In [1]:
```
import pandas as pd
import numpy as np
import statsmodels.api as sm
import scipy.stats as st
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.metrics import confusion_matrix
import matplotlib.mlab as mlab
%matplotlib inline
```

In [2]:
```
df=pd.read_csv(r"C:\Users\LENOVO\Downloads\framingham.csv")
df
```

Out[2]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHyp
0	1	39	4.0	0	0.0	0.0	0	0
1	0	46	2.0	0	0.0	0.0	0	0
2	1	48	1.0	1	20.0	0.0	0	0
3	0	61	3.0	1	30.0	0.0	0	1
4	0	46	3.0	1	23.0	0.0	0	0
...	...	...	...	...	...	...	...	...
4233	1	50	1.0	1	1.0	0.0	0	1
4234	1	51	3.0	1	43.0	0.0	0	0
4235	0	48	2.0	1	20.0	NaN	0	0
4236	0	44	1.0	1	15.0	0.0	0	0
4237	0	52	2.0	0	0.0	0.0	0	0

4238 rows × 16 columns

In [3]:
```
df.head()
```

Out[3]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHyp	di
0	1	39	4.0	0	0.0	0.0	0	0	
1	0	46	2.0	0	0.0	0.0	0	0	
2	1	48	1.0	1	20.0	0.0	0	0	
3	0	61	3.0	1	30.0	0.0	0	1	
4	0	46	3.0	1	23.0	0.0	0	0	

In [4]:
```
df.describe
```

Out[4]:
```
<bound method NDFrame.describe of       male  age  education  currentSmoker
cigsPerDay  BPMeds
0        1   39        4.0              0         0.0     0.0  \
1        0   46        2.0              0         0.0     0.0
2        1   48        1.0              1        20.0     0.0
3        0   61        3.0              1        30.0     0.0
4        0   46        3.0              1        23.0     0.0
...    ...  ...        ...            ...         ...     ...
4233     1   50        1.0              1         1.0     0.0
4234     1   51        3.0              1        43.0     0.0
4235     0   48        2.0              1        20.0     NaN
4236     0   44        1.0              1        15.0     0.0
4237     0   52        2.0              0         0.0     0.0

      prevalentStroke  prevalentHyp  diabetes  totChol  sysBP  diaBP    BMI
0                   0             0         0    195.0  106.0   70.0  26.97
\
1                   0             0         0    250.0  121.0   81.0  28.73
2                   0             0         0    245.0  127.5   80.0  25.34
3                   0             1         0    225.0  150.0   95.0  28.58
4                   0             0         0    285.0  130.0   84.0  23.10
...               ...           ...       ...      ...    ...    ...    ...
4233                0             1         0    313.0  179.0   92.0  25.97
4234                0             0         0    207.0  126.5   80.0  19.71
4235                0             0         0    248.0  131.0   72.0  22.00
4236                0             0         0    210.0  126.5   87.0  19.16
4237                0             0         0    269.0  133.5   83.0  21.47

      heartRate  glucose  TenYearCHD
0          80.0     77.0           0
1          95.0     76.0           0
2          75.0     70.0           0
3          65.0    103.0           1
4          85.0     85.0           0
...         ...      ...         ...
4233       66.0     86.0           1
4234       65.0     68.0           0
4235       84.0     86.0           0
4236       86.0      NaN           0
4237       80.0    107.0           0

[4238 rows x 16 columns]>
```

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

Out[5]:
```
(4238, 16)
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4238 entries, 0 to 4237
Data columns (total 16 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   male             4238 non-null   int64  
 1   age              4238 non-null   int64  
 2   education        4133 non-null   float64
 3   currentSmoker    4238 non-null   int64  
 4   cigsPerDay       4209 non-null   float64
 5   BPMeds           4185 non-null   float64
 6   prevalentStroke  4238 non-null   int64  
 7   prevalentHyp     4238 non-null   int64  
 8   diabetes         4238 non-null   int64  
 9   totChol          4188 non-null   float64
 10  sysBP            4238 non-null   float64
 11  diaBP            4238 non-null   float64
 12  BMI              4219 non-null   float64
 13  heartRate        4237 non-null   float64
 14  glucose          3850 non-null   float64
 15  TenYearCHD       4238 non-null   int64  
dtypes: float64(9), int64(7)
memory usage: 529.9 KB
```

In [7]:

