-- Mini Project --

From the given dataset this are the requirement that to be obtained by performing the exploratory data analysis.

1. How many categorical variables does the data contain? Please state the number of categories for each such variable.

In [1]:
```
import seaborn as sns
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
```

In [2]:
```
df_suicide = pd.read_csv('data.csv')
df_suicide.head()
```

Out[2]:

	country	year	sex	age	suicides_no	population	suicides/100k pop	country-year	HDI for year	gdp_
0	Albania	1987	male	15-24 years	21	312900	6.71	Albania1987	NaN	2,156
1	Albania	1987	male	35-54 years	16	308000	5.19	Albania1987	NaN	2,156
2	Albania	1987	female	15-24 years	14	289700	4.83	Albania1987	NaN	2,156
3	Albania	1987	male	75+ years	1	21800	4.59	Albania1987	NaN	2,156
4	Albania	1987	male	25-34 years	9	274300	3.28	Albania1987	NaN	2,156

In [3]:
```
df_suicide.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 27820 entries, 0 to 27819
Data columns (total 12 columns):
country               27820 non-null object
year                  27820 non-null int64
sex                   27820 non-null object
age                   27820 non-null object
suicides_no           27820 non-null int64
population            27820 non-null int64
suicides/100k pop     27820 non-null float64
country-year          27820 non-null object
HDI for year          8364 non-null float64
 gdp_for_year ($)     27820 non-null object
gdp_per_capita ($)    27820 non-null int64
generation            27820 non-null object
dtypes: float64(2), int64(4), object(6)
memory usage: 2.5+ MB
```

In [4]:
```
df_suicide.duplicated().sum()
```

Out[4]:
```
0
```

In [5]:
```
df_suicide.shape
```

Out[5]:
```
(27820, 12)
```

In [6]:
```
df_suicide_copy = df_suicide.copy()
df_suicide_copy[' gdp_for_year ($) '] = df_suicide_copy[' gdp_for_year ($) '].
str.replace(',','').astype('float64')
print("categorical variables : [ categories ]\n*******************************
*******")
i=0
for var in df_suicide_copy.select_dtypes(exclude=['int64', 'float64']).columns
:
#for var in df_suicide.select_dtypes(include=['object']).columns:
    print(i+1,". ",var, ": ", df_suicide_copy[var].unique())
    i+=1
print("\nThe total number of categorical variables after treatment = ", i)
```

```
categorical variables : [ categories ]
**************************************
1 .  country :  ['Albania' 'Antigua and Barbuda' 'Argentina' 'Armenia' 'Arub
a' 'Australia'
 'Austria' 'Azerbaijan' 'Bahamas' 'Bahrain' 'Barbados' 'Belarus' 'Belgium'
 'Belize' 'Bosnia and Herzegovina' 'Brazil' 'Bulgaria' 'Cabo Verde'
 'Canada' 'Chile' 'Colombia' 'Costa Rica' 'Croatia' 'Cuba' 'Cyprus'
 'Czech Republic' 'Denmark' 'Dominica' 'Ecuador' 'El Salvador' 'Estonia'
 'Fiji' 'Finland' 'France' 'Georgia' 'Germany' 'Greece' 'Grenada'
 'Guatemala' 'Guyana' 'Hungary' 'Iceland' 'Ireland' 'Israel' 'Italy'
 'Jamaica' 'Japan' 'Kazakhstan' 'Kiribati' 'Kuwait' 'Kyrgyzstan' 'Latvia'
 'Lithuania' 'Luxembourg' 'Macau' 'Maldives' 'Malta' 'Mauritius' 'Mexico'
 'Mongolia' 'Montenegro' 'Netherlands' 'New Zealand' 'Nicaragua' 'Norway'
 'Oman' 'Panama' 'Paraguay' 'Philippines' 'Poland' 'Portugal'
 'Puerto Rico' 'Qatar' 'Republic of Korea' 'Romania' 'Russian Federation'
 'Saint Kitts and Nevis' 'Saint Lucia' 'Saint Vincent and Grenadines'
 'San Marino' 'Serbia' 'Seychelles' 'Singapore' 'Slovakia' 'Slovenia'
 'South Africa' 'Spain' 'Sri Lanka' 'Suriname' 'Sweden' 'Switzerland'
 'Thailand' 'Trinidad and Tobago' 'Turkey' 'Turkmenistan' 'Ukraine'
 'United Arab Emirates' 'United Kingdom' 'United States' 'Uruguay'
 'Uzbekistan']
2 .  sex :  ['male' 'female']
3 .  age :  ['15-24 years' '35-54 years' '75+ years' '25-34 years' '55-74 yea
rs'
 '5-14 years']
4 .  country-year :  ['Albania1987' 'Albania1988' 'Albania1989' ... 'Uzbekist
an2012'
 'Uzbekistan2013' 'Uzbekistan2014']
5 .  generation :  ['Generation X' 'Silent' 'G.I. Generation' 'Boomers' 'Mill
enials'
 'Generation Z']

The total number of categorical variables after treatment =  5
```

2. How strong is the correlation between HDI and suicides_no?

In [7]:
```
df_temp = df_suicide[[ 'HDI for year', 'suicides_no']].copy()
df_temp.head(5)
```

Out[7]:

	HDI for year	suicides_no
0	NaN	21
1	NaN	16
2	NaN	14
3	NaN	1
4	NaN	9

In [8]:
```
df_temp.duplicated().sum()
```

Out[8]: 19649

In [9]:
```
df_temp.drop_duplicates(keep='first',inplace=True)
df_temp.shape
```

Out[9]: (8171, 2)

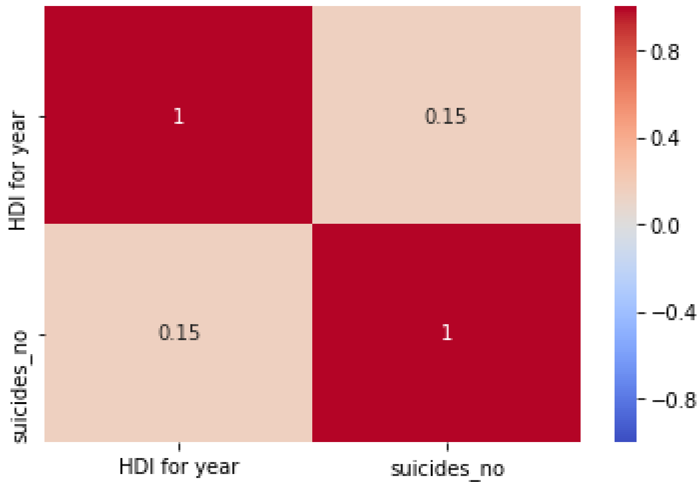
In [10]:
```
print("suicides_no : missing values: ", df_temp['suicides_no'].isnull().sum(),
" which is ", round((df_temp['suicides_no'].isnull().sum()*100)/df_temp['suici
des_no'].shape[0],2),"% of the total number of entries in suicides_no")
print("HDI for year : missing values: ", df_temp['HDI for year'].isnull().sum
(), " which is ", round((df_temp['HDI for year'].isnull().sum()*100)/df_temp[
'HDI for year'].shape[0],2),"% of the total number of entries in HDI for year"
)
```

```
suicides_no : missing values:  0  which is  0.0 % of the total number of entr
ies in suicides_no
HDI for year : missing values:  1807  which is  22.11 % of the total number o
f entries in HDI for year
```

In [11]:
```
def more_outliers(x):
    y=len(x)
    z=x.isna().sum()
    if ((y==z) | (((z*100)/y)>=40)):
        return np.nan
    x= x.dropna(axis = 0, how ='any')
    Q1 = x.quantile(0.25)
    Q3 = x.quantile(0.75)
    IQR = Q3 - Q1
    if ((((x < (Q1 - 1.5 * IQR)) | (x > (Q3 + 1.5 * IQR))).sum())*100)/x.shape
[0] >= 50:
        return round(x.median(),3)
    else:
        return round(x.mean(),3)
```

In [13]:
```
#ax.get_ylim()
ax=sns.heatmap(df_temp_mean.corr(), annot=True, vmin=-1, vmax=1, center= 0, cm
ap= 'coolwarm')
ax.set_ylim(2.0, 0)
print('The correlation between HDI and suicides_no after imputation is: ', rou
nd(df_temp_mean['suicides_no'].corr(df_temp_mean['HDI for year']), 3))
```

```
The correlation between HDI and suicides_no after imputation is:  0.154
```



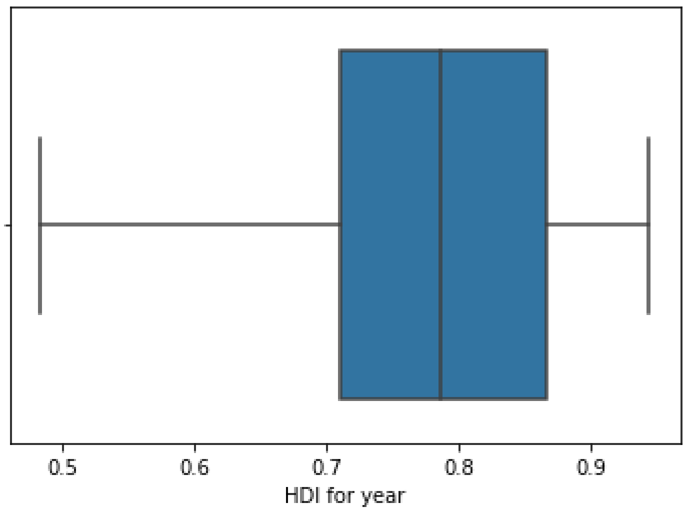
In [14]:
```
df_temp_drop = df_temp.copy().dropna()
df_temp_drop_drop = df_temp_drop.copy()
df_temp_drop.shape
```

Out[14]: (6364, 2)

In [15]:
```
Q1 = df_temp_drop['HDI for year'].quantile(0.25)
Q3 = df_temp_drop['HDI for year'].quantile(0.75)
IQR = Q3 - Q1
print("Outliers Number in HDI for year: ", ((df_temp_drop['HDI for year'] < (Q
1 - 1.5 * IQR)) | (df_temp_drop['HDI for year'] > (Q3 + 1.5 * IQR))).sum(), "o
ut of ", df_temp_drop['HDI for year'].shape[0])
sns.boxplot(x=df_temp_drop['HDI for year'])
```

```
Outliers Number in HDI for year:  0 out of  6364
```

