In [48]:
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
```

In [70]:
```python
hospital_data = pd.read_csv("hospital_appointment.csv")
```

In [71]:
```python
hospital_data
```

Out[71]:

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hipertension	Diabetes	Alcoholism	Handcap	SMS_received	No-show
0	2.987250e+13	5642903	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	0	0	0	0	No
1	5.589980e+14	5642503	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	0	0	0	0	No
2	4.262960e+12	5642549	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	0	0	0	0	No
3	8.679510e+11	5642828	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	0	0	0	No
4	8.841190e+12	5642494	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	1	0	0	0	No
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
110522	2.572130e+12	5651768	F	2016-05-03T09:15:35Z	2016-06-07T00:00:00Z	56	MARIA ORTIZ	0	0	0	0	0	1	No
110523	3.596270e+12	5650093	F	2016-05-03T07:27:33Z	2016-06-07T00:00:00Z	51	MARIA ORTIZ	0	0	0	0	0	1	No
110524	1.557660e+13	5630692	F	2016-04-27T16:03:52Z	2016-06-07T00:00:00Z	21	MARIA ORTIZ	0	0	0	0	0	1	No
110525	9.213490e+13	5630323	F	2016-04-27T15:09:23Z	2016-06-07T00:00:00Z	38	MARIA ORTIZ	0	0	0	0	0	1	No
110526	3.775120e+14	5629448	F	2016-04-27T13:30:56Z	2016-06-07T00:00:00Z	54	MARIA ORTIZ	0	0	0	0	0	1	No

110527 rows × 14 columns

In [4]:
```python
hospital_data.tail()
```

Out[4]:

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hipertension	Diabetes	Alcoholism	Handcap	SMS_received	No-show
110522	2.572130e+12	5651768	F	2016-05-03T09:15:35Z	2016-06-07T00:00:00Z	56	MARIA ORTIZ	0	0	0	0	0	1	No
110523	3.596270e+12	5650093	F	2016-05-03T07:27:33Z	2016-06-07T00:00:00Z	51	MARIA ORTIZ	0	0	0	0	0	1	No
