problem staement:predict and analyze

In [5]:

```
import numpy as np
import pandas as pd
from sklearn import preprocessing
import matplotlib.pyplot as plt
# plt.rc("font", size=14)
import seaborn as sns
sns.set(style="white") #white background style for seaborn plots
sns.set(style="whitegrid", color_codes=True)
import warnings
warnings.simplefilter(action='ignore')
```

In [6]:

```
df = pd.read_csv(r"C:\Users\sowmika\Downloads\framingham.csv")
df
```

Out[6]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalent
0	1	39	4.0	0	0.0	0.0	0	
1	0	46	2.0	0	0.0	0.0	0	
2	1	48	1.0	1	20.0	0.0	0	
3	0	61	3.0	1	30.0	0.0	0	
4	0	46	3.0	1	23.0	0.0	0	
...	...	...	...	...	...	...	...	...
4235	0	48	2.0	1	20.0	NaN	0	
4236	0	44	1.0	1	15.0	0.0	0	
4237	0	52	2.0	0	0.0	0.0	0	
4238	1	40	3.0	0	0.0	0.0	0	
4239	0	39	3.0	1	30.0	0.0	0	

4240 rows × 16 columns

In [7]:

```
df.head()
```

Out[7]:

	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

In [8]:

```
df.tail()
```

Out[8]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	prevalentStroke	prevalent
4235	0	48	2.0	1	20.0	NaN	0	
4236	0	44	1.0	1	15.0	0.0	0	
4237	0	52	2.0	0	0.0	0.0	0	
4238	1	40	3.0	0	0.0	0.0	0	
4239	0	39	3.0	1	30.0	0.0	0	

In [9]:

```
df.shape
```

Out[9]:

```
(4240, 16)
```

In [10]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4240 entries, 0 to 4239
Data columns (total 16 columns):
 #   Column           Non-Null Count  Dtype  
---  ------           --------------  -----  
 0   male             4240 non-null   int64  
 1   age              4240 non-null   int64  
 2   education        4135 non-null   float64
 3   currentSmoker    4240 non-null   int64  
 4   cigsPerDay       4211 non-null   float64
 5   BPMeds           4187 non-null   float64
 6   prevalentStroke  4240 non-null   int64  
 7   prevalentHyp     4240 non-null   int64  
 8   diabetes         4240 non-null   int64  
 9   totChol          4190 non-null   float64
 10  sysBP            4240 non-null   float64
 11  diaBP            4240 non-null   float64
 12  BMI              4221 non-null   float64
 13  heartRate        4239 non-null   float64
 14  glucose          3852 non-null   float64
 15  TenYearCHD       4240 non-null   int64  
dtypes: float64(9), int64(7)
memory usage: 530.1 KB
```

In [11]:

```
df.describe()
```

Out[11]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	pre
count	4240.000000	4240.000000	4135.000000	4240.000000	4211.000000	4187.000000	
mean	0.429245	49.580189	1.979444	0.494104	9.005937	0.029615	
std	0.495027	8.572942	1.019791	0.500024	11.922462	0.169544	
min	0.000000	32.000000	1.000000	0.000000	0.000000	0.000000	
25%	0.000000	42.000000	1.000000	0.000000	0.000000	0.000000	
50%	0.000000	49.000000	2.000000	0.000000	0.000000	0.000000	
75%	1.000000	56.000000	3.000000	1.000000	20.000000	0.000000	
max	1.000000	70.000000	4.000000	1.000000	70.000000	1.000000	

In [12]:

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

Out[12]:

```
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 [13]:

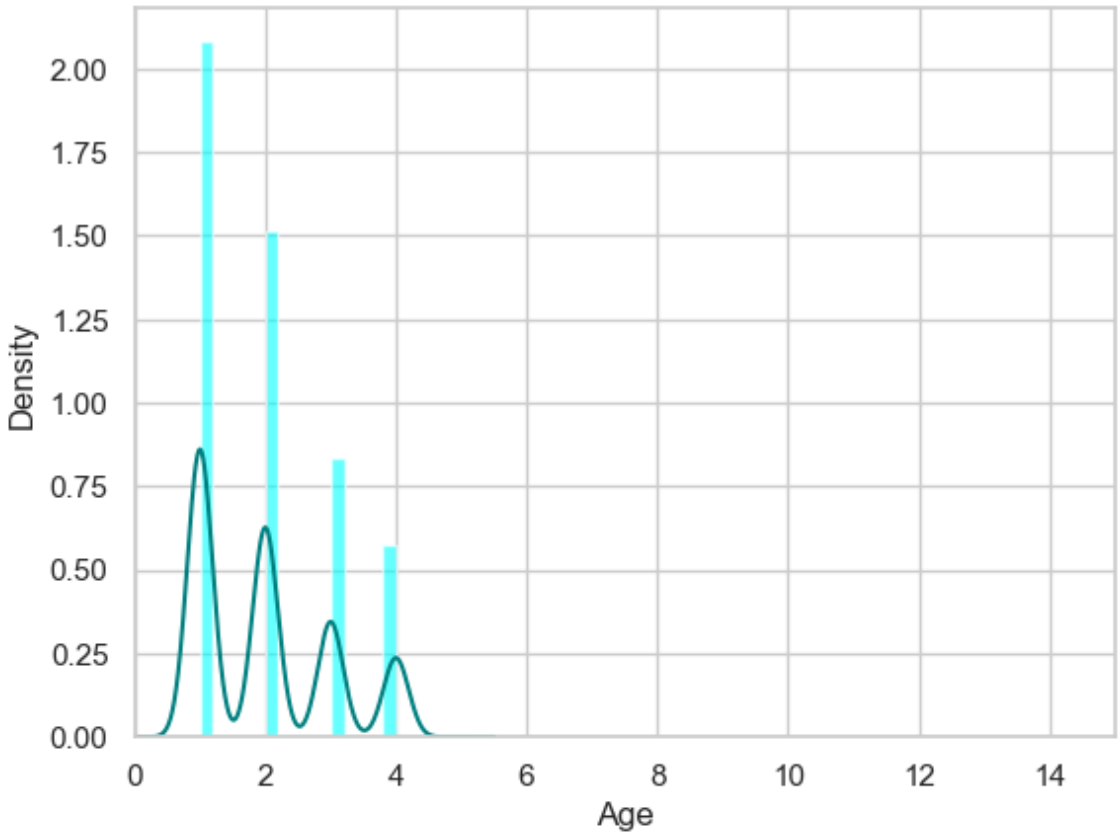
```
df.describe().any()
```

Out[13]:

```
male              True
age               True
education         True
currentSmoker     True
cigsPerDay        True
BPMeds            True
prevalentStroke   True
prevalentHyp      True
diabetes          True
totChol           True
sysBP             True
diaBP             True
BMI               True
heartRate         True
glucose           True
TenYearCHD        True
dtype: bool
```

In [14]:

```
ax = df["education"].hist(bins=15, density=True, stacked=True, color='cyan', alpha=0.6)
df["education"].plot(kind='density', color='teal')
ax.set(xlabel='Age')
plt.xlim(-0,15)
plt.show()
```



In [15]:

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

```
1.9794437726723095
2.0
```

In [16]:

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

```
9.150943396226415
```

In [17]:

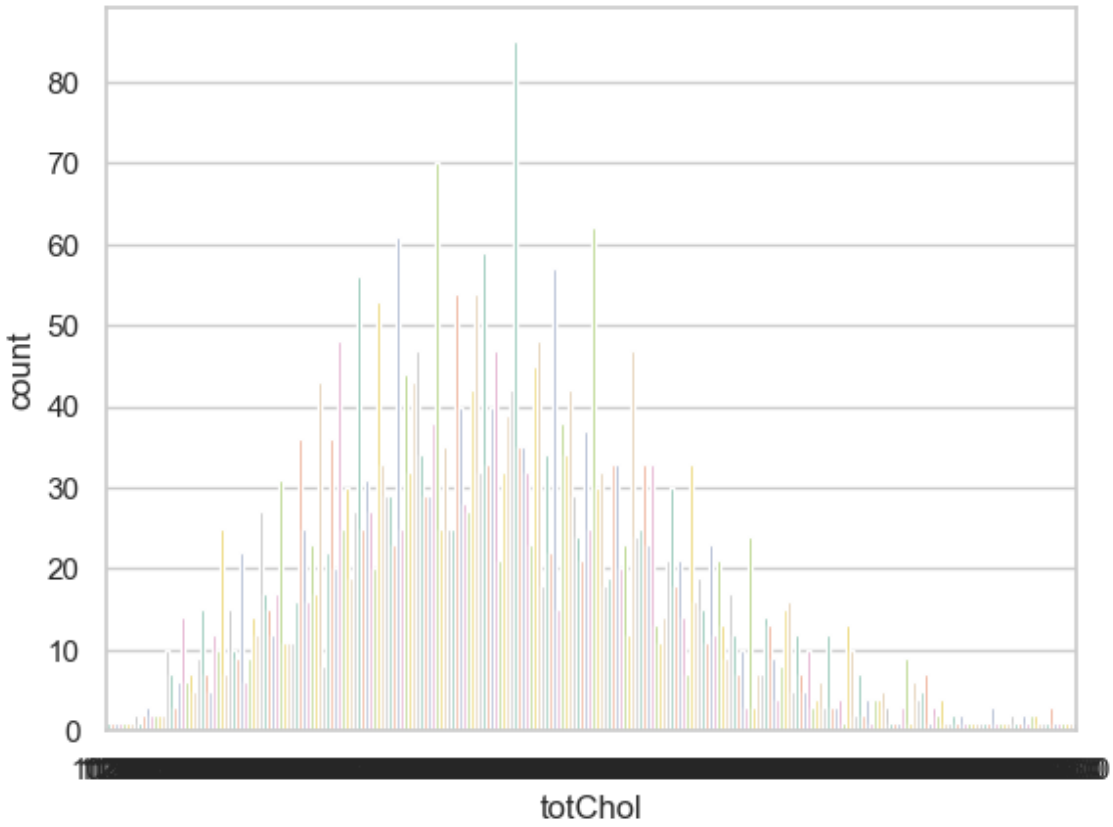
```
print((df['totChol'].isnull().sum()/df.shape[0]*100))
```

```
1.179245283018868
```

In [18]:

```
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 [19]:

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

```
240.0
```

In [20]:

```
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 [21]:

```
data.isnull().sum()
```

Out[21]:

```
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 [22]:

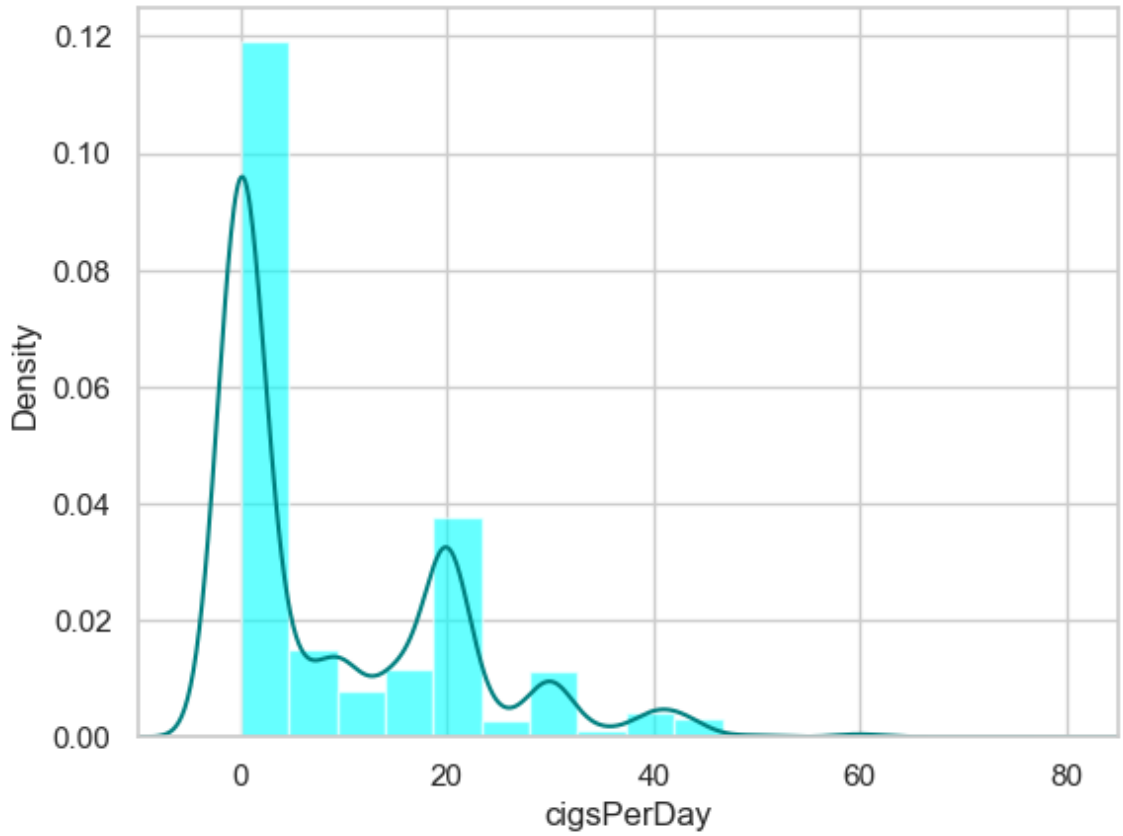
```
data.head()
```

Out[22]:

	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

In [23]:

```
ax = df["cigsPerDay"].hist(bins=15, density=True, stacked=True, color='cyan', alpha=0.6)
df["cigsPerDay"].plot(kind='density', color='teal')
ax.set(xlabel='cigsPerDay')
plt.xlim(-10,85)
plt.show()
```



In [24]:

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

```
9.005936832106388
0.0
```

In [25]:

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

```
1.25
```

In [26]:

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

```
0.4481132075471698
```

In [27]:

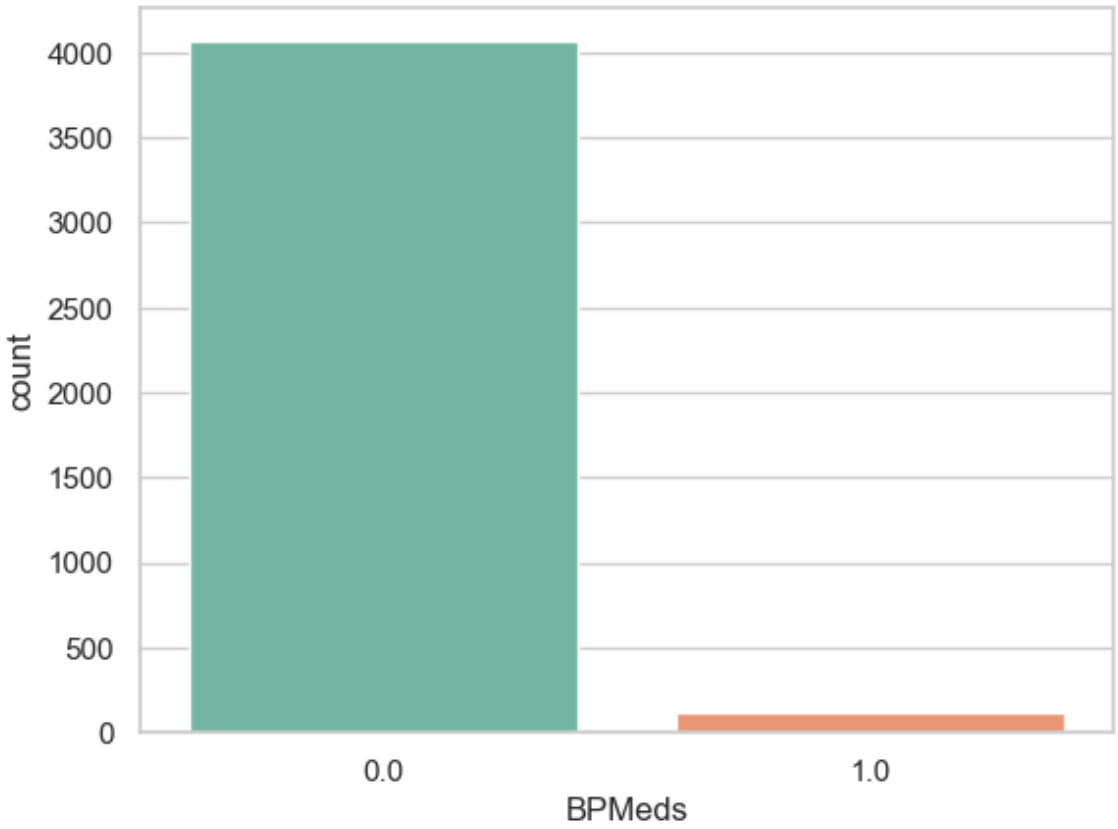
```
print((df['heartRate'].isnull().sum()/df.shape[0]*100))
```

```
0.02358490566037736
```

In [28]:

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

```
BPMeds
0.0    4063
1.0     124
Name: count, dtype: int64
```



In [29]:

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

```
75.0
```

In [32]:

```
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 [33]:

```
data.isnull().sum()
```

Out[33]:

```
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 [34]:

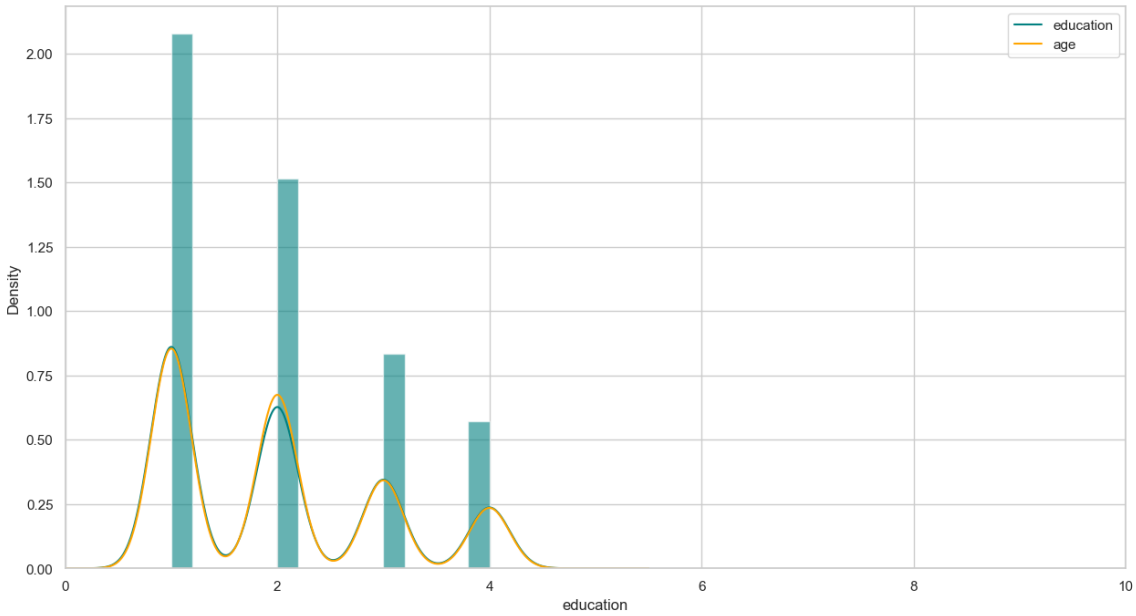
```
data.head()
```

Out[34]:

	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

In [37]:

```
plt.figure(figsize=(15,8))
ax = df["education"].hist(bins=15, density=True, stacked=True, color='teal', alpha=0.6)
df["education"].plot(kind='density', color='teal')
ax =data["education"].hist(bins=15, density=True, stacked=True, color='orange', alpha=0)
data["education"].plot(kind='density', color='orange')
ax.legend(['education', 'age'])
ax.set(xlabel='education')
plt.xlim(-0,10)
plt.show()
```



In [41]:

```
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 [43]:

```
#create categorical variables and drop some variables
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[43]:

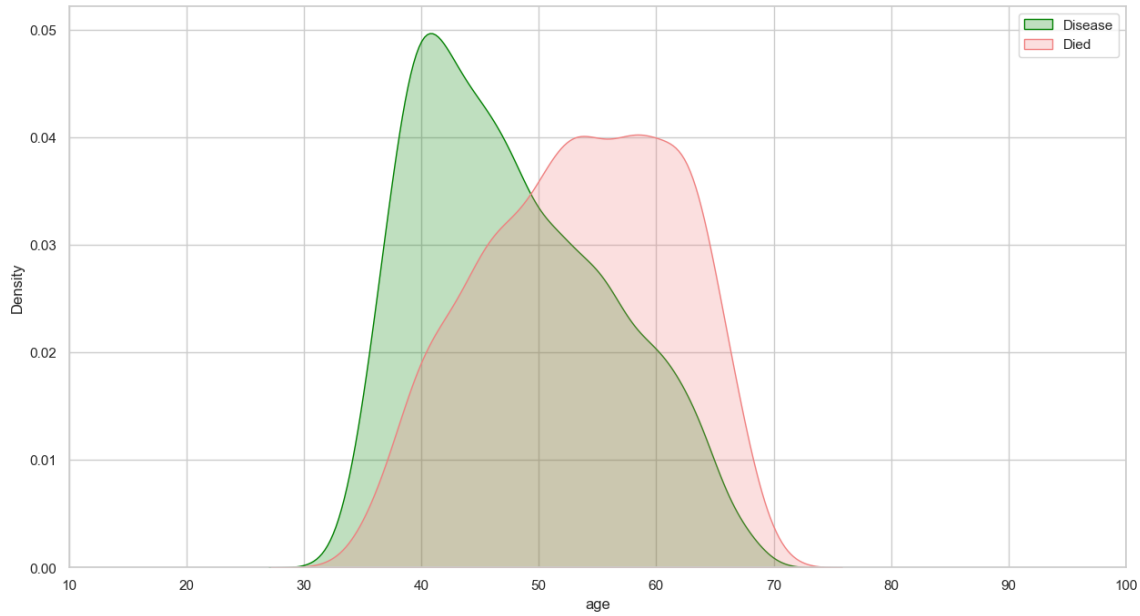
	age	education	cigsPerDay	BPMeds	diabetes	Disease	currentSmoker_0	currentSmoker
0	39	4.0	0.0	0.0	0	1	True	Fal
1	46	2.0	0.0	0.0	0	1	True	Fal
2	48	1.0	20.0	0.0	0	1	False	Tr
3	61	3.0	30.0	0.0	0	0	False	Tr
4	46	3.0	23.0	0.0	0	1	False	Tr

5 rows × 490 columns

Exploratory Data Analysis

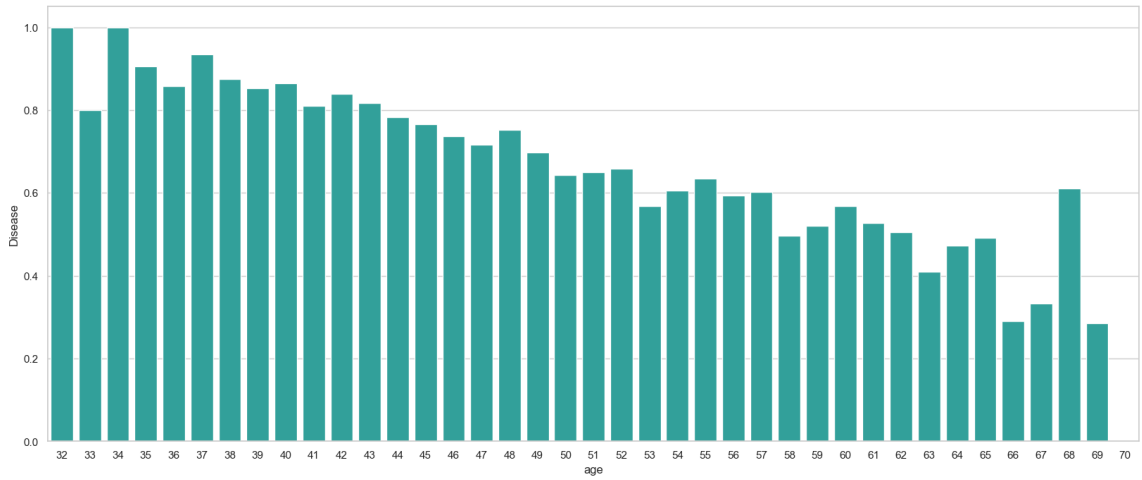
In [49]:

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



In [73]:

```
plt.figure(figsize=(20,8))
avg_survival_byage = final_train[["age", "Disease"]].groupby(['age'], as_index=False).me
g = sns.barplot(x='age', y='Disease', data=avg_survival_byage, color="LightSeaGreen")
plt.show()
```



In [57]:

```
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
       ..
4235    0
4236    0
4237    0
4238    0
4239    0
Name: IsMinor, Length: 4240, dtype: int32
```

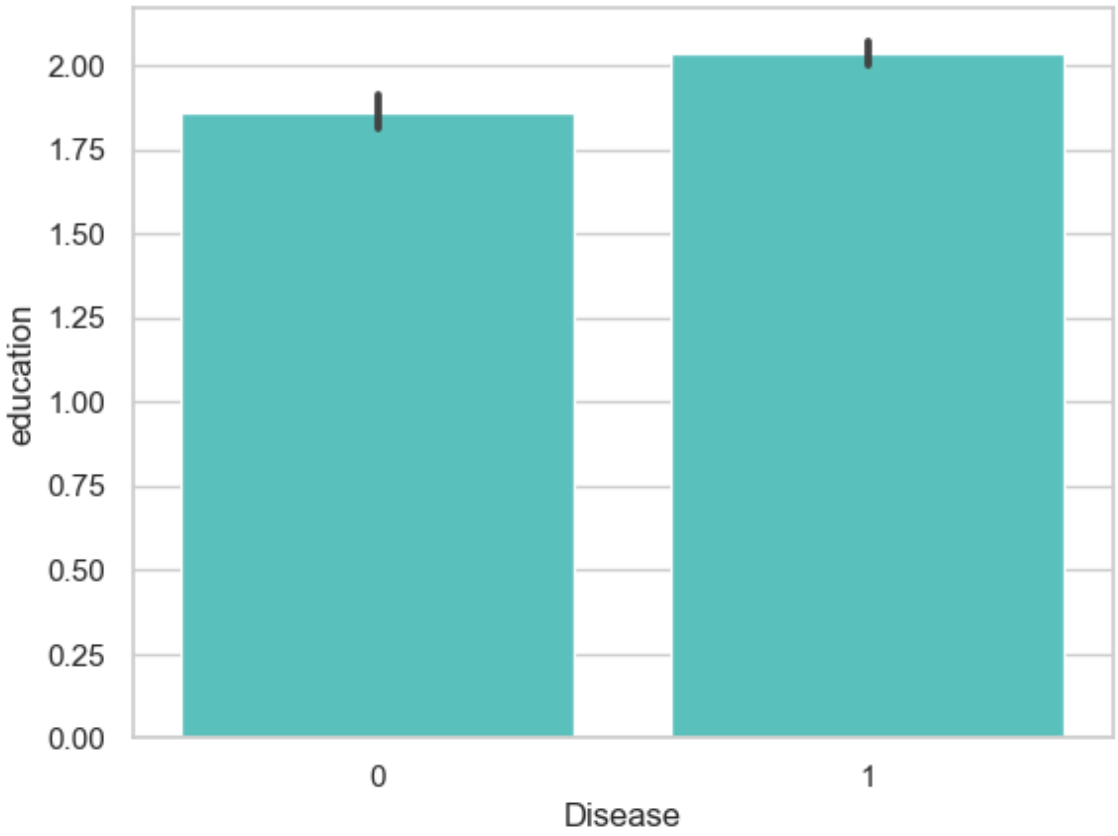
In [60]:

```
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
       ..
4235    0
4236    0
4237    0
4238    0
4239    0
Name: IsMinor, Length: 4240, dtype: int32
```

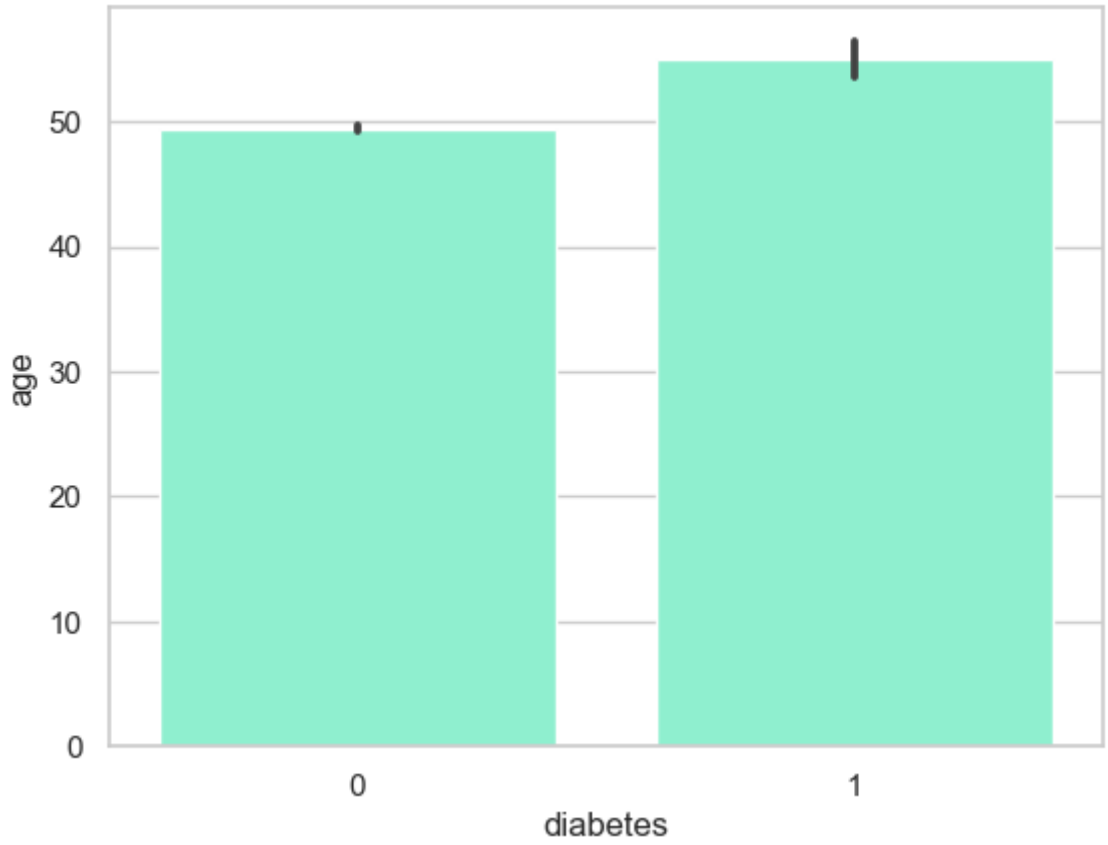
In [62]:

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



In [64]:

```
import seaborn as sns
import matplotlib.pyplot as plt
# Assuming 'train_df' is your DataFrame containing the data
sns.barplot(x='diabetes', y='age', data=df, color='aquamarine')
plt.show()
```



In [ ]:

```

```