In [1]:

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

In [2]:

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

Out[2]:

| | 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 [3]:

```
df.head()
```

Out[3]:

| | 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 [4]:

```
df.tail()
```

Out[4]:

| | male | age | education | currentSmoker | cigsPerDay | BPMeds | prevalentStroke | prevalent |
|---|---|---|---|---|---|---|---|---|
| **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 | |

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.describe()
```

Out[7]:

| | 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 [8]:

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

Out[8]:

```
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 [9]:

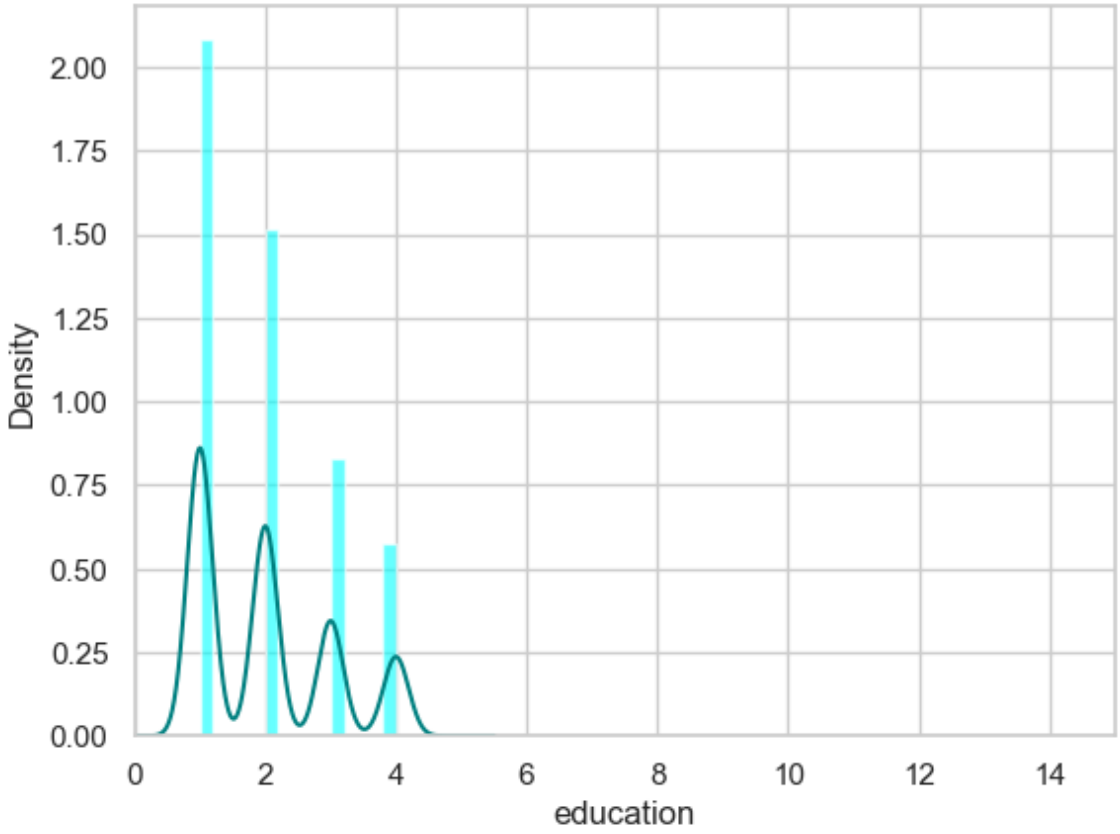
```
df.describe().any()
```

Out[9]:

```
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 [10]:

```
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='education')
plt.xlim(-0,15)
plt.show()
```




In [11]:

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

```
1.9789499153157513
2.0
```

In [12]:

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

```
9.155261915998112
```

In [13]:

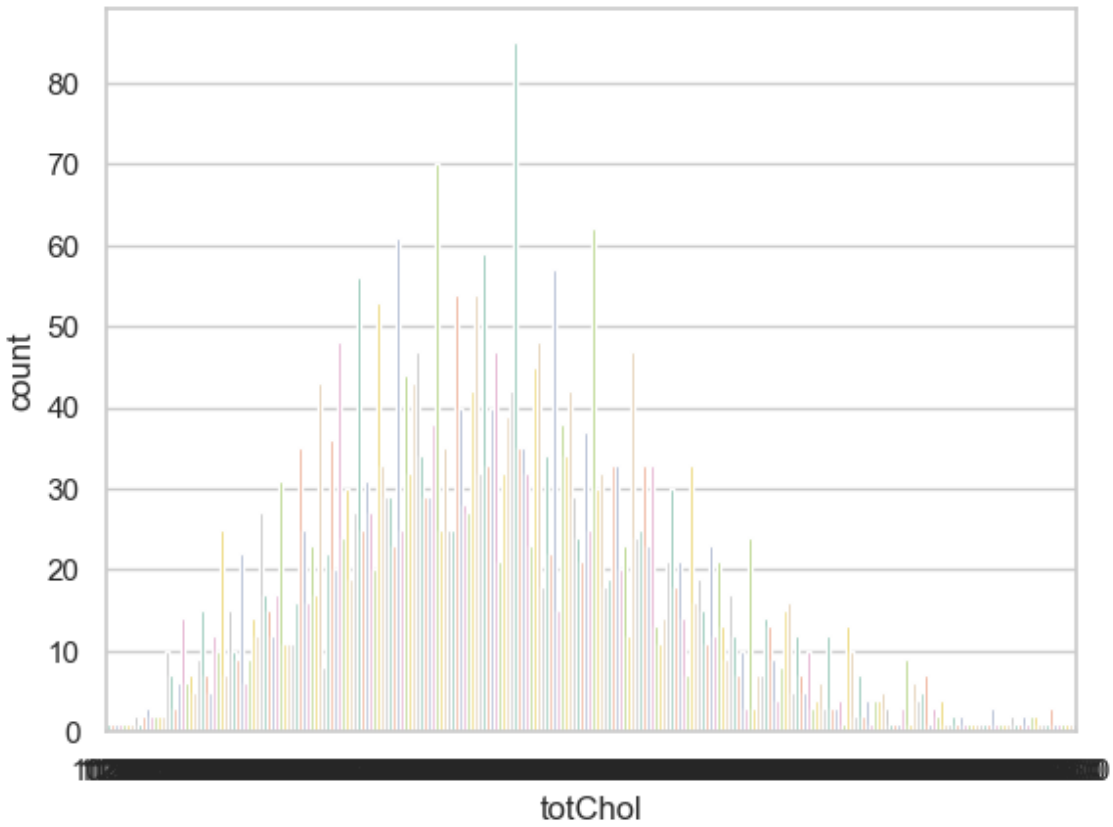
```
print((df['totChol'].isnull().sum()/df.shape[0]*100))
```

```
1.1798017932987257
```

In [14]:

```
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 [15]:

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

```
240.0
```

In [16]:

```
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 [17]:

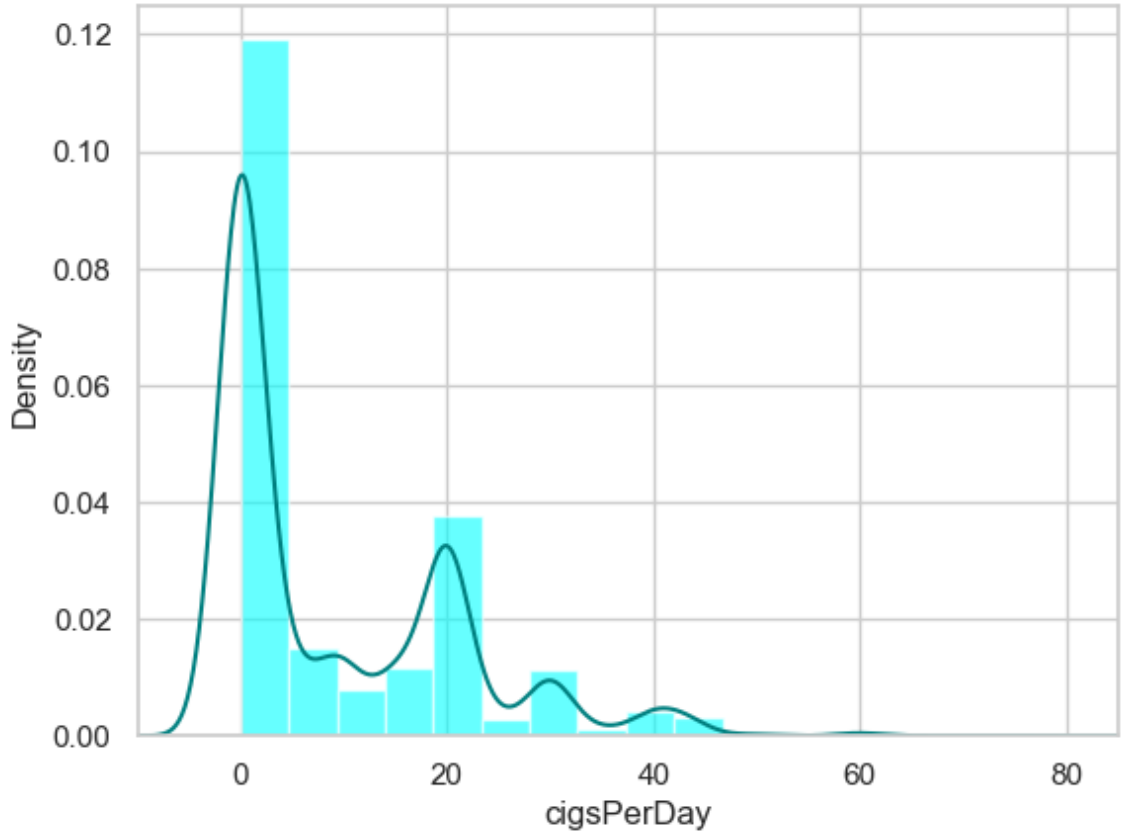
```
data.isnull().sum()
```

Out[17]:

```
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 [18]:

```
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 [19]:

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

```
9.003088619624615
0.0
```

In [20]:

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

```
1.2505899008966492
```

In [21]:

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

```
0.4483246814535158
```

In [22]:

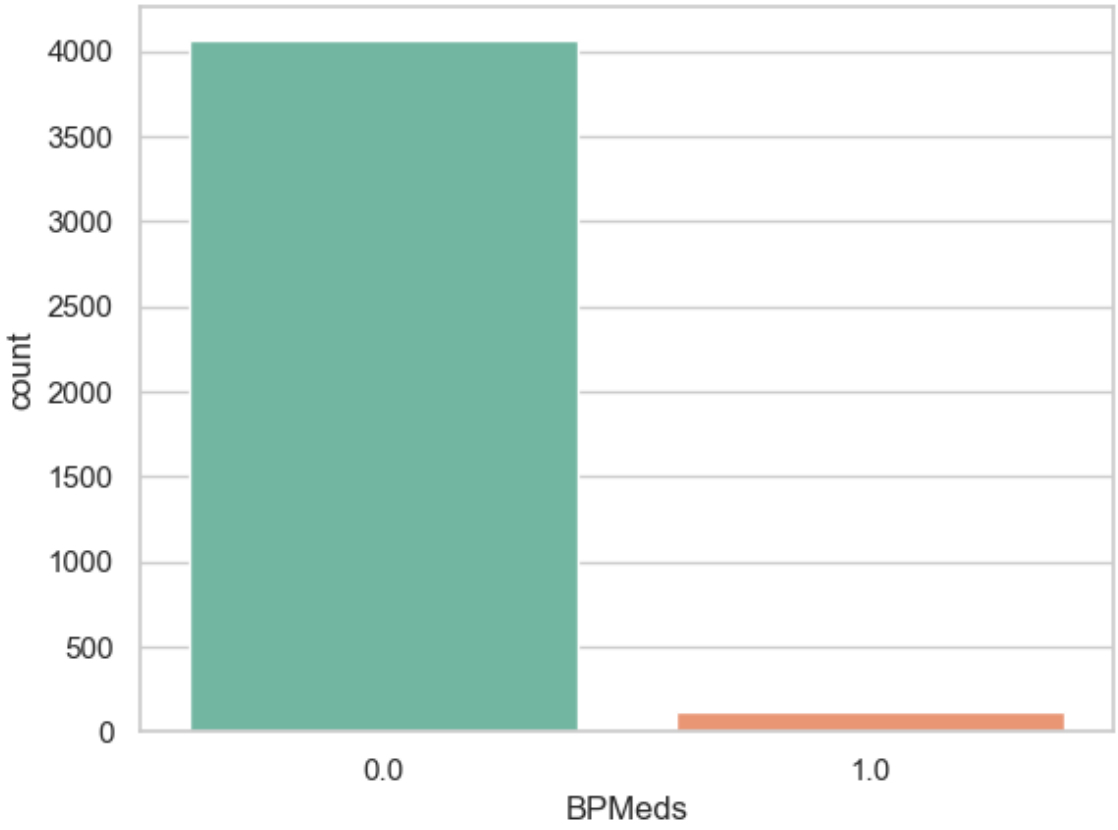
```
print((df['heartRate'].isnull().sum()/df.shape[0]*100))
```

```
0.023596035865974516
```

In [23]:

```
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 [24]:

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

```
75.0
```

In [25]:

```
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 [26]:

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

Out[26]:

```
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 [27]:

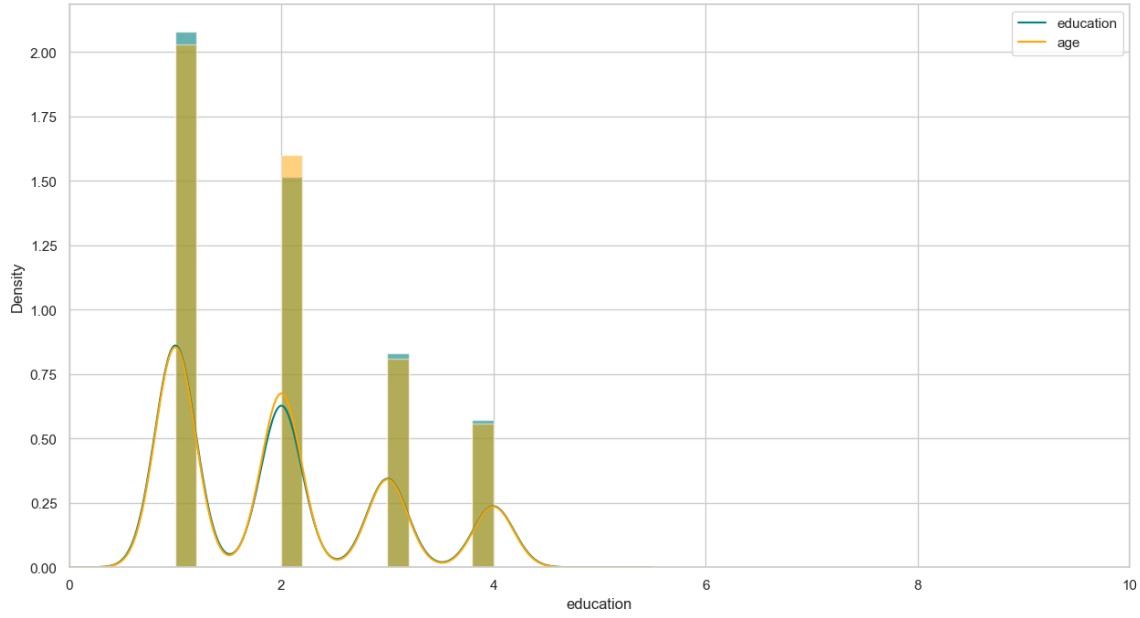
```
data.head()
```

Out[27]:

| | 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 [28]:

```
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=0.5)
data["education"].plot(kind='density',color='orange')
ax.legend(["education","age"])
ax.set(xlabel='education')
plt.xlim(-0,10)
plt.show()
```




In [29]:

```
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 [30]:

```
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()
```

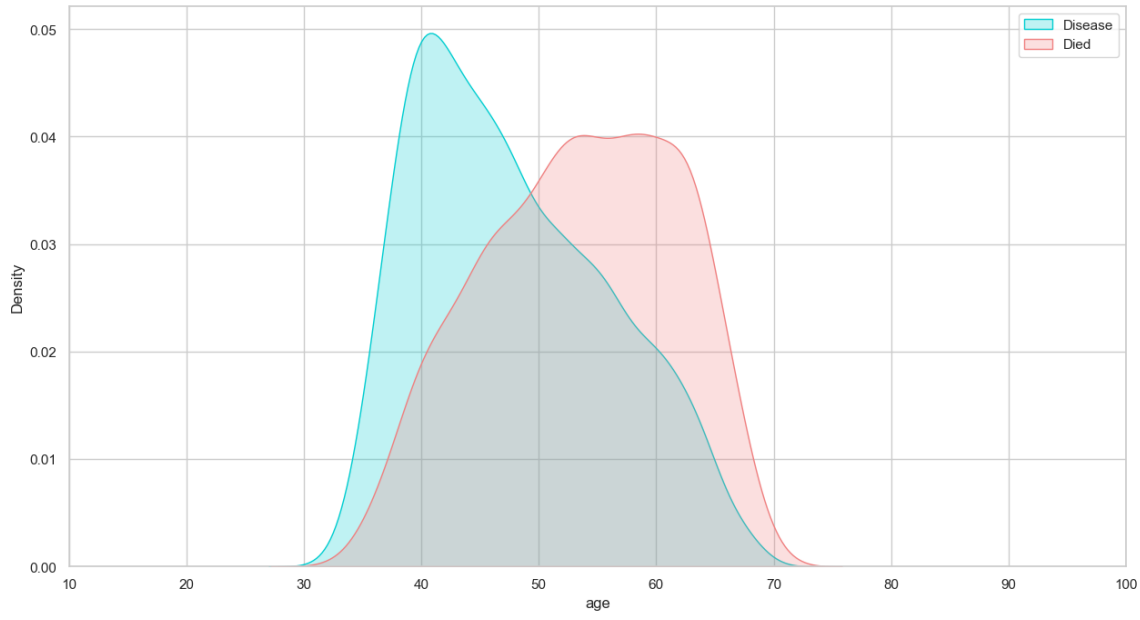
Out[30]:

| | 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

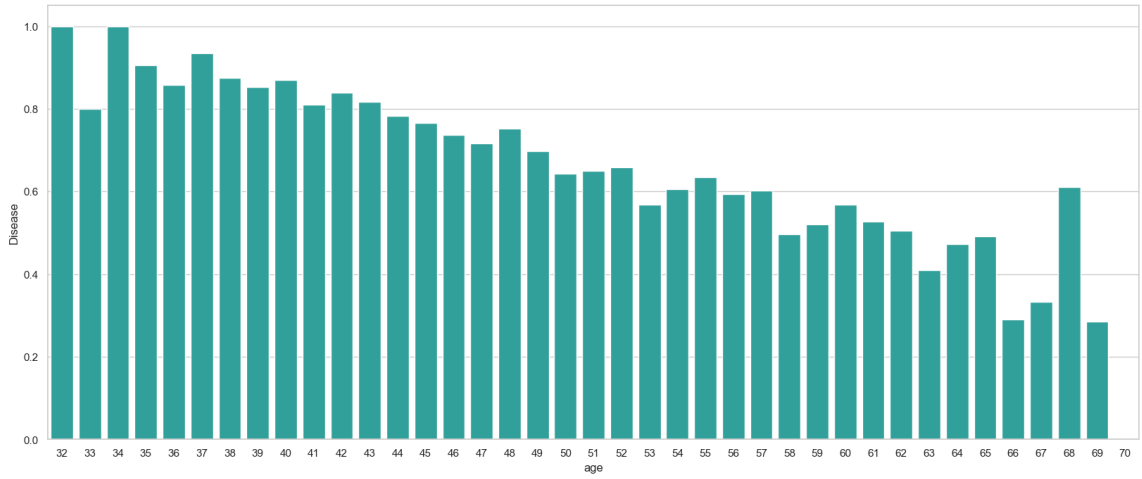
In [31]:

```
plt.figure(figsize=(15,8))
ax=sns.kdeplot(final_train["age"][final_train.Disease== 1], color="darkturquoise",shade=
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 [32]:

```
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()
```



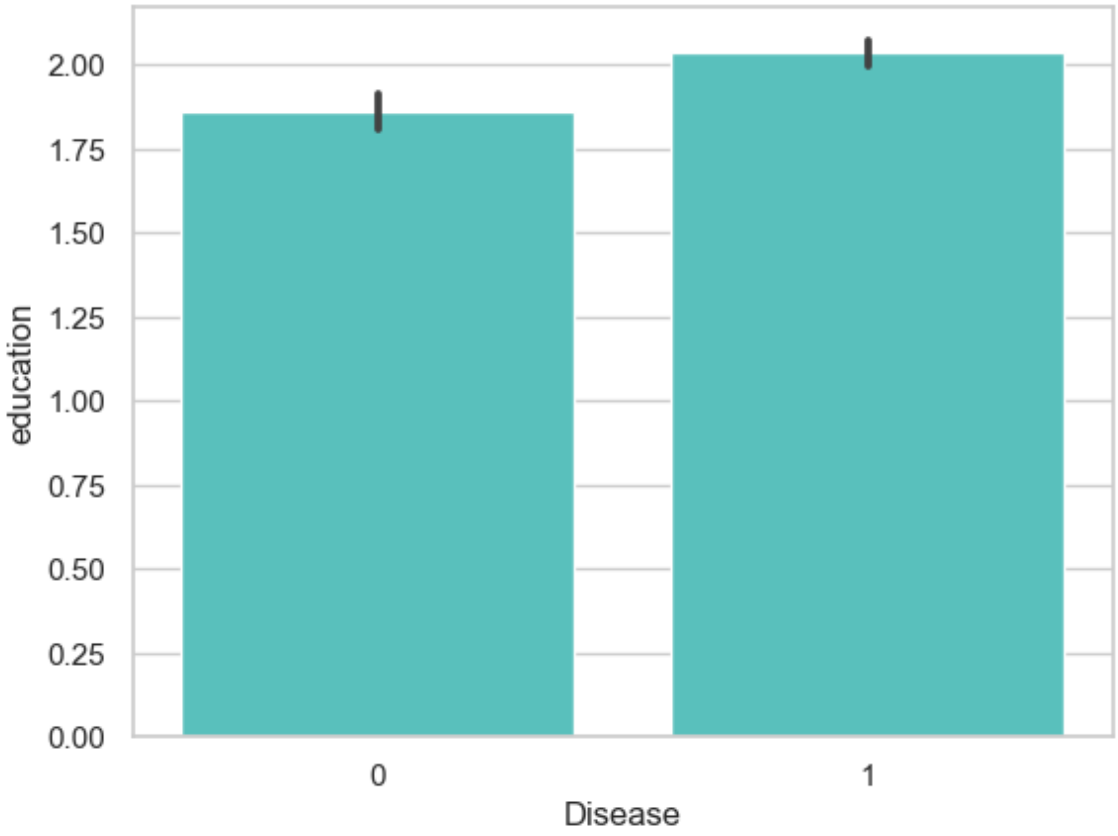

In [33]:

```
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
```

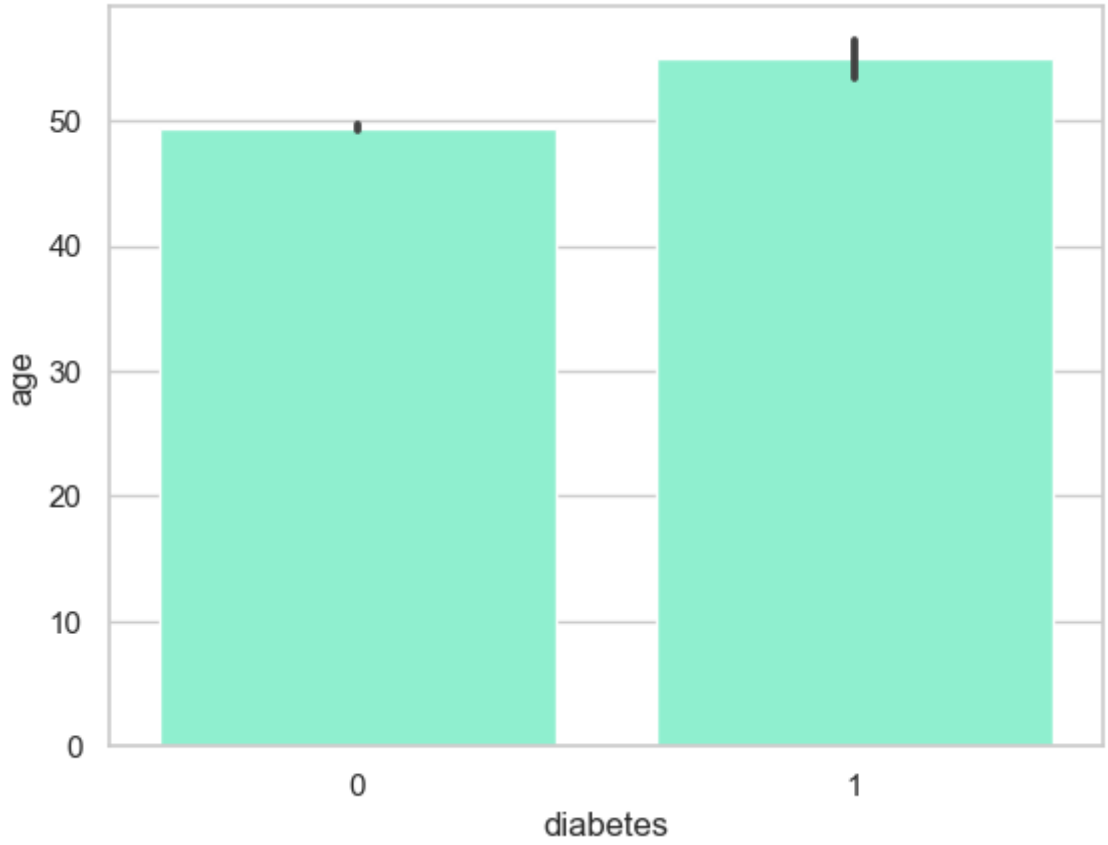
In [34]:

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



In [35]:

```
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 [ ]:

```

```