110524	1.557660e+13	5630692	F	2016-04-27T16:03:52Z	2016-06-07T00:00:00Z	21	MARIA ORTIZ	0	0	0	0	0	1	No
110525	9.213490e+13	5630323	F	2016-04-27T15:09:23Z	2016-06-07T00:00:00Z	38	MARIA ORTIZ	0	0	0	0	0	1	No
110526	3.775120e+14	5629448	F	2016-04-27T13:30:56Z	2016-06-07T00:00:00Z	54	MARIA ORTIZ	0	0	0	0	0	1	No

In [5]:
```python
hospital_data.shape
```

Out[5]:
```
(110527, 14)
```

In [6]:
```python
hospital_data.columns
```

Out[6]:
```
Index(['PatientId', 'AppointmentID', 'Gender', 'ScheduledDay',
       'AppointmentDay', 'Age', 'Neighbourhood', 'Scholarship', 'Hipertension',
       'Diabetes', 'Alcoholism', 'Handcap', 'SMS_received', 'No-show'],
      dtype='object')
```

In [53]:
```python
hospital_data.rename(columns={'No-show': 'No_show'}, inplace=True)
hospital_data.rename(columns={'Hipertension': 'Hypertension'}, inplace=True)
hospital_data.rename(columns={'Handcap': 'Handicap'}, inplace=True)
```

In [54]:
```python
hospital_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 110527 entries, 0 to 110526
Data columns (total 14 columns):
 #   Column          Non-Null Count   Dtype  
---  ------          --------------   -----  
 0   PatientId       110527 non-null  float64
 1   AppointmentID   110527 non-null  int64  
 2   Gender          110527 non-null  object 
 3   ScheduledDay    110527 non-null  object 
 4   AppointmentDay  110527 non-null  object 
 5   Age             110527 non-null  int64  
 6   Neighbourhood   110527 non-null  object 
 7   Scholarship     110527 non-null  int64  
 8   Hypertension    110527 non-null  int64  
 9   Diabetes        110527 non-null  int64  
 10  Alcoholism      110527 non-null  int64  
