PopDeaths

September 28, 2021

[1]:
```
import seaborn as sns
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import re
from IPython.display import display
import statsmodels.api as sm
import statsmodels.formula.api as smf
```

We will first download the data from data.cdc.gov

[2]:
```
data = pd.read_csv("https://data.cdc.gov/api/views/u6jv-9ijr/rows.csv?
↪accessType=DOWNLOAD")
```

We will drop all of the columns in the data that we will not use.

[3]:
```
data.drop('Week Ending Date', axis = 1, inplace = True)
data.drop('State Abbreviation', axis = 1, inplace = True)
data.drop('Week', axis = 1, inplace = True)
data.drop('Cause Subgroup', axis = 1, inplace = True)
data.drop('Time Period', axis = 1, inplace = True)
data.drop('Suppress', axis = 1, inplace = True)
data.drop('Note', axis = 1, inplace = True)
data.drop('Average Number of Deaths in Time Period', axis = 1, inplace = True)
data.drop('Difference from 2015-2019 to 2020', axis = 1, inplace = True)
data.drop('Percent Difference from 2015-2019 to 2020', axis = 1, inplace = True)
data.drop('Type', axis = 1, inplace = True)
```

Since the dataset contains data from 2021 and we are not interested in 2021 data, we will drop this data.

[4]:
```
data = data[data["Year"] != 2021]
```

Let's check for missing data.

[5]:
```
data.isnull().sum()
```

[5]:
```
Jurisdiction        0
Year                0
```

```
Cause Group          0
Number of Deaths     0
dtype: int64
```

Since there is no missing data, we can continue with our analysis. There is data in the dataset that has a jurisdiction of 'United States'. This means that out data is going to be doubled of what it really is so let's drop the observations that have a jurisdiction of 'United States' and only get the state jurisdiction.

[6]:
```
display(data[data['Jurisdiction'] == 'United States'].head())
display(data[data['Jurisdiction'] == 'United States'].count())
```

```
       Jurisdiction  Year                    Cause Group  Number of Deaths
30120  United States  2015  Alzheimer disease and dementia            6187.0
30121  United States  2015  Alzheimer disease and dementia            6187.0
30122  United States  2016  Alzheimer disease and dementia            5155.0
30123  United States  2016  Alzheimer disease and dementia            5155.0
30124  United States  2017  Alzheimer disease and dementia            5844.0

Jurisdiction        8138
Year                8138
Cause Group         8138
Number of Deaths    8138
dtype: int64
```

[7]:
```
index = data[(data['Jurisdiction'] == 'United States')].index
data.drop(index, inplace = True)
display(data[data['Jurisdiction'] == 'United States'].count())
```

```
Jurisdiction        0
Year                0
Cause Group         0
Number of Deaths    0
dtype: int64
```

Let's change the column names so they don't have spaces.

[8]:
```
data.columns = ['Jurisdiction', 'Year', 'CauseGroup', 'NumberOfDeaths']
data.head()
```

[8]:
```
   Jurisdiction  Year                    CauseGroup  NumberOfDeaths
0       Alabama  2015  Alzheimer disease and dementia           120.0
1       Alabama  2015  Alzheimer disease and dementia           120.0
2       Alabama  2016  Alzheimer disease and dementia            76.0
3       Alabama  2016  Alzheimer disease and dementia            76.0
4       Alabama  2017  Alzheimer disease and dementia            96.0
```

We will check the unique years in the dataset and make sure we only have 2015 through 2020.

[9]:
```
data["Year"].unique()
```

[9]:
```
array([2015, 2016, 2017, 2018, 2019, 2020])
```

Now, we will loop through all 6 years and seperate the data by year.

[10]:
```
for year in data['Year'].unique():
    globals()['df_%s' % year] = data[data.Year == year].reset_index(drop = True)
```

[11]:
```
sum_years = data.groupby([data.Year]).sum()

totalDeaths_all = int(sum(sum_years['NumberOfDeaths']))

i = 0
for year in sum_years.index:
    globals()['sum_%s' % year] = int(sum_years.iloc[i])
    i+=1
```

Let's get the total number of deaths per year along with the total deaths for all 6 years.

[12]:
```
years = data['Year'].unique()

years_total = []
for year in years:
    years_total.append(str(year))
years_total.append('Total')

deaths = [item for item in sum_years['NumberOfDeaths']]
deaths.append(totalDeaths_all)
```

[13]:
```
for i in range(len(deaths)):
    deaths[i] = int(deaths[i])
```

[14]:
```
deaths
```

[14]:
```
[4169620, 4185822, 4301084, 4343760, 4341442, 4635925, 25977653]
```

Now, we only need the deaths per year and we want to reverse them so we have 2020 deaths at index 0.

[15]:
```
deaths_ = []
for item in deaths[:-1]:
    deaths_.insert(0,item)
print(deaths_)
```

```
[4635925, 4341442, 4343760, 4301084, 4185822, 4169620]
```

Let's get the population of the United States for all 6 of these years.

[16]:
```
pop = pd.read_html("https://www.multpl.com/united-states-population/table/
↪by-year")[0]
```

[17]:
```
pop = pop.iloc[1:7,]
```

[18]:
```
pop
```

[18]:

	Date	Value	Value
1	Jul 1, 2020	329.88 million	
2	Jul 1, 2019	328.24 million	
3	Jul 1, 2018	326.69 million	
4	Jul 1, 2017	324.99 million	
5	Jul 1, 2016	322.94 million	
6	Jul 1, 2015	320.64 million	

We only want to get year of the date column and the population in just a number so we will split both columns into lists and take the last index of the data column and index 0 of the value column and multiply the value column by 1,000,000 to get the actual population.

[19]:
```
for i in range(len(pop)):
    lst1 = pop.iloc[i,0].split()
    pop.iloc[i,0] = lst1[-1]

    lst2 = pop.iloc[i,1].split()
    pop.iloc[i,1] = lst2[0]
```

[20]:
```
pop.columns = ["Date", "Population"]
```

We will check the data types and if they aren't the right data types, we will convert them.

[21]:
```
pop.dtypes
```

[21]:
```
Date          object
Population    object
dtype: object
```

[22]:
```
pop["Date"] = pd.to_numeric(pop["Date"])
pop["Population"] = pd.to_numeric(pop["Population"])
```

[23]:
```
pop
```

[23]:

	Date	Population
1	2020	329.88
2	2019	328.24
3	2018	326.69
4	2017	324.99
5	2016	322.94
6	2015	320.64

[24]:
```
pop.dtypes
```

[24]:
```
Date            int64
Population    float64
dtype: object
```

[25]:
```
pop["Population"] = pop["Population"] * 1000000
```

[26]:
```
pop["Population"] = pd.to_numeric(pop["Population"], downcast="integer")
```

[27]:
```
pop
```

[27]:

	Date	Population
1	2020	329880000
2	2019	328240000
3	2018	326690000
4	2017	324990000
5	2016	322940000
6	2015	320640000

Now, let's create another dataframe for the population and death rate.

[28]:
```
pop_rate_df = pop.copy()
```

[29]:
```
pop_rate_df["Total_Deaths"] = deaths_
pop_rate_df["Total_Rate"] = pop_rate_df["Total_Deaths"]/
 ↪pop_rate_df["Population"]
```

[30]:
```
pop_rate_df
```

[30]:

	Date	Population	Total_Deaths	Total_Rate
1	2020	329880000	4635925	0.014053
2	2019	328240000	4341442	0.013226
3	2018	326690000	4343760	0.013296
4	2017	324990000	4301084	0.013235
5	2016	322940000	4185822	0.012962
6	2015	320640000	4169620	0.013004

Now, let's seperate the data by causes of death.