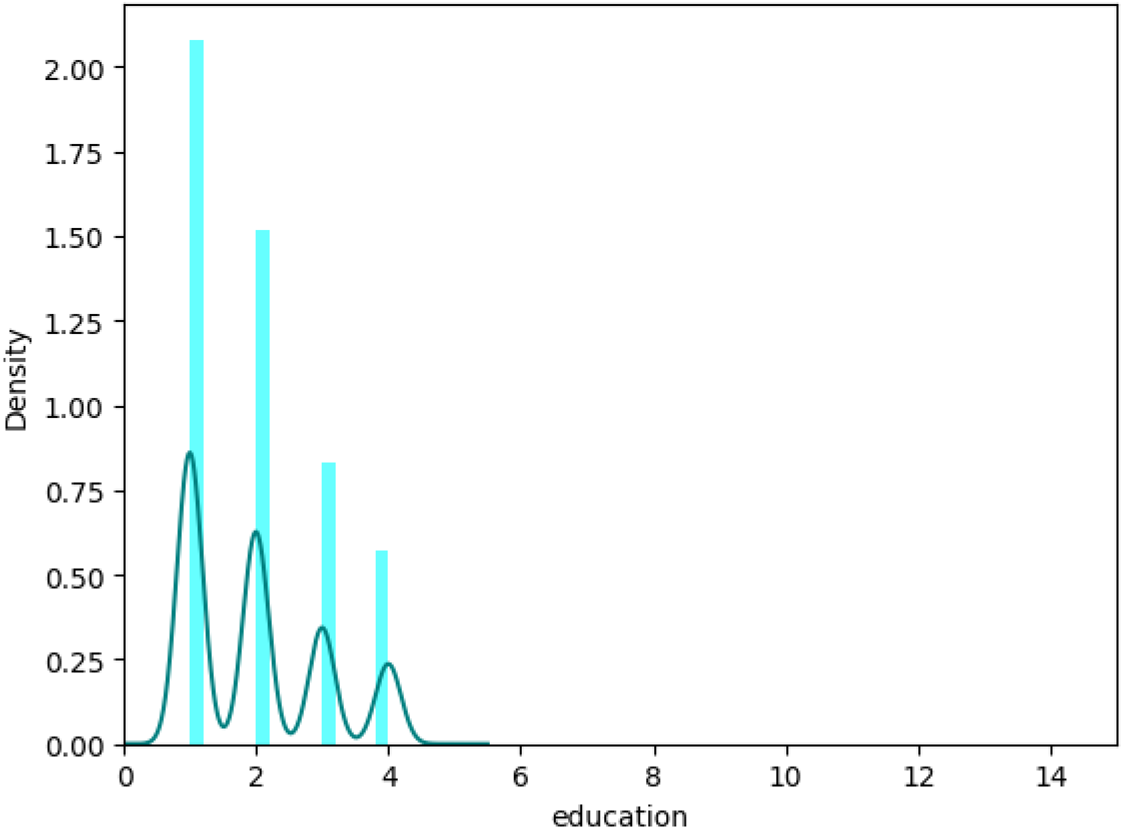
```
df.isnull().sum()
```

Out[7]:

```
male                 0
age                  0
education          105
currentSmoker        0
cigsPerDay          29
BPMeds              53
prevalentStroke      0
prevalentHyp         0
diabetes             0
totChol             50
sysBP                0
diaBP                0
BMI                 19
heartRate            1
glucose            388
TenYearCHD           0
dtype: int64
```

In [8]:

```
a=df['education'].hist(bins=15,density=True,stacked=True,color='cyan',alpha=0.
df['education'].plot(kind='density',color='teal')
a.set(xlabel='education')
plt.xlim(-0,15)
plt.show()
```



In [9]:

```
print(df["education"].mean(skipna=True))
print(df["education"].median(skipna=True))
```

```
1.9789499153157513
2.0
```

In [10]:

```
print((df['glucose'].isnull().sum()/df.shape[0]*100))
```

```
9.155261915998112
```

In [11]:

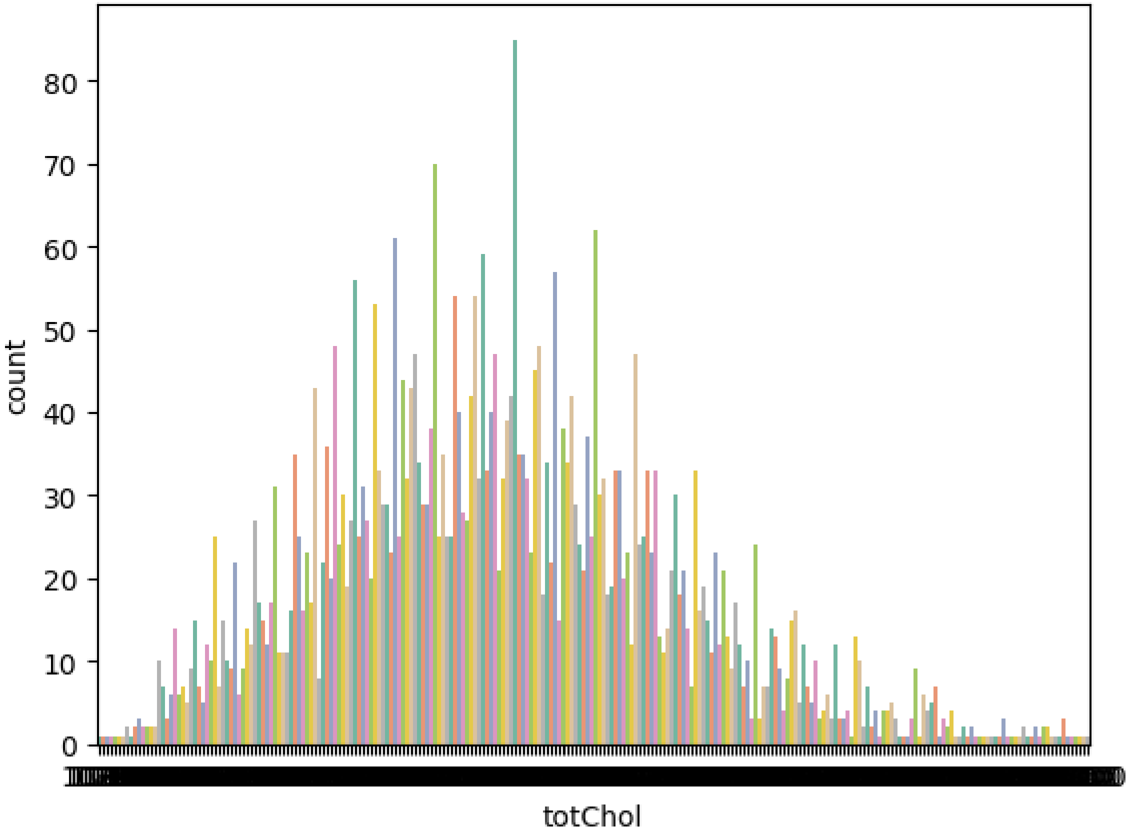
```
print((df['totChol'].isnull().sum()/df.shape[0]*100))
```

```
1.1798017932987257
```

In [12]:

```
print(df['totChol'].value_counts())
sns.countplot(x='totChol',data=df,palette='Set2')
plt.show()
```

```
totChol
240.0    85
220.0    70
260.0    62
210.0    61
232.0    59
         ..
392.0     1
405.0     1
359.0     1
398.0     1
119.0     1
Name: count, Length: 248, dtype: int64
```



In [13]:

```
print(df['totChol'].value_counts().idxmax())
```

```
240.0
```

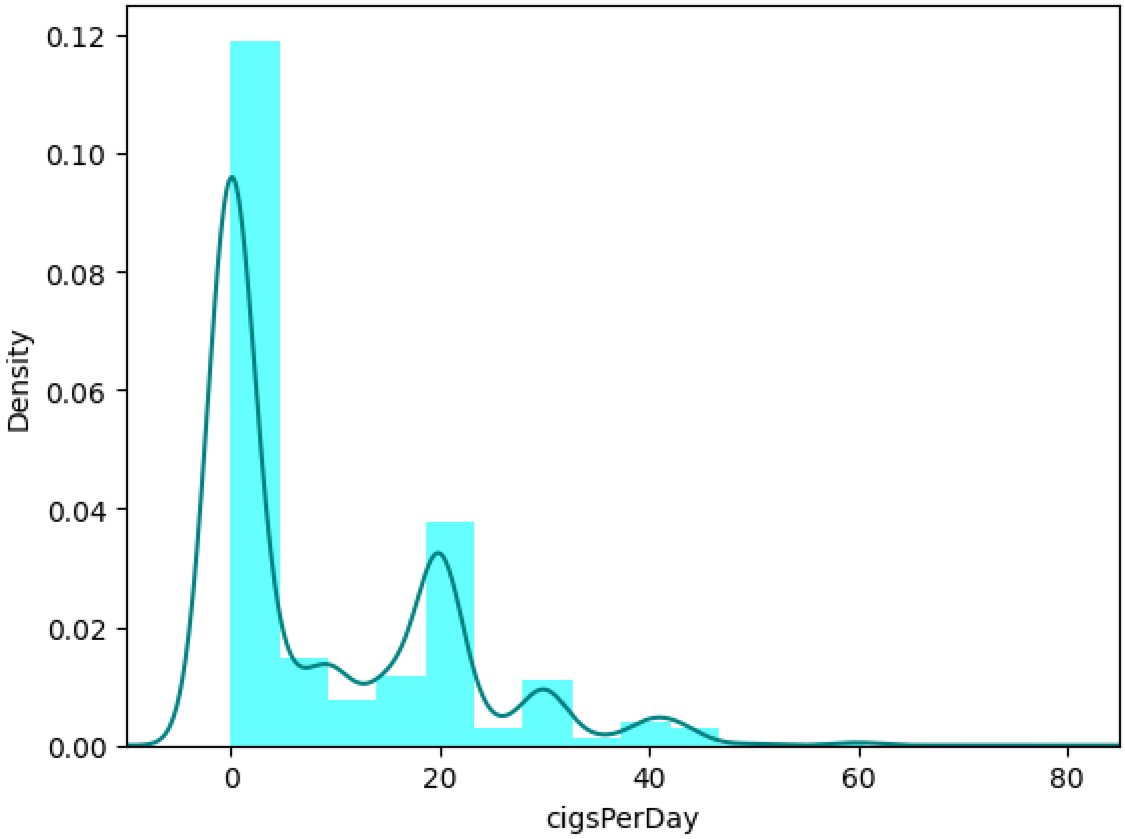
In [14]:

```
data=df.copy()
data['education'].fillna(df['education'].median(skipna=True),inplace=True)
data['totChol'].fillna(df['totChol'].value_counts().idxmax(),inplace=True)
data.drop('glucose',axis=1,inplace=True)
```

In [15]:
```
data.isnull().sum()
```

Out[15]:
```
male                 0
age                  0
education            0
currentSmoker        0
cigsPerDay          29
BPMeds              53
prevalentStroke      0
prevalentHyp         0
diabetes             0
totChol              0
sysBP                0
diaBP                0
BMI                 19
heartRate            1
TenYearCHD           0
dtype: int64
```

In [16]:
```
ax=df["cigsPerDay"].hist(bins=15,density=True,stacked=True,color='cyan',alpha=
df["cigsPerDay"].plot(kind='density',color='teal')
ax.set(xlabel='cigsPerDay')
plt.xlim(-10,85)
plt.show()
```



```
In [18]: print(df['cigsPerDay'].mean(skipna=True))
         print(df['cigsPerDay'].median(skipna=True))
```

```
9.003088619624615
0.0
```

```
In [19]: print((df['BPMeds'].isnull().sum()/df.shape[0]*100))
```

```
1.2505899008966492
```

```
In [20]: print((df['BMI'].isnull().sum()/df.shape[0]*100))
```

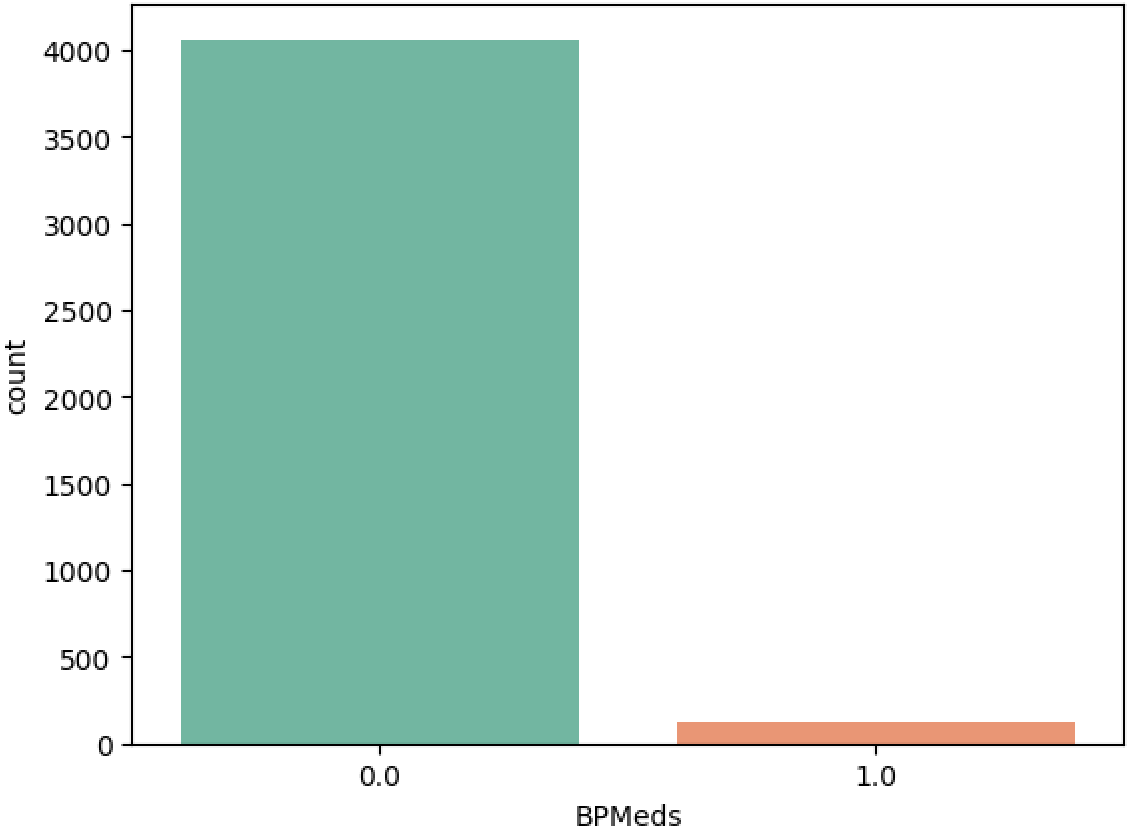
```
0.4483246814535158
```

```
In [21]: print((df['heartRate'].isnull().sum()/df.shape[0]*100))
```

```
0.023596035865974516
```

```
In [22]: print(df['BPMeds'].value_counts())
         sns.countplot(x='BPMeds',data=df,palette='Set2')
         plt.show()
```

```
BPMeds
0.0    4061
1.0     124
Name: count, dtype: int64
```



In [23]:
```
print(df['heartRate'].value_counts().idxmax())
```

```
75.0
```

In [24]:
```
data=df.copy()
data["cigsPerDay"].fillna(df["cigsPerDay"].median(skipna=True),inplace=True)
data["BPMeds"].fillna(df["BPMeds"].value_counts().idxmax(),inplace=True)
data["education"].fillna(df["education"].median(skipna=True),inplace=True)
data["totChol"].fillna(df["totChol"].value_counts().idxmax(),inplace=True)
data.drop('glucose',axis=1,inplace=True)
data.drop('BMI',axis=1,inplace=True)
data.drop('heartRate',axis=1,inplace=True)
```

In [25]:
```
data.isnull().sum()
```

Out[25]:
```
male               0
age                0
education          0
currentSmoker      0
cigsPerDay         0
BPMeds             0
prevalentStroke    0
prevalentHyp       0
diabetes           0
totChol            0
sysBP              0
diaBP              0
TenYearCHD         0
dtype: int64
```

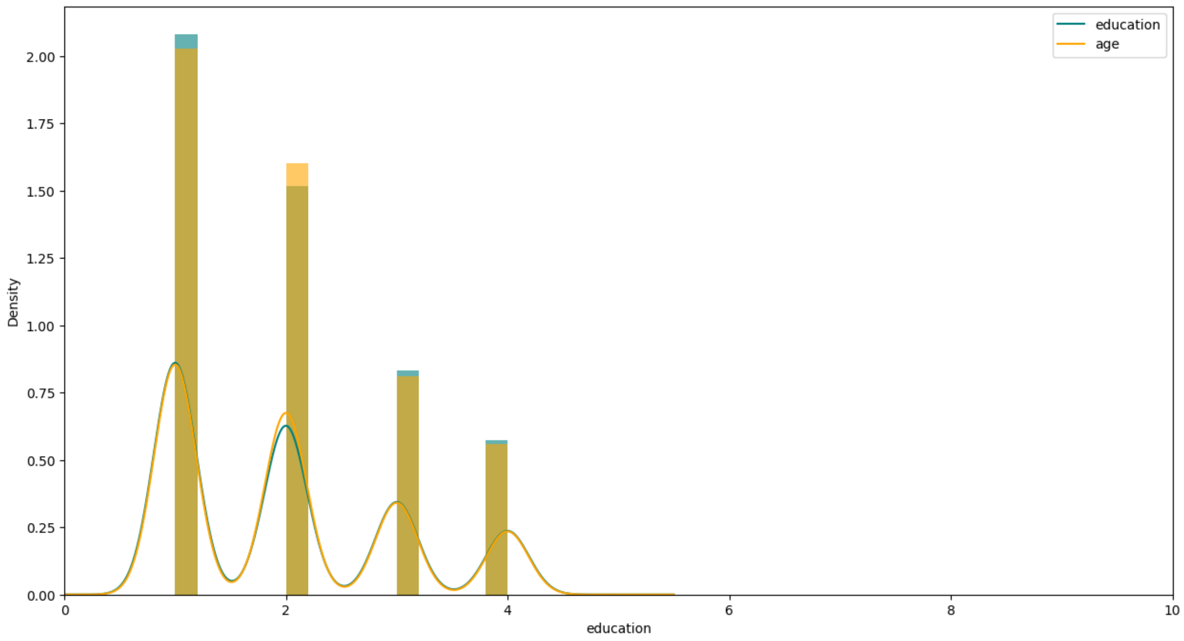
In [26]:
```
data.head()
```

Out[26]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalentHyp	di
0	1	39	4.0	0	0.0	0.0	0	0	
1	0	46	2.0	0	0.0	0.0	0	0	
2	1	48	1.0	1	20.0	0.0	0	0	
3	0	61	3.0	1	30.0	0.0	0	1	
4	0	46	3.0	1	23.0	0.0	0	0	