 11  Handicap        110527 non-null  int64  
 12  SMS_received    110527 non-null  int64  
 13  No_show         110527 non-null  object 
dtypes: float64(1), int64(8), object(5)
memory usage: 11.8+ MB
```

In [55]:
```python
hospital_data.describe()
```

Out[55]:

	PatientId	AppointmentID	Age	Scholarship	Hypertension	Diabetes	Alcoholism	Handicap	SMS_received
count	1.105270e+05	1.105270e+05	110527.000000	110527.000000	110527.000000	110527.000000	110527.000000	110527.000000	110527.000000
mean	1.474963e+14	5.675305e+06	37.088874	0.098266	0.197246	0.071865	0.030400	0.022248	0.321026
std	2.560949e+14	7.129575e+04	23.110205	0.297675	0.397921	0.258265	0.171686	0.161543	0.466873
min	3.920000e+04	5.030230e+06	-1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25%	4.172615e+12	5.640286e+06	18.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
50%	3.173180e+13	5.680573e+06	37.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75%	9.439170e+13	5.725524e+06	55.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000
max	9.999820e+14	5.790484e+06	115.000000	1.000000	1.000000	1.000000	1.000000	4.000000	1.000000

In [56]:
```python
hospital_data.isnull().sum()
```

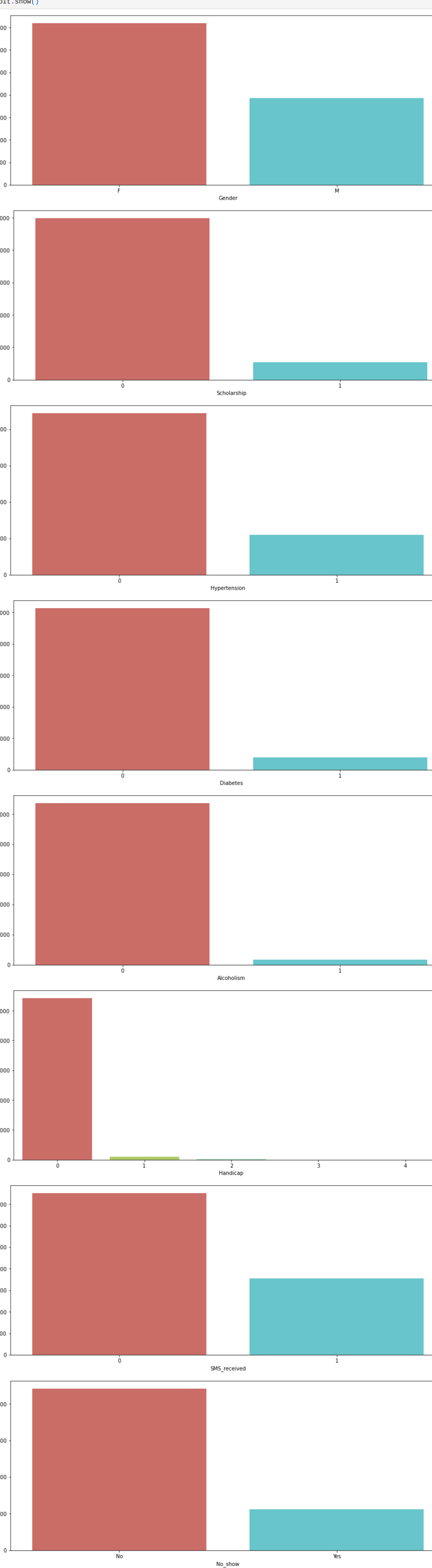
Out[56]:
```
PatientId         0
AppointmentID     0
Gender            0
ScheduledDay      0
AppointmentDay    0
Age               0
Neighbourhood     0
Scholarship       0
Hypertension      0
Diabetes          0
Alcoholism        0
Handicap          0
SMS_received      0
No_show           0
dtype: int64
```

In [57]:
```python
hospital_data.nunique()
```

Out[57]:
```
PatientId          61744
AppointmentID     110527
Gender                 2
ScheduledDay      103549
AppointmentDay        27
Age                  104
Neighbourhood         81
Scholarship            2
Hypertension           2
Diabetes               2
Alcoholism             2
Handicap               5
SMS_received           2
No_show                2
dtype: int64
```

In [58]:
```python
hospital_data1 = hospital_data[['Gender','Scholarship', 'Hypertension','Diabetes', 'Alcoholism', 'Handicap',
                                'SMS_received', 'No_show']]
```

In [59]:
```python
for i in hospital_data1.columns:
    plt.figure(figsize=(15,6))
    sns.countplot(hospital_data1[i], data = hospital_data1,    palette='hls')
    plt.show()
```



In [60]:
```python
hospital_data2 = hospital_data.copy()
```

In [61]:
```python
hospital_data2.drop(['PatientId','AppointmentID','ScheduledDay','AppointmentDay'], axis=1)
```

Out[61]:

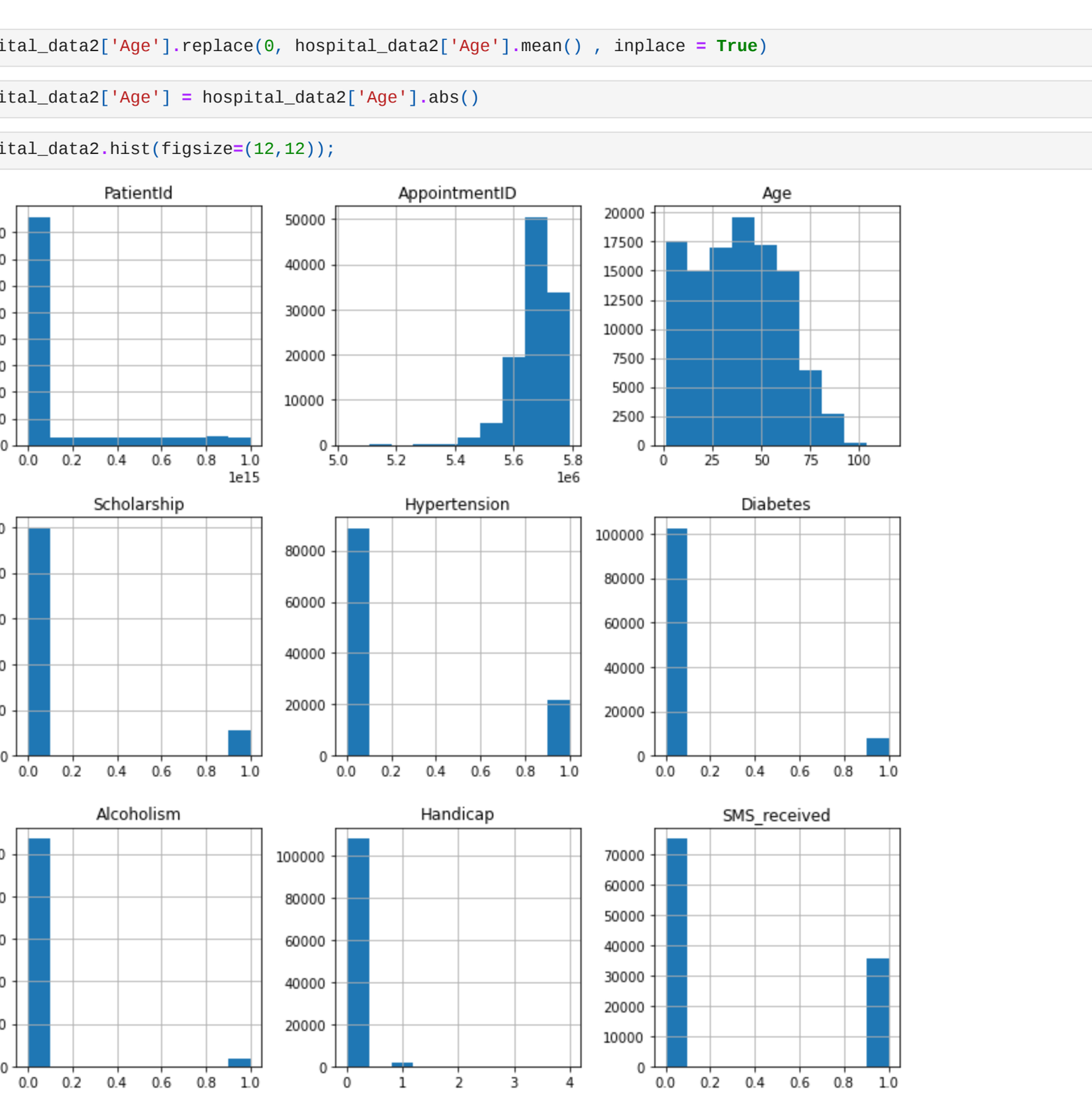
	Gender	Age	Neighbourhood	Scholarship	Hypertension	Diabetes	Alcoholism	Handicap	SMS_received	No_show
0	F	62	JARDIM DA PENHA	0	1	0	0	0	0	No
1	M	56	JARDIM DA PENHA	0	0	0	0	0	0	No
2	F	62	MATA DA PRAIA	0	0	0	0	0	0	No
3	F	8	PONTAL DE CAMBURI	0	0	0	0	0	0	No
4	F	56	JARDIM DA PENHA	0	1	1	0	0	0	No
...	...	...	...	...	...	...	...	...	...	...
110522	F	56	MARIA ORTIZ	0	0	0	0	0	1	No
110523	F	51	MARIA ORTIZ	0	0	0	0	0	1	No
110524	F	21	MARIA ORTIZ	0	0	0	0	0	1	No
110525	F	38	MARIA ORTIZ	0	0	0	0	0	1	No
110526	F	54	MARIA ORTIZ	0	0	0	0	0	1	No

110527 rows × 10 columns

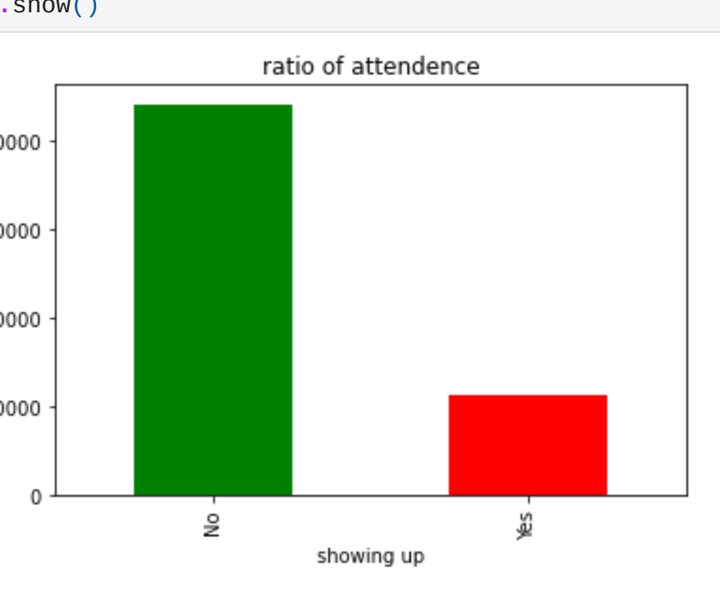
In [62]:
```python
hospital_data2['Age'].replace(0, hospital_data2['Age'].mean() , inplace = True)
```

In [18]:
```python
hospital_data2['Age'] = hospital_data2['Age'].abs()
```

In [19]:
```python
hospital_data2.hist(figsize=(12,12));
```

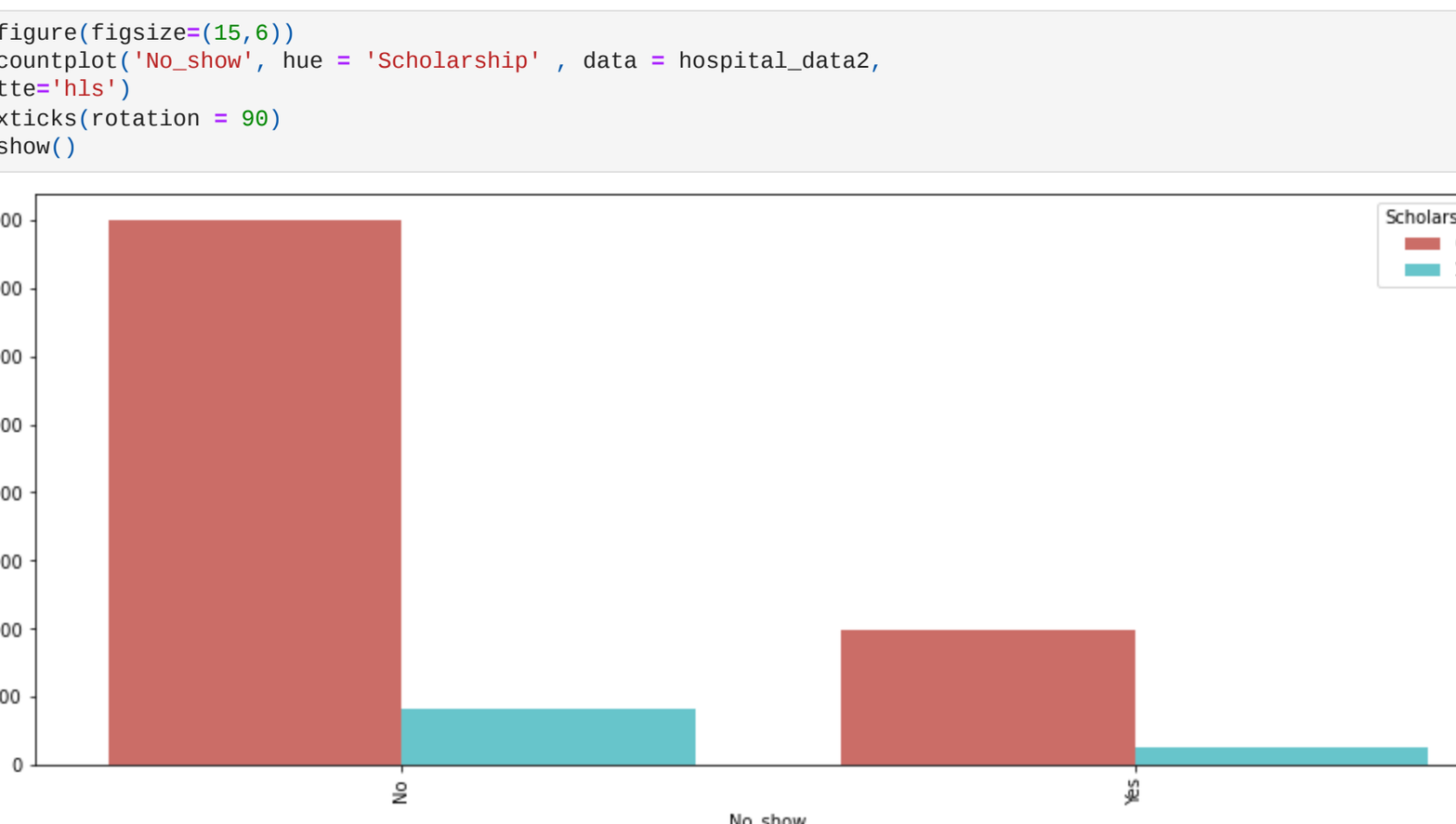


In [20]:
```python
hospital_data2.No_show.value_counts().plot.bar(color=['green','red']);
plt.title("ratio of attendence")
plt.xlabel("showing up")
plt.ylabel("count")
plt.show()
```

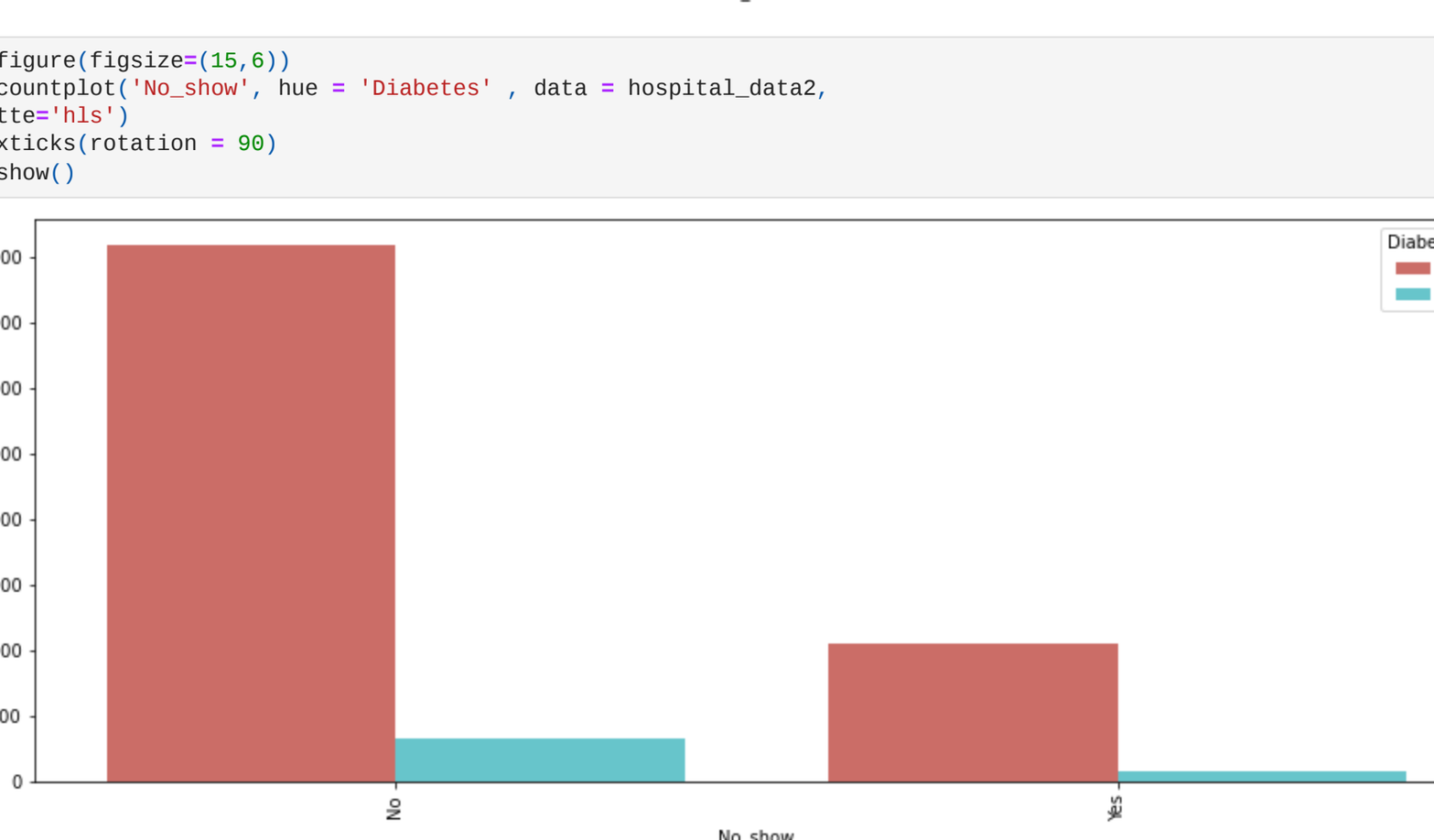


In [21]:
```python
plt.figure(figsize=(15,6))
sns.countplot('No_show', hue = 'Gender' , data = hospital_data2, palette='hls')
plt.xticks(rotation = 90)
plt.show()
```

In [22]:
```python
plt.figure(figsize=(15,6))
sns.countplot('No_show', hue = 'Scholarship' , data = hospital_data2,
palette='hls')
plt.xticks(rotation = 90)
plt.show()
```

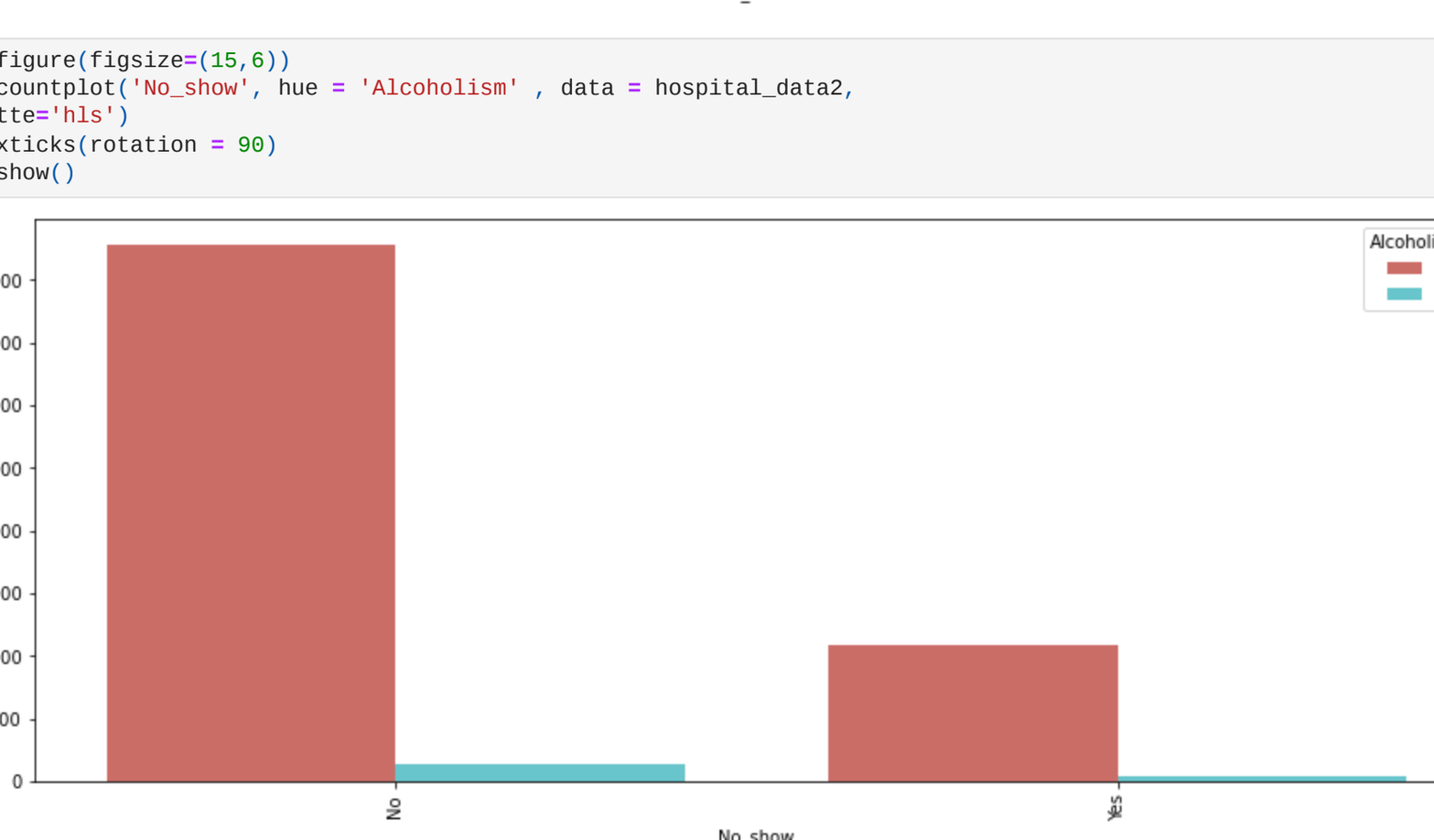


In [23]:
```python
plt.figure(figsize=(15,6))
sns.countplot('No_show', hue = 'Diabetes' , data = hospital_data2,
palette='hls')
plt.xticks(rotation = 90)
plt.show()
```



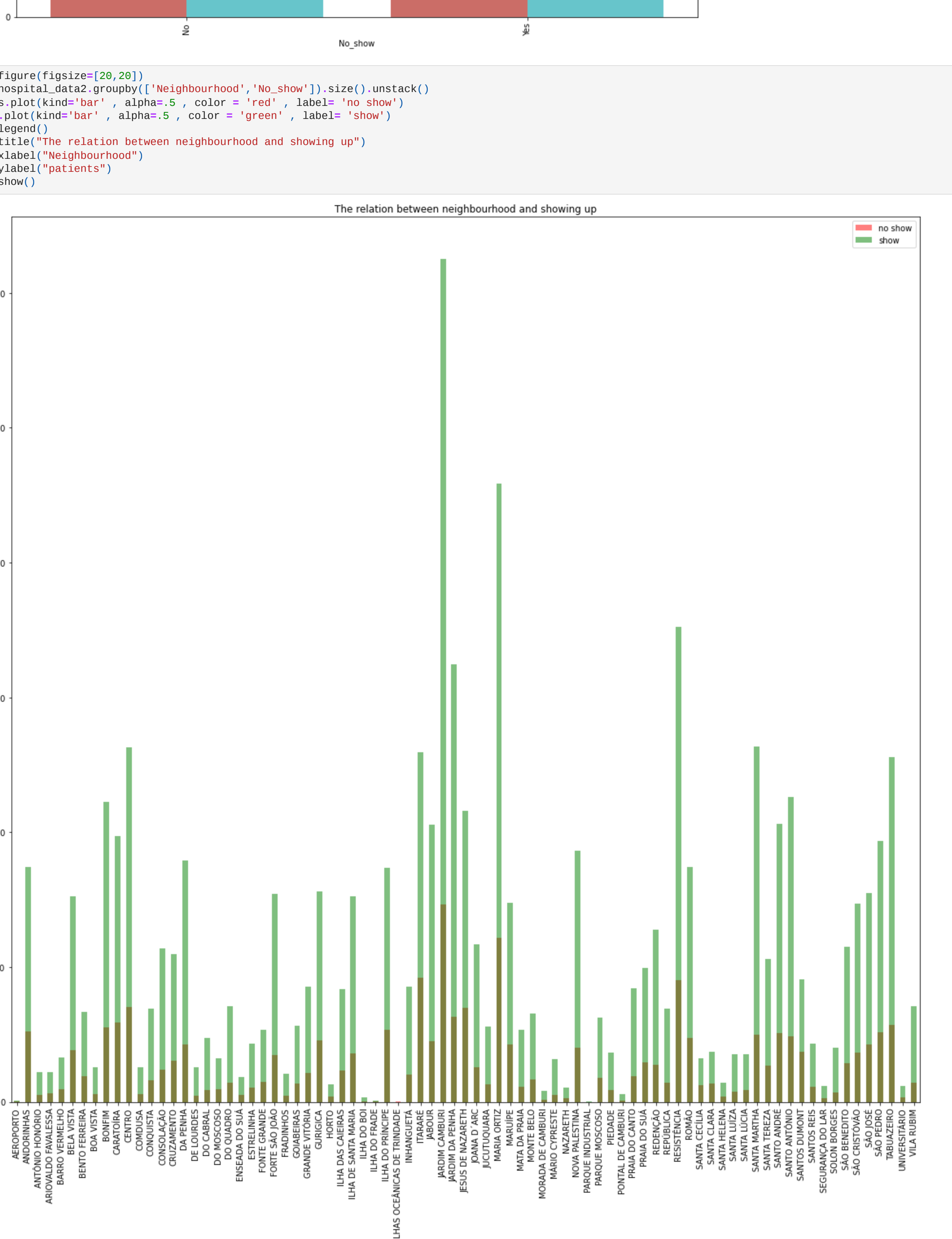
In [24]:
```python
plt.figure(figsize=(15,6))
sns.countplot('No_show', hue = 'Hypertension' , data = hospital_data2,
palette='hls')
plt.xticks(rotation = 90)
plt.show()
```

In [25]:
```python
plt.figure(figsize=(15,6))
sns.countplot('No_show', hue = 'Alcoholism' , data = hospital_data2,
palette='hls')
plt.xticks(rotation = 90)
plt.show()
```

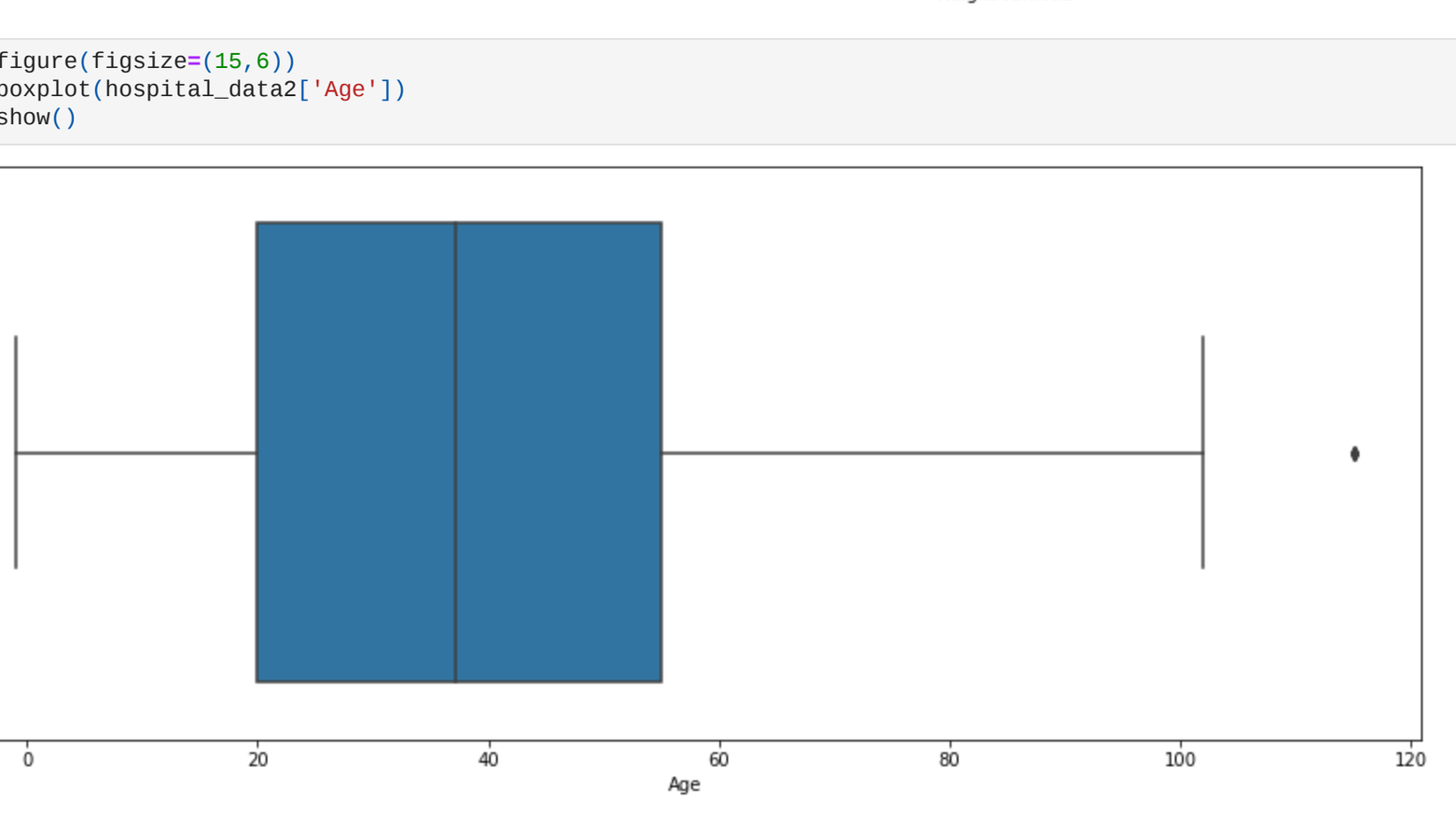


In [26]:
```python
plt.figure(figsize=(15,6))
sns.countplot('No_show', hue = 'SMS_received' , data = hospital_data2,
palette='hls')
plt.xticks(rotation = 90)
plt.show()
```

In [27]:
```python
plt.figure(figsize=[20,20])
e = hospital_data2.groupby(['Neighbourhood','No_show']).size().unstack()
e.Yes.plot(kind='bar' , alpha=.5 , color = 'red' , label= 'no show')
e.No.plot(kind='bar' , alpha=.5 , color = 'green' , label= 'show')
plt.legend()
plt.title("The relation between neighbourhood and showing up")
plt.xlabel("Neighbourhood")
plt.ylabel("patients")
plt.show()
```



In [64]:
```python
plt.figure(figsize=(15,6))
sns.boxplot(hospital_data2['Age'])
plt.show()
```



In [29]:
```python
hospital_age= hospital_data2['Age']
Q3 = hospital_age.quantile(0.75)
Q1 = hospital_age.quantile(0.25)
IQR = Q3-Q1
lower_limit = Q1 -(1.5*IQR)
upper_limit = Q3 +(1.5*IQR)
age_outliers = hospital_age[(hospital_age <lower_limit) | (hospital_age >upper_limit)]
age_outliers
```

Out[29]:
```
63912    115.0
63915    115.0
68127    115.0
76284    115.0
97666    115.0
Name: Age, dtype: float64
```

In [65]:
```python
lower_limit
```

Out[65]:
```
-32.5
```

In [66]:
```python
upper_limit
```

Out[66]:
```
107.5
```

In [30]:
```python
hospital_data_new = hospital_data.drop([63912, 63915, 68127, 76284, 97666])
```

In [31]:
```python
hospital_data_new.corr()
```

Out[31]:

	PatientId	AppointmentID	Age	Scholarship	Hypertension	Diabetes	Alcoholism	Handicap	SMS_received
PatientId	1.000000	0.004027	-0.004157	-0.002879	-0.006492	0.001607	0.011013	-0.007820	-0.009792
AppointmentID	0.004027	1.000000	-0.019152	0.022617	0.012742	0.022631	0.032946	0.014111	-0.256635
Age	-0.004157	-0.019152	1.000000	-0.092431	0.504727	0.292510	0.095863	0.077370	0.012686
Scholarship	-0.002879	0.022617	-0.092431	1.000000	-0.019729	-0.024898	0.035020	-0.008520	0.001190
Hypertension	-0.006492	0.012742	0.504727	-0.019729	1.000000	0.433096	0.087973	0.080249	-0.006306
Diabetes	0.001607	0.022631	0.292510	-0.024898	0.433096	1.000000	0.018471	0.057629	-0.014554
Alcoholism	0.011013	0.032946	0.095863	0.035020	0.087973	0.018471	1.000000	0.004689	-0.026150
Handicap	-0.007820	0.014111	0.077370	-0.008520	0.080249	0.057629	0.004689	1.000000	-0.024025
SMS_received	-0.009792	-0.256635	0.012686	0.001190	-0.006306	-0.014554	-0.026150	-0.024025	1.000000

In [32]:
```python
plt.figure(figsize=(15,6))
sns.heatmap(hospital_data_new.corr(), annot = True)
plt.show()
```

In [33]:
```python
hospital_data_new.head()
```

Out[33]:

	PatientId	AppointmentID	Gender	ScheduledDay	AppointmentDay	Age	Neighbourhood	Scholarship	Hypertension	Diabetes	Alcoholism	Handicap	SMS_received	No_show
0	2.987250e+13	5642903	F	2016-04-29T18:38:08Z	2016-04-29T00:00:00Z	62	JARDIM DA PENHA	0	1	0	0	0	0	No
1	5.589980e+14	5642503	M	2016-04-29T16:08:27Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	0	0	0	0	0	No
2	4.262960e+12	5642549	F	2016-04-29T16:19:04Z	2016-04-29T00:00:00Z	62	MATA DA PRAIA	0	0	0	0	0	0	No
3	8.679510e+11	5642828	F	2016-04-29T17:29:31Z	2016-04-29T00:00:00Z	8	PONTAL DE CAMBURI	0	0	0	0	0	0	No
4	8.841190e+12	5642494	F	2016-04-29T16:07:23Z	2016-04-29T00:00:00Z	56	JARDIM DA PENHA	0	1	1	0	0	0	No

In [67]:
```python
from sklearn import preprocessing
label_encoder = preprocessing.LabelEncoder()
hospital_data_new['Gender']= label_encoder.fit_transform(hospital_data_new['Gender'])
hospital_data_new['No_show']= label_encoder.fit_transform(hospital_data_new['No_show'])
```

In [69]:
```python
hospital_data_new['No_show']
```

Out[69]:
```
0         0
1         0
2         0
3         0
4         0
         ..
110522    0
110523    0
110524    0
110525    0
110526    0
Name: No_show, Length: 110522, dtype: int64
```

In [35]:
```python
hospital_data_new.columns
```

Out[35]:
```
Index(['PatientId', 'AppointmentID', 'Gender', 'ScheduledDay',
       'AppointmentDay', 'Age', 'Neighbourhood', 'Scholarship', 'Hypertension',
       'Diabetes', 'Alcoholism', 'Handicap', 'SMS_received', 'No_show'],
      dtype='object')
```

In [36]:
```python
x = hospital_data_new[['Gender', 'Scholarship', 'Hypertension','Diabetes', 'Alcoholism', 'Handicap', 'SMS_received']]
```

In [37]:
```python
y = hospital_data_new.No_show
```

In [38]:
```python
x.shape
```

Out[38]:
```
(110522, 7)
```

In [39]:
```python
y.shape
```

Out[39]:
```
(110522,)
```

In [40]:
```python
from sklearn.model_selection import train_test_split
```

In [41]:
```python
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.2,random_state=42)
```

In [42]:
```python
from sklearn.linear_model import LogisticRegression
```

In [43]:
```python
classifier= LogisticRegression(random_state=0)
classifier.fit(x_train, y_train)
```

Out[43]:
```
LogisticRegression(random_state=0)
```

In [44]:
```python
print("Training Accuracy :", classifier.score(x_train, y_train))
print("Testing Accuracy :", classifier.score(x_test, y_test))
```

```
Training Accuracy : 0.7983645678998382
Testing Accuracy : 0.7969690115358516
```

In [45]:
```python
from sklearn.tree import DecisionTreeClassifier
```

In [46]:
```python
classifier_dt= DecisionTreeClassifier(criterion='entropy', random_state=0)
classifier_dt.fit(x_train, y_train)
```

Out[46]:
```
DecisionTreeClassifier(criterion='entropy', random_state=0)
```

In [47]:
```python
print("Training Accuracy :", classifier_dt.score(x_train, y_train))
print("Testing Accuracy :", classifier_dt.score(x_test, y_test))
```

```
Training Accuracy : 0.7986020787857538
Testing Accuracy : 0.7970594888034381
```

In [ ]: