Problem statement:

To predict the risk of heart diseases using Logistic Regression

In [19]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

In [20]:

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

Out[20]:

	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	
...	...	...	...	...	...	...	...	
4233	1	50	1.0	1	1.0	0.0	0	
4234	1	51	3.0	1	43.0	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 rows × 16 columns

In [21]:

```
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 [22]:

```
df.describe()
```

Out[22]:

	male	age	education	currentSmoker	cigsPerDay	BPMeds	pre
count	4238.000000	4238.000000	4133.000000	4238.000000	4209.000000	4185.000000	
mean	0.429212	49.584946	1.978950	0.494101	9.003089	0.029630	
std	0.495022	8.572160	1.019791	0.500024	11.920094	0.169584	
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 [24]:

```
df.shape
```

Out[24]:

```
(4238, 16)
```

In [25]:

```
df.isnull().any()
```

Out[25]:

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

In [26]:

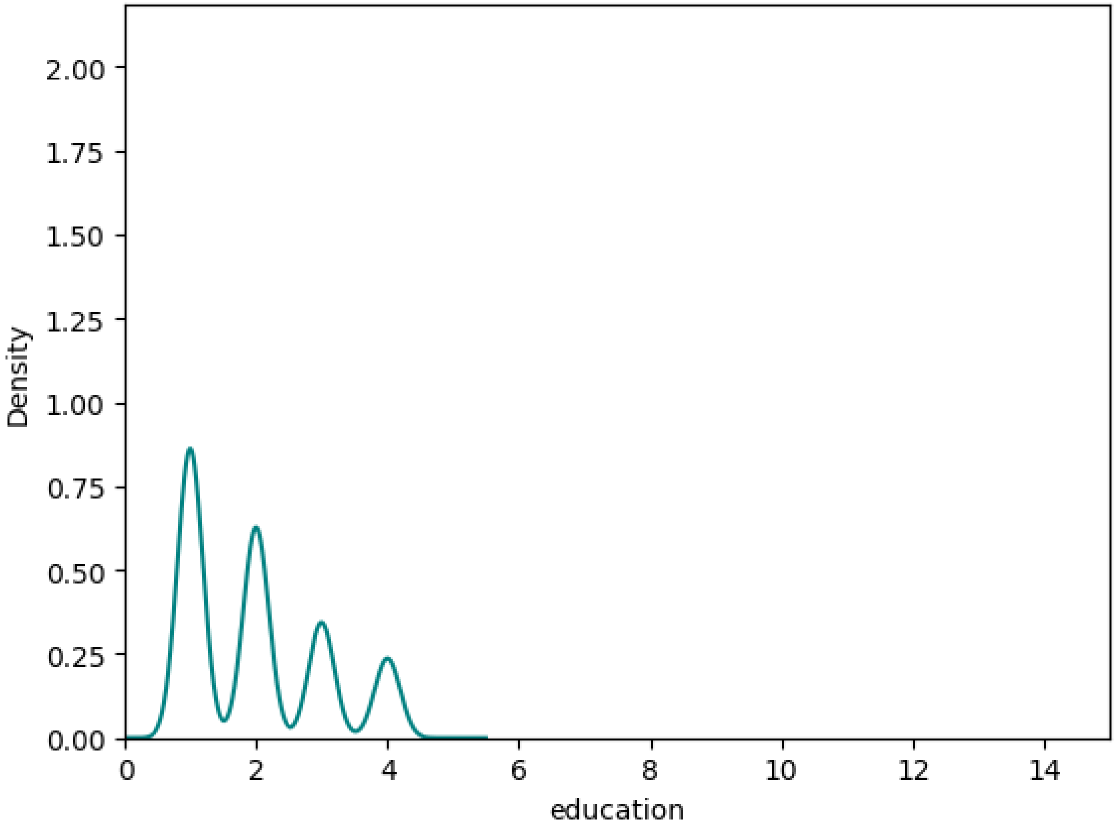
```
df.describe().any()
```

Out[26]:

```
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 [30]:

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



In [31]:

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

```
1.9789499153157513
2.0
```

In [32]:

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

```
9.155261915998112
```

In [33]:

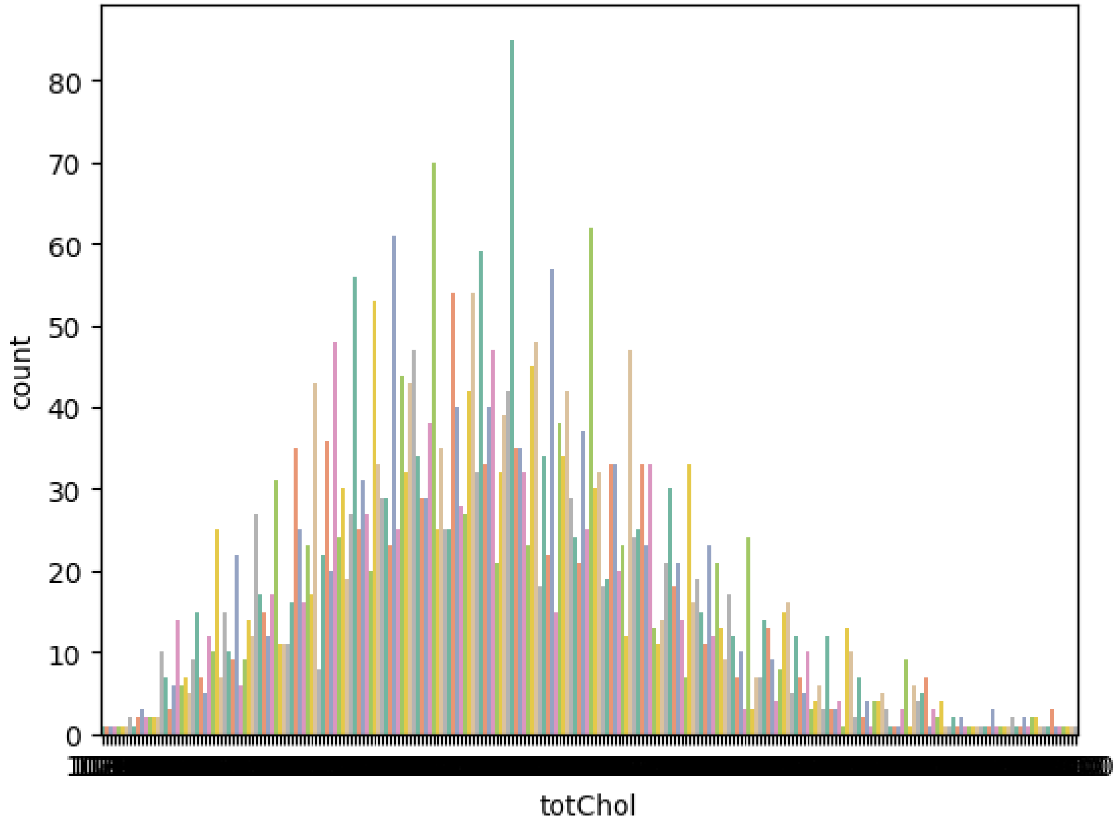
```
print((df['totChol'].isnull().sum()/df.shape[0]*100))
```

```
1.1798017932987257
```

In [34]:

```
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 [35]:

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

```
240.0
```

In [37]:

```
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 [38]:

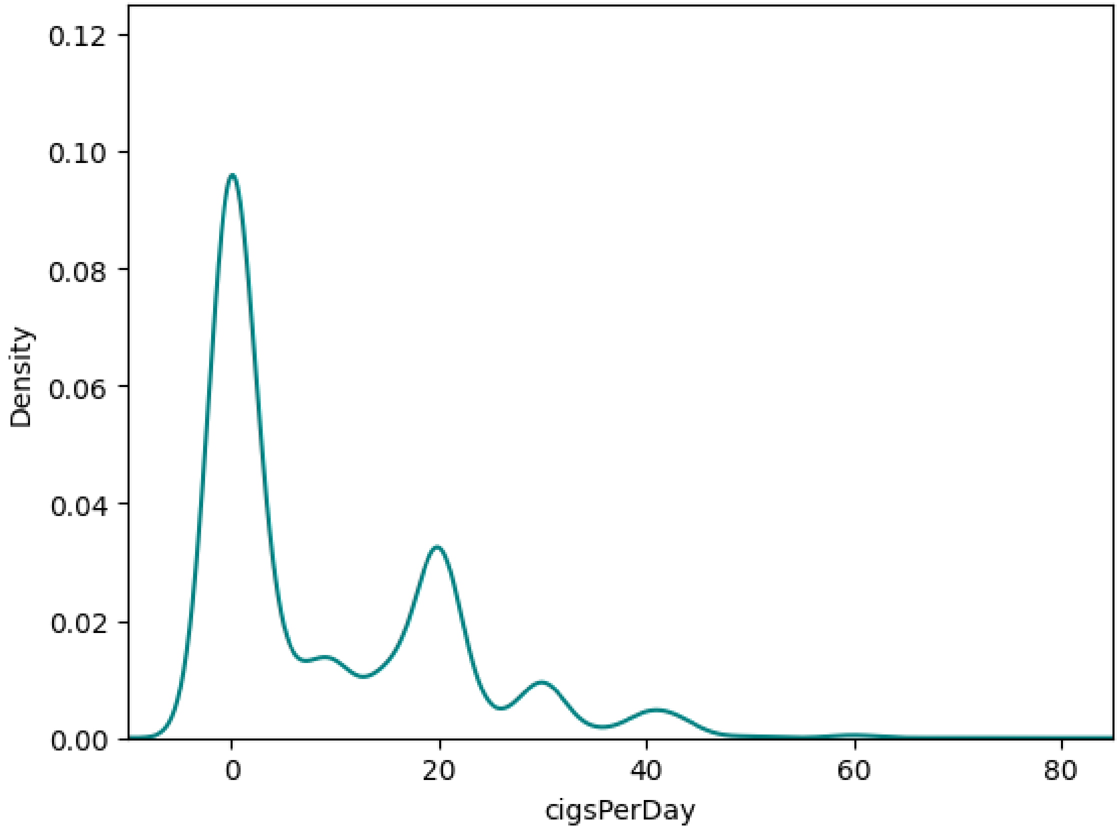
```
df.isnull().any()
```

Out[38]:

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

In [40]:

```
ax=df["cigsPerDay"].hist (bins=15, density=True, stacked=True, color='cyan', alpha= 0)
df["cigsPerDay"].plot(kind='density',color='teal')
ax.set(xlabel='cigsPerDay')
plt.xlim(-10,85)
plt.show()
```



In [41]:

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

```
9.003088619624615
0.0
```

In [42]:

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

```
1.2505899008966492
```

In [43]:

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

```
0.4483246814535158
```

In [44]:

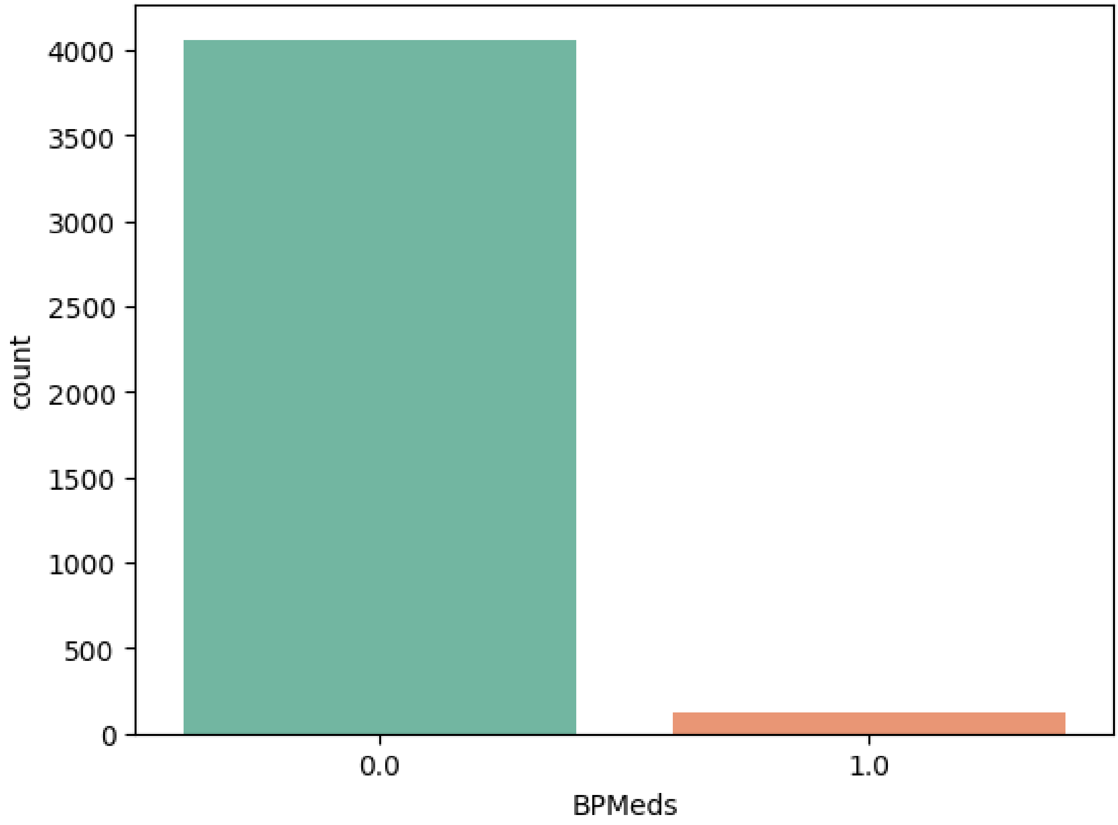
```
print((df['heartRate'].isnull().sum()/df.shape[0]*100))
```

```
0.023596035865974516
```

In [45]:

```
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 [46]:

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

```
75.0
```

In [51]:

```
data=df.copy()
data["cigsPerDay"].fillna(df["cigsPerDay"].median (skipna=True), inplace=True)
data["BPMeds"].fillna(df["BPMeds"].median (skipna=True), 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 [52]:

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

Out[52]:

```
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 [54]:

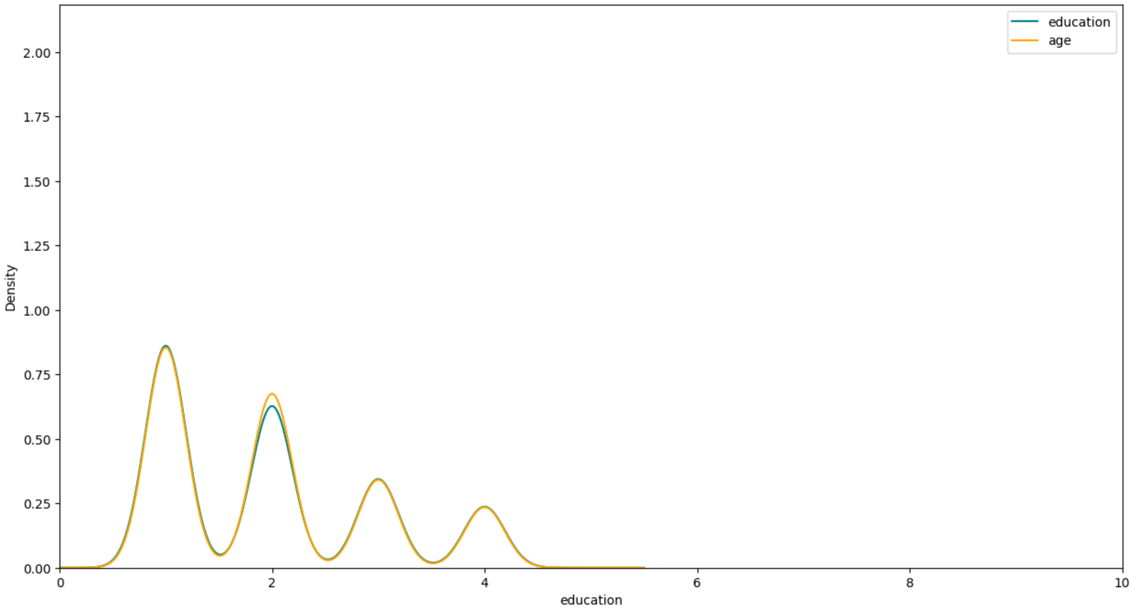
```
df.head()
```

Out[54]:

	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 [58]:

```
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', alpha=0)
data["education"].plot(kind='density',color='orange')
ax.legend(["education", "age"])
ax.set(xlabel='education')
plt.xlim(-0,10)
plt.show()
```



In [61]:

```
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 [63]:

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

In [64]:

```
training.drop("diaBP",axis=1,inplace=True)
final_train=training
final_train.head()
```

Out[64]:

	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

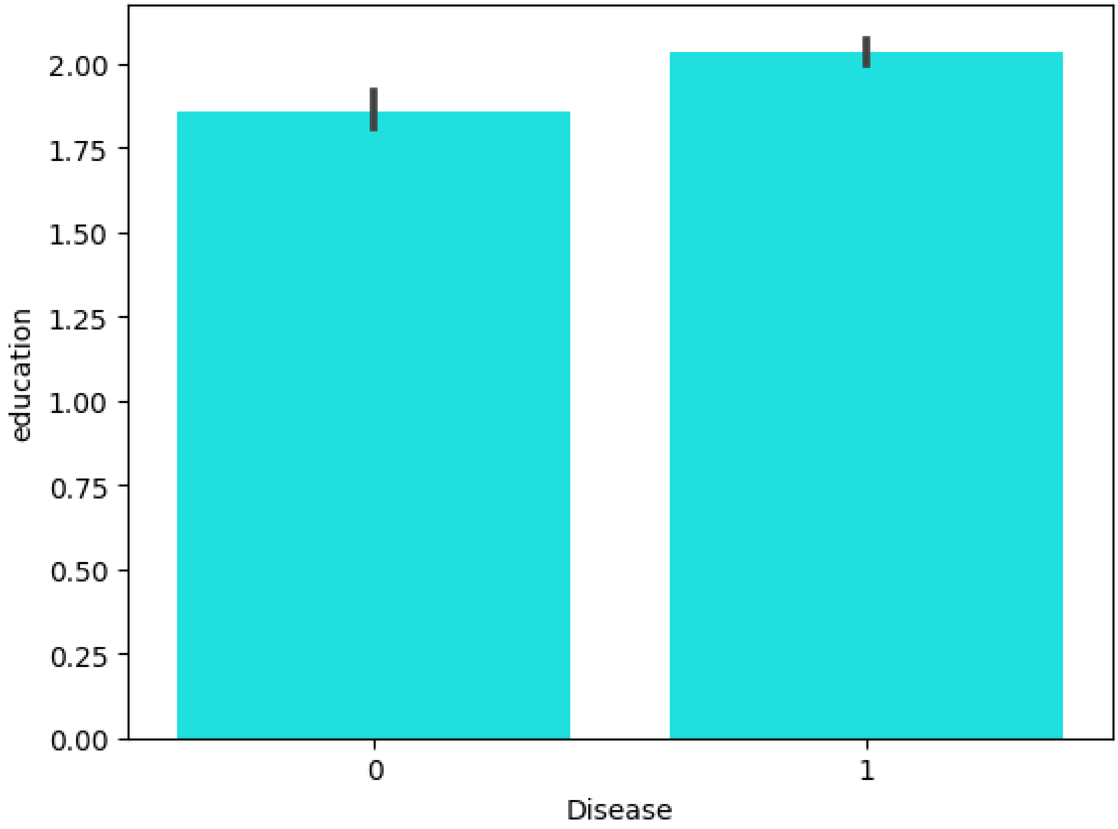
In [70]:

```
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
```

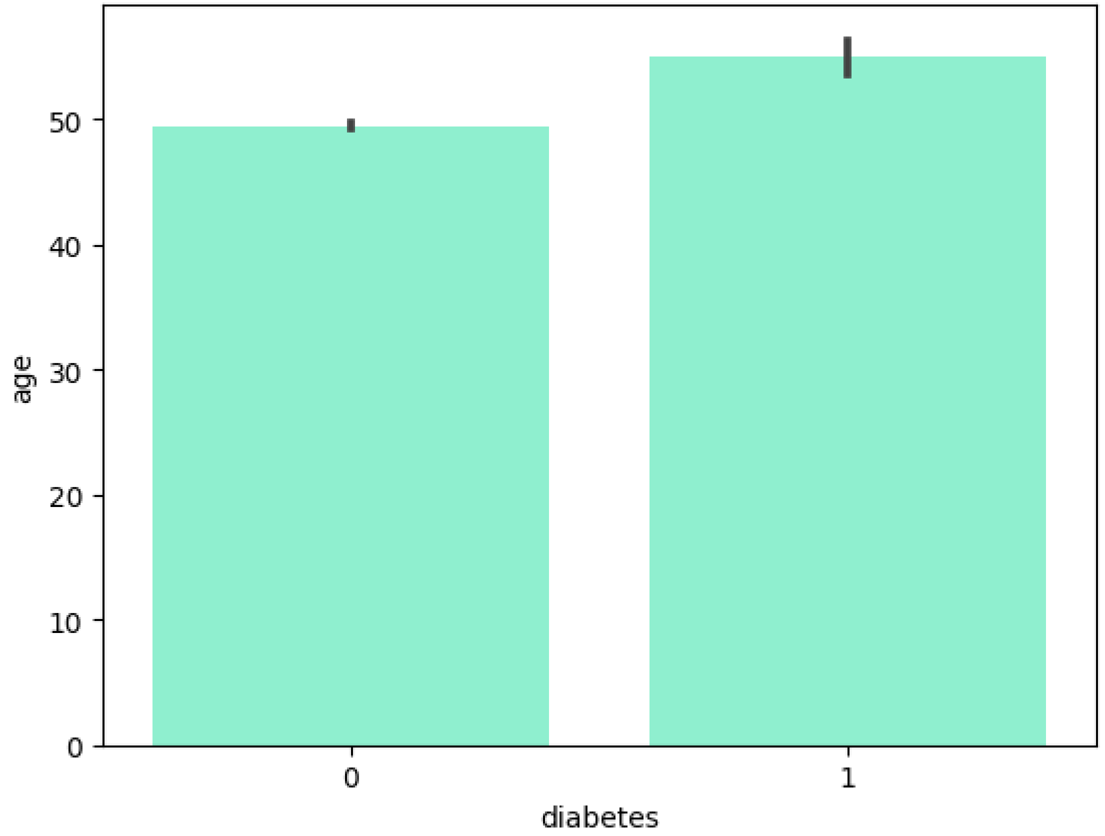
In [73]:

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



In [74]:

```
sns.barplot(x='diabetes', y='age', data=df, color='aquamarine')
plt.show()
```



In [ ]:

```

```