Out[15]: <matplotlib.axes._subplots.AxesSubplot at 0x5b2b6ac08>



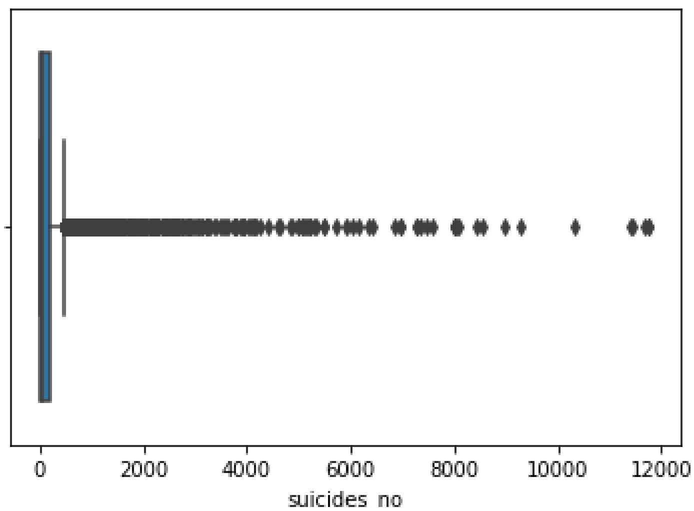
In [16]:
```
##Replaced outliers in HDI for year
whisker1=Q1-1.5*IQR
for i in (np.where((df_temp_drop['HDI for year'] < whisker1))):
    df_temp_drop.iloc[i, df_temp_drop.columns.get_loc('HDI for year')]= whiske
r1
whisker2=Q3+1.5*IQR
for i in (np.where((df_temp_drop['HDI for year'] > whisker2))):
    df_temp_drop.iloc[i, df_temp_drop.columns.get_loc('HDI for year')]= whiske
r2
len(np.where((((df_temp_drop['HDI for year'] <(Q1-1.5*IQR)) | (df_temp_drop['H
DI for year'] >(Q3+1.5*IQR)))))[0])
```

Out[16]: 0

In [17]:
```
Q11 = df_temp_drop['suicides_no'].quantile(0.25)
Q31 = df_temp_drop['suicides_no'].quantile(0.75)
IQR1 = Q31 - Q11
print("Outliers Number in HDI for year: ", ((df_temp_drop['suicides_no'] < (Q1
1 - 1.5 * IQR1)) | (df_temp_drop['suicides_no'] > (Q31 + 1.5 * IQR1))).sum(),
"out of ", df_temp_drop['suicides_no'].shape[0])
sns.boxplot(x=df_temp_drop['suicides_no'])
```

```
Outliers Number in HDI for year:  806 out of  6364
```

Out[17]: <matplotlib.axes._subplots.AxesSubplot at 0x5b2dacac8>

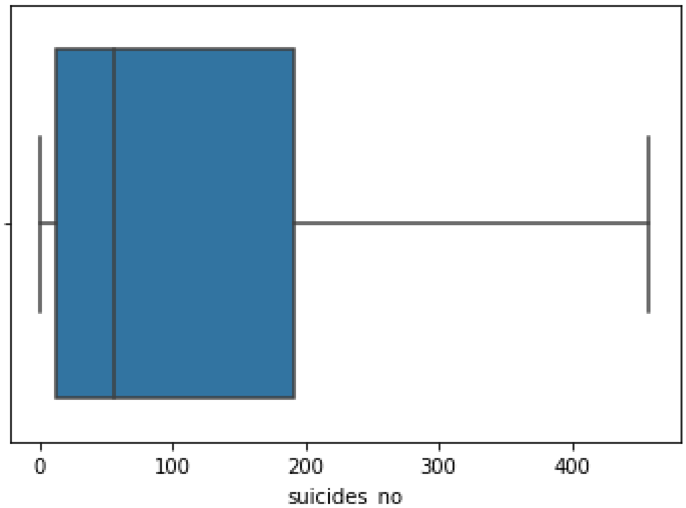


In [18]:
```
##Replaced outliers in suicides_no
whisker11=Q11-1.5*IQR1
for i in (np.where((df_temp_drop['suicides_no'] < whisker11))):
    df_temp_drop.iloc[i, df_temp_drop.columns.get_loc('suicides_no')]= whisker
11
whisker21=Q31+1.5*IQR1
for i in (np.where((df_temp_drop['suicides_no'] > whisker21))):
    df_temp_drop.iloc[i, df_temp_drop.columns.get_loc('suicides_no')]= whisker
21
len(np.where((((df_temp_drop['suicides_no'] <(Q11-1.5*IQR1)) | (df_temp_drop[
'suicides_no'] >(Q31+1.5*IQR1)))))[0])
```

Out[18]: 0

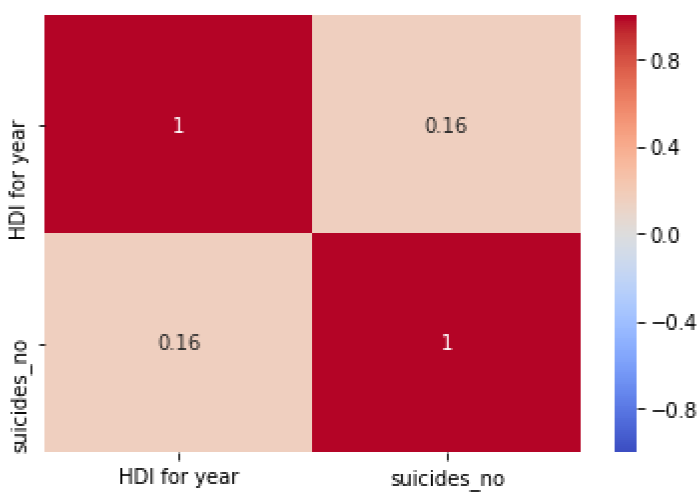
In [19]:
```
sns.boxplot(x=df_temp_drop['suicides_no'])
```

Out[19]: <matplotlib.axes._subplots.AxesSubplot at 0x5b0e81f88>



In [20]:
```
#ax.get_ylim()
ax=sns.heatmap(df_temp_drop.corr(), annot=True, vmin=-1, vmax=1, center= 0, cm
ap= 'coolwarm')
ax.set_ylim(2.0, 0)
print('The correlation between HDI and suicides_no after dropping columns with
missing values and replacing outliers with whiskers is: ', round(df_temp_drop[
'suicides_no'].corr(df_temp_drop['HDI for year']), 3))
```

```
The correlation between HDI and suicides_no after dropping columns with missi
ng values and replacing outliers with whiskers is:  0.162
```



In [21]:

```
##Deleting rows having outliers in HDI for year or suicides_no based on IQR Sc
ore method
for i in (np.where((df_temp_drop_drop['HDI for year'] < whisker1) | (df_temp_d
rop_drop['HDI for year'] > whisker2))):
    df_temp_drop_drop.drop(df_temp_drop_drop.index[i],inplace=True)
for i in (np.where((df_temp_drop_drop['suicides_no'] < whisker11) | (df_temp_d
rop_drop['suicides_no'] > whisker21))):
    df_temp_drop_drop.drop(df_temp_drop_drop.index[i],inplace=True)
len(np.where((((df_temp_drop_drop['HDI for year'] <(Q1-1.5*IQR)) | (df_temp_dr
op_drop['HDI for year'] >(Q3+1.5*IQR)))))[0]) , len(np.where((((df_temp_drop_d
rop['suicides_no'] <(Q11-1.5*IQR1)) | (df_temp_drop_drop['suicides_no'] >(Q31+
1.5*IQR1)))))[0])
```

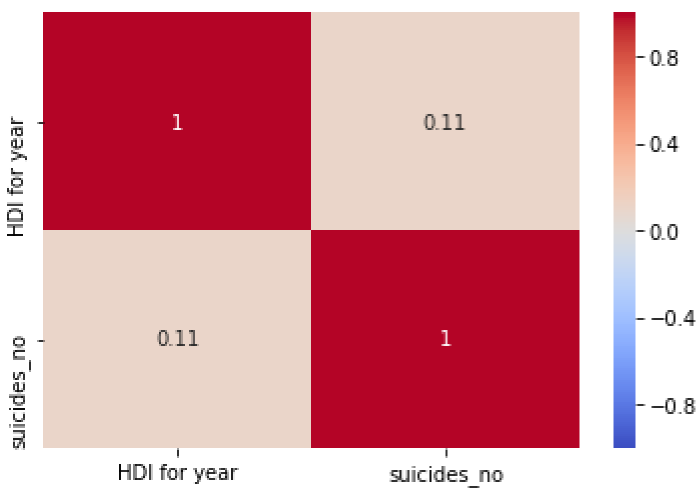
Out[21]:

```
(0, 0)
```

In [22]:

```
#ax.get_ylim()
ax=sns.heatmap(df_temp_drop_drop.corr(), annot=True, vmin=-1, vmax=1, center=
0, cmap= 'coolwarm')
ax.set_ylim(2.0, 0)
print('The correlation between HDI and suicides_no after dropping columns with
missing values and dropping outliers is: ', round(df_temp_drop_drop['suicides_
no'].corr(df_temp_drop_drop['HDI for year']), 3))
```

```
The correlation between HDI and suicides_no after dropping columns with missi
ng values and dropping outliers is:  0.108
```



3. Which generation has the highest number of suicides/100k pop?

In [12]:
```
print("Let's first impute COUNTRYWISE, with mean of 'HDI for year' FOR THAT CO
UNTRY for countries for which atleast 40% data is available and for all the re
st, imputing doesn't seem so wise, so we simply drop")
df_temp_mean = df_temp.copy()
df_temp_mean['HDI for year'] = df_suicide.groupby('country')['HDI for year'].t
ransform(lambda x: x.fillna(more_outliers(x)))
df_temp_mean['HDI for year'] = df_suicide.groupby('country')['HDI for year'].t
ransform(lambda x: x.replace(' ', more_outliers(x)))
df_temp_mean = df_temp_mean.dropna()
df_temp_mean['HDI for year'].isnull().sum()
```

```
Let's first impute COUNTRYWISE, with mean of 'HDI for year' FOR THAT COUNTRY
for countries for which atleast 40% data is available and for all the rest, i
mputing doesn't seem so wise, so we simply drop
```

Out[12]: 0

In [23]:
```
df_temp = df_suicide[[ 'generation', 'suicides/100k pop', 'country', 'sex', 'a
ge', 'country-year']].copy()
df_temp.head(5)
```

Out[23]:

	generation	suicides/100k pop	country	sex	age	country-year
0	Generation X	6.71	Albania	male	15-24 years	Albania1987
1	Silent	5.19	Albania	male	35-54 years	Albania1987
2	Generation X	4.83	Albania	female	15-24 years	Albania1987
3	G.I. Generation	4.59	Albania	male	75+ years	Albania1987
4	Boomers	3.28	Albania	male	25-34 years	Albania1987

In [24]:
```
df_temp.duplicated().sum()
```

Out[24]: 0

In [25]:
```
df_temp = df_suicide[[ 'generation', 'suicides/100k pop', 'year']].copy()
df_temp.head(5)
```

Out[25]:

	generation	suicides/100k pop	year
0	Generation X	6.71	1987
1	Silent	5.19	1987
2	Generation X	4.83	1987
3	G.I. Generation	4.59	1987
4	Boomers	3.28	1987

In [26]:
```
print("generation : missing values: ", df_temp['generation'].isnull().sum(), " which is ", round((df_temp['generation'].isnull().sum()*100)/df_temp['generation'].shape[0],2),"% of the total number of entries in generation")
print("suicides/100k pop : missing values: ", df_temp['suicides/100k pop'].isnull().sum(), " which is ", round((df_temp['suicides/100k pop'].isnull().sum()*100)/df_temp['suicides/100k pop'].shape[0],2),"% of the total number of entries in suicides/100k pop")
```

```
generation : missing values:  0  which is  0.0 % of the total number of entries in generation
suicides/100k pop : missing values:  0  which is  0.0 % of the total number of entries in suicides/100k pop
```

In [27]:
```
df_temp.groupby('generation').first(g)
```

Out[27]:

generation	suicides/100k pop	year
Boomers	3.28	1987
G.I. Generation	4.59	1987
Generation X	6.71	1987
Generation Z	1.47	2007
Millenials	0.00	1992
Silent	5.19	1987

In [28]:
```
df_temp.groupby(['generation','year']).sum().groupby('generation').sum().sort_values("suicides/100k pop",ascending = False)
```

Out[28]:

generation	suicides/100k pop
Silent	117217.55
Boomers	73563.05
Generation X	67648.45
G.I. Generation	65708.86
Millenials	31461.74
Generation Z	944.18

In [29]:
```
print("Generation having highest total number of suicides/100k pop is : ", df_temp.groupby(['generation','year']).sum().groupby('generation').sum().sort_values("suicides/100k pop",ascending = False).head(1).reset_index().iloc[0,0])
```

```
Generation having highest total number of suicides/100k pop is :  Silent
```

In [30]:
```
df_temp.groupby(['generation','year']).sum().groupby('generation').mean().sort
_values("suicides/100k pop",ascending = False)
```

Out[30]:

generation	suicides/100k pop
G.I. Generation	4106.803750
Silent	3663.048437
Boomers	2373.001613
Generation X	2114.014062
Millenials	1210.066923
Generation Z	104.908889

In [31]:
```
print("Generation having highest (average) (annual) number of suicides/100k po
p is : ", df_temp.groupby(['generation','year']).sum().groupby('generation').m
ean().sort_values("suicides/100k pop",ascending = False).head(1).reset_index()
.iloc[0,0])
```

```
Generation having highest (average) (annual) number of suicides/100k pop is :
G.I. Generation
```

4. Which country has the least number of suicides between 1990-1995?

In [32]:
```
df_temp = df_suicide[[ 'year', 'suicides_no', 'country', 'sex', 'age', 'countr
y-year']].copy()
df_temp.head(5)
```

Out[32]:

	year	suicides_no	country	sex	age	country-year
0	1987	21	Albania	male	15-24 years	Albania1987
1	1987	16	Albania	male	35-54 years	Albania1987
2	1987	14	Albania	female	15-24 years	Albania1987
3	1987	1	Albania	male	75+ years	Albania1987
4	1987	9	Albania	male	25-34 years	Albania1987

In [33]:
```
df_temp.duplicated().sum()
```

Out[33]: 0

In [34]:
```
df_temp = df_suicide[['year', 'suicides_no', 'country']].copy()
df_temp.head(5)
```

Out[34]:

	year	suicides_no	country
0	1987	21	Albania
1	1987	16	Albania
2	1987	14	Albania
3	1987	1	Albania
4	1987	9	Albania

In [35]:
```
print("year : missing values: ", df_temp['year'].isnull().sum(), " which is ", round((df_temp['year'].isnull().sum()*100)/df_temp['year'].shape[0],2),"% of t
he total number of entries in year")
print("suicides_no : missing values: ", df_temp['suicides_no'].isnull().sum(), " which is ", round((df_temp['suicides_no'].isnull().sum()*100)/df_temp['suici
des_no'].shape[0],2),"% of the total number of entries in suicides_no")
print("country : missing values: ", df_temp['country'].isnull().sum(), " which is ", round((df_temp['country'].isnull().sum()*100)/df_temp['country'].shape[0
],2),"% of the total number of entries in country")
```

```
year : missing values:  0  which is  0.0 % of the total number of entries in
year
suicides_no : missing values:  0  which is  0.0 % of the total number of entr
ies in suicides_no
country : missing values:  0  which is  0.0 % of the total number of entries
in country
```

In [36]:
```
df_temp.loc[(df_temp['year']>1990) & (df_temp['year']<1995)].groupby('country'
, as_index=False)['suicides_no'].sum().sort_values("suicides_no",ascending = T
rue)
```

Out[36]:

	country	suicides_no
58	Saint Kitts and Nevis	0
36	Jamaica	1
1	Antigua and Barbuda	1
28	Grenada	7
7	Bahamas	10
...	...	...
68	Ukraine	48661
26	Germany	52876
37	Japan	81633
70	United States	123468
57	Russian Federation	202470

73 rows × 2 columns

In [37]:
```
print('The country having least number of suicides between 1990-1995 (not incl
uding 1990 and 1995) is : ', df_temp.loc[(df_temp['year']>1990) & (df_temp['ye
ar']<1995)].groupby('country', as_index=False)['suicides_no'].sum().sort_value
s("suicides_no",ascending = True).head(1).reset_index().iloc[0,1])
```

```
The country having least number of suicides between 1990-1995 (not including
1990 and 1995) is :  Saint Kitts and Nevis
```

5. Are there any countries with no suicides recorded? Create a new data frame which ranks these countries by HDI.

In [38]:
```
#Since only one new data frame has to be created and ranking has to be done by
HDI,
#it has been avoided to rank countries year wise
#NaN values in HDI have been dropped and
#The countries with valid HDI values have been ranked based on mean of these H
DI values
#for all years for that country for which data is available
df_temp = df_suicide[['country', 'suicides_no', 'HDI for year','year']].copy()
df_temp.head(5)
```

Out[38]:

	country	suicides_no	HDI for year	year
0	Albania	21	NaN	1987
1	Albania	16	NaN	1987
2	Albania	14	NaN	1987
3	Albania	1	NaN	1987
4	Albania	9	NaN	1987

In [39]:
```
print("The countries with no suicides recorded in atleast one year: ", end="\n
")
print(df_temp.loc[df_temp['suicides_no']==0].drop_duplicates(["country"]).rese
t_index()['country'])
```

```
The countries with no suicides recorded in atleast one year:
0                   Albania
1       Antigua and Barbuda
2                   Armenia
3                     Aruba
4                 Australia
               ...
77      Trinidad and Tobago
78             Turkmenistan
79     United Arab Emirates
80           United Kingdom
81                  Uruguay
Name: country, Length: 82, dtype: object
```

In [40]:
```
print("New DATAFRAME: ", end="\n")
new_df = df_temp.loc[df_temp['suicides_no']==0].dropna().groupby('country')[[
'HDI for year']].mean().sort_values("HDI for year",ascending = False).reset_in
dex().copy()
new_df.index = np.arange(1, len(new_df)+1)
#new_df[new_df.duplicated(['country'])]
print(new_df)
```

```
New DATAFRAME:
        country  HDI for year
1        Norway      0.912000
2   Switzerland      0.900250
3       Denmark      0.896375
4   Netherlands      0.877000
5     Singapore      0.876429
..          ...           ...
61     Paraguay      0.623833
62    Nicaragua      0.623333
63   Azerbaijan      0.615200
64       Guyana      0.598750
65    Guatemala      0.579167

[65 rows x 2 columns]
```

In [41]:
```
df_temp1 = df_suicide[['country', 'suicides_no', 'HDI for year','year']].copy
()
#print(df_temp1[df_temp1.groupby('year')['suicides_no'].sum() == 0])
df_ = df_temp1.groupby(['country'])['suicides_no'].sum().sort_values(ascending
=True).reset_index()
df_ = df_[df_['suicides_no'] == 0]
print("The countries with no record of suicide in all the years:\n")
df_.iloc[:,0]
```

```
The countries with no record of suicide in all the years:
```

Out[41]:
```
0                 Dominica
1    Saint Kitts and Nevis
Name: country, dtype: object
```

In [42]:
```
for var in df_['country']:
    print(df_temp1[df_temp1['country'] == var]['HDI for year'].mean())
```

```
nan
nan
```

In [43]:
```
print("Clearly data not available for these countries to rank based on HDI")
```

```
Clearly data not available for these countries to rank based on HDI
```

6. Generate suitable graphs for comparing suicides between men and women for the top 5 countries with the highest suicide rate per 100,000.

In [44]:
```
df_temp = df_suicide[[ 'country', 'year', 'suicides/100k pop', 'suicides_no', 'sex']].dropna().copy()
df_temp.head(5)
```

Out[44]:

	country	year	suicides/100k pop	suicides_no	sex
0	Albania	1987	6.71	21	male
1	Albania	1987	5.19	16	male
2	Albania	1987	4.83	14	female
3	Albania	1987	4.59	1	male
4	Albania	1987	3.28	9	male

In [45]:
```
print('Top 5 Countries with highest (average) (annual) suicide rate per 100K population: ')
#print(df_temp.groupby(['country','year','sex'])['suicides/100k pop'].sum().reset_index().groupby(['country','year'])['suicides/100k pop'].sum())
df__ = df_temp.groupby(['country','year','sex'])['suicides/100k pop'].sum().reset_index().groupby(['country','year'])['suicides/100k pop'].sum().groupby(['country']).mean().sort_values(ascending=False).reset_index().head(5)
#df__['male'] = np.nan
#df__['female'] = np.nan
#df__['female'] = np.nan
print(df__)
```

```
Top 5 Countries with highest (average) (annual) suicide rate per 100K population: 
             country  suicides/100k pop
0          Lithuania         481.312727
1          Sri Lanka         423.541818
2  Russian Federation         418.708519
3            Hungary         390.618077
4            Belarus         372.910952
```

In [46]:
```
df__1=df__.copy()
df__1 = df__1.append(df__,ignore_index=True)
df__1['sex'] = np.nan
df__1['sex_suicide_no'] = np.nan
df__1['suicides_no'] = np.nan
print(df__1)
```

```
             country  suicides/100k pop  sex  sex_suicide_no  suicides_no
0          Lithuania         481.312727  NaN             NaN          NaN
1          Sri Lanka         423.541818  NaN             NaN          NaN
2  Russian Federation         418.708519  NaN             NaN          NaN
3            Hungary         390.618077  NaN             NaN          NaN
4            Belarus         372.910952  NaN             NaN          NaN
5          Lithuania         481.312727  NaN             NaN          NaN
6          Sri Lanka         423.541818  NaN             NaN          NaN
7  Russian Federation         418.708519  NaN             NaN          NaN
8            Hungary         390.618077  NaN             NaN          NaN
9            Belarus         372.910952  NaN             NaN          NaN
```

In [47]:
```
i=0
for var in df__['country']:
    df__1.iloc[i, df__1.columns.get_loc('sex_suicide_no')] = a = df_temp[df_temp['country']==var].groupby(['country','year','sex'])['suicides_no'].sum().reset_index().groupby(['country','sex'])['suicides_no'].sum().reset_index().iloc[1,2]
    df__1.iloc[i+5, df__1.columns.get_loc('sex_suicide_no')] = b = df_temp[df_temp['country']==var].groupby(['country','year','sex'])['suicides_no'].sum().reset_index().groupby(['country','sex'])['suicides_no'].sum().reset_index().iloc[0,2]
    df__1.iloc[i, df__1.columns.get_loc('suicides_no')] = a+b
    df__1.iloc[i+5, df__1.columns.get_loc('suicides_no')] = a+b
    df__1.iloc[i, df__1.columns.get_loc('sex')] = "male"
    df__1.iloc[i+5, df__1.columns.get_loc('sex')] = "female"
    i+=1
print("Total number of suicides (from 1985 - 2016) by males and females for Top 5 countries\nhaving highest (average) (annual) suicide rate per 100k population : ")
df__1
```

```
Total number of suicides (from 1985 - 2016) by males and females for Top 5 countries
having highest (average) (annual) suicide rate per 100k population :
```

Out[47]:

	country	suicides/100k pop	sex	sex_suicide_no	suicides_no
0	Lithuania	481.312727	male	23028.0	28039.0
1	Sri Lanka	423.541818	male	42043.0	55641.0
2	Russian Federation	418.708519	male	995412.0	1209742.0
3	Hungary	390.618077	male	55776.0	73891.0
4	Belarus	372.910952	male	49890.0	59892.0
5	Lithuania	481.312727	female	5011.0	28039.0
6	Sri Lanka	423.541818	female	13598.0	55641.0
7	Russian Federation	418.708519	female	214330.0	1209742.0
8	Hungary	390.618077	female	18115.0	73891.0
9	Belarus	372.910952	female	10002.0	59892.0

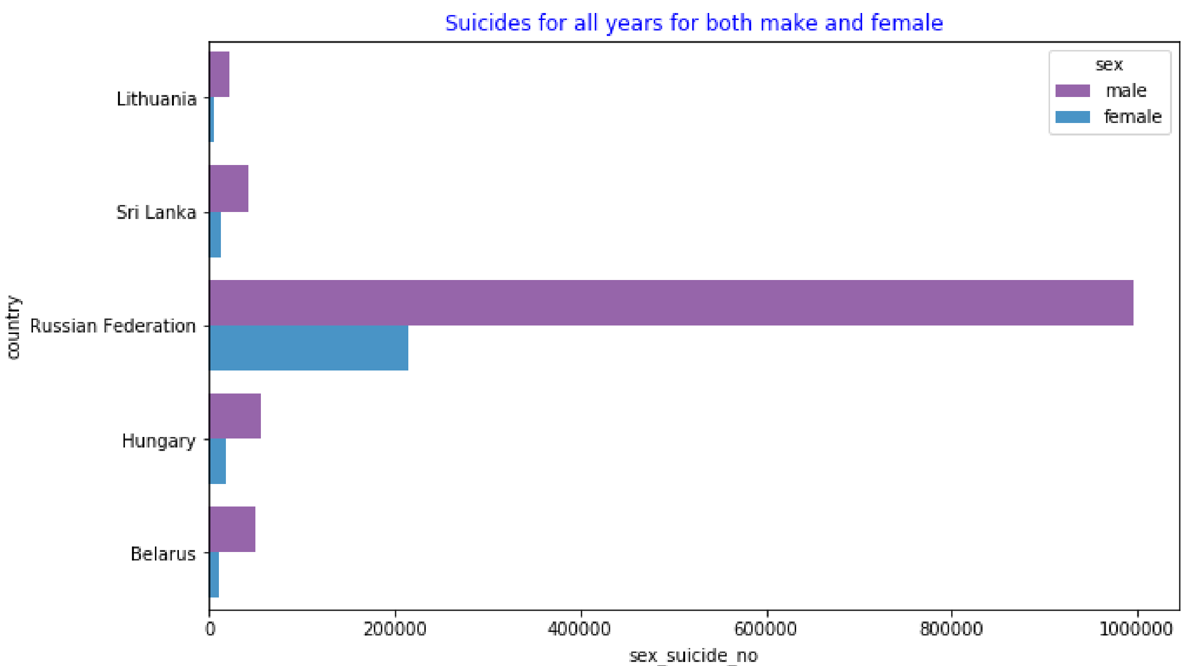
In [48]:
```python
df_d=pd.DataFrame()
for var in df__['country']:
    df_d  = df_d.append(df_temp[df_temp['country']==var] , ignore_index=True)
df_d
```

Out[48]:

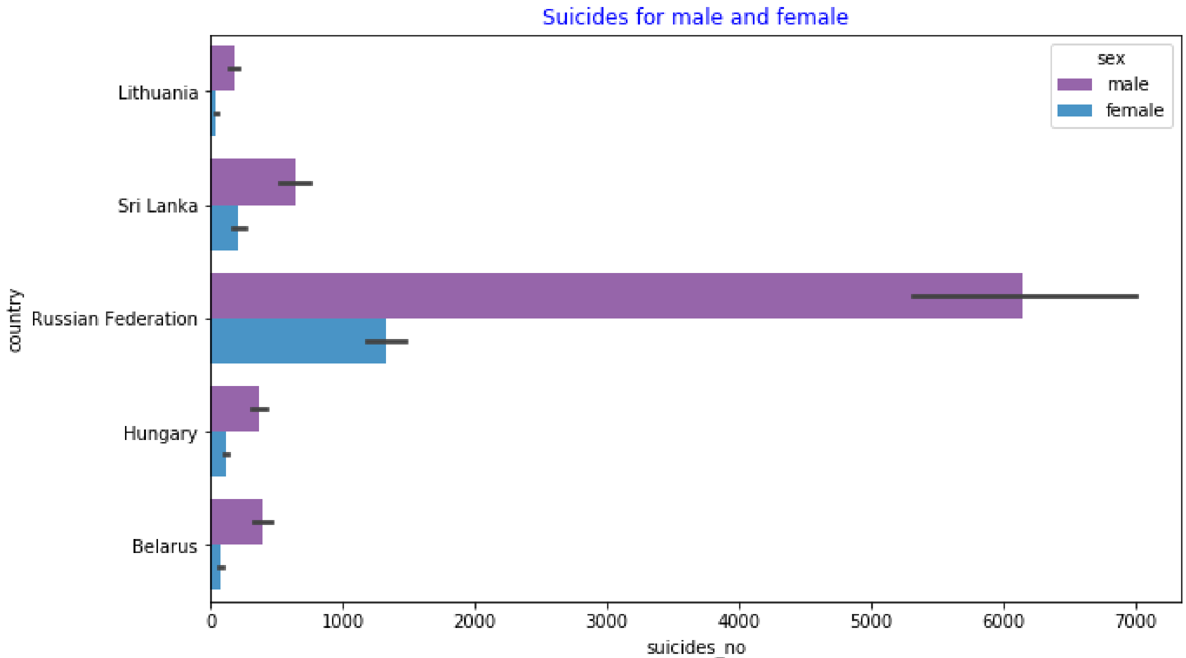
	country	year	suicides/100k pop	suicides_no	sex
0	Lithuania	1995	144.85	632	male
1	Lithuania	1995	141.91	67	male
2	Lithuania	1995	118.53	325	male
3	Lithuania	1995	79.37	226	male
4	Lithuania	1995	50.80	134	male
...	...	...	...	...	...
1275	Belarus	2014	5.91	68	female
1276	Belarus	2014	5.50	41	female
1277	Belarus	2014	2.74	15	female
1278	Belarus	2014	1.32	6	female
1279	Belarus	2014	0.42	2	male

1280 rows × 5 columns

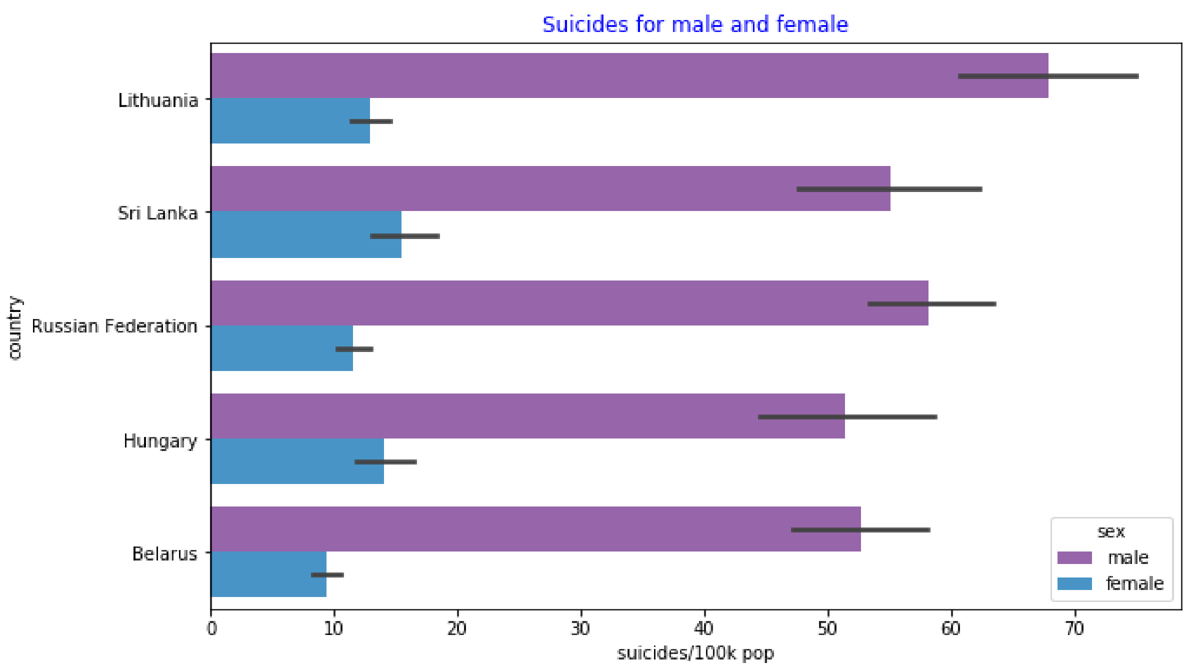
In [49]:
```python
fig, ax = plt.subplots(figsize=(10,6))
sns.barplot( "sex_suicide_no", "country", data=df__1, hue="sex", palette=["#9b
59b6", "#3498db"], linewidth=1)
plt.title("Suicides for all years for both make and female", color="b")
plt.show()
```



In [50]:
```
fig, ax = plt.subplots(figsize=(10,6))
sns.barplot( "suicides_no", "country", data=df_d, hue="sex", palette=["#9b59b6", "#3498db"], linewidth=1)
plt.title("Suicides for male and female", color="b")
plt.show()
```



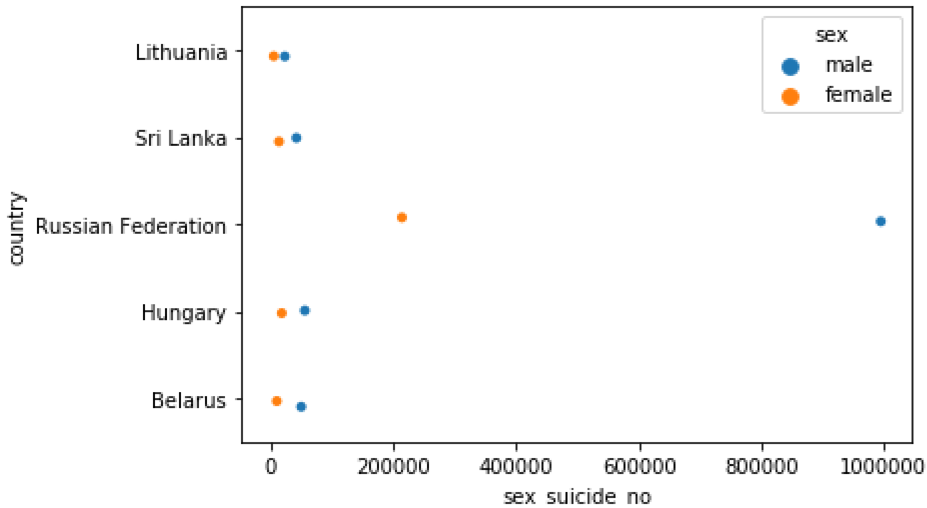
In [51]:
```
fig, ax = plt.subplots(figsize=(10,6))
sns.barplot( "suicides/100k pop", "country", data=df_d, hue="sex", palette=["#9b59b6", "#3498db"], linewidth=1)
plt.title("Suicides for male and female", color="b")
plt.show()
```



In [52]:
```
print('Total suicides for all years: ')
sns.stripplot(x="sex_suicide_no", y="country", hue="sex", data=df__1)
```

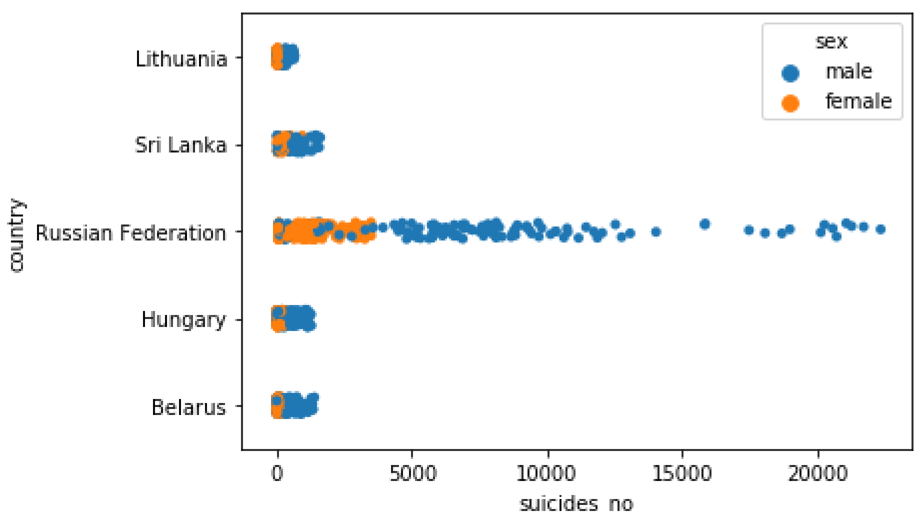
```
Total suicides for all years: 
```

Out[52]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x5b4358b48>
```



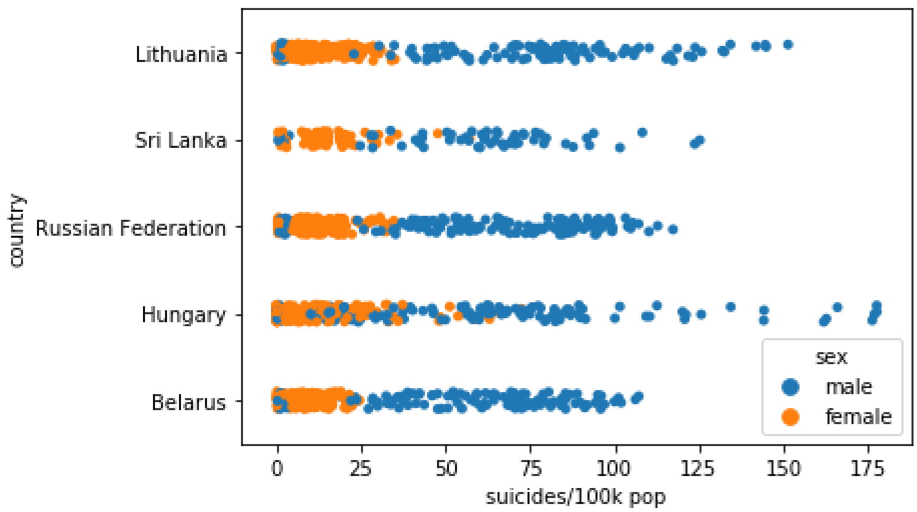
In [53]:
```
sns.stripplot(x="suicides_no", y="country", hue="sex", data=df_d)
```

Out[53]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x5b559d788>
```



In [54]:
```
sns.stripplot(x="suicides/100k pop", y="country", hue="sex", data=df_d)
```

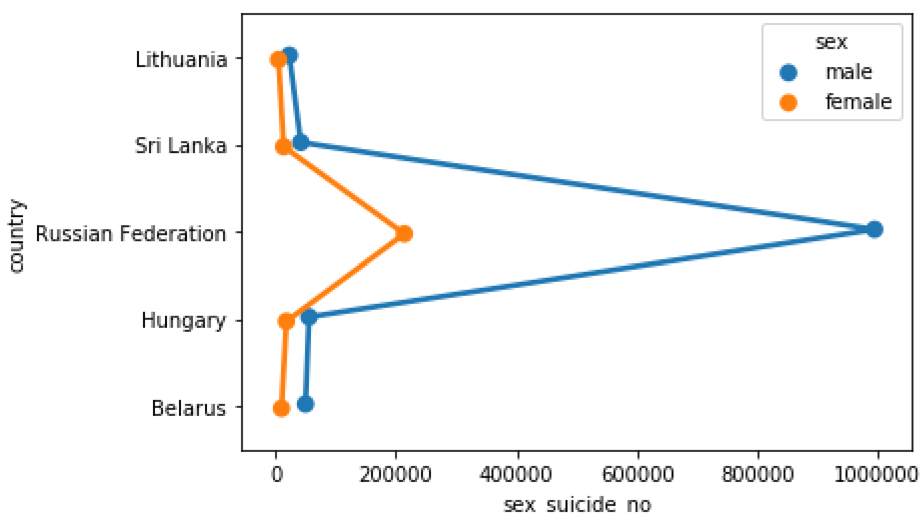
Out[54]: <matplotlib.axes._subplots.AxesSubplot at 0x5b2aae208>



In [55]:
```
print("Total suicides for all years:")
sns.pointplot(x="sex_suicide_no", y="country", hue="sex", data=df__1, dodge=True)
```

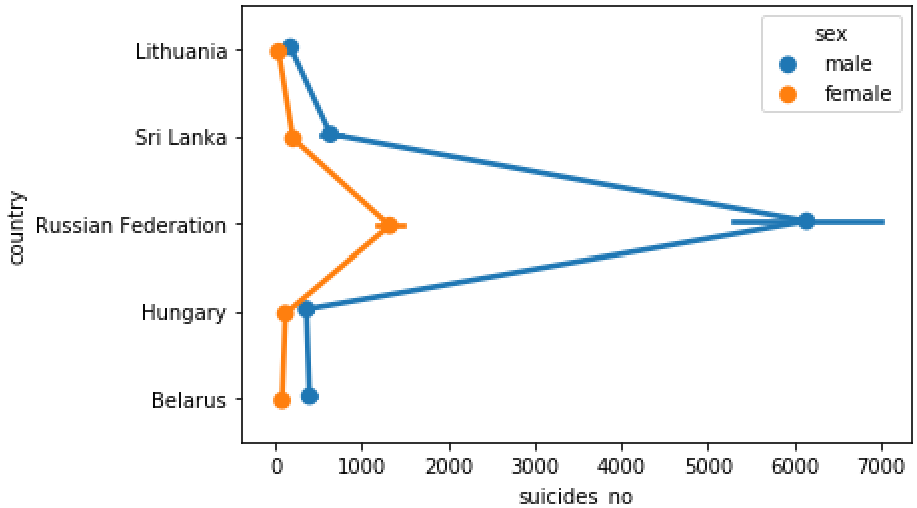
Total suicides for all years:

Out[55]: <matplotlib.axes._subplots.AxesSubplot at 0x5b41e5348>



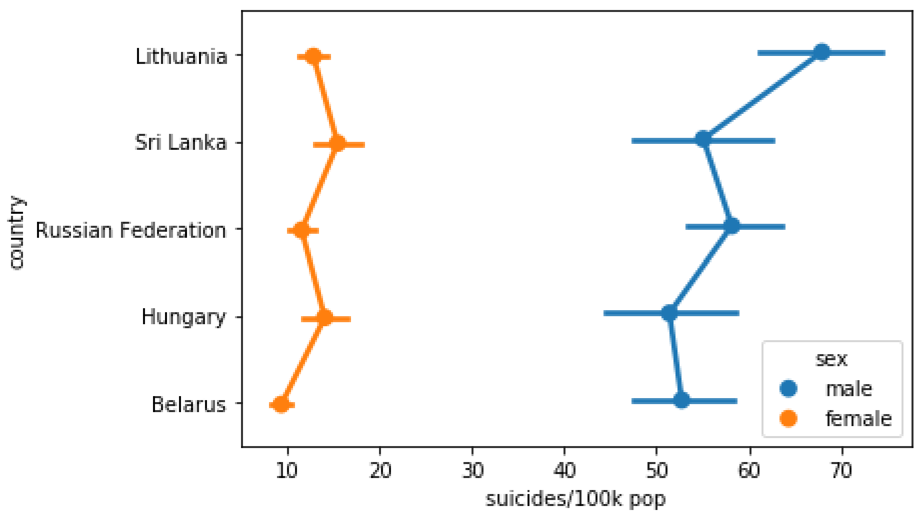
In [56]:
```
sns.pointplot(x="suicides_no", y="country", hue="sex", data=df_d, dodge=True)
```

Out[56]: <matplotlib.axes._subplots.AxesSubplot at 0x5b55eab88>



In [57]:
```
sns.pointplot(x="suicides/100k pop", y="country", hue="sex", data=df_d, dodge=
True)
```

Out[57]: <matplotlib.axes._subplots.AxesSubplot at 0x5b5681988>



7. Are there any redundant columns in the dataset? Which coulmn is it? Can that column be dropped? State your reasons.

In [58]:
```
#df_suicide
print('The columns having row-wise redundancy are: ')
for var in df_suicide.columns:
    if df_suicide[var].duplicated().any()==True:
        print("*************")
        print(var)
        print("*************\nUnique values for this column: \n",df_suicide[va
r].unique())
```

```
The columns having row-wise redundancy are:
*************
country
*************
Unique values for this column:
 ['Albania' 'Antigua and Barbuda' 'Argentina' 'Armenia' 'Aruba' 'Australia'
 'Austria' 'Azerbaijan' 'Bahamas' 'Bahrain' 'Barbados' 'Belarus' 'Belgium'
 'Belize' 'Bosnia and Herzegovina' 'Brazil' 'Bulgaria' 'Cabo Verde'
 'Canada' 'Chile' 'Colombia' 'Costa Rica' 'Croatia' 'Cuba' 'Cyprus'
 'Czech Republic' 'Denmark' 'Dominica' 'Ecuador' 'El Salvador' 'Estonia'
 'Fiji' 'Finland' 'France' 'Georgia' 'Germany' 'Greece' 'Grenada'
 'Guatemala' 'Guyana' 'Hungary' 'Iceland' 'Ireland' 'Israel' 'Italy'
 'Jamaica' 'Japan' 'Kazakhstan' 'Kiribati' 'Kuwait' 'Kyrgyzstan' 'Latvia'
 'Lithuania' 'Luxembourg' 'Macau' 'Maldives' 'Malta' 'Mauritius' 'Mexico'
 'Mongolia' 'Montenegro' 'Netherlands' 'New Zealand' 'Nicaragua' 'Norway'
 'Oman' 'Panama' 'Paraguay' 'Philippines' 'Poland' 'Portugal'
 'Puerto Rico' 'Qatar' 'Republic of Korea' 'Romania' 'Russian Federation'
 'Saint Kitts and Nevis' 'Saint Lucia' 'Saint Vincent and Grenadines'
 'San Marino' 'Serbia' 'Seychelles' 'Singapore' 'Slovakia' 'Slovenia'
 'South Africa' 'Spain' 'Sri Lanka' 'Suriname' 'Sweden' 'Switzerland'
 'Thailand' 'Trinidad and Tobago' 'Turkey' 'Turkmenistan' 'Ukraine'
 'United Arab Emirates' 'United Kingdom' 'United States' 'Uruguay'
 'Uzbekistan']
*************
year
*************
Unique values for this column:
 [1987 1988 1989 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
 2003 2004 2005 2006 2007 2008 2009 2010 1985 1986 1990 1991 2012 2013
 2014 2015 2011 2016]
*************
sex
*************
Unique values for this column:
 ['male' 'female']
*************
age
*************
Unique values for this column:
 ['15-24 years' '35-54 years' '75+ years' '25-34 years' '55-74 years'
 '5-14 years']
*************
suicides_no
*************
Unique values for this column:
 [  21   16   14 ... 5503 4359 2872]
*************
population
*************
Unique values for this column:
 [ 312900  308000  289700 ... 2762158 2631600 1438935]
*************
suicides/100k pop
*************
Unique values for this column:
 [ 6.71  5.19  4.83 ... 47.86 40.75 26.61]
*************
```

```
country-year
*************
Unique values for this column:
 ['Albania1987' 'Albania1988' 'Albania1989' ... 'Uzbekistan2012'
 'Uzbekistan2013' 'Uzbekistan2014']
*************
HDI for year
*************
Unique values for this column:
 [  nan 0.619 0.656 0.695 0.722 0.781 0.783 0.694 0.705 0.731 0.762 0.775
 0.811 0.818 0.831 0.833 0.836 0.632 0.605 0.648 0.721 0.723 0.728 0.733
 0.865 0.882 0.898 0.927 0.93  0.932 0.933 0.935 0.764 0.794 0.815 0.853
 0.879 0.881 0.884 0.885 0.609 0.64  0.778 0.78  0.774 0.786 0.727 0.816
 0.819 0.817 0.821 0.824 0.7   0.716 0.753 0.765 0.793 0.785 0.683 0.796
 0.798 0.806 0.851 0.874 0.866 0.883 0.886 0.889 0.888 0.89  0.644 0.664
 0.701 0.71  0.711 0.715 0.724 0.576 0.608 0.702 0.737 0.742 0.746 0.752
 0.755 0.686 0.696 0.713 0.749 0.773 0.779 0.782 0.827 0.849 0.861 0.867
 0.892 0.903 0.909 0.91  0.912 0.654 0.699 0.788 0.814 0.83  0.832 0.573
 0.596 0.629 0.679 0.706 0.718 0.72  0.623 0.652 0.682 0.704 0.75  0.756
 0.761 0.766 0.807 0.653 0.685 0.73  0.776 0.772 0.768 0.769 0.8   0.848
 0.852 0.85  0.847 0.863 0.868 0.87  0.862 0.902 0.908 0.92  0.921 0.923
 0.631 0.645 0.665 0.674 0.698 0.717 0.732 0.522 0.566 0.603 0.638 0.658
 0.662 0.666 0.719 0.838 0.855 0.859 0.857 0.869 0.878 0.741 0.825 0.887
 0.672 0.735 0.74  0.747 0.754 0.801 0.906 0.911 0.915 0.916 0.759 0.799
 0.864 0.739 0.483 0.513 0.552 0.611 0.617 0.624 0.626 0.627 0.542 0.581
 0.618 0.63  0.634 0.802 0.823 0.828 0.826 0.896 0.897 0.899 0.77  0.803
 0.895 0.893 0.894 0.738 0.829 0.856 0.873 0.872 0.65  0.671 0.729 0.791
 0.891 0.69  0.804 0.795 0.809 0.812 0.615 0.562 0.593 0.614 0.639 0.655
 0.67  0.813 0.837 0.839 0.805 0.88  0.822 0.575 0.647 0.777 0.748 0.877
 0.919 0.922 0.82  0.905 0.907 0.625 0.628 0.917 0.931 0.94  0.941 0.942
 0.944 0.714 0.564 0.579 0.604 0.646 0.668 0.669 0.677 0.84  0.843 0.676
 0.844 0.841 0.703 0.751 0.691 0.697 0.757 0.771 0.736 0.743 0.767 0.763
 0.876 0.613 0.643 0.651 0.659 0.663 0.725 0.845 0.597 0.692 0.707 0.709
 0.901 0.904 0.846 0.924 0.925 0.928 0.539 0.572 0.684 0.726 0.673 0.688
 0.913 0.667 0.79  0.594 0.661 0.675]
*************
 gdp_for_year ($)
*************
Unique values for this column:
 ['2,156,624,900' '2,126,000,000' '2,335,124,988' ... '51,821,573,338'
 '57,690,453,461' '63,067,077,179']
*************
gdp_per_capita ($)
*************
Unique values for this column:
 [ 796  769  833 ... 1964 2150 2309]
*************
generation
*************
Unique values for this column:
 ['Generation X' 'Silent' 'G.I. Generation' 'Boomers' 'Millenials'
 'Generation Z']
```

In [59]:
```
print('Row-wise redundancy: There is redundancy in almost every column. Redund
ancy can be avoided by creating a primary key and splitting the dataframe into
multiple dataframes linked by that primary key. Here, if we drop duplicates in
country, we lose important data such as suicide_no for multiple years. Similar
ly, if we remove redundancy in generation, we cannot study suicide_no for vari
ous generations countrywise. They can be removed, however, in certain situatio
ns, e.g., when we are trying to study correlation between a categorical and a
 numerical variable. But, if we drop the whole column, it results in loss of i
mportant data, if we are trying to study other columns in relation to that col
umn. But, if we don\'t need that column, it can sure be dropped. E.g, If our s
ole purpose is to study correlation between HDI and suicides_no, then there is
no need of other columns.')
print('\nColumn-wise redundancy: Then, there are columns such as \'country\',
\'year\' and \'country-year\', one of which can be safely removed as the value
s of one can be obtained from the other one/ two, e.g., by selecting string.[-
4:] and then converting the data type into int64, we can get year from country
- year. Also, there are columns like \'population\', \'gdp_per_capita ($)\' an
d \' gdp_for_year ($) \', one of which can be removed as we can easily find on
e from other two, e.g, gdp per capita = gdp/population. Similarly one of \'sui
cides_no\', \'population\' and \'suicides/100k pop\' can be dropped.')
```

```
Row-wise redundancy: There is redundancy in almost every column. Redundancy c
an be avoided by creating a primary key and splitting the dataframe into mult
iple dataframes linked by that primary key. Here, if we drop duplicates in co
untry, we lose important data such as suicide_no for multiple years. Similarl
y, if we remove redundancy in generation, we cannot study suicide_no for vari
ous generations countrywise. They can be removed, however, in certain situati
ons, e.g., when we are trying to study correlation between a categorical and
a numerical variable. But, if we drop the whole column, it results in loss of
important data, if we are trying to study other columns in relation to that c
olumn. But, if we don't need that column, it can sure be dropped. E.g, If our
sole purpose is to study correlation between HDI and suicides_no, then there
is no need of other columns.

Column-wise redundancy: Then, there are columns such as 'country', 'year' and
'country-year', one of which can be safely removed as the values of one can b
e obtained from the other one/ two, e.g., by selecting string.[-4:] and then
converting the data type into int64, we can get year from country- year. Als
o, there are columns like 'population', 'gdp_per_capita ($)' and ' gdp_for_ye
ar ($) ', one of which can be removed as we can easily find one from other tw
o, e.g, gdp per capita = gdp/population. Similarly one of 'suicides_no', 'pop
ulation' and 'suicides/100k pop' can be dropped.
```

8. Please obtain the distribution of suicides for each age group for Argentina. Plot these as graphs

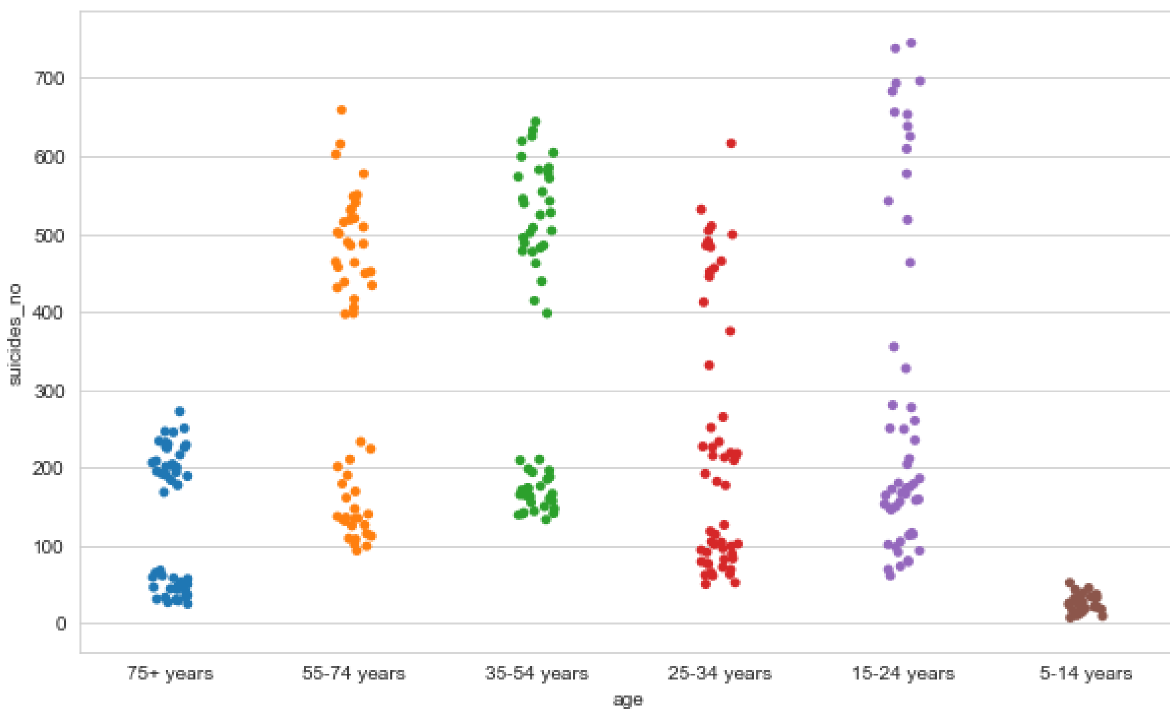
In [60]:
```
df_temp=df_suicide[df_suicide['country'] == 'Argentina'][['age','suicides_no'
]].dropna().drop_duplicates().copy()
df_temp.head()
```

Out[60]:

	age	suicides_no
588	75+ years	202
589	55-74 years	485
590	35-54 years	414
591	55-74 years	210
592	25-34 years	177

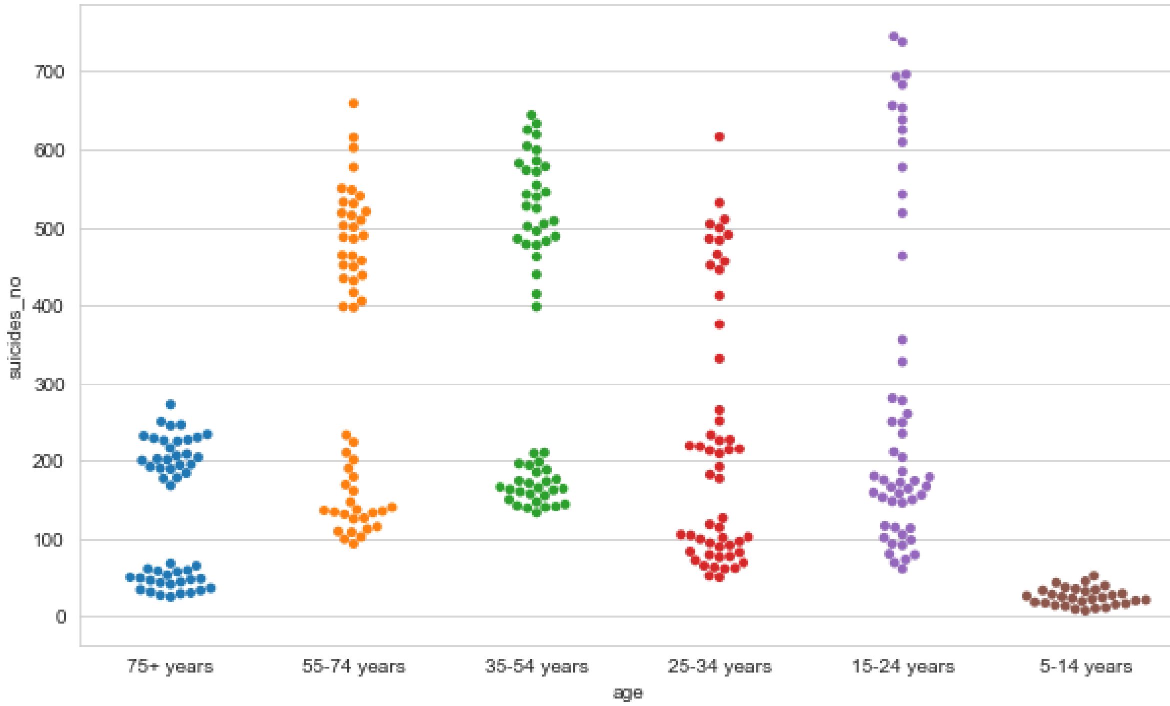
In [61]:
```
print("Categorical distribution plot: ")
sns.set_style('whitegrid')
fig, ax = plt.subplots(figsize=(10,6))
ax = sns.stripplot(x="age", y="suicides_no", data=df_temp)
```

```
Categorical distribution plot:
```



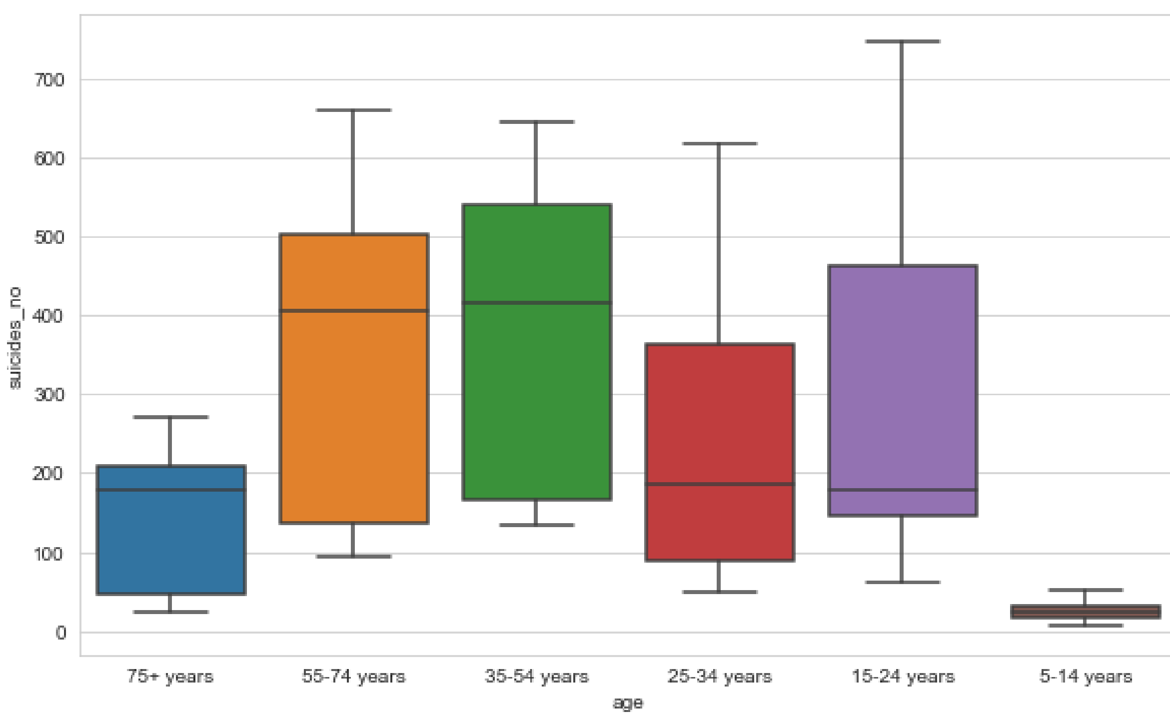
In [62]:
```
print("Categorical scatter plot: ")
fig, ax = plt.subplots(figsize=(10,6))
ax = sns.swarmplot(x="age", y="suicides_no", data=df_temp)
```

```
Categorical scatter plot:
```



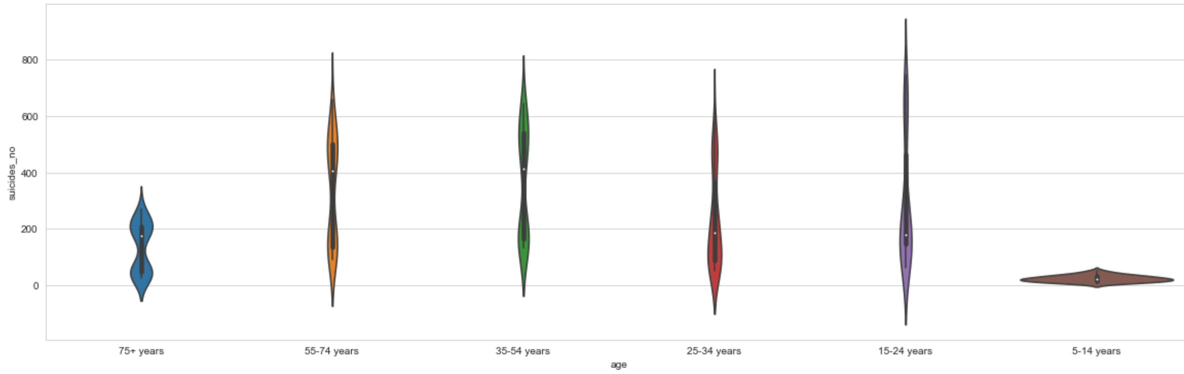
In [63]:
```
print("Categorical distribution plot: ")
fig, ax = plt.subplots(figsize=(10,6))
ax = sns.boxplot(x="age", y="suicides_no", data=df_temp)
```

```
Categorical distribution plot:
```



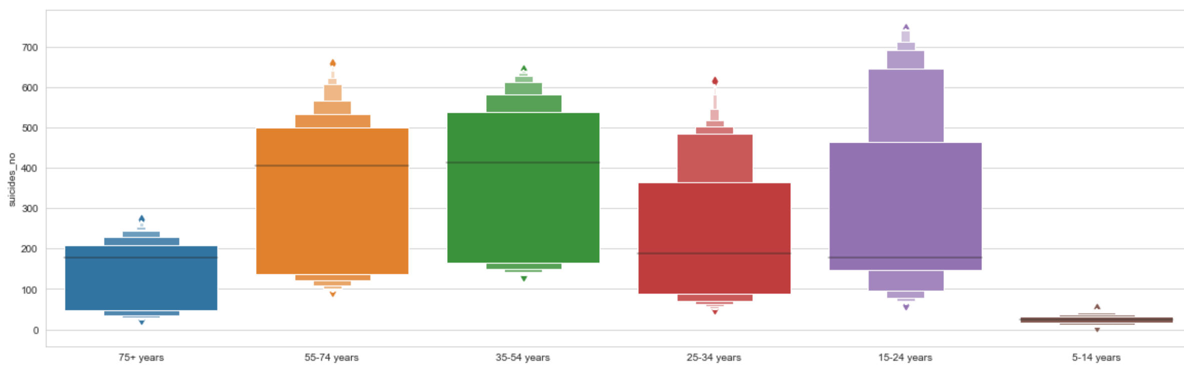
In [64]:
```
print("Categorical distribution plot: ")
fig, ax = plt.subplots(figsize=(20,6))
ax = sns.violinplot(x="age", y="suicides_no", data=df_temp)
```

```
Categorical distribution plot:
```



In [65]:
```
print("Categorical distribution plot: ")
fig, ax = plt.subplots(figsize=(20,6))
ax = sns.boxenplot(x="age", y="suicides_no", data=df_temp)
```

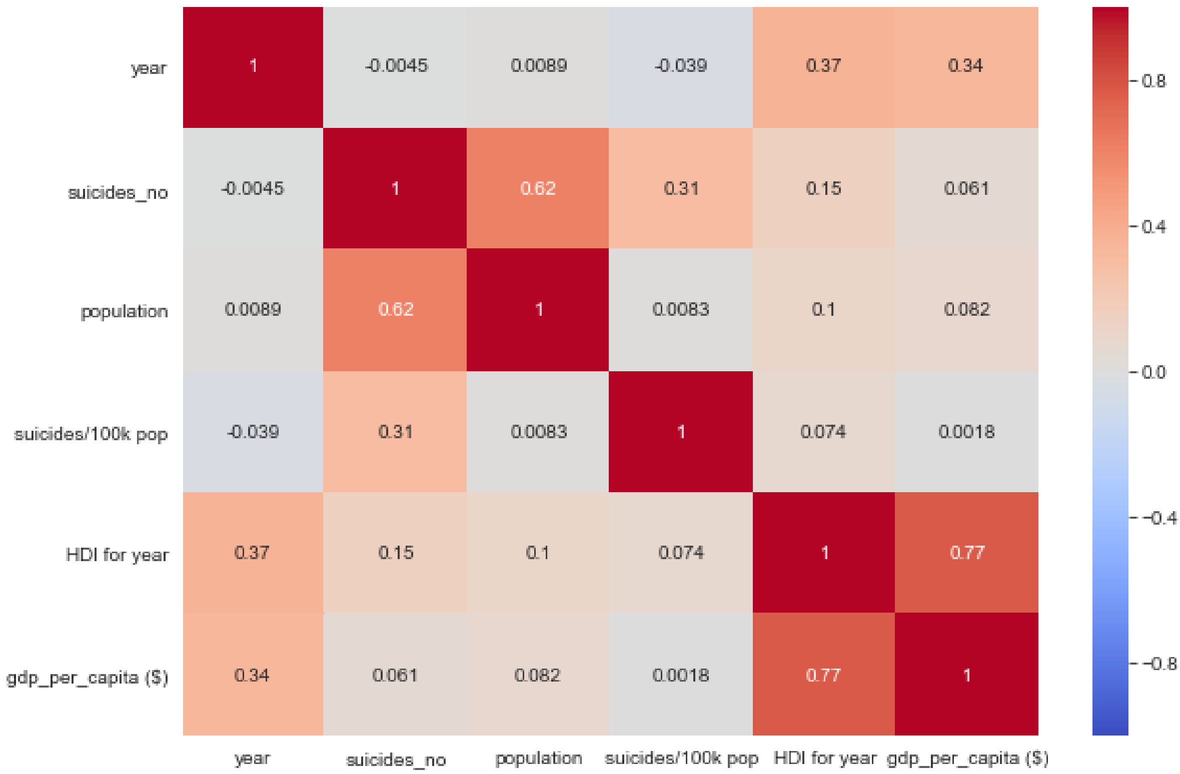
```
Categorical distribution plot:
```



9. Generate a correlation heatmap for the dataset. Which pairs of variables are highly correlated.

In [66]:
```
#sns.heatmap(df_suicide.corr())
fig, ax = plt.subplots(figsize=(10,7))
ax=sns.heatmap(df_suicide.corr(), annot=True, vmin=-1, vmax=1, center= 0, cmap
= 'coolwarm')
#ax.get_ylim()
ax.set_ylim(6, 0)
```

Out[66]: (6, 0)



In [67]:
```
print('The pairs of variables which are highly correlated are : gdp_per_capita
($) and HDI for year with a correlation of 0.77, population and suicides_no wi
th a correlation of 0.62')
```

```
The pairs of variables which are highly correlated are : gdp_per_capita ($) a
nd HDI for year with a correlation of 0.77, population and suicides_no with a
correlation of 0.62
```

10. Generate the following tables:

a) A table containing the columns ‘Country’, ‘Year’, ‘Total suicides’. Total Suicides has to be calculated from the existing table.

In [68]:
```
df_new = df_suicide.groupby(['country','year'])['suicides_no'].sum().reset_ind
ex().copy()
df_new= df_new.rename(columns={'suicides_no': 'Total suicides', 'country':'Cou
ntry','year':'Year'})
df_new.head(5)
```

Out[68]:

	Country	Year	Total suicides
0	Albania	1987	73
1	Albania	1988	63
2	Albania	1989	68
3	Albania	1992	47
4	Albania	1993	73

b) A Table containing the columns ‘Country’, ‘Year’, ‘per capita gdp’.

In [69]:
```
df_new2 = df_suicide.groupby(['country','year'])['gdp_per_capita ($)'].first()
.reset_index().copy()
df_new2= df_new2.rename(columns={'gdp_per_capita ($)': 'per capita gdp', 'coun
try':'Country','year':'Year'})
df_new2.head(5)
```

Out[69]:

	Country	Year	per capita gdp
0	Albania	1987	796
1	Albania	1988	769
2	Albania	1989	833
3	Albania	1992	251
4	Albania	1993	437

c) Merge the above two tables using ‘Country’ as the merge column.

In [70]:
```
merged = pd.merge(df_new, df_new2, on='Country', how="inner").rename(columns={
'Year_x':'Year'}).drop_duplicates(subset=('Country','Year','per capita gdp'),
keep='first', inplace=False).drop_duplicates(subset=('Country','Year','per cap
ita gdp'), keep='first', inplace=False)
merged = merged[merged['Year'] == merged['Year_y']].drop(columns=['Year_y']).r
eset_index().drop(columns=['index'])
merged.head()
```

Out[70]:

	Country	Year	Total suicides	per capita gdp
0	Albania	1987	73	796
1	Albania	1988	63	769
2	Albania	1989	68	833
3	Albania	1992	47	251
4	Albania	1993	73	437

--------------------------------- Happy Learning --