[31]:
```
# Get Alzheimer deaths per year and store in a variable called␣
 ↪'deathsAlzheimer_year' where year is the actual year
for year in data['Year'].unique():
    globals()['deathsAlzheimer_%s' % year] = int(data.query(f"CauseGroup ==␣
 ↪'Alzheimer disease and dementia' and Year == {year}")['NumberOfDeaths'].
 ↪sum())
```

```
# Get Malignant deaths per year and store in a variable called␣
 ↪'deathsMalignant_year' where year is the actual year                 ␣
 ↪
for year in data['Year'].unique():
    globals()['deathsMalignant_%s' % year] = int(data.query(f"CauseGroup ==␣
 ↪'Malignant neoplasms' and Year == {year}")['NumberOfDeaths'].sum())

# Get Respiratory deaths per year and store in a variable called␣
 ↪'deathsRespiratory_year' where year is the actual year               ␣
 ↪
for year in data['Year'].unique():
    globals()['deathsRespiratory_%s' % year] = int(data.query(f"CauseGroup ==␣
 ↪'Respiratory diseases' and Year == {year}")['NumberOfDeaths'].sum())

# Get Circulatory deaths per year and store in a variable called␣
 ↪'deathsCirculatory_year' where year is the actual year               ␣
 ↪
for year in data['Year'].unique():
    globals()['deathsCirculatory_%s' % year] = int(data.query(f"CauseGroup ==␣
 ↪'Circulatory diseases' and Year == {year}")['NumberOfDeaths'].sum())

# Get Other deaths per year and store in a variable called 'deathsOther_year'␣
 ↪where year is the actual year                                        ␣
 ↪
for year in data['Year'].unique():
    globals()['deathsOther_%s' % year] = int(data.query(f"CauseGroup == 'Other␣
 ↪select causes' and Year == {year}")['NumberOfDeaths'].sum())

yearCauseDeaths = data.groupby([data.Year, data.CauseGroup]).sum().reset_index()

myDict = {}
for i in range(len(yearCauseDeaths)):
    if myDict == {}:
        myDict = {yearCauseDeaths.iloc[i,0]:[yearCauseDeaths.iloc[i,-1]]}
    else:
        if yearCauseDeaths.iloc[i,0] in myDict.keys():
            myDict[yearCauseDeaths.iloc[i,0]].append(yearCauseDeaths.iloc[i,-1])
        else:
            myDict.update({yearCauseDeaths.iloc[i,0]:[yearCauseDeaths.
 ↪iloc[i,-1]]})

colNames = yearCauseDeaths["CauseGroup"].unique()
col_names = []

for item in colNames:
    col_names.append(item.split(" ")[0])
```

```
df_deathsCausePerYear = pd.DataFrame(myDict.values(), columns = col_names)
df_deathsCausePerYear

years = myDict.keys()

df_deathsCausePerYear.insert(0, "Year", years)

display(df_deathsCausePerYear)
```

	Year	Alzheimer	Circulatory	Malignant	Other	Respiratory
0	2015	490130.0	1649122.0	1196044.0	314026.0	520298.0
1	2016	498712.0	1658822.0	1200410.0	315756.0	512122.0
2	2017	525012.0	1702588.0	1207174.0	326626.0	539684.0
3	2018	535206.0	1722912.0	1207218.0	330710.0	547714.0
4	2019	544754.0	1733834.0	1208100.0	331254.0	523500.0
5	2020	621419.0	1875160.0	1233403.0	373682.0	532261.0

Convert the values from float to integer.

[32]:
```
df_deathsCausePerYear["Alzheimer"] = pd.
 ↪to_numeric(df_deathsCausePerYear["Alzheimer"], downcast="integer")
df_deathsCausePerYear["Circulatory"] = pd.
 ↪to_numeric(df_deathsCausePerYear["Circulatory"], downcast="integer")
df_deathsCausePerYear["Malignant"] = pd.
 ↪to_numeric(df_deathsCausePerYear["Malignant"], downcast="integer")
df_deathsCausePerYear["Other"] = pd.to_numeric(df_deathsCausePerYear["Other"],␣
 ↪downcast="integer")
df_deathsCausePerYear["Respiratory"] = pd.
 ↪to_numeric(df_deathsCausePerYear["Respiratory"], downcast="integer")

df_deathsCausePerYear
```

[32]:

	Year	Alzheimer	Circulatory	Malignant	Other	Respiratory
0	2015	490130	1649122	1196044	314026	520298
1	2016	498712	1658822	1200410	315756	512122
2	2017	525012	1702588	1207174	326626	539684
3	2018	535206	1722912	1207218	330710	547714
4	2019	544754	1733834	1208100	331254	523500
5	2020	621419	1875160	1233403	373682	532261

We need to reverse the number of deaths so that 2020 is at the first index.

[33]:
```
alz = []
circ = []
malig = []
oth = []
resp = []
```

```
for item in df_deathsCausePerYear["Alzheimer"]:
    alz.insert(0,item)
for item in df_deathsCausePerYear["Circulatory"]:
    circ.insert(0,item)
for item in df_deathsCausePerYear["Malignant"]:
    malig.insert(0,item)
for item in df_deathsCausePerYear["Other"]:
    oth.insert(0,item)
for item in df_deathsCausePerYear["Respiratory"]:
    resp.insert(0,item)
print(alz)
print(circ)
print(malig)
print(oth)
print(resp)
```

```
[621419, 544754, 535206, 525012, 498712, 490130]
[1875160, 1733834, 1722912, 1702588, 1658822, 1649122]
[1233403, 1208100, 1207218, 1207174, 1200410, 1196044]
[373682, 331254, 330710, 326626, 315756, 314026]
[532261, 523500, 547714, 539684, 512122, 520298]
```

[34]:
```
cat_deaths_rate_df = pop_rate_df
```

[35]:
```
cat_deaths_rate_df = cat_deaths_rate_df.rename(columns={"Total_Rate":
 ↪"Death_Rate"})
```

Let's put the data of deaths into a dataframe called 'cat_deaths_rate_df'.

[36]:
```
cat_deaths_rate_df["Alzheimer"] = alz
cat_deaths_rate_df["Circulatory"] = circ
cat_deaths_rate_df["Malignant"] = malig
cat_deaths_rate_df["Other"] = oth
cat_deaths_rate_df["Respiratory"] = resp
```

Now, we will get the rate of death per cause by dividing the number of deaths per cause per year by the number of total deaths per year and remove all of the total deaths per cause per year and total deaths per year.

[37]:
```
cat_deaths_rate_df["Alz_Rate"] = cat_deaths_rate_df["Alzheimer"]/
 ↪cat_deaths_rate_df["Total_Deaths"]
cat_deaths_rate_df["Circ_Rate"] = cat_deaths_rate_df["Circulatory"]/
 ↪cat_deaths_rate_df["Total_Deaths"]
cat_deaths_rate_df["Malig_Rate"] = cat_deaths_rate_df["Malignant"]/
 ↪cat_deaths_rate_df["Total_Deaths"]
cat_deaths_rate_df["Other_Rate"] = cat_deaths_rate_df["Other"]/
 ↪cat_deaths_rate_df["Total_Deaths"]
```

```
cat_deaths_rate_df["Resp_Rate"] = cat_deaths_rate_df["Respiratory"]/
↪cat_deaths_rate_df["Total_Deaths"]

cat_deaths_rate_df
```

[37]:

	Date	Population	Total_Deaths	Death_Rate	Alzheimer	Circulatory	\
1	2020	329880000	4635925	0.014053	621419	1875160	
2	2019	328240000	4341442	0.013226	544754	1733834	
3	2018	326690000	4343760	0.013296	535206	1722912	
4	2017	324990000	4301084	0.013235	525012	1702588	
5	2016	322940000	4185822	0.012962	498712	1658822	
6	2015	320640000	4169620	0.013004	490130	1649122	

	Malignant	Other	Respiratory	Alz_Rate	Circ_Rate	Malig_Rate	\
1	1233403	373682	532261	0.134044	0.404485	0.266053	
2	1208100	331254	523500	0.125478	0.399368	0.278272	
3	1207218	330710	547714	0.123213	0.396641	0.277920	
4	1207174	326626	539684	0.122065	0.395851	0.280667	
5	1200410	315756	512122	0.119143	0.396295	0.286780	
6	1196044	314026	520298	0.117548	0.395509	0.286847	

	Other_Rate	Resp_Rate
1	0.080606	0.114812
2	0.076300	0.120582
3	0.076135	0.126092
4	0.075940	0.125476
5	0.075435	0.122347
6	0.075313	0.124783

[38]:
```
cat_deaths_rate_df = cat_deaths_rate_df.drop(columns=["Population",␣
↪"Total_Deaths", "Alzheimer", "Circulatory", "Malignant", "Other",␣
↪"Respiratory"])
```

[39]:
```
cat_deaths_rate_df
```

[39]:

	Date	Death_Rate	Alz_Rate	Circ_Rate	Malig_Rate	Other_Rate	Resp_Rate
1	2020	0.014053	0.134044	0.404485	0.266053	0.080606	0.114812
2	2019	0.013226	0.125478	0.399368	0.278272	0.076300	0.120582
3	2018	0.013296	0.123213	0.396641	0.277920	0.076135	0.126092
4	2017	0.013235	0.122065	0.395851	0.280667	0.075940	0.125476
5	2016	0.012962	0.119143	0.396295	0.286780	0.075435	0.122347
6	2015	0.013004	0.117548	0.395509	0.286847	0.075313	0.124783

Below is the population, total deaths, and total rate dataframe.

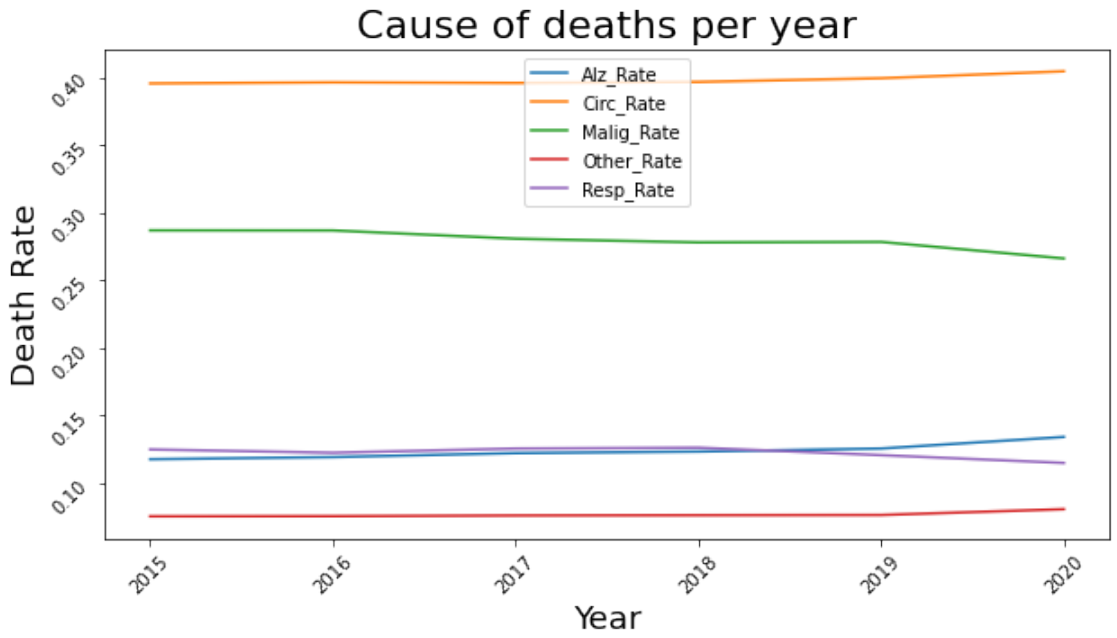
[40]:
```
pop_rate_df
```

[40]:

	Date	Population	Total_Deaths	Total_Rate
1	2020	329880000	4635925	0.014053
2	2019	328240000	4341442	0.013226
3	2018	326690000	4343760	0.013296
4	2017	324990000	4301084	0.013235
5	2016	322940000	4185822	0.012962
6	2015	320640000	4169620	0.013004

Let's plot the cause of deaths per year.

[41]:
```
fig = plt.gcf()
fig.set_size_inches(10, 5)
plt.plot("Date", "Alz_Rate", data=cat_deaths_rate_df)
plt.plot("Date", "Circ_Rate", data=cat_deaths_rate_df)
plt.plot("Date", "Malig_Rate", data=cat_deaths_rate_df)
plt.plot("Date", "Other_Rate", data=cat_deaths_rate_df)
plt.plot("Date", "Resp_Rate", data=cat_deaths_rate_df)
plt.title("Cause of deaths per year", size = 22)
plt.xlabel("Year", size = 18)
plt.ylabel("Death Rate", size = 18)
plt.xticks(rotation = 45)
plt.yticks(rotation = 45)
plt.legend()
plt.show()
```



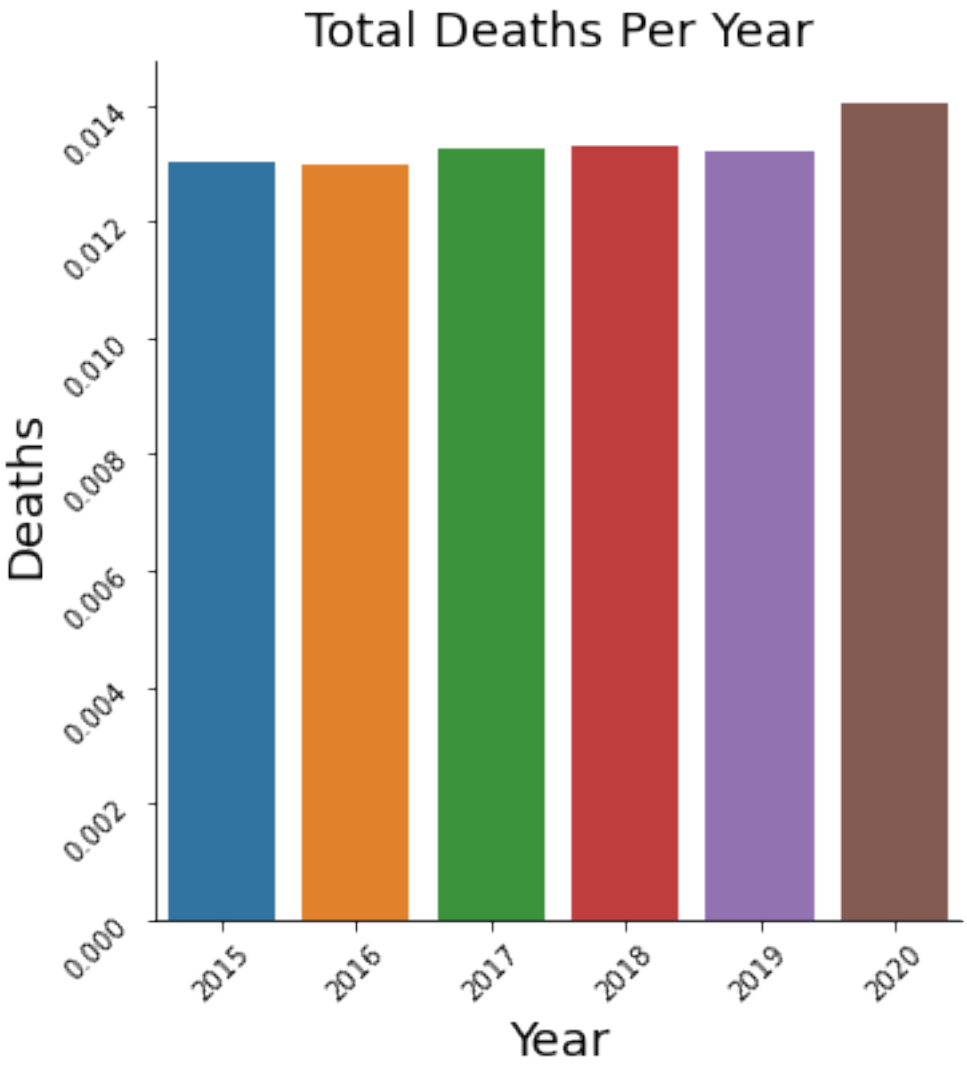
Now, let's plot the total deaths per year with a barplot.

[42]:
```
pop_rate_df
```

[42]:

	Date	Population	Total_Deaths	Total_Rate
1	2020	329880000	4635925	0.014053
2	2019	328240000	4341442	0.013226
3	2018	326690000	4343760	0.013296
4	2017	324990000	4301084	0.013235
5	2016	322940000	4185822	0.012962
6	2015	320640000	4169620	0.013004

[43]:
```
sns.catplot(x="Date", y="Total_Rate", kind="bar", data=pop_rate_df)
plt.title("Total Deaths Per Year", size=18)
plt.xlabel("Year", size=18)
plt.ylabel("Deaths", size=18)
plt.xticks(rotation=45)
plt.yticks(rotation=45)
plt.show()
```



0.1 Conclusion

The total death rate per population for every year starting with 2015 and ending with 2020 is 0.013004, 0.012962, 0.013235, 0.013296, 0.013226, and 0.014053 which is not a significant difference.

The death rate per cause is about the same for every year for every cause so there is no significant difference.

The line graph indicates a clear picture that there is no significant difference in causes of death per year with circulatory being the leading cause of death and malignant being the second highest cause of death. Alzheimer and respiratory are about the same.

The barplot indicates that there is no significant difference in deaths per year.