In [27]:

```
plt.figure(figsize=(15,8))
ax=df["education"].hist(bins=15,density=True,stacked=True,color='teal',alpha=0
df["education"].plot(kind='density',color='teal')
ax=data["education"].hist(bins=15,density=True,stacked=True,color='orange',alph
data["education"].plot(kind='density',color='orange')
ax.legend(["education","age"])
ax.set(xlabel='education')
plt.xlim(-0,10)
plt.show()
```



In [28]:

```
data['Disease']=np.where((data["prevalentHyp"]+data["prevalentStroke"])>0,0,1)
data.drop('prevalentHyp',axis=1,inplace=True)
data.drop('prevalentStroke',axis=1,inplace=True)
```

In [29]:

```
training=pd.get_dummies(data,columns=["currentSmoker","totChol","sysBP"])
training.drop('TenYearCHD',axis=1,inplace=True)
training.drop('male',axis=1,inplace=True)
training.drop('diaBP',axis=1,inplace=True)
final_train=training
final_train.head()
```

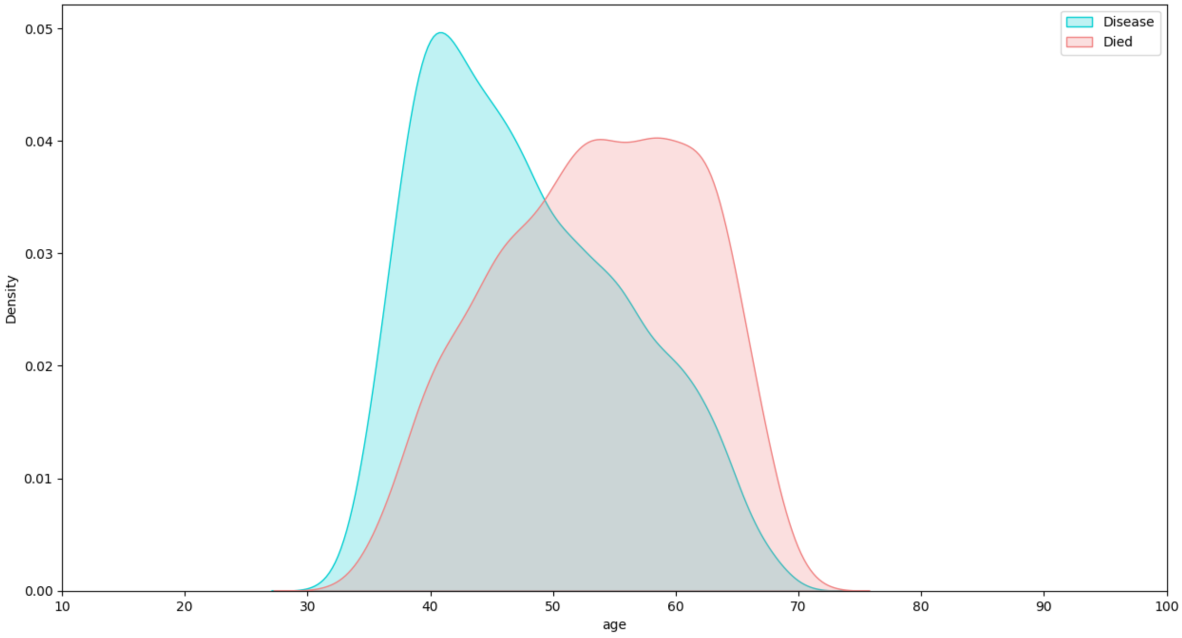
Out[29]:

	age	education	cigsPerDay	BPMeds	diabetes	Disease	currentSmoker_0	currentSmoker_1
0	39	4.0	0.0	0.0	0	1	True	False
1	46	2.0	0.0	0.0	0	1	True	False
2	48	1.0	20.0	0.0	0	1	False	True
3	61	3.0	30.0	0.0	0	0	False	True
4	46	3.0	23.0	0.0	0	1	False	True

