult mortality rate, and infant death rate. We use several clustering methods such as Two-Step, Hierarchical, and Nearest Neighbor to detect several correlations in which we will go into further detail[7].

Keywords: SPSS, Cluster Analysis, Hierarchical, Twostep, K-Mean, Nearest Neighbor, Life Expectancy, Adult Mortality, Infant Deaths, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.

INTRODUCTION:

Our project focuses on the top eighteen highest life expectancy countries from the year 2010 to 2015. Our primary focus on life expectancy is the relation to adult mortality rate and infant deaths. Our main goal was to determine if there was any correlation between those values. For example, do countries with higher life expectancy have higher or lower adult mortality rates and/or infant deaths? We used a dataset from the World Health Organization (WHO) and then used SPSS as the statistical analysis tool to use several methods on our datasets such as Hierarchical Clustering, Two-Step Cluster Analysis, and Nearest Neighbor Analysis.

BACKGROUND:

In order to start our research project, our first step was to acquire some reliable data to work with. We first attempted to download and use various data sets from the worldbank.org [2] website. However, the data sets were massive (over 2GB-5GB of data) and we were having a lot of issues running any of the clustering methods due to its large size. We then acquired a smaller dataset from the Global Health Observatory (GHO) data repository that is under WHO. They keep track of the health status as well as many other related factors for all countries such as BMI, Polio, Schooling stats, HIV/AIDS, etc. Their datasets are available to the public for the purpose of health data analysis. The dataset relates to life expectancy and health factors in 193 countries.

CORRESPONDENCE

G. Jeevan Reddy

GVSU College of Computing- Health Informatics and Bioinformatics, M.S Grand Valley State University, Grand Rapids, MI, USA, 49504

gurralaj@mail.gvsu.edu

Citation: Adrian Mora (2026). Top eighteen countries with the highest life expectancy in relation to adult mortality rate and infant death rate (2010-2015) Eco Science Journal.2026 3(3).

FORMULATION PROCESS:

Once we had our data set, we narrowed it down from 193 countries to the top eighteen countries with the highest life expectancy in 2015 [4]. The countries we focused on are the following: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, and the United States. We also deleted additional columns from our dataset that were not required (i.e. GDP, Population, etc...). Once the data was finalized (Figured 1), we imported the data into the HPC Blade system to use SPSS (statistical analysis software) for further analysis.

8 : HepatitisB 95

	Country	Year	Status	Lifeexpectancy	AdultMortality	infantdeaths
1	Australia	2014	Developed	82.7000000000000	6	1
2	Austria	2012	Developed	88.0000000000000	7	0
3	Belgium	2011	Developed	83.0000000000000	8	0
4	Italy	2010	Developed	81.8000000000000	6	2
5	Italy	2011	Developed	82.0000000000000	6	2
6	Italy	2012	Developed	82.0000000000000	6	2
7	Netherlands	2013	Developed	81.4000000000000	6	1
8	Spain	2013	Developed	82.4000000000000	6	1
9	United States of America	2010	Developed	78.7000000000000	15	25
10	United States of America	2011	Developed	78.7000000000000	16	25
11	United States of America	2012	Developed	78.8000000000000	16	24
12	United States of America	2013	Developed	78.9000000000000	16	23
13	United States of America	2014	Developed	79.1000000000000	14	23
14	United States of America	2015	Developed	79.3000000000000	13	23
15	Australia	2010	Developed	81.9000000000000	64	1
16	Australia	2011	Developed	82.0000000000000	63	1
17	Australia	2012	Developed	82.3000000000000	61	1
18	Australia	2013	Developed	82.5000000000000	61	1
19	Australia	2015	Developed	82.8000000000000	59	1
20	Austria	2010	Developed	84.0000000000000	75	0
21	Austria	2011	Developed	88.0000000000000	73	0
22	Austria	2013	Developed	81.1000000000000	68	0
23	Austria	2014	Developed	81.4000000000000	66	0
24	Austria	2015	Developed	81.5000000000000	65	0
25	Belgium	2010	Developed	80.0000000000000	81	0
26	Belgium	2012	Developed	83.0000000000000	78	0
27	Belgium	2013	Developed	87.0000000000000	77	0
28	Belgium	2014	Developed	89.0000000000000	76	0
29	Belgium	2015	Developed	81.1000000000000	74	0
30	Denmark	2010	Developed	79.2000000000000	84	0
31	Denmark	2010	Developed	79.2000000000000	84	0
32	Denmark	2011	Developed	79.7000000000000	79	0
33	Denmark	2011	Developed	79.7000000000000	79	0
34	Denmark	2012	Developed	80.0000000000000	76	0
35	Denmark	2012	Developed	80.0000000000000	76	0
36	Denmark	2013	Developed	81.0000000000000	75	0
37	Denmark	2013	Developed	81.0000000000000	75	0
38	Denmark	2014	Developed	84.0000000000000	73	0
39	Denmark	2014	Developed	84.0000000000000	73	0
40	Denmark	2015	Developed	86.0000000000000	71	0
41	Denmark	2015	Developed	86.0000000000000	71	0
42	Finland	2010	Developing	79.9000000000000	89	0
43	Finland	2011	Developing	83.0000000000000	86	0
44	Finland	2012	Developing	84.0000000000000	82	0
45	Finland	2013	Developing	87.0000000000000	79	0
46	Finland	2014	Developing	89.0000000000000	78	0
47	Finland	2015	Developing	81.1000000000000	76	0
48	France	2010	Developing	81.3000000000000	86	3
49	France	2011	Developing	81.7000000000000	83	3
50	France	2012	Developing	81.5000000000000	83	3
51	France	2013	Developing	82.0000000000000	81	3
52	France	2014	Developing	82.2000000000000	79	3
53	France	2015	Developing	82.4000000000000	78	2

FIG-1. Global Health Observatory Data.

HIERARCHICAL CLUSTERING:

Hierarchical Clustering is an algorithm that groups similar objects into groups called clusters. It is the most common method in clustering. The process treats each object as an individual cluster, then continuously repeats the same process by identifying two similar clusters and merging them into one similar cluster. This process continues until all the clusters are merged together. Using SPSS, we ran our dataset and we were able to determine a correlation between the following countries (Spain, Australia, Italy, and Austria) and the US from 2010 to 2015. This helped us conclude that those countries have a similar life expectancy, adult mortality rate, and infant death rate. We then processed using a two-step clustering analysis to further investigate the data.

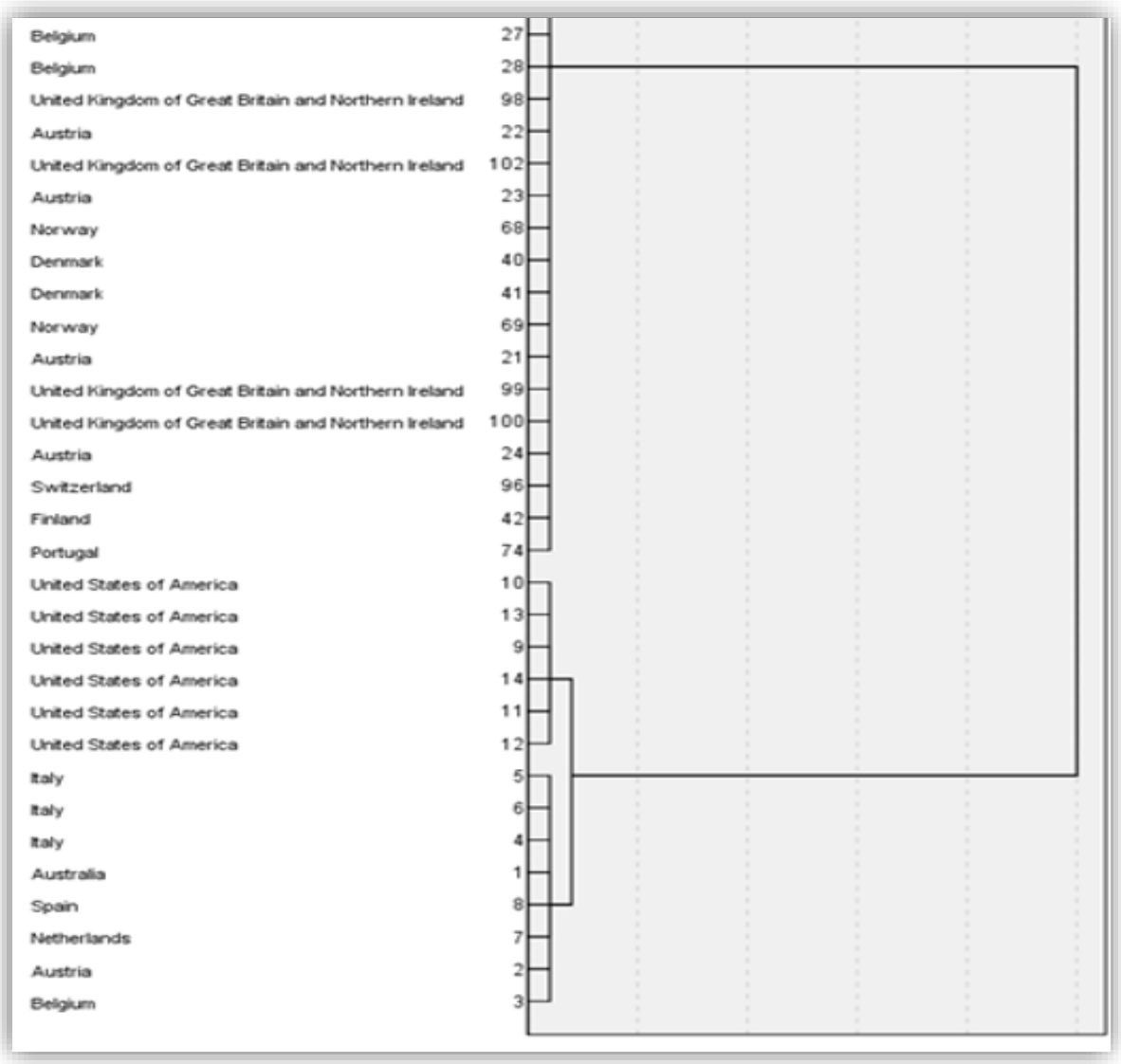

FIG-2. Countries Dendrogram.

TWO-STEP CLUSTERING ANALYSIS:

Two-step clustering was our second SPSS cluster analysis. It is a combination of a hierarchical cluster and a k-mean cluster. The k-mean cluster is used in large data sets, and it lets you test various numbers of clusters. Our inputs where life expectancy, adult mortality, and infant death and this resulted in having a good cluster quality (Figure 3), meaning we have good dataset and clusters to work with.

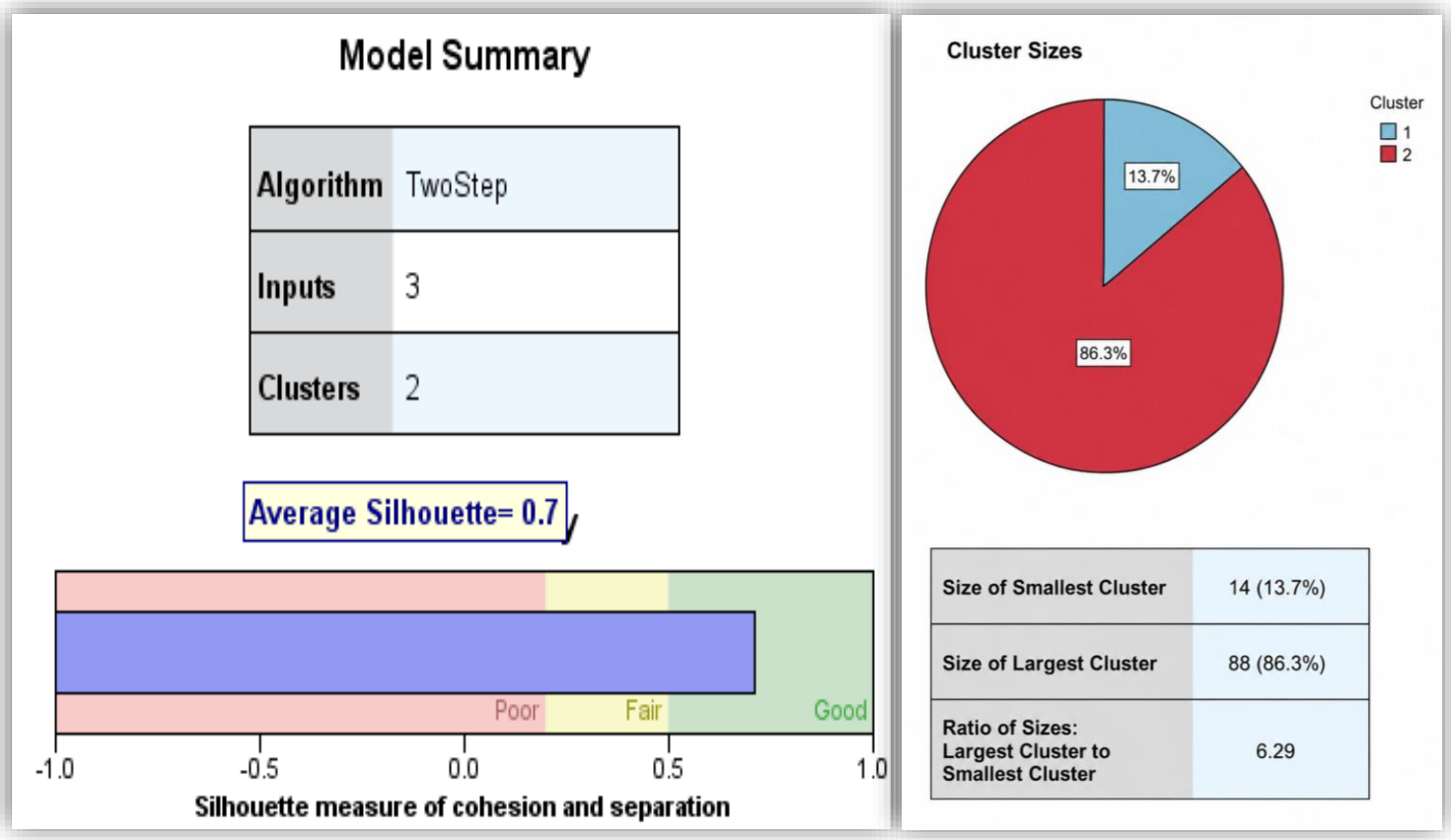

FIG-3. Clustering Analysis Test.

In the pie chart (Figure 3) we can observe two clusters which will be discuss in further detail. Cluster-1 is at 13.7%, which indicates that cluster-1 shares similarities of countries with low adult mortality rate. Cluster-2 is at 86.3%, indicating a higher adult mortality rate from those countries. We can also confirm our findings by looking at the mean values of each variable (Figure 5). The mean value of adult mortality is higher in cluster-2 than cluster-1. In addition, the mean values of infant deaths in cluster-1 are higher than cluster-2.

Number of infant deaths

	2010	2011	2012	2013	2014	2015
United States	25,536.0	24,844.0	24,185.0	23,596.0	23,109.0	22,726.0
United Kingdom	3,490.0	3,381.0	3,270.0	3,169.0	3,083.0	3,010.0
France	2,826.0	2,800.0	2,763.0	2,714.0	2,659.0	2,608.0
Japan	2,601.0	2,570.0	2,391.0	2,282.0	2,169.0	2,116.0
Germany	2,346.0	2,317.0	2,306.0	2,311.0	2,330.0	2,357.0
Italy	1,893.0	1,824.0	1,744.0	1,658.0	1,566.0	1,471.0
Canada	1,845.0	1,841.0	1,833.0	1,819.0	1,800.0	1,774.0
Spain	1,564.0	1,474.0	1,385.0	1,301.0	1,227.0	1,162.0
Australia	1,198.0	1,156.0	1,112.0	1,071.0	1,040.0	1,019.0
Netherlands	685.0	661.0	641.0	624.0	609.0	596.0
Belgium	457.0	449.0	440.0	429.0	417.0	404.0
Switzerland	311.0	313.0	316.0	320.0	323.0	324.0
Portugal	301.0	288.0	276.0	267.0	259.0	254.0
Sweden	280.0	278.0	276.0	275.0	273.0	271.0
Austria	279.0	273.0	266.0	261.0	257.0	255.0
Denmark	214.0	208.0	206.0	206.0	208.0	211.0
Norway	157.0	150.0	144.0	139.0	134.0	130.0
Finland	149.0	141.0	131.0	121.0	111.0	100.0

FIG-4. Number of Infant Deaths-WB.

On the other hand, when comparing life expectancy, we see minor differences in their mean values. Therefore, we can determine that from 2010 to 2015 the eighteen countries with the highest life expectancy also contain a higher adult mortality rate and a lower infant death rate. However, we did have one anomaly and that was the United States because despite showing high life expectancy values it also showed an exponentially higher infant death rate and a lower adult mortality rate.

Our findings were confirmed when we looked at the number of infant deaths from the World Bank (Figure 4)[2]. According to their databases, the United States has eight times more infant deaths than the second-highest country (United Kingdom). An article by NICHD[3] states that during 2011 the United States had five causes of infant mortality which were the following: birth defects, preterm birth along with low birth weight, sudden infant death syndrome (SIDS), pregnancy complications, and accidents.

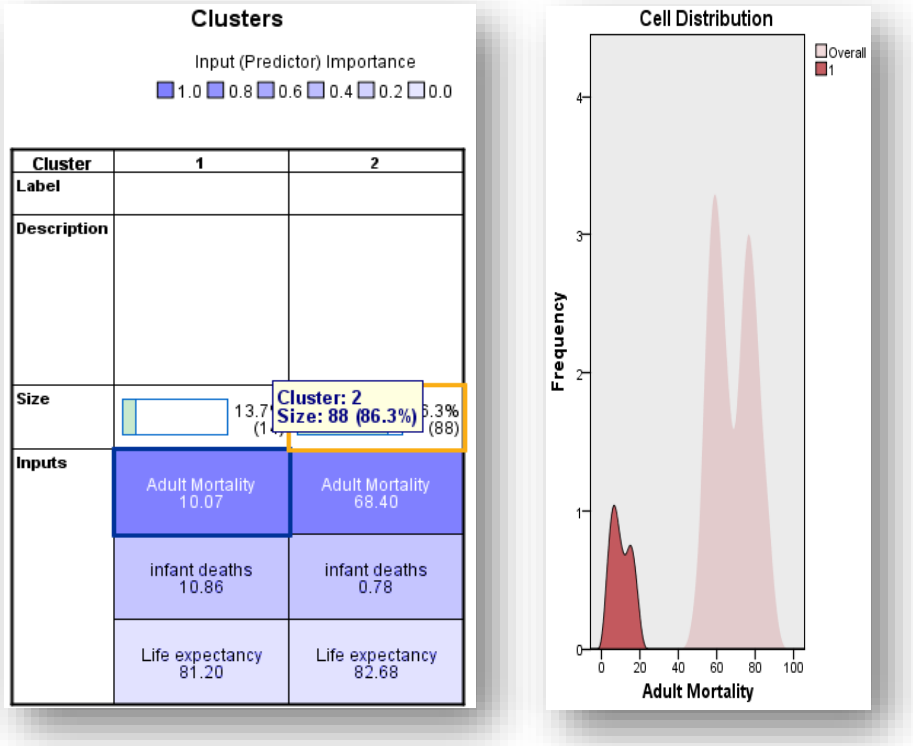

FIG-5. Adult Mortality - Ages 0 to 20.

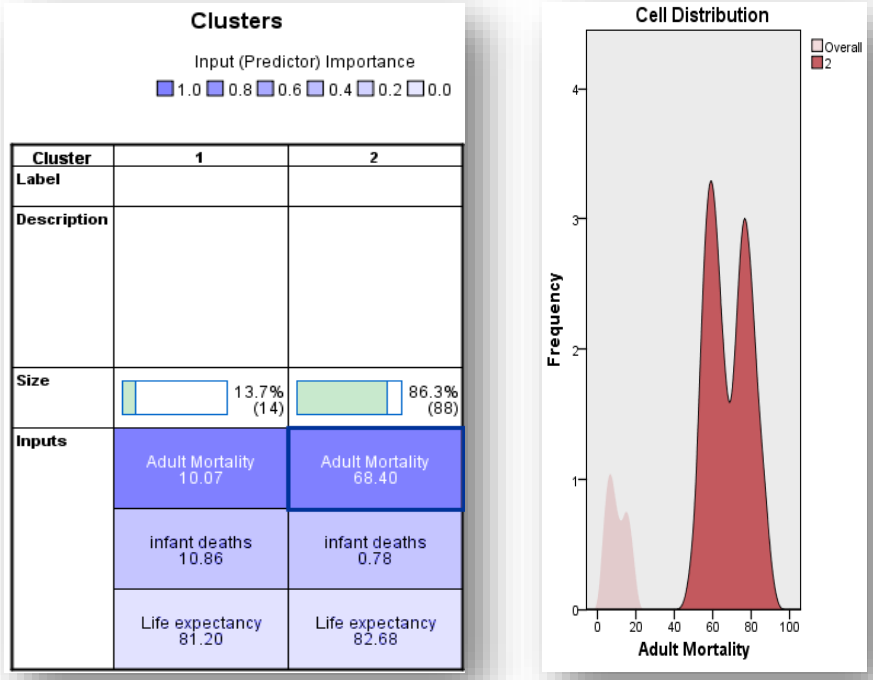

FIG-6. Adult Mortality - Ages 40 to 100.

In cluster-1's cell distribution (Figure 5) we see that the adult mortality for the ages of 0 to 21 is lower due to a lower frequency of 0 to 1. In cluster 2 (Figure 6) we see the opposite, showing that the adult mortality for ages 40 to 100 have a higher chance of dying due to the higher frequency of 0 to 3.3.

NEARREST NEIGHBOR ANALYSIS:

K nearest neighbor analysis in a way to classify cases (data) on their similarity with other cases. It measures (e.g. distance functions) the similarity between a point and its nearest neighbor. K is used as a numerical value to determine how many neighbors to compare the similarities. In our nearest neighbor analysis (Figure 7) we see that for the majority of the countries the adult mortality is fairly high while the life expectancy ranges from 79 to 89 years of age. However, let's highlight a few clusters that were formed using K= 4.

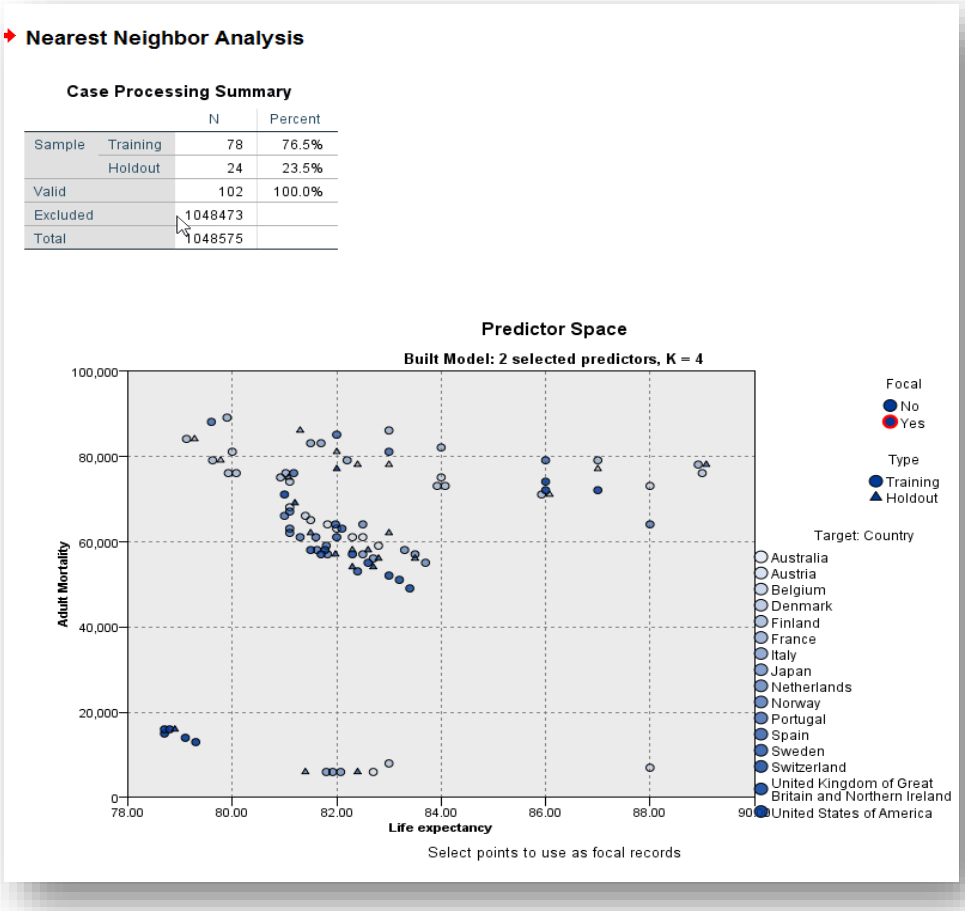

FIG-7. Countries Adult Mortality.

A. UNITED STATES: The first one is located in the bottom left (figure 7) which is the united states from various years, indicating that the adult mortality rate is below 20,000 while the life expectancy is around 79 years of age. Adult mortality rates are anywhere from 15 years of age to 65 meaning that in the united states, we have a good healthcare system and most adults are able to get some medical assistance to treat their problem(s). Therefore, keeping adult mortality rates lower in comparison to the other countries. We also ran the nearest neighbor analysis for infant death and just like our previous two-step clustering analysis we were able to determine that the united states had a high infant death rate in comparison to the other top countries.

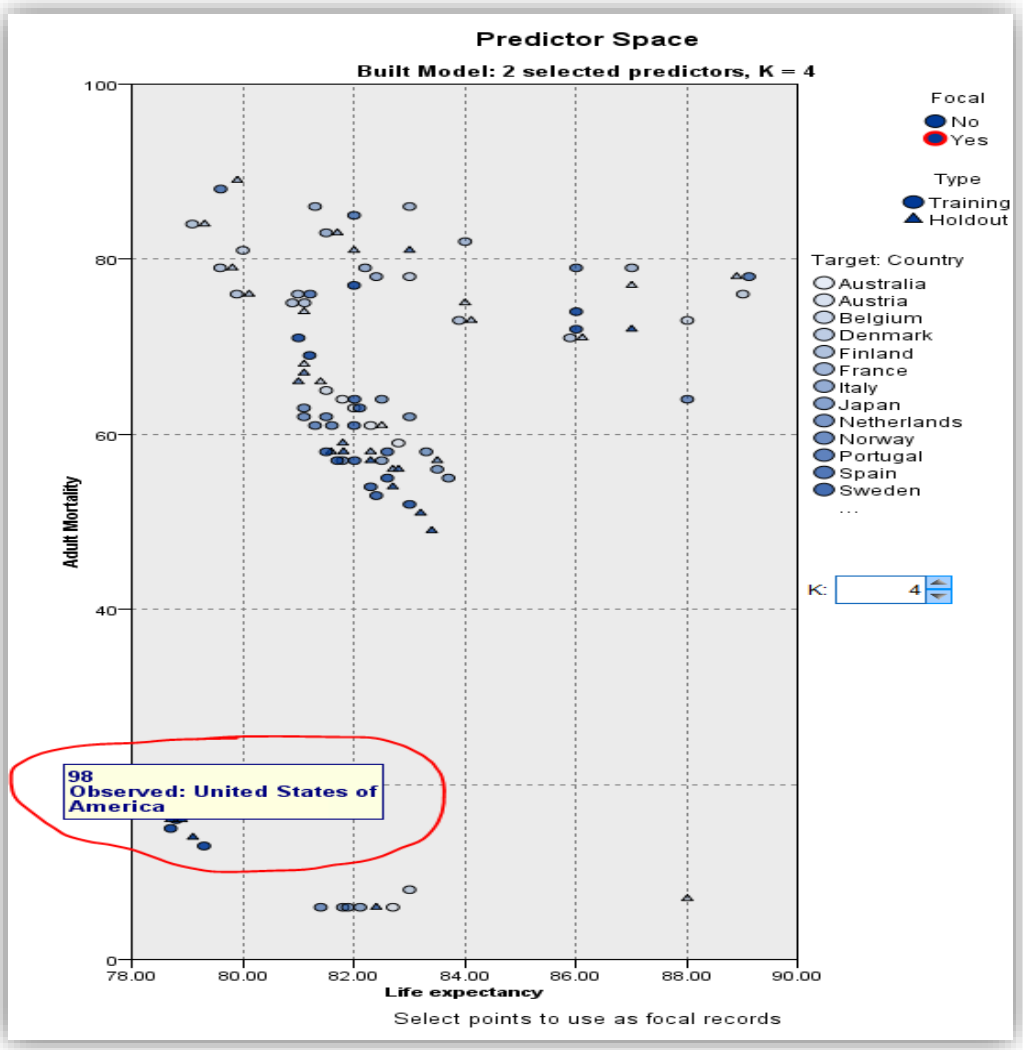

FIG-8. Life Expectancy vs Mortality Rate.

B. NETHERLANDS, ITALY (3 YEARS), AND AUSTRALIA: our second exception is located in the bottom left to the right of the united states which is circled in red (figure 8). This cluster is compromise of several countries; the Netherlands, Austr alia, and Italy for three different years. We can determine from this cluster that those countries have a similar life expectancy ranging from 81 to 83 years of age and their adult mortality rate are only 6,000 (6 per 1,000 of population). In conclusion, these co untries have a really low mortality rate in comparison to all the other countries, while maintaining an above average life expectancy of 71 which was the average life expectancy at birth from 2010-2015[8].

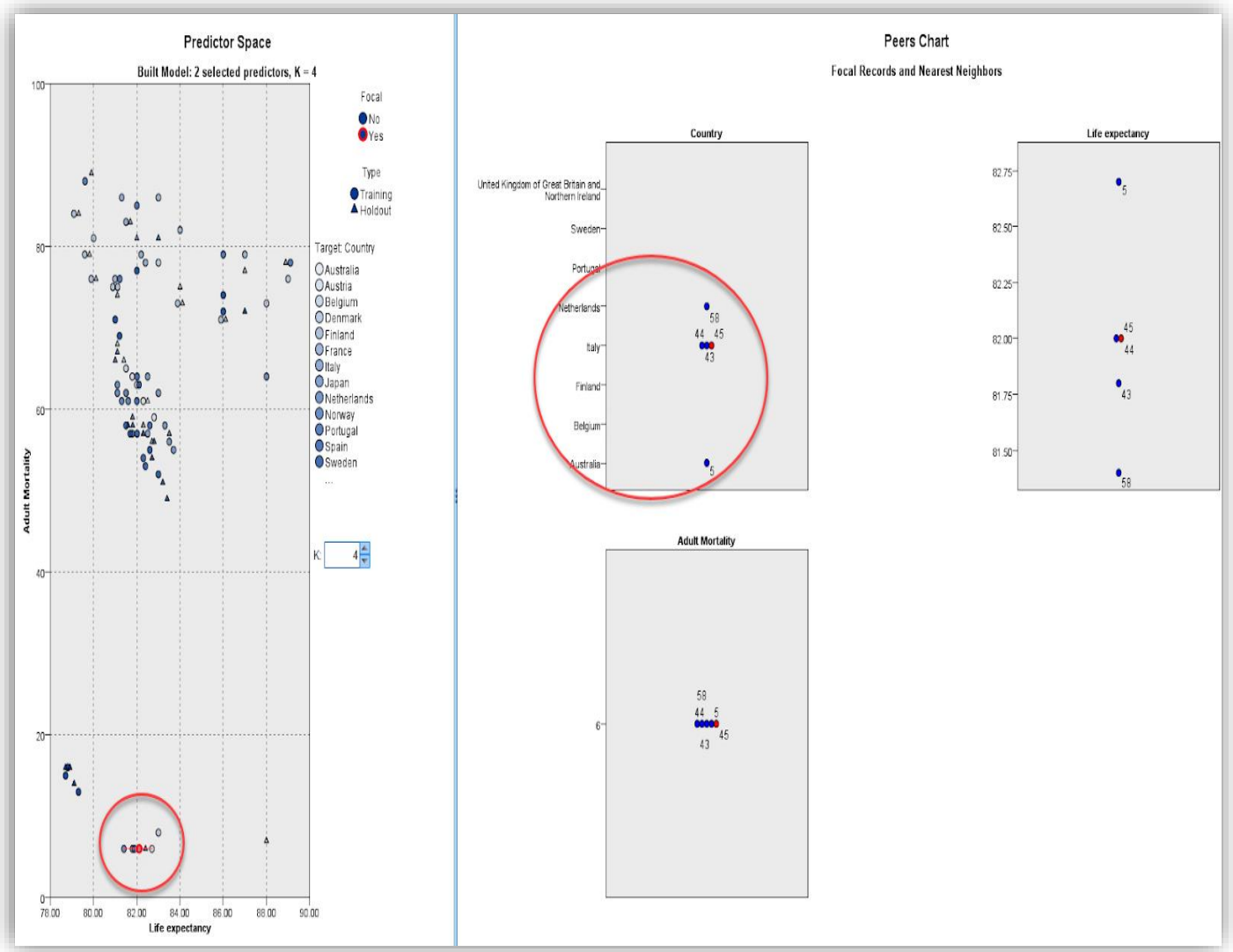

FIG-9. Nearest Neighbor Analysis of Countries.

CONCLUSION:

In a rapidly increasing big data driven world, we need to have tools such as hardware and software to be able to analyze crucial data such as medical information to help us determine potential issues or improve clinical practices. The goal of our project was to analyze the top eighteen countries with the highest life expectancy and determine if there was any correlation between them in particularly looking into adult mortality rates and infant death rates. We were able to conclude a couple of things. First, the united states have a low adult mortality (ages 15 to 65) rate in comparison to other countries, meaning the health care system in the us is very good. However, the united states also had the highest infant death rate. The infant death rate was eight times higher than the second highest country. This leads us to believe that there could be some improvements in the healthcare industry when dealing with pregnancies, and newborns. The findings were confirmed by additional research topics[2] that described the top five causes of infant mortality in the us along with the world bank (figure 4) re-assuring the high infant death rate of the united states.

BIBILOGRAPHY:

1. School of public health. (2019). *'we live in a world of big data'* | *sph* |*bostonuniversity*. *[*online]availableat:https://www.bu.edu/sph/2019/12/06/we-live-in-a-world-of-big-data/ [accessed 1 Dec. 2019].

2. Data.worldbank.org. (2019). Life expectancy at birth, total (years) | data. [online] available at: https://data.worldbank.org/indicator/sp.dyn.le00.in?end=2017&start=1960 [accessed 1 Dec. 2019].

3. Https://www.nichd.nih.gov/. (2019). What causes infant mortality?. [online] available at: https://www.nichd.nih.gov/health/topics/infant-mortality/topicinfo/causes [accessed 3 Dec. 2019].

4. Kaggle.com. (2019). *Life expectancy (who)*. [online] available at: https://www.kaggle.com/kumarajarshi/life-expectancy-who [accessed 1 Dec. 2019].

5. Foreman, k., marquez, n., dolgert, a., fukutaki, k., fullman, n., mcgaughey, m., pletcher, m., smith, a., tang, k., yuan, c., brown, j., friedman, j., he, j., heuton, k., holmberg, m., patel, d., reidy, p., carter, a., cercy, k., chapin, a., douwes-schultz, d., frank, t., goettsch, f., liu, p., nandakumar, v., reitsma, m., reuter, v., sadat, n., sorensen, r., srinivasan, v., updike, r., york, h., lopez, a., lozano, r., lim, s., mokdad, a., vollset, s. And murray, c. (2019). *Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016–40 for 195 countries and territories*. [online] available at:https://www.sciencedirect.com/science/article/pii/s0140673618316945 [accessed 2 Dec. 2019].

6. Fao.org.(2019).[online]availableat:http://www.fao.org/tempref/ag/reserved/pplpf/ftpout/gianluca/stats/statistics%20%20a%20handbook%20of%20statistical%20analyses%20using%20spss%20-%20excellent%20!!!.pdf [accessed 2 Dec. 2019].
7. Ibm.com.(2019). Ibm knowledge center. [online] available at: https://www.ibm.com/support/knowledgecenter/en/sslvmb_24.0.0/spss/base/idh_twostep_main.html [accessed 2 Dec. 2019].

8. Population.un.org (2019). [online] available at https//: population.un.org/wpp/publications/files/world_population_2015_wallchart.pdf [accessed 3 dec. 2019].