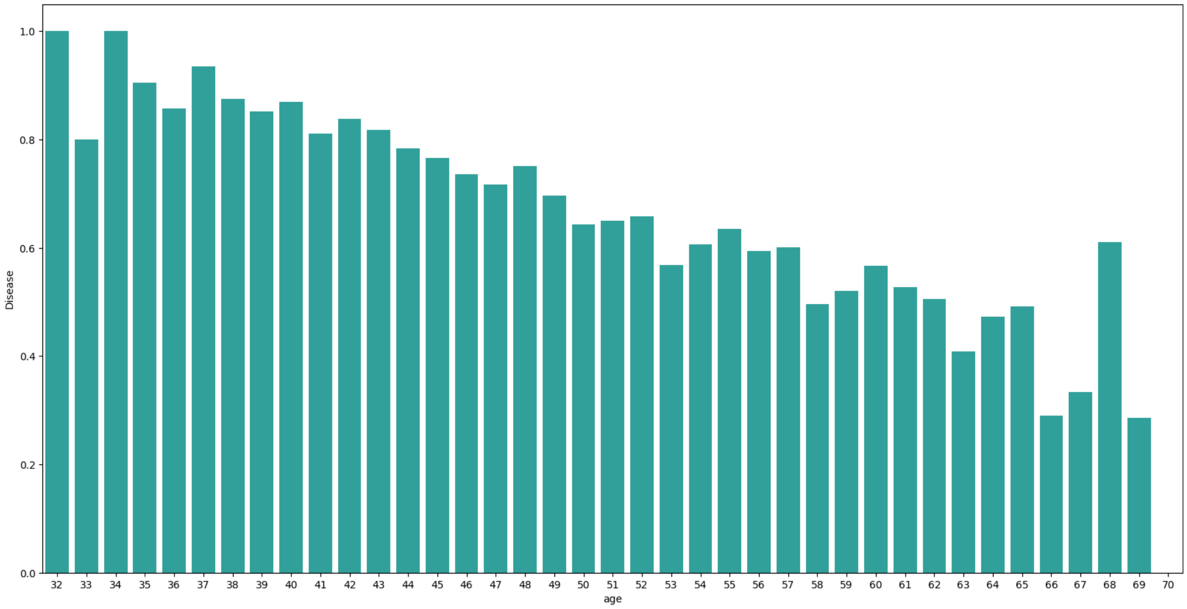
5 rows × 490 columns

In [31]:
```
plt.figure(figsize=(15,8))
ax = sns.kdeplot(final_train["age"][final_train.Disease == 1],color="darkturqu
sns.kdeplot(final_train["age"][final_train.Disease == 0],color="lightcoral",sh
plt.legend(['Disease','Died'])
ax.set(xlabel='age')
plt.xlim(10,100)
plt.show()
```

```
C:\Users\LENOVO\AppData\Local\Temp\ipykernel_6092\1255524709.py:2: FutureWarn
ing:

`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.

  ax = sns.kdeplot(final_train["age"][final_train.Disease == 1],color="darktu
rquoise",shade=True)
C:\Users\LENOVO\AppData\Local\Temp\ipykernel_6092\1255524709.py:3: FutureWarn
ing:

`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.

  sns.kdeplot(final_train["age"][final_train.Disease == 0],color="lightcora
l",shade=True)
```



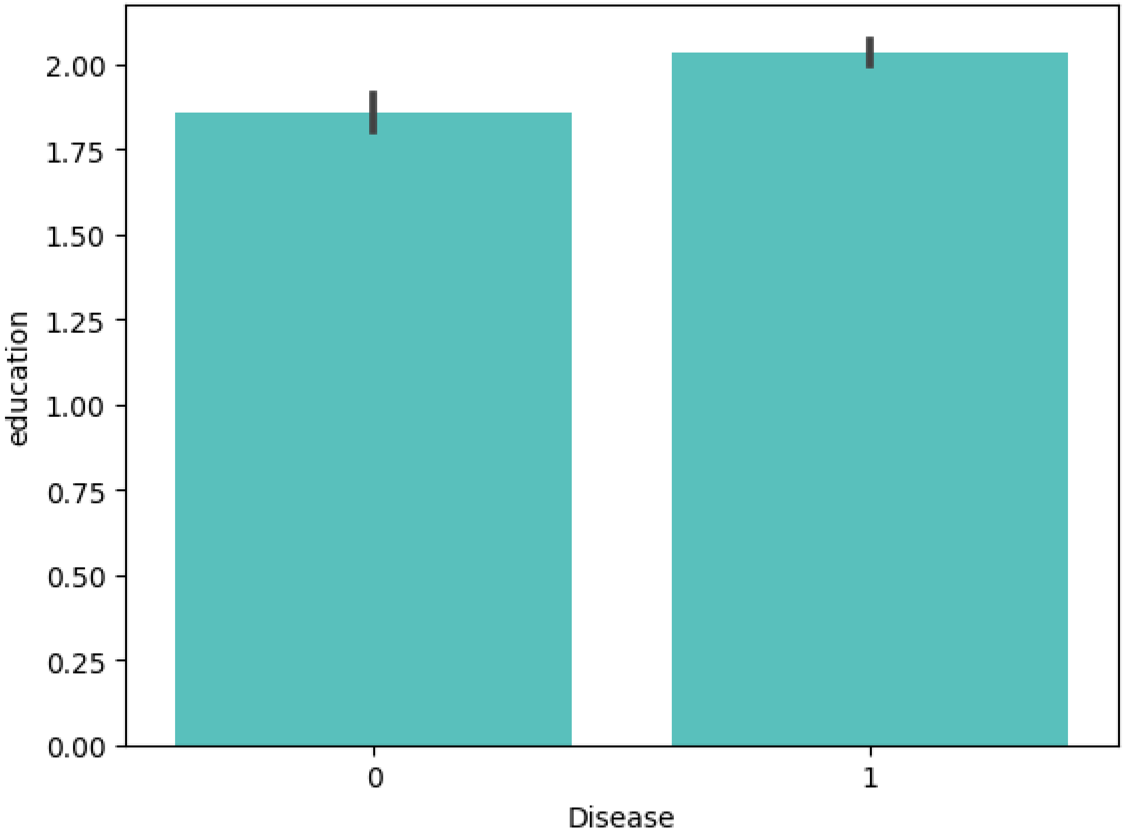
In [30]:
```
plt.figure(figsize=(20,10))
avg_survival_byage=final_train[["age","Disease"]].groupby(['age'],as_index=Fals
g=sns.barplot(x='age',y='Disease',data=avg_survival_byage,color="LightSeaGreen
plt.show()
```



In [32]:
```
final_train['IsMinor']=np.where(final_train['age']<=16,1,0)
print(final_train['IsMinor'])
```

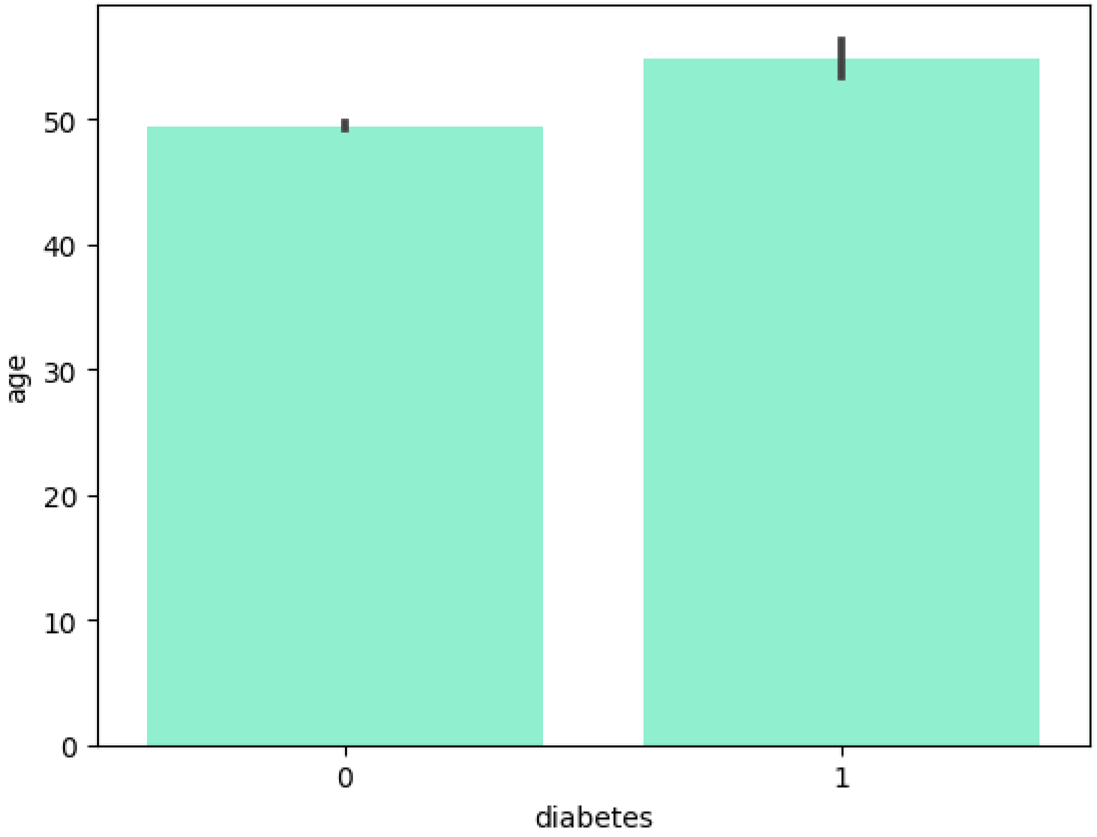
```
0       0
1       0
2       0
3       0
4       0
       ..
4233    0
4234    0
4235    0
4236    0
4237    0
Name: IsMinor, Length: 4238, dtype: int32
```

```
In [33]: sns.barplot(x='Disease',y='education',data=final_train,color="mediumturquoise"
         plt.show()
```



In [34]:

```
import seaborn as sns
import matplotlib.pyplot as plt
sns.barplot(x='diabetes',y='age',data=df,color="aquamarine")
plt.show()
```



In [ ]: