noshowappointment

November 23, 2018

1 *NO SHOW ANALYSIS STUDY*

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2 *Steps for analysis process*

2.0.1 2. *Steps for analysis process*

2.0.2 1- questions

2.0.3 2- wrangle

- a- gather
- b- assess
- c- clean

2.0.4 3- explor

- EDA(exploratotry data analysis)
- AUGMENTIG data to maximize the potential of analysis ,visualization and modeles
- finding pattern
- visualize relationship
- build intution
- remove outliers
- creat more and decribtive feture

2.0.5 4- draw conclousion

2.0.6 5- comunicate

---

3 *1.1- questions*

This study focuses on three factors, age ,sex and gender and tries to find a relationship through which to predict the extent of the commitment of patients to their show up at appointment dates of visits specified to them and tries to answer questions like 1- What factors may help to predict if a patient will show up for their scheduled appointment? 2- Why do 30% of patients miss their scheduled appointments? 3- is that possible to predict someone to no-show an appointment? 4- Is there any relation between patients age and their commitment to appointment attendens?
5- Is there any relationship of the waiting days between the schedule_day and appointment_day affect on the commitment to attends? 6- Is there any relation between patients gender and their commitment to appointment attendens?
7- does gender in different age stage affects their commitment to show up on the appointement date?

3.0.1 2. *Data Collection and Wrangling*

a-gathering data we already have data so we need to have general look to see what data we have to see what type of question we can aske in this analysis

```
In [1]: # we will import all liberies we need in our analysis
        import pandas as pd
        import numpy as np
        import datetime
        from time import strftime
        from sklearn.model_selection import train_test_split
        from sklearn.model_selection import GridSearchCV
        from sklearn.preprocessing import LabelEncoder
        from sklearn.tree import DecisionTreeClassifier
        from sklearn.ensemble import RandomForestClassifier
        import matplotlib.pyplot as plt
        %matplotlib inline
        import seaborn as sns

        df = pd.read_csv('C:\\Users\\zas\\Downloads\\class3\\no show\\noshowappointments-kaggl
        df.head()
```

```
Out[1]:       PatientId  AppointmentID Gender          ScheduledDay  \
        0  2.987250e+13        5642903      F  2016-04-29T18:38:08Z
        1  5.589978e+14        5642503      M  2016-04-29T16:08:27Z
        2  4.262962e+12        5642549      F  2016-04-29T16:19:04Z
        3  8.679512e+11        5642828      F  2016-04-29T17:29:31Z
        4  8.841186e+12        5642494      F  2016-04-29T16:07:23Z

                 AppointmentDay  Age      Neighbourhood  Scholarship  Hipertension  \
        0  2016-04-29T00:00:00Z   62    JARDIM DA PENHA            0             1
        1  2016-04-29T00:00:00Z   56    JARDIM DA PENHA            0             0
        2  2016-04-29T00:00:00Z   62      MATA DA PRAIA            0             0
        3  2016-04-29T00:00:00Z    8  PONTAL DE CAMBURI            0             0
        4  2016-04-29T00:00:00Z   56    JARDIM DA PENHA            0             1

           Diabetes  Alcoholism  Handcap  SMS_received No-show
        0         0           0        0             0      No
        1         0           0        0             0      No
        2         0           0        0             0      No
        3         0           0        0             0      No
        4         1           0        0             0      No
```

3.0.2 *b-assessing data*

```
In [2]: df.head()
```

```
Out[2]:       PatientId  AppointmentID Gender          ScheduledDay  \
        0  2.987250e+13        5642903      F  2016-04-29T18:38:08Z
        1  5.589978e+14        5642503      M  2016-04-29T16:08:27Z
        2  4.262962e+12        5642549      F  2016-04-29T16:19:04Z
        3  8.679512e+11        5642828      F  2016-04-29T17:29:31Z
        4  8.841186e+12        5642494      F  2016-04-29T16:07:23Z

                 AppointmentDay  Age      Neighbourhood  Scholarship  Hipertension  \
        0  2016-04-29T00:00:00Z   62    JARDIM DA PENHA            0             1
        1  2016-04-29T00:00:00Z   56    JARDIM DA PENHA            0             0
        2  2016-04-29T00:00:00Z   62      MATA DA PRAIA            0             0
        3  2016-04-29T00:00:00Z    8  PONTAL DE CAMBURI            0             0
        4  2016-04-29T00:00:00Z   56    JARDIM DA PENHA            0             1

           Diabetes  Alcoholism  Handcap  SMS_received No-show
        0         0           0        0             0      No
        1         0           0        0             0      No
        2         0           0        0             0      No
        3         0           0        0             0      No
        4         1           0        0             0      No
```

```
In [3]: # same thing applies to `.tail()` which returns the last few rows
        df.tail()
```

```
Out[3]:            PatientId  AppointmentID Gender          ScheduledDay  \
        110522  2.572134e+12        5651768      F  2016-05-03T09:15:35Z
        110523  3.596266e+12        5650093      F  2016-05-03T07:27:33Z
        110524  1.557663e+13        5630692      F  2016-04-27T16:03:52Z
        110525  9.213493e+13        5630323      F  2016-04-27T15:09:23Z
        110526  3.775115e+14        5629448      F  2016-04-27T13:30:56Z

                      AppointmentDay  Age Neighbourhood  Scholarship  Hipertension  \
        110522  2016-06-07T00:00:00Z   56   MARIA ORTIZ            0             0
        110523  2016-06-07T00:00:00Z   51   MARIA ORTIZ            0             0
        110524  2016-06-07T00:00:00Z   21   MARIA ORTIZ            0             0
        110525  2016-06-07T00:00:00Z   38   MARIA ORTIZ            0             0
        110526  2016-06-07T00:00:00Z   54   MARIA ORTIZ            0              0

                Diabetes  Alcoholism  Handcap  SMS_received No-show
        110522         0           0        0             1      No
        110523         0           0        0             1      No
        110524         0           0        0             1      No
        110525         0           0        0             1      No
        110526         0           0        0             1      No
```

```
In [4]: # this returns a tuple of the dimensions of the dataframe
        print('total number of rows in data => {}'.format(df.shape[0]))
        print('total number of columns in data => {}'.format(df.shape[1]))
```

```
total number of rows in data => 110527
total number of columns in data => 14
```

```
In [5]: # general information about data
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 110527 entries, 0 to 110526
Data columns (total 14 columns):
PatientId         110527 non-null float64
AppointmentID     110527 non-null int64
Gender            110527 non-null object
ScheduledDay      110527 non-null object
AppointmentDay    110527 non-null object
Age               110527 non-null int64
Neighbourhood     110527 non-null object
Scholarship       110527 non-null int64
Hipertension      110527 non-null int64
Diabetes          110527 non-null int64
Alcoholism        110527 non-null int64
Handcap           110527 non-null int64
SMS_received      110527 non-null int64
No-show           110527 non-null object
dtypes: float64(1), int64(8), object(5)
memory usage: 9.7+ MB
```

3.0.3 *c-cleaning data*

3.0.4 *check data for :1-missing data 2-duplicate data 3-incorrect data types*

```
In [6]: # check missing value as see in above no missing values but to confirm:

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

```
PatientId         0
AppointmentID     0
Gender            0
ScheduledDay      0
AppointmentDay    0
Age               0
Neighbourhood     0
Scholarship       0
Hipertension      0
Diabetes          0
Alcoholism        0
Handcap           0
SMS_received      0
No-show           0
dtype: int64
```

3.0.5 ======>>>>> : No null values

```
In [7]: #check duplicated data
        df.duplicated().sum()
```

```
Out[7]: 0
```

3.0.6 ======>>>>> : No duplicated data

what type of data we have?

3.0.7 object data type need further investigation to shows - what is it?

```
In [8]: type(df['Gender'][0])
```

```
Out[8]: str
```

```
In [9]: type(df['AppointmentDay'][0])
```

```
Out[9]: str
```

```
In [10]: type(df['Neighbourhood'][0])
```

```
Out[10]: str
```

```
In [11]: type(df['ScheduledDay'][0])
```

```
Out[11]: str
```

```
In [12]: type(df['No-show'][0])
```

```
Out[12]: str
```

3.0.8 Observations

3.0.9 ===>>> :

some fieldes of incorect data type and need to change

```
In [13]: # we have date time object type  so we need to change it to date time
         df['PatientId'] = df['PatientId'].astype('int64')
         df['ScheduledDay'] = pd.to_datetime(df['ScheduledDay']).dt.date.astype('datetime64[ns
         df['AppointmentDay'] = pd.to_datetime(df['AppointmentDay']).dt.date.astype('datetime6
```

```
In [14]: # Get Day of the Week for ScheduledDay and AppointmentDay
         df['schedule_day_week'] = df['ScheduledDay'].dt.weekday_name
         df['appointment_day_week'] = df['AppointmentDay'].dt.weekday_name
```

```
In [15]: # Get the Waiting Time in Days of the Patients.
         df['waiting_days'] = df['AppointmentDay'] - df['ScheduledDay']
         df['waiting_days'] = df['waiting_days'].dt.days
```

4 Sort by date

```
In [16]: df.sort_values(["ScheduledDay","AppointmentDay"], inplace=True, ascending=True)
```

5 rename columns

```
In [17]: df.rename(columns={'PatientId':'patient_id','AppointmentID': 'appointment_id' , 'Neig
                              'Hipertension':'hypertension', 'Handcap':'handicap','Diabetes':'di
                              'SMS_received':'sms_received','ScheduledDay':'schedule_day', 'Appo
                              'No-show':'no_show'}, inplace=True)
```

```
In [18]: #check data
         df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110527 entries, 3764 to 110514
Data columns (total 17 columns):
patient_id              110527 non-null int64
appointment_id          110527 non-null int64
gender                  110527 non-null object
schedule_day            110527 non-null datetime64[ns]
appointment_day         110527 non-null datetime64[ns]
age                     110527 non-null int64
neighborhood            110527 non-null object
scholarship             110527 non-null int64
hypertension            110527 non-null int64
diabetes                110527 non-null int64
alcoholism              110527 non-null int64
handicap                110527 non-null int64
```

```
sms_received            110527 non-null int64
no_show                 110527 non-null object
schedule_day_week       110527 non-null object
appointment_day_week    110527 non-null object
waiting_days            110527 non-null int64
dtypes: datetime64[ns](2), int64(10), object(5)
memory usage: 13.1+ MB
```

```
In [19]: # check data
         df.head(3)
```

```
Out[19]:              patient_id  appointment_id gender schedule_day appointment_day  \
         3764    832256398961987         5030230      F   2015-11-10      2016-05-04   
         46292    91637474953513         5122866      M   2015-12-03      2016-05-02   
         102786     454287126844         5134227      M   2015-12-07      2016-06-03   

                 age neighborhood  scholarship  hypertension  diabetes  alcoholism  \
         3764     51  RESISTÊNCIA            0             0         0           0   
         46292    34   VILA RUBIM            0             1         0           0   
         102786   67      MARUÍPE            0             1         1           0   

                 handicap  sms_received no_show schedule_day_week appointment_day_week  \
         3764           0             1      No           Tuesday            Wednesday   
         46292          0             1     Yes          Thursday               Monday   
         102786         0             0      No            Monday               Friday   

                 waiting_days  
         3764             176  
         46292            151  
         102786           179  
```

```
In [20]: # this returns the number of unique values in each column FOR ALL
         df.nunique()
```

```
Out[20]: patient_id               62299
         appointment_id          110527
         gender                       2
         schedule_day               111
         appointment_day             27
         age                        104
         neighborhood                81
         scholarship                  2
         hypertension                 2
         diabetes                     2
         alcoholism                   2
         handicap                     5
         sms_received                 2
         no_show                      2
```

```
schedule_day_week             6
appointment_day_week          6
waiting_days                131
dtype: int64
```

5.0.1 what are the unique values for:

gender,age,scholarship,hypertension,diabetes,alcoholism,handicap,smreceived and no_show ?

```
In [21]: print("Unique Values in `Gender` => {}".format(df.gender.unique()))
         print("Unique Values in `Scholarship` => {}".format(df.scholarship.unique()))
         print("Unique Values in `Hypertension` => {}".format(df.hypertension.unique()))
         print("Unique Values in `Diabetes` => {}".format(df.diabetes.unique()))
         print("Unique Values in `Alcoholism` => {}".format(df.alcoholism.unique()))
         print("Unique Values in `Handicap` => {}".format(df.handicap.unique()))
         print("Unique Values in `Sms_received` => {}".format(df.sms_received.unique()))
         print("Unique Values in `No_show` => {}".format(df.no_show.unique()))
```

```
Unique Values in `Gender` => ['F' 'M']
Unique Values in `Scholarship` => [0 1]
Unique Values in `Hypertension` => [0 1]
Unique Values in `Diabetes` => [0 1]
Unique Values in `Alcoholism` => [0 1]
Unique Values in `Handicap` => [0 1 2 3 4]
Unique Values in `Sms_received` => [1 0]
Unique Values in `No_show` => ['No' 'Yes']
```

```
In [22]: # unique data for patient_id
         print('Number of unque values of patient_id =>  : {}'.format(df.patient_id.unique().s
         print('percent of patient who registered for appointment more than one time =>  : {} %
```

```
Number of unque values of patient_id =>  : 62299
percent of patient who registered for appointment more than one time =>  : 43.63458702398509 %
```

```
In [23]: # Print Unique Values for 'schedule_day'
         print("Unique Values in `schedule_day` => {}".format(np.sort(df.schedule_day.dt.strft
```

```
Unique Values in `schedule_day` => ['2015-11-10' '2015-12-03' '2015-12-07' '2015-12-08' '2015-
 '2015-12-15' '2016-01-04' '2016-01-05' '2016-01-07' '2016-01-11'
 '2016-01-13' '2016-01-14' '2016-01-19' '2016-01-20' '2016-01-21'
 '2016-01-22' '2016-01-25' '2016-01-26' '2016-01-27' '2016-01-28'
 '2016-01-29' '2016-02-01' '2016-02-02' '2016-02-03' '2016-02-04'
 '2016-02-05' '2016-02-11' '2016-02-12' '2016-02-15' '2016-02-16'
 '2016-02-17' '2016-02-18' '2016-02-19' '2016-02-22' '2016-02-23'
 '2016-02-24' '2016-02-25' '2016-02-26' '2016-02-29' '2016-03-01'
 '2016-03-02' '2016-03-03' '2016-03-04' '2016-03-05' '2016-03-07'
 '2016-03-08' '2016-03-09' '2016-03-10' '2016-03-11' '2016-03-14'
 '2016-03-15' '2016-03-16' '2016-03-17' '2016-03-18' '2016-03-19'
 '2016-03-21' '2016-03-22' '2016-03-23' '2016-03-28' '2016-03-29'
 '2016-03-30' '2016-03-31' '2016-04-01' '2016-04-05' '2016-04-06'
 '2016-04-07' '2016-04-08' '2016-04-09' '2016-04-11' '2016-04-12'
 '2016-04-13' '2016-04-14' '2016-04-15' '2016-04-16' '2016-04-18'
 '2016-04-19' '2016-04-20' '2016-04-25' '2016-04-26' '2016-04-27'
 '2016-04-28' '2016-04-29' '2016-04-30' '2016-05-02' '2016-05-03'
 '2016-05-04' '2016-05-05' '2016-05-06' '2016-05-07' '2016-05-09'
 '2016-05-10' '2016-05-11' '2016-05-12' '2016-05-13' '2016-05-14'
 '2016-05-16' '2016-05-17' '2016-05-18' '2016-05-19' '2016-05-20'
 '2016-05-24' '2016-05-25' '2016-05-30' '2016-05-31' '2016-06-01'
 '2016-06-02' '2016-06-03' '2016-06-04' '2016-06-06' '2016-06-07'
 '2016-06-08']
```

We can see from the above details that the schedule_day for appointments are: starting from 2015-11-10 upto 2016-06-08 that's around 7 months .

```
In [24]: # Print Unique Values for 'AppointmentDay'
         print("Unique Values in `appointment_day` => {}".format(np.sort(df.appointment_day.dt
```

```
Unique Values in `appointment_day` => ['2016-04-29' '2016-05-02' '2016-05-03' '2016-05-04' '20
 '2016-05-06' '2016-05-09' '2016-05-10' '2016-05-11' '2016-05-12'
 '2016-05-13' '2016-05-14' '2016-05-16' '2016-05-17' '2016-05-18'
 '2016-05-19' '2016-05-20' '2016-05-24' '2016-05-25' '2016-05-30'
 '2016-05-31' '2016-06-01' '2016-06-02' '2016-06-03' '2016-06-06'
 '2016-06-07' '2016-06-08']
```

5.0.2 starting from 2016-04-29 upto 2016-06-08. that's around 1 month

```
In [25]: # Print Unique Values for 'waiting_days'
         print("Unique Values in `waiting_days` => {}".format(np.sort(df.waiting_days.unique()
```

```
Unique Values in `waiting_days` => [ -6  -1   0   1   2   3   4   5   6   7   8   9  10  11  1
  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33
  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51
  52  53  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69
  70  71  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87
  88  89  90  91  92  93  94  95  96  97  98 101 102 103 104 105 107 108
 109 110 111 112 115 117 119 122 123 125 126 127 132 133 139 142 146 151
 155 162 169 176 179]
```

```
In [26]: #cleaning data for waiting days
         df[df['waiting_days']==-6]
```

```
Out[26]:             patient_id  appointment_id gender schedule_day appointment_day  \
         71533  998231581612122         5686628      F   2016-05-11      2016-05-05
```

```
       age   neighborhood  scholarship  hypertension  diabetes  alcoholism  \
71533   81  SANTO ANTÔNIO            0             0         0           0

       handicap  sms_received no_show schedule_day_week appointment_day_week  \
71533         0             0     Yes         Wednesday             Thursday

       waiting_days
71533            -6
```

In [27]:
```
print(df[df['waiting_days']==-6].shape[0])
```

```
1
```

In [28]:
```
df[df['waiting_days']==-1]
```

Out[28]:
```
             patient_id  appointment_id gender schedule_day appointment_day  \
72362   3787481966821         5655637      M   2016-05-04      2016-05-03
64175  24252258389979         5664962      F   2016-05-05      2016-05-04
27033   7839272661752         5679978      M   2016-05-10      2016-05-09
55226   7896293967868         5715660      F   2016-05-18      2016-05-17

       age   neighborhood  scholarship  hypertension  diabetes  alcoholism  \
72362    7     TABUAZEIRO            0             0         0           0
64175   22     CONSOLAÇÃO            0             0         0           0
27033   38    RESISTÊNCIA            0             0         0           0
55226   19  SANTO ANTÔNIO            0             0         0           0

       handicap  sms_received no_show schedule_day_week appointment_day_week  \
72362         0             0     Yes         Wednesday              Tuesday
64175         0             0     Yes          Thursday            Wednesday
27033         1             0     Yes           Tuesday               Monday
55226         1             0     Yes         Wednesday              Tuesday

       waiting_days
72362            -1
64175            -1
27033            -1
55226            -1
```

In [29]:
```
df[df['waiting_days']==-1].shape
```

Out[29]:
```
(4, 17)
```

6 ===>>>(-6 waitng_days) this may be by mistake ===>>> (-1 waiting_days) this may be by mistake

In [30]:
```
# to drop this wrong data by using index
df.drop([71533,72362,64175,27033,55226],inplace= True)
```

```
In [31]: # Print Unique Values for 'waiting_days to check cleaning process'
         print("Unique Values in `waiting_days` => {}".format(np.sort(df.waiting_days.unique())

Unique Values in `waiting_days` => [  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14
  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35
  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53
  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71
  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89
  90  91  92  93  94  95  96  97  98 101 102 103 104 105 107 108 109 110
 111 112 115 117 119 122 123 125 126 127 132 133 139 142 146 151 155 162
 169 176 179]
```

```
In [32]: # unique values in age and clean data
         df['age'][0]
         type(df['age'][0])

Out[32]: numpy.int64
```

```
In [33]: print("Unique Values in `age` => {}".format(np.sort(df.age.unique())))

Unique Values in `age` => [ -1   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34
  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52
  53  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70
  71  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88
  89  90  91  92  93  94  95  96  97  98  99 100 102 115]
```

```
In [34]: df.query('age == -1')

Out[34]:             patient_id  appointment_id gender schedule_day appointment_day  \
         99832  465943158731293         5775010      F   2016-06-06      2016-06-06

                age neighborhood  scholarship  hypertension  diabetes  alcoholism  \
         99832   -1        ROMÃO            0             0         0           0

                handicap  sms_received no_show schedule_day_week appointment_day_week  \
         99832         0             0      No            Monday               Monday

                waiting_days
         99832             0
```

Note there is one row that contain age -1 in min . So lets drop that row. * Note (-1) may be mistak in recording or she is pregnant wamen and the appointment for embryo investigation *

```
In [35]: # to drop this wrong data by using index
         df.drop([99832],inplace= True)
```

```
In [36]: # to check cleaning process
         print("Unique Values in `age` => {}".format(np.sort(df.age.unique())))

Unique Values in `age` => [  0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16
  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35
  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53
  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71
  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89
  90  91  92  93  94  95  96  97  98  99 100 102 115]
```

```
In [37]: # Print Unique Values for 'neighborhood'
         print("Unique Values in `neighborhood` => {}".format(np.sort(df.neighborhood.unique()

Unique Values in `neighborhood` => ['AEROPORTO' 'ANDORINHAS' 'ANTÔNIO HONÓRIO' 'ARIOVALDO FAVA
 'BARRO VERMELHO' 'BELA VISTA' 'BENTO FERREIRA' 'BOA VISTA' 'BONFIM'
 'CARATOÍRA' 'CENTRO' 'COMDUSA' 'CONQUISTA' 'CONSOLAÇÃO' 'CRUZAMENTO'
 'DA PENHA' 'DE LOURDES' 'DO CABRAL' 'DO MOSCOSO' 'DO QUADRO'
 'ENSEADA DO SUÁ' 'ESTRELINHA' 'FONTE GRANDE' 'FORTE SÃO JOÃO' 'FRADINHOS'
 'GOIABEIRAS' 'GRANDE VITÓRIA' 'GURIGICA' 'HORTO' 'ILHA DAS CAIEIRAS'
 'ILHA DE SANTA MARIA' 'ILHA DO BOI' 'ILHA DO FRADE' 'ILHA DO PRÍNCIPE'
 'ILHAS OCEÂNICAS DE TRINDADE' 'INHANGUETÁ' 'ITARARÉ' 'JABOUR'
 'JARDIM CAMBURI' 'JARDIM DA PENHA' 'JESUS DE NAZARETH' 'JOANA DťARC'
 'JUCUTUQUARA' 'MARIA ORTIZ' 'MARUÍPE' 'MATA DA PRAIA' 'MONTE BELO'
 'MORADA DE CAMBURI' 'MÁRIO CYPRESTE' 'NAZARETH' 'NOVA PALESTINA'
 'PARQUE INDUSTRIAL' 'PARQUE MOSCOSO' 'PIEDADE' 'PONTAL DE CAMBURI'
 'PRAIA DO CANTO' 'PRAIA DO SUÁ' 'REDENÇÃO' 'REPÚBLICA' 'RESISTÊNCIA'
 'ROMÃO' 'SANTA CECÍLIA' 'SANTA CLARA' 'SANTA HELENA' 'SANTA LUÍZA'
 'SANTA LÚCIA' 'SANTA MARTHA' 'SANTA TEREZA' 'SANTO ANDRÉ' 'SANTO ANTÔNIO'
 'SANTOS DUMONT' 'SANTOS REIS' 'SEGURANÇA DO LAR' 'SOLON BORGES'
 'SÃO BENEDITO' 'SÃO CRISTÓVÃO' 'SÃO JOSÉ' 'SÃO PEDRO' 'TABUAZEIRO'
 'UNIVERSITÁRIO' 'VILA RUBIM']
```

```
In [38]: # check all the data with general look
         # this returns useful descriptive statistics for each column of data
         df.describe()

Out[38]:          patient_id  appointment_id            age    scholarship  \
         count  1.105210e+05    1.105210e+05  110521.000000  110521.000000
         mean   1.474906e+14    5.675304e+06      37.089386       0.098271
         std    2.560860e+14    7.129691e+04      23.109885       0.297682
         min    3.921700e+04    5.030230e+06       0.000000       0.000000
         25%    4.172457e+12    5.640284e+06      18.000000       0.000000
         50%    3.173185e+13    5.680573e+06      37.000000       0.000000
         75%    9.438963e+13    5.725524e+06      55.000000       0.000000
         max    9.999816e+14    5.790484e+06     115.000000       1.000000

                hypertension       diabetes    alcoholism       handicap  \
         count  110521.000000  110521.000000  110521.000000  110521.000000
         mean        0.197257       0.071869       0.030401       0.022231
         std         0.397929       0.258272       0.171690       0.161494
         min         0.000000       0.000000       0.000000       0.000000
         25%         0.000000       0.000000       0.000000       0.000000
         50%         0.000000       0.000000       0.000000       0.000000
         75%         0.000000       0.000000       0.000000       0.000000
         max         1.000000       1.000000       1.000000       4.000000

                 sms_received   waiting_days
         count  110521.000000  110521.000000
         mean        0.321043      10.184345
         std         0.466879      15.255153
         min         0.000000       0.000000
         25%         0.000000       0.000000
         50%         0.000000       4.000000
         75%         1.000000      15.000000
         max         1.000000     179.000000
```

```
In [39]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110521 entries, 3764 to 110514
Data columns (total 17 columns):
patient_id              110521 non-null int64
appointment_id          110521 non-null int64
gender                  110521 non-null object
schedule_day            110521 non-null datetime64[ns]
appointment_day         110521 non-null datetime64[ns]
age                     110521 non-null int64
neighborhood            110521 non-null object
scholarship             110521 non-null int64
hypertension            110521 non-null int64
diabetes                110521 non-null int64
alcoholism              110521 non-null int64
handicap                110521 non-null int64
sms_received            110521 non-null int64
no_show                 110521 non-null object
schedule_day_week       110521 non-null object
appointment_day_week    110521 non-null object
waiting_days            110521 non-null int64
dtypes: datetime64[ns](2), int64(10), object(5)
memory usage: 13.1+ MB
```

```
In [40]: df.sample(3)
```

```
Out[40]:           patient_id  appointment_id gender schedule_day appointment_day  \
         92745   3577217613616         5753311      F   2016-05-31      2016-06-01
```

```
57588  29385646535938         5732125      F   2016-05-24      2016-05-25
39927   3719512376873         5745470      F   2016-05-30      2016-05-30

       age    neighborhood  scholarship  hypertension  diabetes  alcoholism  \
92745   57  JARDIM CAMBURI            0             0         0           0
57588   48    SÃO BENEDITO            0             0         0           0
39927   39  JARDIM CAMBURI            0             0         0           0

       handicap  sms_received no_show schedule_day_week appointment_day_week  \
92745         0             0      No           Tuesday            Wednesday
57588         0             0     Yes           Tuesday            Wednesday
39927         0             0      No            Monday               Monday

       waiting_days
92745             1
57588             1
39927             0
```

In [41]:
```
# checking data for unique  value for patient_id
df.shape
```

Out[41]:
```
(110521, 17)
```

In [42]:
```
no_show_mask=df[df['no_show']== 'No']
no_show_mask.groupby(['no_show']).patient_id.value_counts()
```

Out[42]:
```
no_show  patient_id
No       822145925426128    87
         99637671331        80
         26886125921145     70
         33534783483176     65
         258424392677       62
         75797461494159     60
         6264198675331      59
         871374938638855    59
         66844879846766     56
         872278549442       54
         89239687393655     52
         8435223536         51
         853439686798559    50
         65433599726992     45
         14479974122994     41
         9452745294842      40
         81894521843749     40
         188232341789524    38
         2271579924275      36
         13364929297498     35
         986162815579582    34
         88834999836575     33
         9496196639835      32
         712458866975343    32
         6128878448536      29
         1484143378533      28
         81213966782532     25
         416755661551767    25
         8634164126317      24
         36994987339512     20
                            ..
         997947382467135     1
         997996185168359     1
         998191338231254     1
         998231581612122     1
         998286994841161     1
         998477879186918     1
         998482373284124     1
         998488365413733     1
         998592581343995     1
         998612492555522     1
         998695728115913     1
         998716271695485     1
         998761852951836     1
         998812997463737     1
         998892829971348     1
         998944177977238     1
         998949741232789     1
         999188133741356     1
         999295345736423     1
         999312893251191     1
         999348642534853     1
         999479168794227     1
         999637954175253     1
         999748162235124     1
         999819435422379     1
         999927491195721     1
         999934989273974     1
         999946536742891     1
         999968578354866     1
         999981631772427     1
Name: patient_id, Length: 54153, dtype: int64
```

```
In [43]: no_show_mask.groupby(['no_show']).patient_id.value_counts().describe()
```

```
Out[43]: count    54153.000000
         mean         1.628848
         std          1.638682
         min          1.000000
         25%          1.000000
```

```
50%            1.000000
75%            2.000000
max           87.000000
Name: patient_id, dtype: float64
```

7 ohh !!!

from above describtive data there are some observartion

1. range of patients who show up start from : 1 show up time up to : 87 show up time

2. we need to investigate patients who were show up <= 2 times as 75% of patient showup 2 times or less

3. we need to investigate patient who were show up > 87 times as 25% of patient showup 2 times or more so who is this patient that book 87 appointment?

```
In [44]: no_show_mask.query('patient_id== 822145925426128').nunique()
```

```
Out[44]: patient_id                1
         appointment_id           87
         gender                    1
         schedule_day             24
         appointment_day          24
         age                       1
         neighborhood              1
         scholarship               1
         hypertension              1
         diabetes                  1
         alcoholism                1
         handicap                  1
         sms_received              2
         no_show                   1
         schedule_day_week         5
         appointment_day_week      5
         waiting_days              6
         dtype: int64
```

```
In [45]: no_show_mask.query('patient_id== 822145925426128').schedule_day.value_counts()
```

```
Out[45]: 2016-05-13    7
         2016-06-01    6
         2016-05-25    5
         2016-05-16    5
         2016-05-04    5
         2016-06-08    5
         2016-05-20    5
```

```
        2016-05-18    4
        2016-05-24    4
        2016-06-03    4
        2016-05-30    4
        2016-06-06    4
        2016-05-02    3
        2016-05-09    3
        2016-04-29    3
        2016-05-31    3
        2016-05-06    3
        2016-05-12    3
        2016-05-10    3
        2016-05-17    3
        2016-05-11    2
        2016-05-03    1
        2016-05-05    1
        2016-06-02    1
        Name: schedule_day, dtype: int64
```

```
In [46]: print("frequencey of Unique Values in `schedule_day` => {}".format(np.sort(no_show_mas

frequencey of Unique Values in `schedule_day` => [1 1 1 2 3 3 3 3 3 3 3 3 4 4 4 4 4 5 5 5 5 5
```

```
In [47]: print("values in `schedule_day` => {}".format(np.sort(no_show_mask.query('patient_id==

values in `schedule_day` => ['2016-04-29T00:00:00.000000000' '2016-04-29T00:00:00.000000000'
 '2016-04-29T00:00:00.000000000' '2016-05-02T00:00:00.000000000'
 '2016-05-02T00:00:00.000000000' '2016-05-02T00:00:00.000000000'
 '2016-05-03T00:00:00.000000000' '2016-05-04T00:00:00.000000000'
 '2016-05-04T00:00:00.000000000' '2016-05-04T00:00:00.000000000'
 '2016-05-04T00:00:00.000000000' '2016-05-04T00:00:00.000000000'
 '2016-05-05T00:00:00.000000000' '2016-05-06T00:00:00.000000000'
 '2016-05-06T00:00:00.000000000' '2016-05-06T00:00:00.000000000'
 '2016-05-09T00:00:00.000000000' '2016-05-09T00:00:00.000000000'
 '2016-05-09T00:00:00.000000000' '2016-05-10T00:00:00.000000000'
 '2016-05-10T00:00:00.000000000' '2016-05-10T00:00:00.000000000'
 '2016-05-11T00:00:00.000000000' '2016-05-11T00:00:00.000000000'
 '2016-05-12T00:00:00.000000000' '2016-05-12T00:00:00.000000000'
 '2016-05-12T00:00:00.000000000' '2016-05-13T00:00:00.000000000'
 '2016-05-13T00:00:00.000000000' '2016-05-13T00:00:00.000000000'
 '2016-05-13T00:00:00.000000000' '2016-05-13T00:00:00.000000000'
 '2016-05-13T00:00:00.000000000' '2016-05-13T00:00:00.000000000'
 '2016-05-16T00:00:00.000000000' '2016-05-16T00:00:00.000000000'
 '2016-05-16T00:00:00.000000000' '2016-05-16T00:00:00.000000000'
 '2016-05-16T00:00:00.000000000' '2016-05-17T00:00:00.000000000'
 '2016-05-17T00:00:00.000000000' '2016-05-17T00:00:00.000000000'
 '2016-05-18T00:00:00.000000000' '2016-05-18T00:00:00.000000000'
 '2016-05-18T00:00:00.000000000' '2016-05-18T00:00:00.000000000'
 '2016-05-20T00:00:00.000000000' '2016-05-20T00:00:00.000000000'
 '2016-05-20T00:00:00.000000000' '2016-05-20T00:00:00.000000000'
 '2016-05-20T00:00:00.000000000' '2016-05-24T00:00:00.000000000'
 '2016-05-24T00:00:00.000000000' '2016-05-24T00:00:00.000000000'
 '2016-05-24T00:00:00.000000000' '2016-05-25T00:00:00.000000000'
 '2016-05-25T00:00:00.000000000' '2016-05-25T00:00:00.000000000'
 '2016-05-25T00:00:00.000000000' '2016-05-25T00:00:00.000000000'
 '2016-05-30T00:00:00.000000000' '2016-05-30T00:00:00.000000000'
 '2016-05-30T00:00:00.000000000' '2016-05-30T00:00:00.000000000'
 '2016-05-31T00:00:00.000000000' '2016-05-31T00:00:00.000000000'
 '2016-05-31T00:00:00.000000000' '2016-06-01T00:00:00.000000000'
 '2016-06-01T00:00:00.000000000' '2016-06-01T00:00:00.000000000'
 '2016-06-01T00:00:00.000000000' '2016-06-01T00:00:00.000000000'
 '2016-06-01T00:00:00.000000000' '2016-06-02T00:00:00.000000000'
 '2016-06-03T00:00:00.000000000' '2016-06-03T00:00:00.000000000'
 '2016-06-03T00:00:00.000000000' '2016-06-03T00:00:00.000000000'
 '2016-06-06T00:00:00.000000000' '2016-06-06T00:00:00.000000000'
 '2016-06-06T00:00:00.000000000' '2016-06-06T00:00:00.000000000'
 '2016-06-08T00:00:00.000000000' '2016-06-08T00:00:00.000000000'
 '2016-06-08T00:00:00.000000000' '2016-06-08T00:00:00.000000000'
 '2016-06-08T00:00:00.000000000']
```

```
In [48]: # describtive data for patient_id== 822145925426128
         no_show_mask.query('patient_id== 822145925426128').describe()
```

```
Out[48]:          patient_id  appointment_id   age  scholarship  hypertension  \
         count  8.700000e+01    8.700000e+01  87.0         87.0          87.0
         mean   8.221459e+14    5.716648e+06  38.0          0.0           0.0
         std    0.000000e+00    4.250145e+04   0.0          0.0           0.0
         min    8.221459e+14    5.638995e+06  38.0          0.0           0.0
         25%    8.221459e+14    5.684154e+06  38.0          0.0           0.0
         50%    8.221459e+14    5.714349e+06  38.0          0.0           0.0
         75%    8.221459e+14    5.753104e+06  38.0          0.0           0.0
         max    8.221459e+14    5.790220e+06  38.0          0.0           0.0

                diabetes  alcoholism  handicap  sms_received  waiting_days
         count      87.0        87.0      87.0     87.000000     87.000000
         mean        0.0         0.0       0.0      0.022989      0.735632
         std         0.0         0.0       0.0      0.150736      2.982350
         min         0.0         0.0       0.0      0.000000      0.000000
         25%         0.0         0.0       0.0      0.000000      0.000000
         50%         0.0         0.0       0.0      0.000000      0.000000
         75%         0.0         0.0       0.0      0.000000      0.000000
         max         0.0         0.0       0.0      1.000000     20.000000
```

```
In [49]: print("frequencey of Unique Values in `sms_received` => {}".format(np.sort(no_show_mas
```

```
frequencey of Unique Values in `sms_received` => [ 2 85]
```

```
In [50]: no_show_mask.query('patient_id== 822145925426128').sms_received.value_counts()

Out[50]: 0    85
         1     2
         Name: sms_received, dtype: int64
```

```
In [51]: print("frequencey of Unique Values in `waiting_days` => {}".format(np.sort(no_show_mas

frequencey of Unique Values in `waiting_days` => [ 1  1  1  2  2 80]
```

```
In [52]: no_show_mask.query('patient_id== 822145925426128').waiting_days.value_counts()

Out[52]: 0     80
         7      2
         3      2
         20     1
         14     1
         10     1
         Name: waiting_days, dtype: int64
```

data shows that:

1. this patient registered from 1:7 times per day

- this patient have been shown up almost daily and go back to his home during saturday and sunday
- this patient is male and 38 years old
- this patient have No scholarship ,No hypertension,NO diabetes, No alcoholism, No handicap
- if this patient has no chronic disease and not in_patient case this hospital data need to be reviewed
- if this patient has chronic disease or he was in_patient case it is very difficult to expect what are main factors that affect show up because data mixed by about 25% but we will try

```
In [53]: # here we are going to drop about 25% of paient to clean data and will investigate 75
         no_show_mask.groupby(['no_show']).patient_id.value_counts().describe()

Out[53]: count    54153.000000
         mean         1.628848
         std          1.638682
         min          1.000000
         25%          1.000000
         50%          1.000000
         75%          2.000000
         max         87.000000
         Name: patient_id, dtype: float64
```

```
In [54]: fr=df.groupby('no_show').patient_id.value_counts();
         ffr=fr.sort_values(ascending=False)
         f=ffr.to_frame(name='id_value_counts')
         merged = pd.merge(df, f, on='patient_id',how='inner')
         df=merged
         df.head()
```

```
Out[54]:         patient_id  appointment_id gender schedule_day appointment_day  age  \
         0  832256398961987         5030230      F   2015-11-10      2016-05-04   51
         1  832256398961987         5030230      F   2015-11-10      2016-05-04   51
         2  832256398961987         5656075      F   2016-05-04      2016-06-07   51
         3  832256398961987         5656075      F   2016-05-04      2016-06-07   51
         4  832256398961987         5711549      F   2016-05-18      2016-05-18   51

           neighborhood  scholarship  hypertension  diabetes  alcoholism  handicap  \
         0  RESISTÊNCIA            0             0         0           0         0
         1  RESISTÊNCIA            0             0         0           0         0
         2  RESISTÊNCIA            0             0         0           0         0
         3  RESISTÊNCIA            0             0         0           0         0
         4  RESISTÊNCIA            0             0         0           0         0

            sms_received no_show schedule_day_week appointment_day_week  waiting_days  \
         0             1      No           Tuesday            Wednesday           176
         1             1      No           Tuesday            Wednesday           176
         2             1     Yes         Wednesday              Tuesday            34
         3             1     Yes         Wednesday              Tuesday            34
         4             0      No         Wednesday            Wednesday             0

            id_value_counts
         0                3
         1                1
         2                3
         3                1
         4                3
```

```
In [55]: df.shape
```

```
Out[55]: (144047, 18)
```

```
In [56]: df.drop_duplicates(['appointment_id'],inplace =True)
```

```
In [57]: df.shape
```

```
Out[57]: (110521, 18)
```

```
In [58]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 110521 entries, 0 to 144046
```

```
Data columns (total 18 columns):
patient_id              110521 non-null int64
appointment_id          110521 non-null int64
gender                  110521 non-null object
schedule_day            110521 non-null datetime64[ns]
appointment_day         110521 non-null datetime64[ns]
age                     110521 non-null int64
neighborhood            110521 non-null object
scholarship             110521 non-null int64
hypertension            110521 non-null int64
diabetes                110521 non-null int64
alcoholism              110521 non-null int64
handicap                110521 non-null int64
sms_received            110521 non-null int64
no_show                 110521 non-null object
schedule_day_week       110521 non-null object
appointment_day_week    110521 non-null object
waiting_days            110521 non-null int64
id_value_counts         110521 non-null int64
dtypes: datetime64[ns](2), int64(11), object(5)
memory usage: 13.9+ MB
```

```
In [59]: #test data
         df.query('patient_id==832256398961987')
```

```
Out[59]:         patient_id  appointment_id gender schedule_day appointment_day  age  \
         0  832256398961987         5030230      F   2015-11-10      2016-05-04   51
         2  832256398961987         5656075      F   2016-05-04      2016-06-07   51
         4  832256398961987         5711549      F   2016-05-18      2016-05-18   51
         6  832256398961987         5710989      F   2016-05-18      2016-05-18   51

           neighborhood  scholarship  hypertension  diabetes  alcoholism  handicap  \
         0  RESISTÊNCIA            0             0         0           0         0
         2  RESISTÊNCIA            0             0         0           0         0
         4  RESISTÊNCIA            0             0         0           0         0
         6  RESISTÊNCIA            0             0         0           0         0

            sms_received no_show schedule_day_week appointment_day_week  waiting_days  \
         0             1      No           Tuesday            Wednesday           176
         2             1     Yes         Wednesday              Tuesday            34
         4             0      No         Wednesday            Wednesday             0
         6             0      No         Wednesday            Wednesday             0

            id_value_counts
         0                3
         2                3
         4                3
         6                3
```

check cleaned data

```
In [60]: df.nunique()
```

```
Out[60]: patient_id                62298
         appointment_id           110521
         gender                        2
         schedule_day                111
         appointment_day              27
         age                         103
         neighborhood                 81
         scholarship                   2
         hypertension                  2
         diabetes                      2
         alcoholism                    2
         handicap                      5
         sms_received                  2
         no_show                       2
         schedule_day_week             6
         appointment_day_week          6
         waiting_days                129
         id_value_counts              45
         dtype: int64
```

```
In [61]: df=df[df['id_value_counts'] <=2]
```

```
In [62]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 74513 entries, 8 to 144046
Data columns (total 18 columns):
patient_id              74513 non-null int64
appointment_id          74513 non-null int64
gender                  74513 non-null object
schedule_day            74513 non-null datetime64[ns]
appointment_day         74513 non-null datetime64[ns]
age                     74513 non-null int64
neighborhood            74513 non-null object
scholarship             74513 non-null int64
hypertension            74513 non-null int64
diabetes                74513 non-null int64
alcoholism              74513 non-null int64
handicap                74513 non-null int64
sms_received            74513 non-null int64
no_show                 74513 non-null object
schedule_day_week       74513 non-null object
appointment_day_week    74513 non-null object
waiting_days            74513 non-null int64
id_value_counts         74513 non-null int64
```

```
dtypes: datetime64[ns](2), int64(11), object(5)
memory usage: 9.4+ MB
```

```
In [63]: df.id_value_counts.value_counts()
```

```
Out[63]: 1    46080
         2    28433
         Name: id_value_counts, dtype: int64
```

```
In [64]: df.shape
```

```
Out[64]: (74513, 18)
```

```
In [65]: df.nunique()
```

```
Out[65]: patient_id              54616
         appointment_id          74513
         gender                      2
         schedule_day              106
         appointment_day            27
         age                       103
         neighborhood               81
         scholarship                 2
         hypertension                2
         diabetes                    2
         alcoholism                  2
         handicap                    5
         sms_received                2
         no_show                     2
         schedule_day_week           6
         appointment_day_week        6
         waiting_days              127
         id_value_counts             2
         dtype: int64
```

```
In [66]: df.query('patient_id==832256398961987')
```

```
Out[66]: Empty DataFrame
         Columns: [patient_id, appointment_id, gender, schedule_day, appointment_day, age, neig
         Index: []
```

```
In [67]: df.patient_id.value_counts()
```

```
Out[67]: 441433296929249    4
         51658925611435     4
         69963791545945     4
         78455617611547     4
         35464699342698     4
```

```
4353727533862      4
771441193369474    4
4261423269424      4
974582186455348    4
37465465438659     4
245549134617978    4
817677252861147    4
86274467844129     4
231555659478       4
38693569211684     4
4547276853192      4
86372499519789     4
686996292887145    4
3646739615918      4
1557188256434      4
465819897253861    4
973722563588354    4
74247153831        4
678429168299       4
53696749534376     4
43254452912441     4
5356271742799      4
889199553545224    4
2437363243742      4
8986883641367      4
                  ..
38118111589538     1
899663744221       1
122686944736       1
669254934961587    1
87466578526746     1
86417144662683     1
81322135681325     1
869641781739192    1
516536613569731    1
1373217456392      1
54836279856844     1
43571231774888     1
3262764691235      1
56577435252888     1
96271757579665     1
65436869821333     1
548481565948631    1
8993253691972      1
13995936927756     1
845944463515389    1
64824497451827     1
37835674789744     1
```

```
533285254712513    1
7121621183755      1
64323681297265     1
978472222273       1
45235594794        1
68399884568884     1
4451461514286      1
57863365759569     1
Name: patient_id, Length: 54616, dtype: int64
```

```
In [68]: df.query('patient_id==441433296929249')
```

```
Out[68]:              patient_id  appointment_id gender schedule_day appointment_day  \
         116649  441433296929249         5697605      F   2016-05-13      2016-05-13
         116651  441433296929249         5697671      F   2016-05-13      2016-05-20
         116653  441433296929249         5751605      F   2016-05-31      2016-06-07
         116655  441433296929249         5771593      F   2016-06-03      2016-06-06

                 age    neighborhood  scholarship  hypertension  diabetes  alcoholism  \
         116649   19  NOVA PALESTINA            0             0         0           0
         116651   19  NOVA PALESTINA            0             0         0           0
         116653   19  NOVA PALESTINA            0             0         0           0
         116655   19  NOVA PALESTINA            0             0         0           0

                 handicap  sms_received no_show schedule_day_week appointment_day_week  \
         116649         0             0      No            Friday               Friday
         116651         0             0     Yes            Friday               Friday
         116653         0             1     Yes           Tuesday              Tuesday
         116655         0             0      No            Friday               Monday

                 waiting_days  id_value_counts
         116649             0                2
         116651             7                2
         116653             7                2
         116655             3                2
```

8 *Now data ready to be analysied*

Now data ready to be analysied

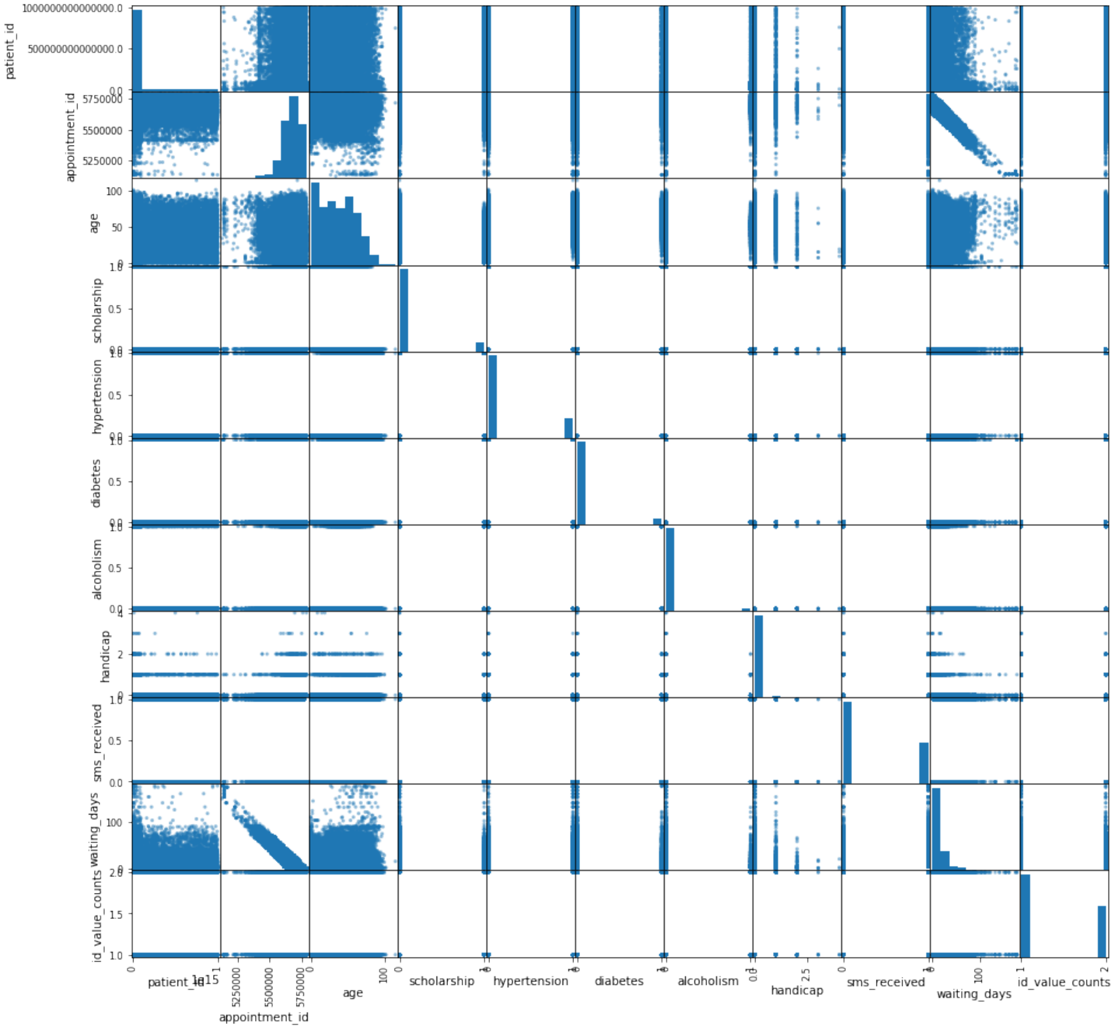
9 *DATA ANALYSIS and exploration*

9.0.1 EDA(EXPLORATORY DATA ANALYSIS)

9.1 By drawing histogram and scatter matrix we are looking for patterns for different types of data columns and now we will go in more deep investigation

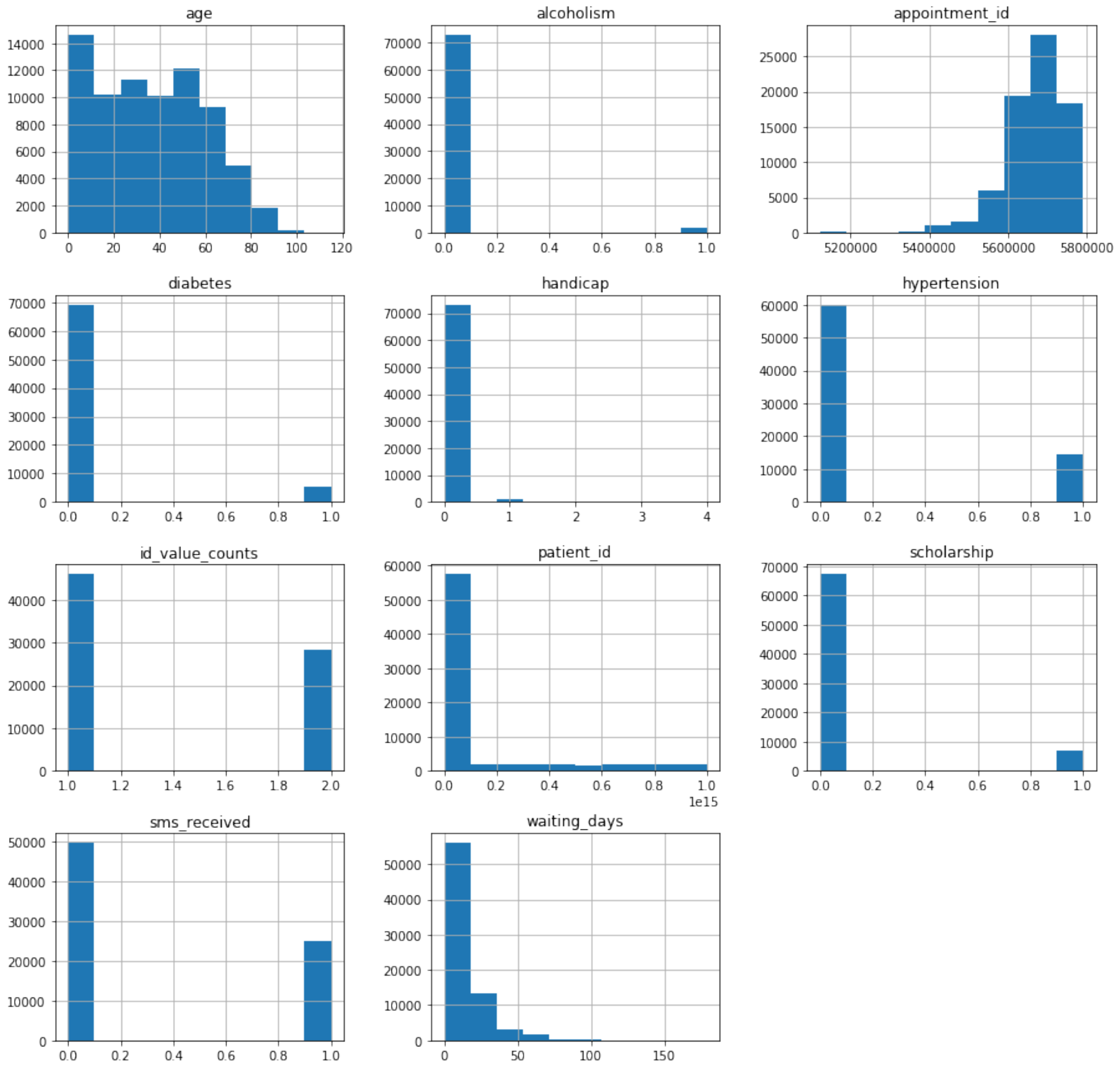
9.1.1 using scatter_matrix() and histogaram to have quecik look for all data and trying to find pattern

```
In [69]: import pandas as pd
         %matplotlib inline
         pd.plotting.scatter_matrix(df,figsize=(15,15));
```



10 *finding pattern*

```
In [70]: df.hist(figsize=(15,15));
```



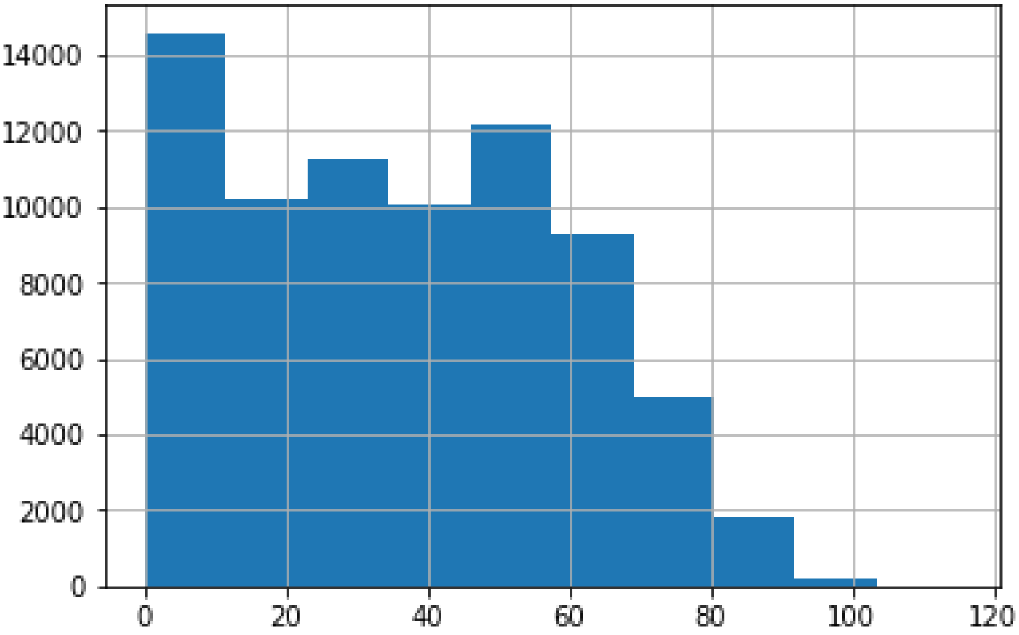
11 *1- age study:*

Is there any relation between patient age and their commitment to appointment attendens?

```
In [71]: df.age.count()
```

```
Out[71]: 74513
```

```
In [72]: df.age.hist();
```



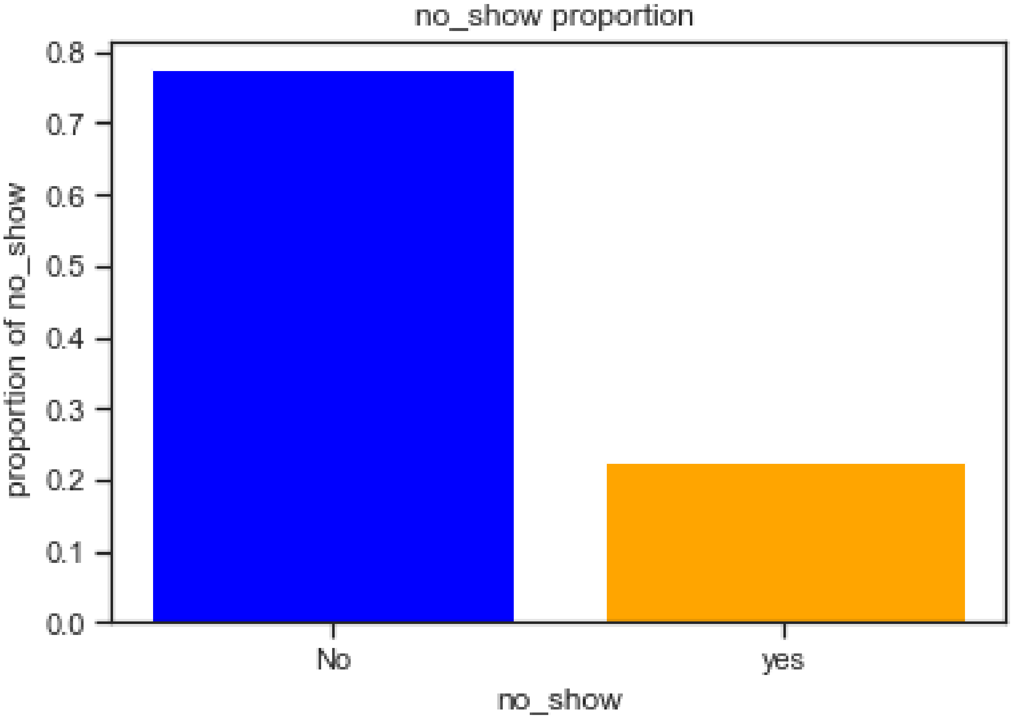
separation and visualization of patients who show up according to their ages

```
In [73]: no_show_mask=df[df['no_show']== 'No']

In [74]: print('Total number of patient who record Appointment Booking {} patient'.format(df.no
         print('Number of patient who show up from id :  {}  patient'.format(no_show_mask.shape
         print('percent of patient who show up {}'.format(no_show_mask.shape[0]/(df.no_show.sha
         print('percent of patient who were Not show up {} patient'.format((1-no_show_mask.shap

Total number of patient who record Appointment Booking 74513 patient
Number of patient who show up from id :  57785  patient
percent of patient who show up 77.55022613503684
percent of patient who were Not show up 22.449773864963163 patient
```

11.0.1 *visualize relationship*

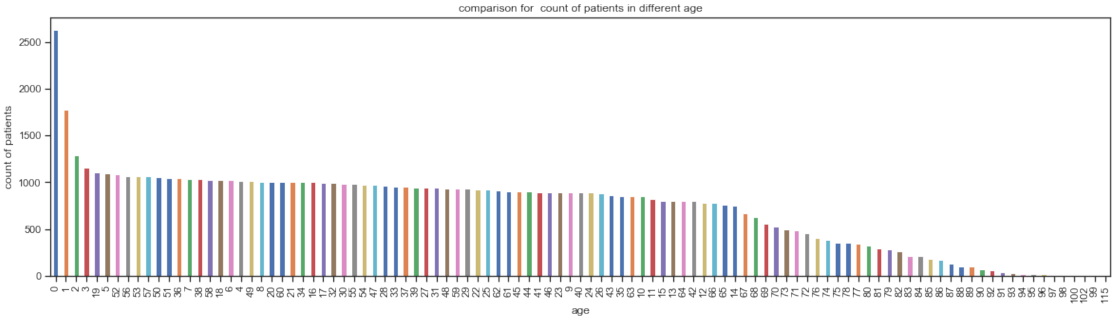
```
In [75]: from  matplotlib import pyplot
         import seaborn as sns
         sns.set(style='ticks')
         %matplotlib inline

         mal_noshow_zeroage=df[(df.age) & (df.no_show == 'No')].shape[0]
         mal_yesshow_zeroage=df[(df.age) & (df.no_show == 'Yes')].shape[0]
         total=mal_noshow_zeroage+mal_yesshow_zeroage
         proportion_no=mal_noshow_zeroage/total
         proportion_yes=mal_yesshow_zeroage/total
```

```
In [76]: colors=['blue','orange']
         plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
         plt.title("no_show proportion ")
         plt.xlabel("no_show")
         plt.ylabel("proportion of no_show ");
```



count number of patients who book appointments according to their ages

```
In [77]: df.age.value_counts().plot(kind='bar',figsize=(20,5))
         plt.title('comparison for  count of patients in different age')
         plt.xlabel('age')
         plt.ylabel('count of patients');
```



find out trend lines of patient who show up and not show up according to their ages

Bulding up new column to follow no_show counts in every patient's age

```
In [78]: counts_no_yes=df.groupby('age').no_show.value_counts()
         counts_sorting=counts_no_yes.sort_values(ascending=True)
         counts_sorting_to_fram=counts_sorting.to_frame(name='no_show_count')
         merged = pd.merge(df, counts_sorting_to_fram, on='age',how='inner')
```

```
In [79]: merged.shape
```

```
Out[79]: (149018, 19)
```

```
In [80]: merged.drop_duplicates(['appointment_id'],inplace =True)
```

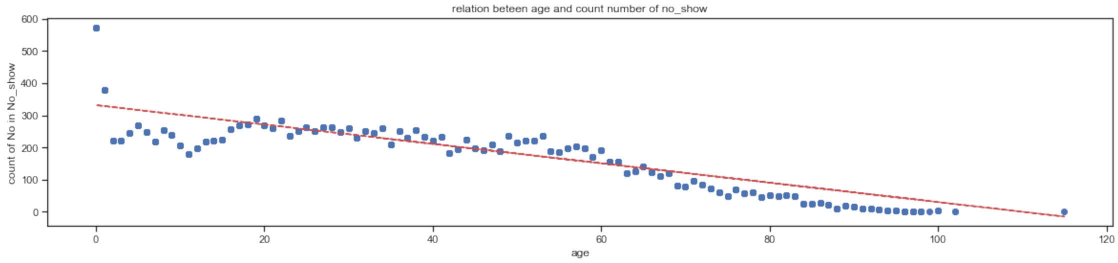
```
In [81]: merged.shape
```

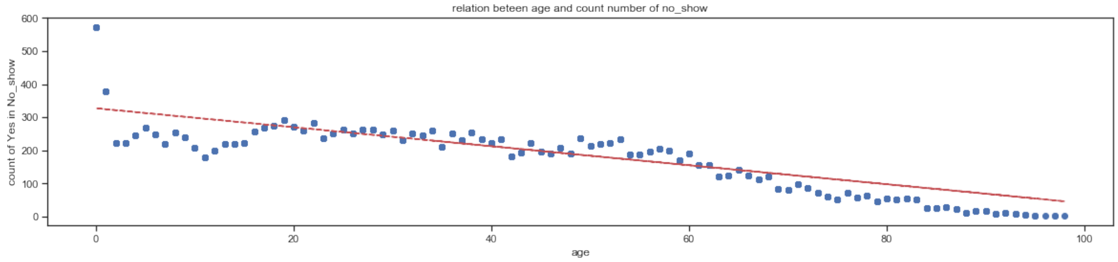
```
Out[81]: (74513, 19)
```

```
In [82]: df=merged
```

11.1 *Trend lines of no_show according to patient's age factor*

```
In [83]: df_no=df[df['no_show']=='No']
         plt.figure(figsize = (20,4))
         x = df_no['age']
         y = df_no['no_show_count']
         plt.title('relation beteen age and count number of no_show')
         plt.xlabel('age')
         plt.ylabel('count of No in No_show')
         plt.scatter(x, y)
         z = np.polyfit(x, y, 1)
         p = np.poly1d(z)
         plt.plot(x,p(x),"r--")
         plt.show()



         df_yes=df[df['no_show']=='Yes']
         plt.figure(figsize = (20,4))
         x = df_yes['age']
         y = df_yes['no_show_count']
         plt.title('relation beteen age and count number of no_show')
         plt.xlabel('age')
         plt.ylabel('count of Yes in No_show')
         plt.scatter(x, y)
         z = np.polyfit(x, y, 1)
         p = np.poly1d(z)
         plt.plot(x,p(x),"r--")
         plt.show()
```





from trend line we see:

1. in general count number of patients who book appointment is inversely proportional to their age

- there are some some periodes where the trend line is directrly proprtional to their age

12 *build intution*

12.0.1 we want to slice this big range according to different stage

to study the relation between age and no_show first we need to clasify age in to groups

1. Fetus (Unborn)

- Newborn (Birth - 1 month)
- Baby (1 month and 1 day - 2 years)
- Toddler (3 - 5)
- Kids (6 - 9)
- Pre-Teen (10 - 12)
- Teenager (13 - 17)
- Young Adult (18 - 20)
- Adult (21 - 39)
- Young Middle-Aged Adult (40 - 49)
- Middle-Aged Adult (50 - 54)
- Very Young Senior Citizen (55 - 64)
- Young Senior Citizen (65 - 74)

- Senior Citizen (75 - 84)
- Old Senior Citizen (85+)

Adding new coulmn to clasify patients into age stages

```
In [84]: # Bin edges that will be used to "cut" the data into groups
         # we use -1 the start of sries to include babys with 0 age
         bin_edges = [-1,3,6,10 ,13,18,21,40,50,55,65,75,85,116] # Fill in this list with five

         # Labels for different age_stage groups
         bin_names = ['Baby', 'Toddler','Kids', 'Pre-Teen', 'Teenager','Young_Adult','Adult','
         # Creates age_stage column
         df['age_stage'] = pd.cut(df['age'], bin_edges, labels=bin_names)

         #df['age_stage']=df.loc['bin_edges','bin_names']
         # Checks for successful creation of this column
         df.head(3)
```

```
Out[84]:        patient_id  appointment_id gender schedule_day appointment_day  age  \
         0  91637474953513         5122866      M   2015-12-03      2016-05-02   34
         2  91637474953513         5648860      M   2016-05-02      2016-05-11   34
         4  35864643985587         5358168      F   2016-02-17      2016-05-05   34

           neighborhood  scholarship  hypertension  diabetes  alcoholism  handicap  \
         0   VILA RUBIM            0             1         0           0         0
         2   VILA RUBIM            0             1         0           0         0
         4  RESISTÊNCIA            0             0         0           0         0

            sms_received no_show schedule_day_week appointment_day_week  waiting_days  \
         0             1     Yes          Thursday               Monday           151
         2             1     Yes            Monday            Wednesday             9
         4             1      No         Wednesday             Thursday            78

            id_value_counts  no_show_count age_stage
         0                2            259     Adult
         2                2            259     Adult
         4                1            259     Adult
```

```
In [85]: # to confirm there is no null
         df[df.age_stage.isnull()]
```

```
Out[85]: Empty DataFrame
         Columns: [patient_id, appointment_id, gender, schedule_day, appointment_day, age, nei
         Index: []
```

```
In [86]: df.isnull().sum()
```

```
Out[86]: patient_id              0
         appointment_id          0
         gender                  0
         schedule_day            0
         appointment_day         0
         age                     0
         neighborhood            0
         scholarship             0
         hypertension            0
         diabetes                0
         alcoholism              0
         handicap                0
         sms_received            0
         no_show                 0
         schedule_day_week       0
         appointment_day_week    0
         waiting_days            0
         id_value_counts         0
         no_show_count           0
         age_stage               0
         dtype: int64
```

```
In [87]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 74513 entries, 0 to 149017
Data columns (total 20 columns):
patient_id              74513 non-null int64
appointment_id          74513 non-null int64
gender                  74513 non-null object
schedule_day            74513 non-null datetime64[ns]
appointment_day         74513 non-null datetime64[ns]
age                     74513 non-null int64
neighborhood            74513 non-null object
scholarship             74513 non-null int64
hypertension            74513 non-null int64
diabetes                74513 non-null int64
alcoholism              74513 non-null int64
handicap                74513 non-null int64
sms_received            74513 non-null int64
no_show                 74513 non-null object
schedule_day_week       74513 non-null object
appointment_day_week    74513 non-null object
waiting_days            74513 non-null int64
id_value_counts         74513 non-null int64
no_show_count           74513 non-null int64
age_stage               74513 non-null category
dtypes: category(1), datetime64[ns](2), int64(12), object(5)
memory usage: 10.0+ MB
```

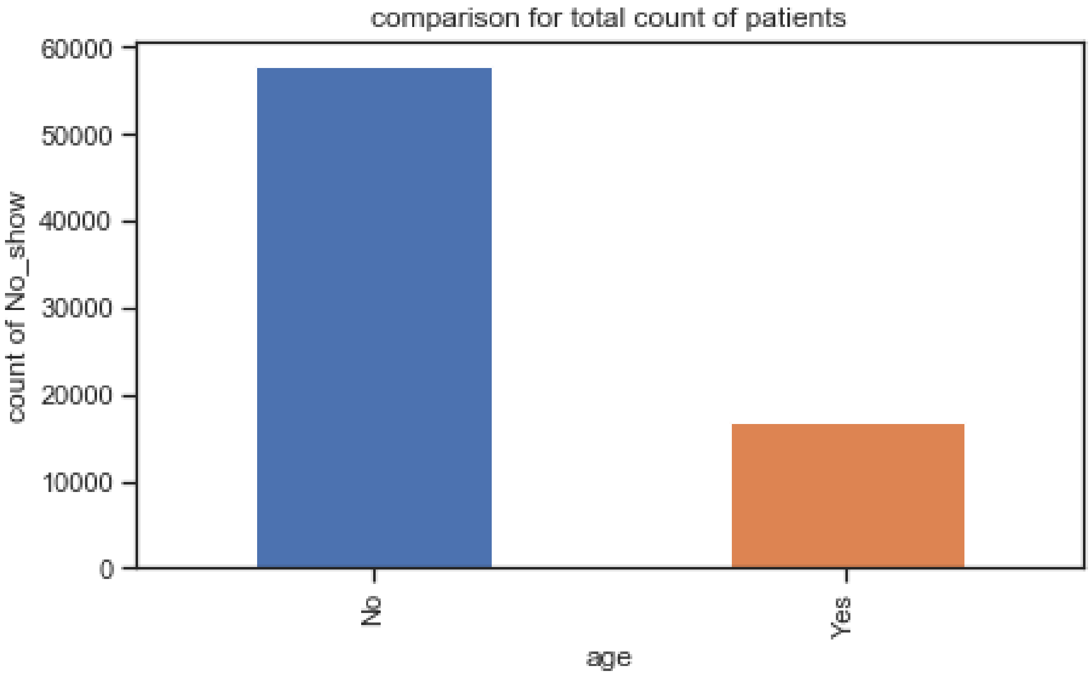
13 *creat more and describtive feture*

comparison for different age stages versuse no_show

```
In [88]: df.groupby('no_show').age_stage.count()
```

```
Out[88]: no_show
         No     57785
         Yes    16728
         Name: age_stage, dtype: int64
```

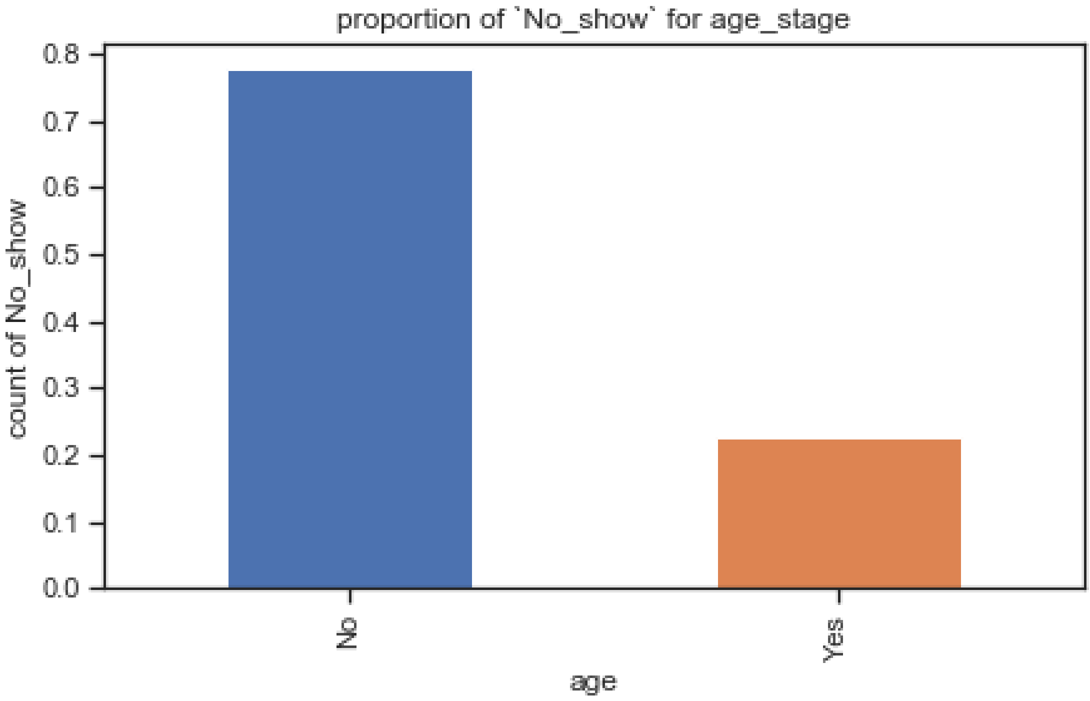
```
In [89]: df.groupby('no_show').age_stage.count().plot(kind ='bar',figsize=(7,4))
         plt.title('comparison for total count of patients')
         plt.xlabel('age')
         plt.ylabel('count of No_show');
```



```
In [90]: print("proportion of `No_show` for age_stage  => {}".format(df.groupby('no_show').age_
```

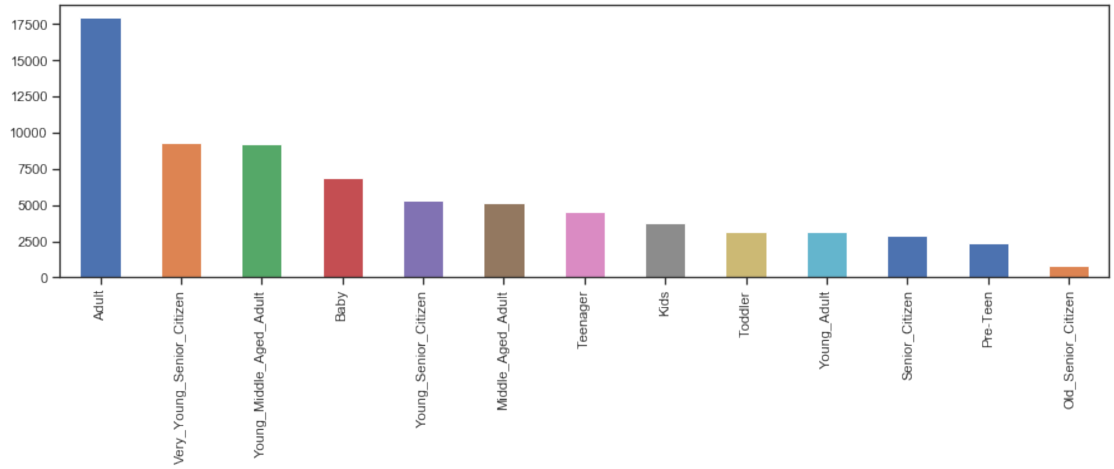
```
proportion of `No_show` for age_stage  => no_show
No     0.775502
Yes    0.224498
Name: age_stage, dtype: float64
```

```
In [91]: (df.groupby('no_show').age_stage.count()/df.age_stage.count()).plot(kind ='bar',figsi
         plt.title('proportion of `No_show` for age_stage')
         plt.xlabel('age')
         plt.ylabel('count of No_show');
```



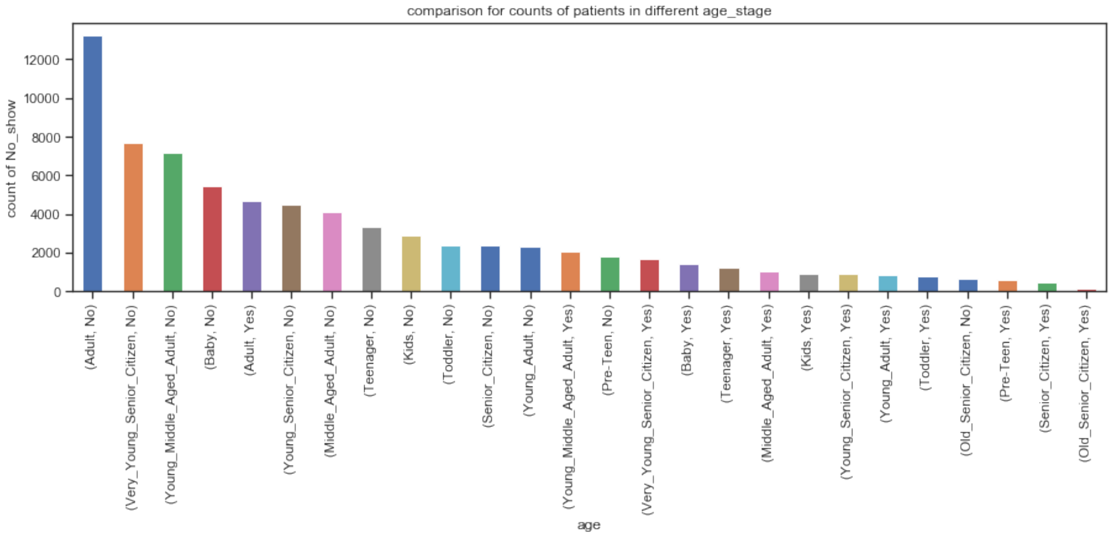
14 *sorting data sets for different age stages*

```
In [92]: df.age_stage.value_counts()

Out[92]: Adult                          17941
         Very_Young_Senior_Citizen       9316
         Young_Middle_Aged_Adult         9217
         Baby                            6843
         Young_Senior_Citizen            5350
         Middle_Aged_Adult               5154
         Teenager                        4579
         Kids                            3785
         Toddler                         3145
         Young_Adult                     3115
         Senior_Citizen                  2869
         Pre-Teen                        2402
         Old_Senior_Citizen               797
         Name: age_stage, dtype: int64

In [93]: df['age_stage'].value_counts().plot(kind='bar',figsize=(15,4));
```



14.1 *comparison of counts of patients for no_show in different age_stage*

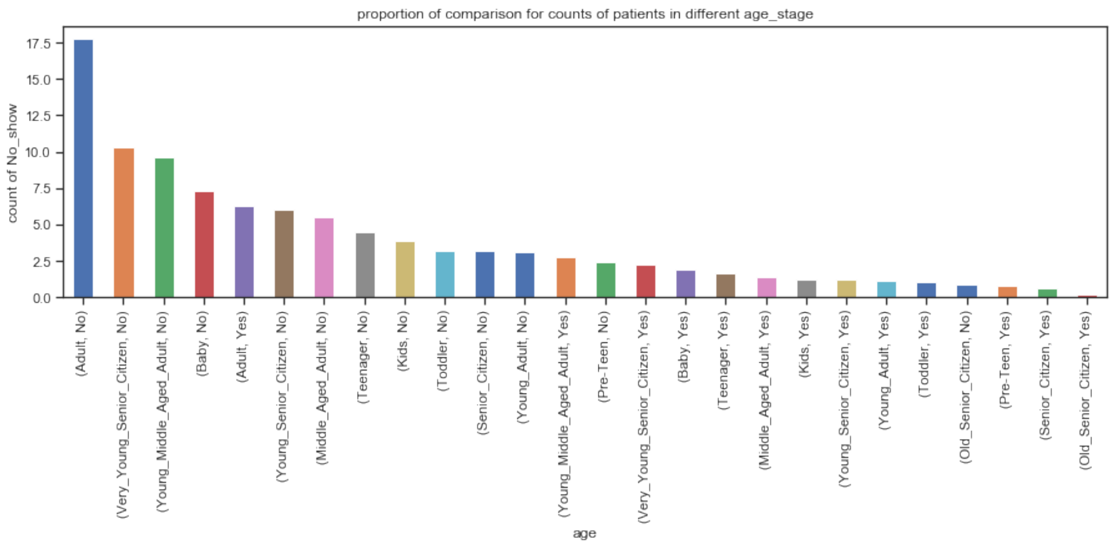
```
In [94]: fr=df.groupby('age_stage').no_show.value_counts();
         fr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
         plt.title('comparison for counts of patients in different age_stage')
         plt.xlabel('age')
         plt.ylabel('count of No_show');
```



14.2 *proportional comparison of counts of patients for no_show in different age_stage*

```
In [95]: tr=((df.groupby('age_stage').no_show.value_counts())/df.age_stage.count())*100
         tr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
```

```
plt.title('proportion of comparison for counts of patients in different age_stage')
plt.xlabel('age')
plt.ylabel('count of No_show');
```



neumerical proportional comparison for count of patients versus no_show in different age_stage

```
In [96]: tr=((df.groupby('age_stage').no_show.value_counts())/df.age_stage.count())*100
         tr.sort_values(ascending=False)
```

```
Out[96]: age_stage                  no_show
         Adult                      No          17.764685
         Very_Young_Senior_Citizen  No          10.273375
         Young_Middle_Aged_Adult    No           9.594299
         Baby                       No           7.311476
         Adult                      Yes          6.312992
         Young_Senior_Citizen       No           5.996269
         Middle_Aged_Adult          No           5.506422
         Teenager                   No           4.478413
         Kids                       No           3.846309
         Toddler                    No           3.198100
         Senior_Citizen             No           3.192731
         Young_Adult                No           3.077315
         Young_Middle_Aged_Adult    Yes          2.775355
         Pre-Teen                   No           2.422396
         Very_Young_Senior_Citizen  Yes          2.229141
         Baby                       Yes          1.872157
         Teenager                   Yes          1.666823
         Middle_Aged_Adult          Yes          1.410492
         Kids                       Yes          1.233342
```

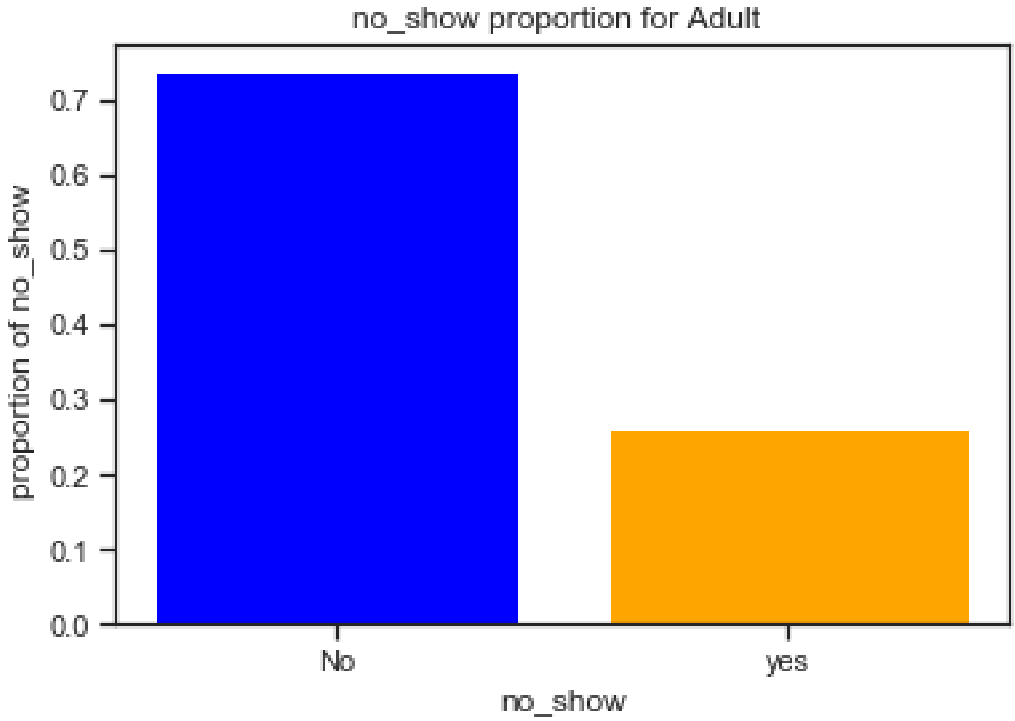
```
Young_Senior_Citizen       Yes         1.183686
Young_Adult                Yes         1.103163
Toddler                    Yes         1.022640
Old_Senior_Citizen         No          0.888436
Pre-Teen                   Yes         0.801202
Senior_Citizen             Yes         0.657603
Old_Senior_Citizen         Yes         0.181176
Name: no_show, dtype: float64
```

15 *Adult age stage stage :*

```
In [97]: mal_noshow_zeroage=df[(df.age_stage == 'Adult') & (df.no_show == 'No')].shape[0]
         mal_yesshow_zeroage=df[(df.age_stage == 'Adult') & (df.no_show == 'Yes')].shape[0]
         total=mal_noshow_zeroage+mal_yesshow_zeroage
         proportion_no=mal_noshow_zeroage/total
         proportion_yes=mal_yesshow_zeroage/total
         print('proportion of no_show in Adult stage   "No":{}'.format(proportion_no))
         print('proportion of no_show in Adult  "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Adult stage   "No":0.7378072571205618
proportion of no_show in Adult  "Yes":0.26219274287943817
```

```
In [98]: colors=['blue','orange']
         plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
         plt.title("no_show proportion for Adult ")
         plt.xlabel("no_show")
         plt.ylabel("proportion of no_show ");
```

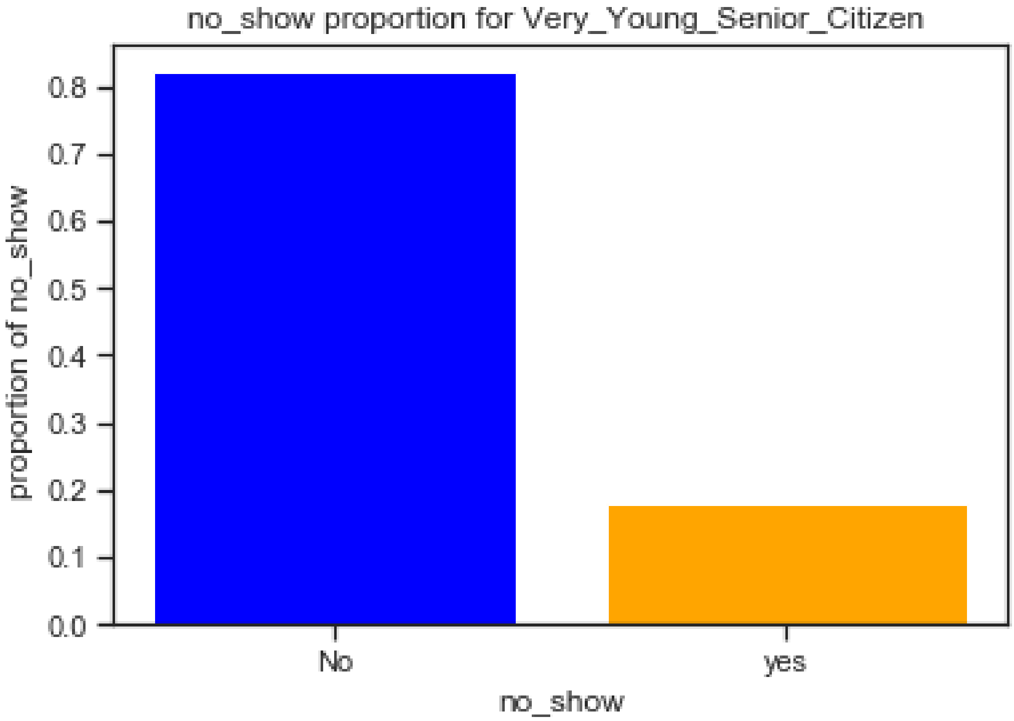


16 *Very_Young_Senior_Citizen:*

```
In [99]: v_noshow=df[(df.age_stage == 'Very_Young_Senior_Citizen') & (df.no_show == 'No')].shap
         v_yesshow=df[(df.age_stage == 'Very_Young_Senior_Citizen') & (df.no_show == 'Yes')].sl
         total=v_noshow+v_yesshow
         proportion_no=v_noshow/total
         proportion_yes=v_yesshow/total
         print('proportion of no_show in Adult stage   "No":{}'.format(proportion_no))
         print('proportion of no_show in Adult  "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Adult stage   "No":0.8217045942464577
proportion of no_show in Adult  "Yes":0.1782954057535423
```

```
In [100]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Very_Young_Senior_Citizen ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

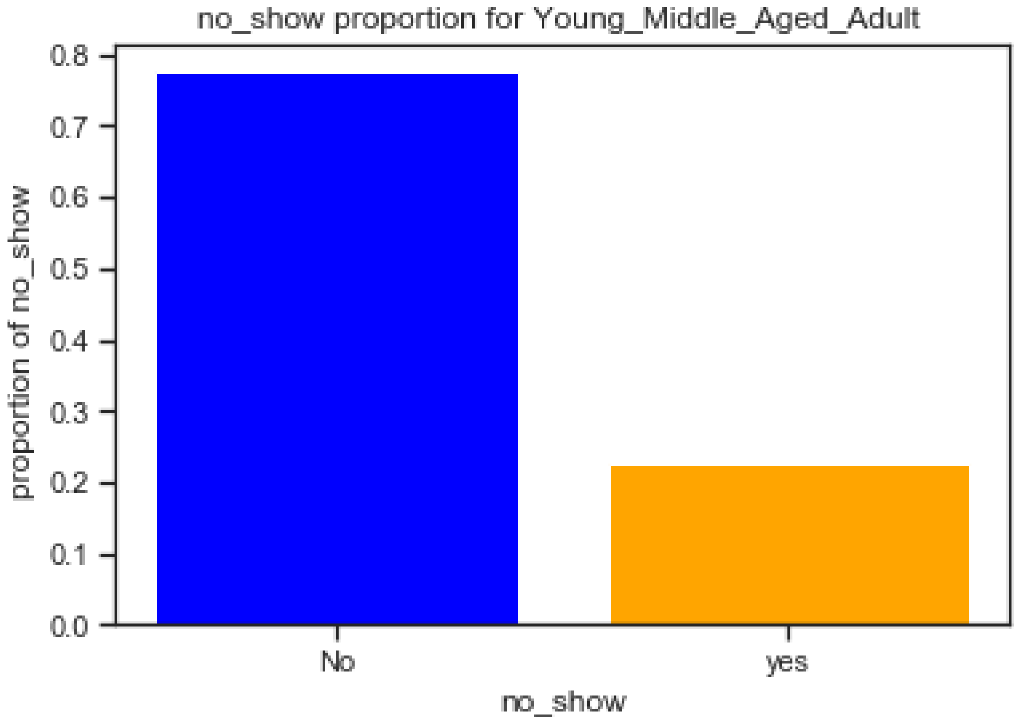


17 *Young_Middle_Aged_Adult age stage :*

```
In [101]: mal_noshow_zeroage=df[(df.age_stage == 'Young_Middle_Aged_Adult') & (df.no_show == 'I
          mal_yesshow_zeroage=df[(df.age_stage == 'Young_Middle_Aged_Adult') & (df.no_show ==
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Adult stage   "No":{}'.format(proportion_no))
          print('proportion of no_show in Adult  "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Adult stage   "No":0.7756319843766952
proportion of no_show in Adult  "Yes":0.22436801562330477
```

```
In [102]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color = colors)
          plt.title("no_show proportion for Young_Middle_Aged_Adult ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

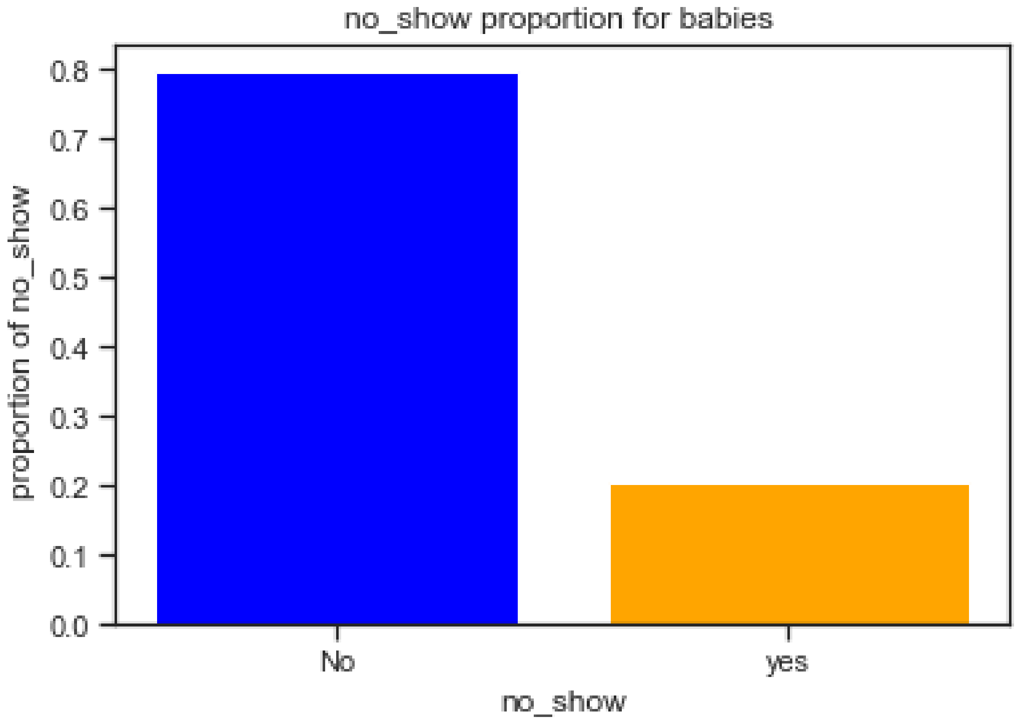


18 *Baby age stage :*

```
In [103]: mal_noshow_zeroage=df[(df.age_stage == 'Baby') & (df.no_show == 'No')].shape[0]
          mal_yesshow_zeroage=df[(df.age_stage == 'Baby') & (df.no_show == 'Yes')].shape[0]
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Baby stage   "No":{}'.format(proportion_no))
          print('proportion of no_show in Baby stage   "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Baby stage   "No":0.7961420429636125
proportion of no_show in Baby stage   "Yes":0.20385795703638754
```

```
In [104]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for babies ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

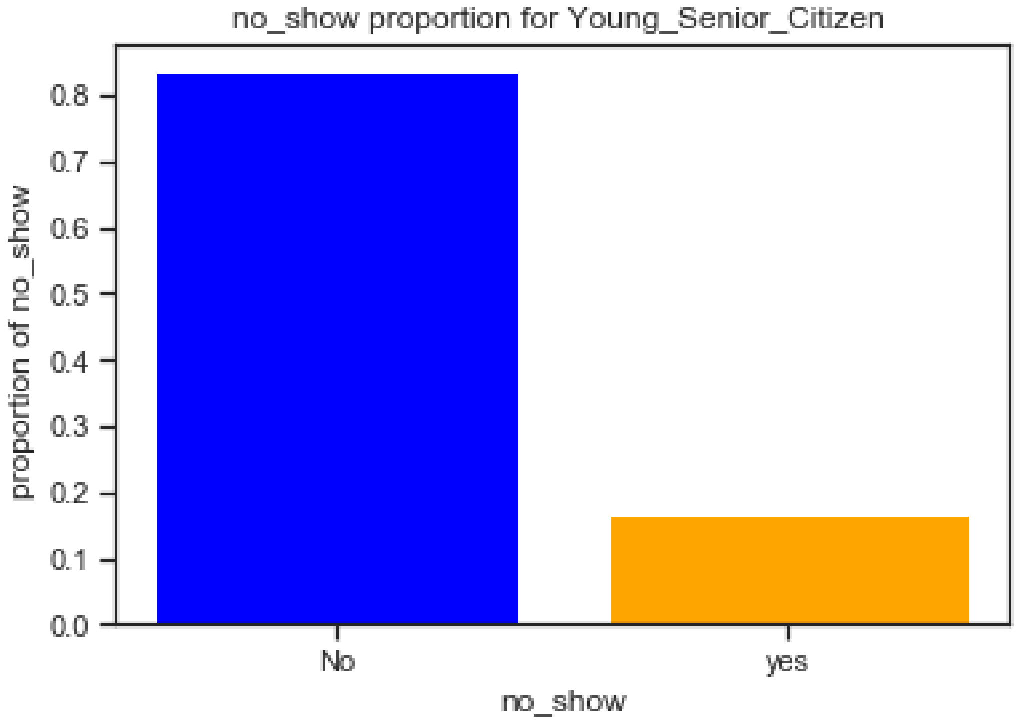


19 *Young_Senior_Citizen :*

```
In [105]: mal_noshow_zeroage=df[(df.age_stage == 'Young_Senior_Citizen') & (df.no_show == 'No')
          mal_yesshow_zeroage=df[(df.age_stage == 'Young_Senior_Citizen') & (df.no_show == 'Yes
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in baby stage   "No":{}'.format(proportion_no))
          print('proportion of no_show in baby stage   "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in baby stage   "No":0.8351401869158879
proportion of no_show in baby stage   "Yes":0.16485981308411216
```

```
In [106]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Young_Senior_Citizen ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

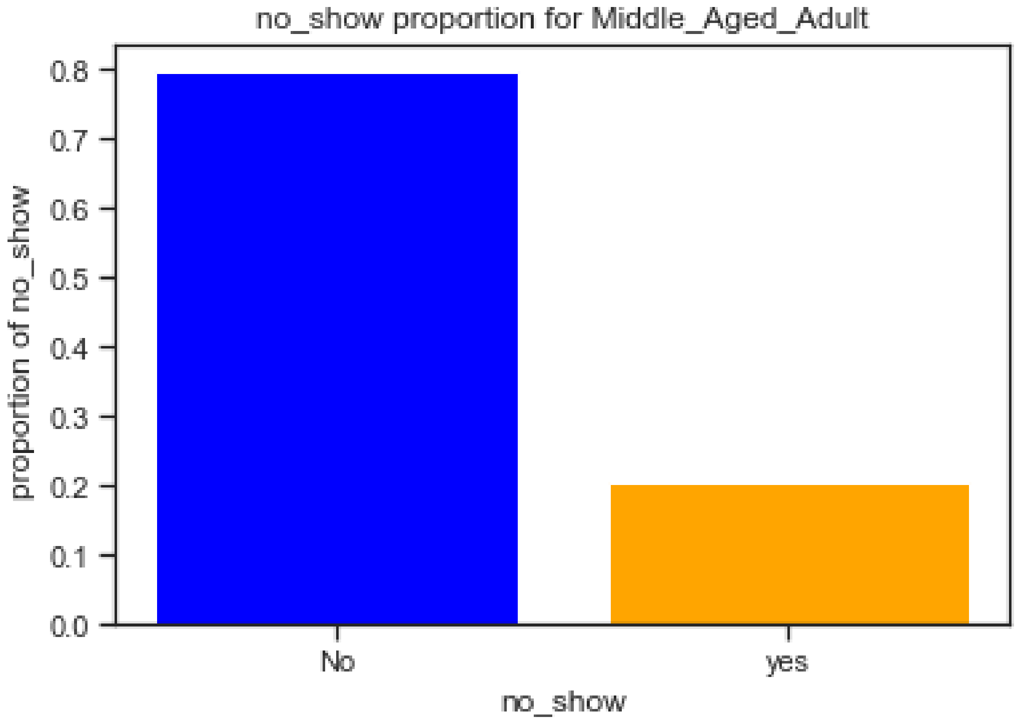


20 *Middle_Aged_Adult :*

```
In [107]: mal_noshow_zeroage=df[(df.age_stage == 'Middle_Aged_Adult') & (df.no_show == 'No')].
          mal_yesshow_zeroage=df[(df.age_stage == 'Middle_Aged_Adult') & (df.no_show == 'Yes')]
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Middle_Aged_Adult stage   "No":{}'.format(proportion_
          print('proportion of no_show in Middle_Aged_Adult stage   "Yes":{}'.format(proportio
```

```
proportion of no_show in Middle_Aged_Adult stage   "No":0.7960807140085371
proportion of no_show in Middle_Aged_Adult stage   "Yes":0.20391928599146295
```

```
In [108]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Middle_Aged_Adult")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

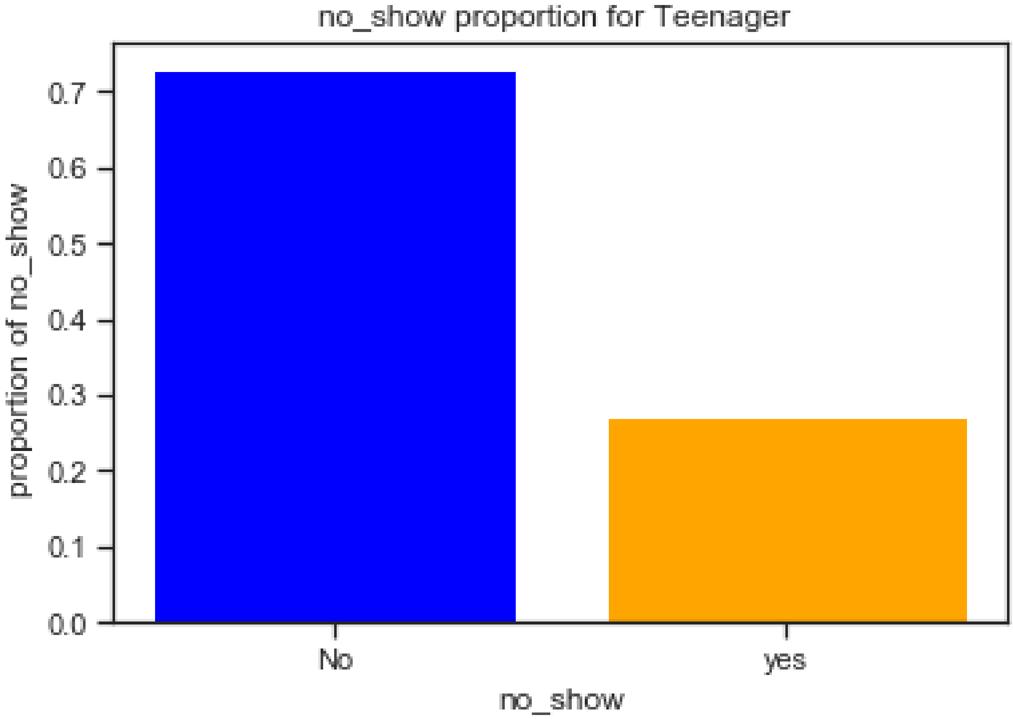


21 *Teenager :*

```
In [109]: mal_noshow_zeroage=df[(df.age_stage == 'Teenager') & (df.no_show == 'No')].shape[0]
          mal_yesshow_zeroage=df[(df.age_stage == 'Teenager') & (df.no_show == 'Yes')].shape[0
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Teenager stage   "No":{}'.format(proportion_no))
          print('proportion of no_show in Teenager stage   "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Teenager stage   "No":0.7287617383708234
proportion of no_show in Teenager stage   "Yes":0.2712382616291767
```

```
In [110]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Teenager ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

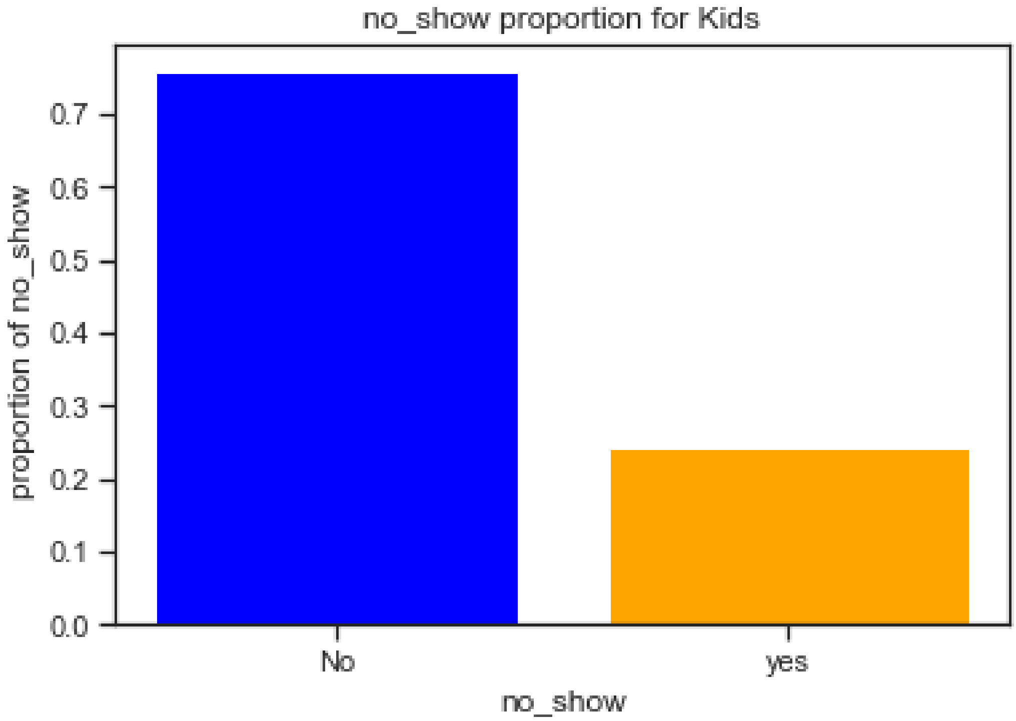


22 *Kids :*

```
In [111]: mal_noshow_zeroage=df[(df.age_stage == 'Kids') & (df.no_show == 'No')].shape[0]
          mal_yesshow_zeroage=df[(df.age_stage == 'Kids') & (df.no_show == 'Yes')].shape[0]
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Kid  stage   "No":{}'.format(proportion_no))
          print('proportion of no_show in Kid  stage   "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Kid  stage   "No":0.7571994715984148
proportion of no_show in Kid  stage   "Yes":0.2428005284015852
```

```
In [112]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Kids")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

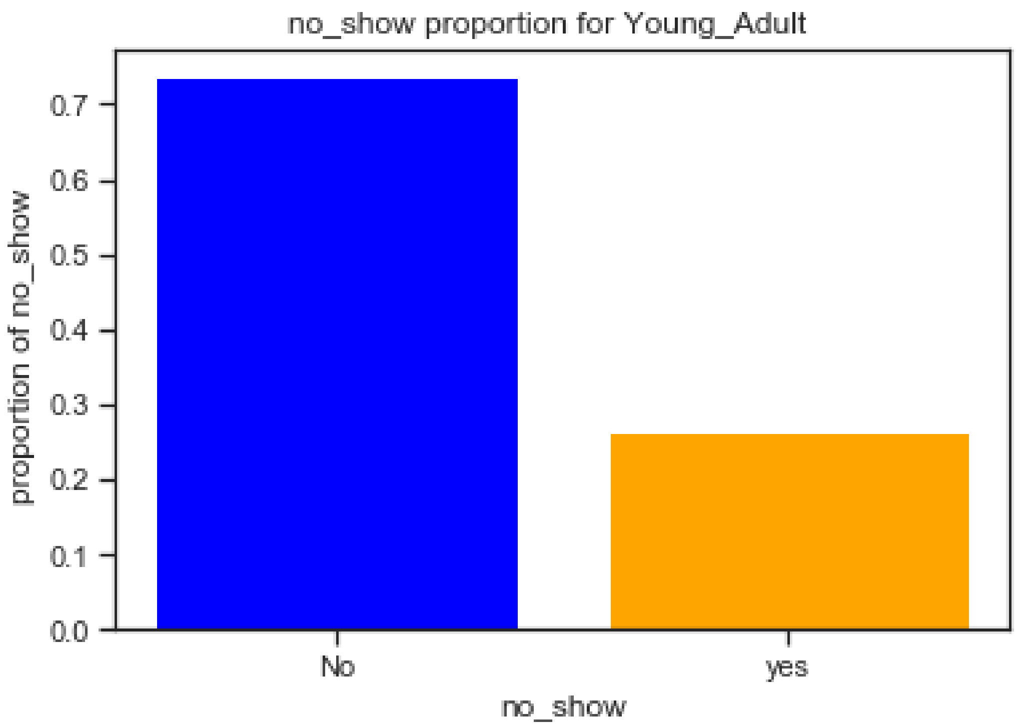


23 *Young_Adult :*

```
In [113]: mal_noshow_zeroage=df[(df.age_stage == 'Young_Adult') & (df.no_show == 'No')].shape[
          mal_yesshow_zeroage=df[(df.age_stage == 'Young_Adult') & (df.no_show == 'Yes')].shape
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Young_Adult   stage   "No":{}'.format(proportion_no)
          print('proportion of no_show in Young_Adult  stage   "Yes":{}'.format(proportion_yes
```

```
proportion of no_show in Young_Adult   stage   "No":0.736115569823435
proportion of no_show in Young_Adult  stage   "Yes":0.263884430176565
```

```
In [114]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Young_Adult   ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

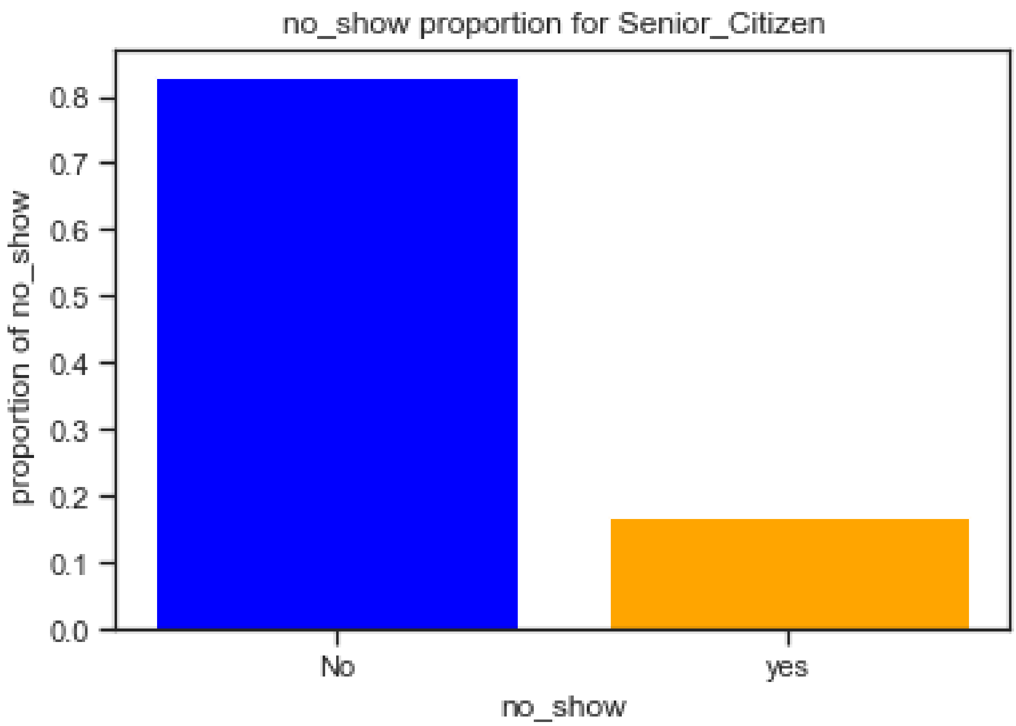


24 *Senior_Citizen :*

```
In [115]: mal_noshow_zeroage=df[(df.age_stage == 'Senior_Citizen') & (df.no_show == 'No')].sha
          mal_yesshow_zeroage=df[(df.age_stage == 'Senior_Citizen') & (df.no_show == 'Yes')].s
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Senior_Citizen  stage   "No":{}'.format(proportion_n
          print('proportion of no_show in Senior_Citizen  stage   "Yes":{}'.format(proportion_
```

```
proportion of no_show in Senior_Citizen  stage   "No":0.8292087835482747
proportion of no_show in Senior_Citizen  stage   "Yes":0.17079121645172535
```

```
In [116]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Senior_Citizen  ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

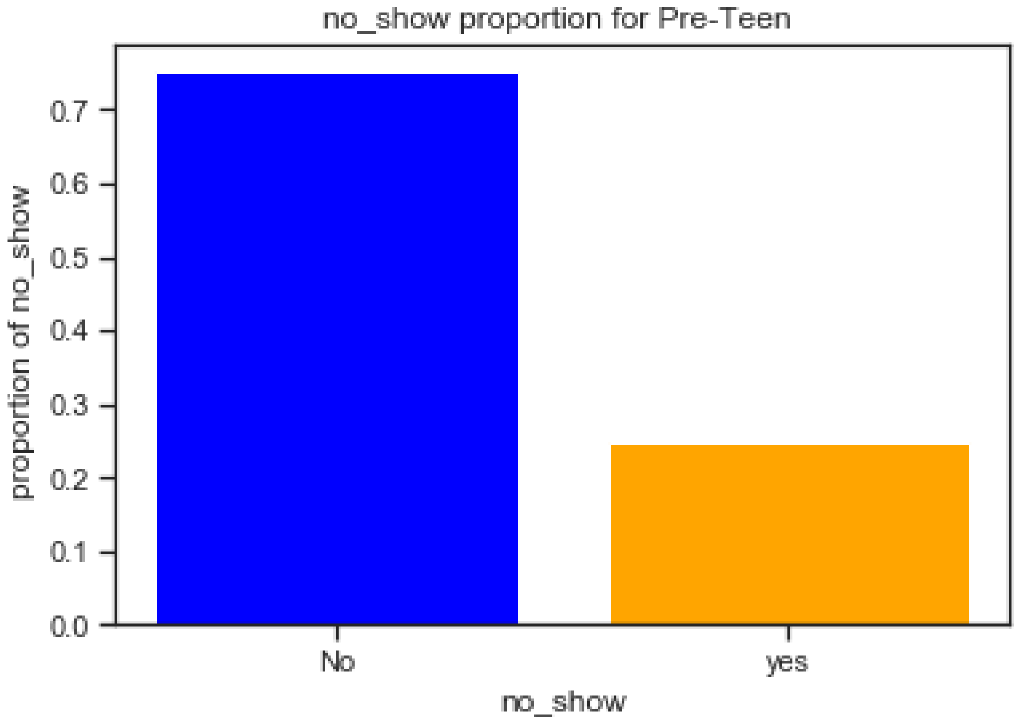


25 *Pre-Teen:*

```
In [117]: mal_noshow_zeroage=df[(df.age_stage == 'Pre-Teen') & (df.no_show == 'No')].shape[0]
          mal_yesshow_zeroage=df[(df.age_stage == 'Pre-Teen') & (df.no_show == 'Yes')].shape[0
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Pre-Teen   "No":{}'.format(proportion_no))
          print('proportion of no_show in Pre-Teen   "Yes":{}'.format(proportion_yes))
```

```
proportion of no_show in Pre-Teen   "No":0.7514571190674438
proportion of no_show in Pre-Teen   "Yes":0.2485428809325562
```

```
In [118]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Pre-Teen ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

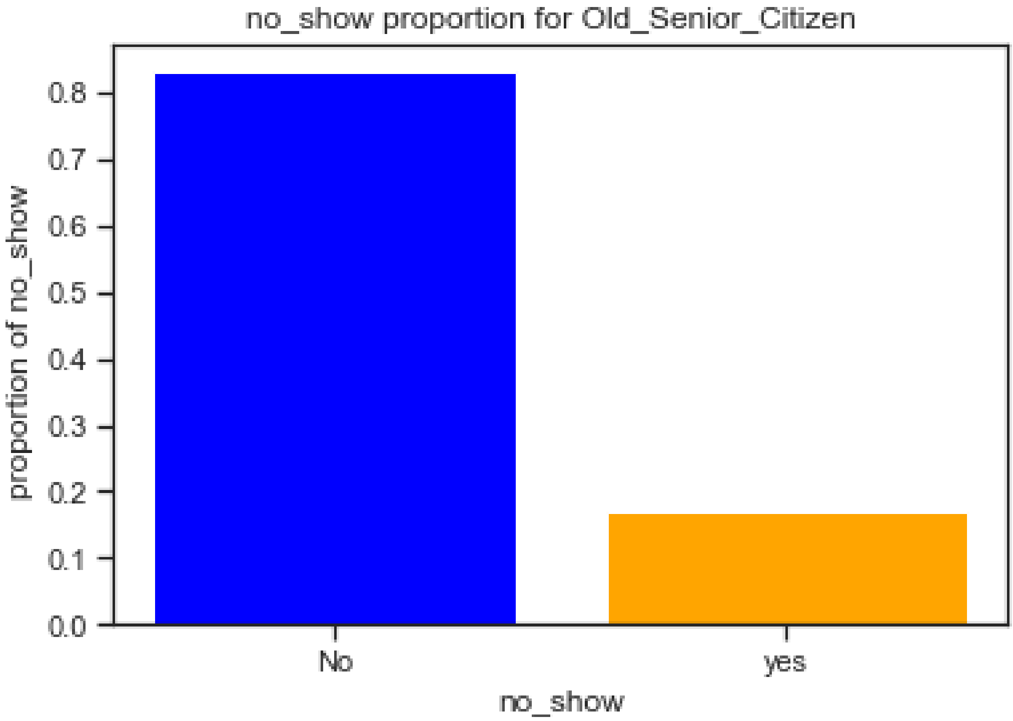


26 *Old_Senior_Citizen :*

```
In [119]: mal_noshow_zeroage=df[(df.age_stage == 'Old_Senior_Citizen') & (df.no_show == 'No')]
          mal_yesshow_zeroage=df[(df.age_stage == 'Old_Senior_Citizen') & (df.no_show == 'Yes'
          total=mal_noshow_zeroage+mal_yesshow_zeroage
          proportion_no=mal_noshow_zeroage/total
          proportion_yes=mal_yesshow_zeroage/total
          print('proportion of no_show in Old_Senior_Citizen  stage   "No":{}'.format(proporti
          print('proportion of no_show in Old_Senior_Citizen  stage   "Yes":{}'.format(proport
```

```
proportion of no_show in Old_Senior_Citizen  stage   "No":0.8306148055207027
proportion of no_show in Old_Senior_Citizen  stage   "Yes":0.16938519447929737
```

```
In [120]: colors=['blue','orange']
          plt.bar(["No", "yes"], [proportion_no, proportion_yes],color=colors)
          plt.title("no_show proportion for Old_Senior_Citizen  ")
          plt.xlabel("no_show")
          plt.ylabel("proportion of no_show ");
```

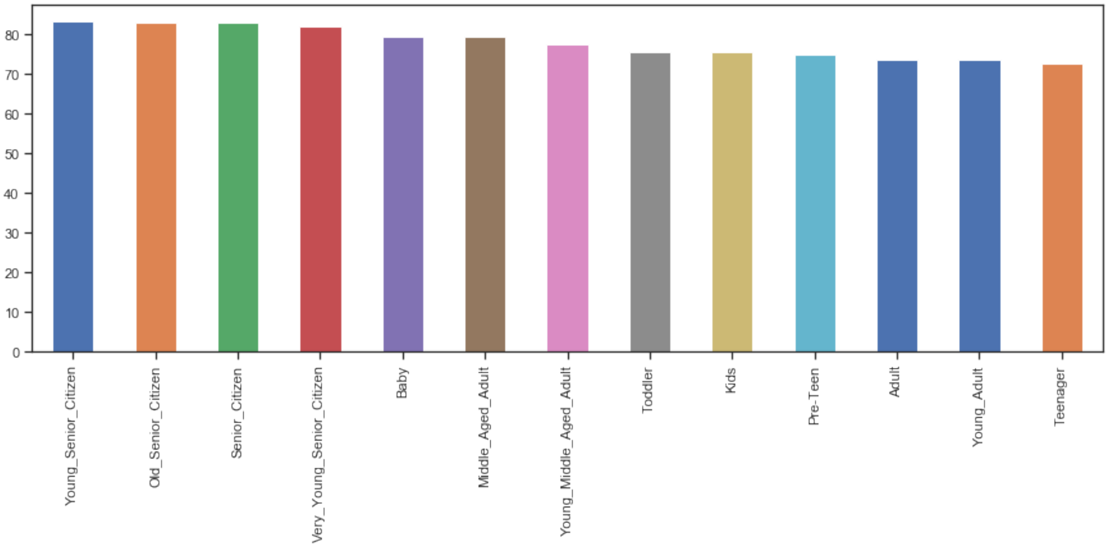


rankingof the percentage of the patients who will come to their appointment on time according to their age

```
In [121]: ranking= df.query('no_show=="No"').age_stage.value_counts()
          rankin= df.age_stage.value_counts()
          per=ranking/rankin*100
          per.sort_values(ascending=False)
```

```
Out[121]: Young_Senior_Citizen          83.514019
          Old_Senior_Citizen            83.061481
          Senior_Citizen                82.920878
          Very_Young_Senior_Citizen     82.170459
          Baby                          79.614204
          Middle_Aged_Adult             79.608071
          Young_Middle_Aged_Adult       77.563198
          Toddler                       75.771065
          Kids                          75.719947
          Pre-Teen                      75.145712
          Adult                         73.780726
          Young_Adult                   73.611557
          Teenager                      72.876174
          Name: age_stage, dtype: float64
```

```
In [122]: per.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```

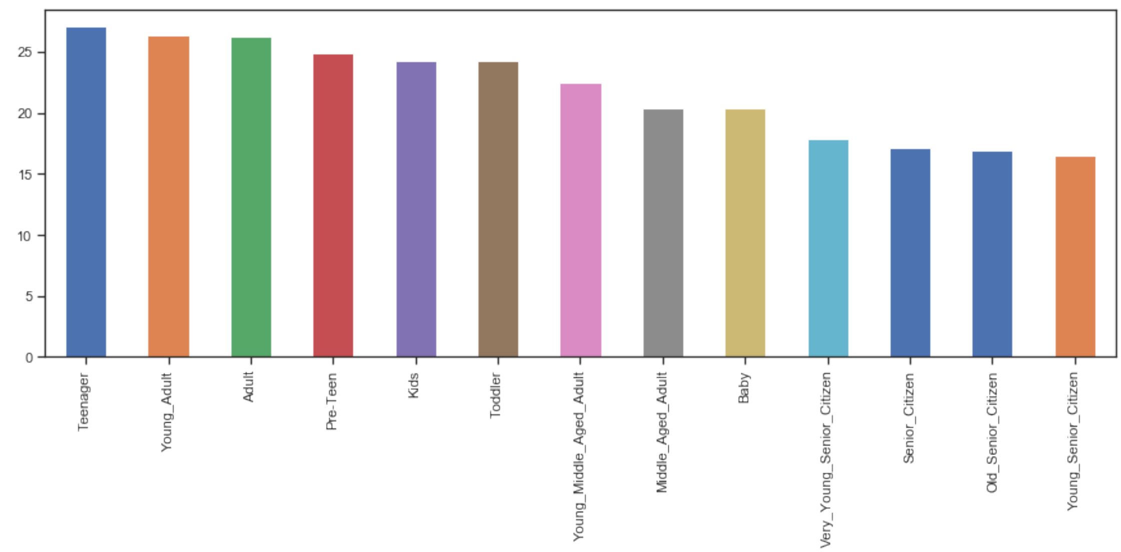


rankingof the percentage of the patients who will not come to their appointment according to their age

```
In [123]: ranking= df.query('no_show=="Yes"').age_stage.value_counts()
          rankin= df.age_stage.value_counts()
          per=ranking/rankin*100
          per.sort_values(ascending=False)
```

```
Out[123]: Teenager                     27.123826
          Young_Adult                  26.388443
          Adult                        26.219274
          Pre-Teen                     24.854288
          Kids                         24.280053
          Toddler                      24.228935
          Young_Middle_Aged_Adult      22.436802
          Middle_Aged_Adult            20.391929
          Baby                         20.385796
          Very_Young_Senior_Citizen    17.829541
          Senior_Citizen               17.079122
          Old_Senior_Citizen           16.938519
          Young_Senior_Citizen         16.485981
          Name: age_stage, dtype: float64
```

```
In [124]: per.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```



27 *conclusion :*

1. count number of patients who are bookig appointment in general is inversely proportional to their age which is not logic where the logic is as people become elder they will more expose to have diseases than youngers

- to discover the reason for that we need to see main clasification of peoples in Brazil
- patient with age more than or equal 55 years old have commitment for no_show appointment date more than 80%
- Babies with age less than 3 years old have commitment for no_show appointment date almost 80%
- patient with age range from 50 : 54 years old have commitment for no_show appointment date almost 80%
- patient with age range from 3 : 12 years old have commitment for no_show appointment date more than 75% but less than 80%
- patient with age range from 13 : 49 years old have commitment for no_show appointment date more than 70% and less than 75%

index	age of patient	commitment for no_show appointment date
1	3 years old	>80%
2	50:54 years old	almost =80%
3	3:12 years old	75%:80%
4	13:49 years old	70%:75%

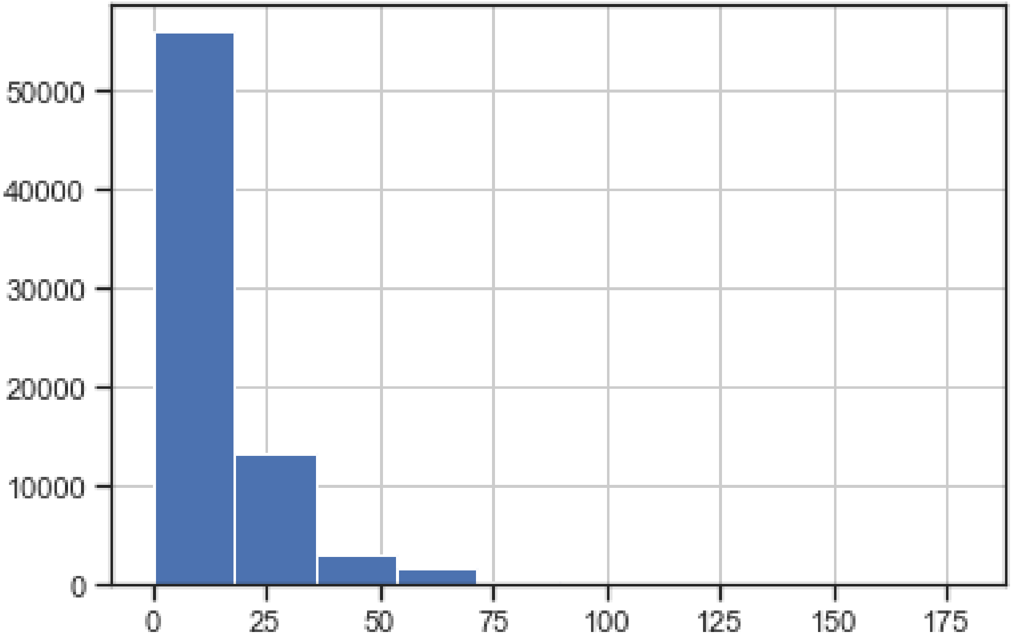
```
In [125]: df.head(3)
```

```
Out[125]:        patient_id  appointment_id gender schedule_day appointment_day   age  \
0  91637474953513         5122866      M   2015-12-03      2016-05-02   34
2  91637474953513         5648860      M   2016-05-02      2016-05-11   34
4  35864643985587         5358168      F   2016-02-17      2016-05-05   34

  neighborhood  scholarship  hypertension  diabetes  alcoholism  handicap  \
0   VILA RUBIM            0             1         0           0         0
2   VILA RUBIM            0             1         0           0         0
4  RESISTÊNCIA            0             0         0           0         0

   sms_received no_show schedule_day_week appointment_day_week  waiting_days  \
0             1     Yes          Thursday               Monday           151
2             1     Yes            Monday            Wednesday             9
4             1      No         Wednesday             Thursday            78

   id_value_counts  no_show_count age_stage
0                2            259     Adult
2                2            259     Adult
4                1            259     Adult
```

28 2-waiting days study:

Is there any relationship of the waiting days between the schedule_day and appointment_day affect on the commitment to attends?

```
In [126]: df.waiting_days.hist();
```



```
In [127]: df.waiting_days.describe()
```

```
Out[127]: count    74513.000000
          mean        11.273469
          std         16.238094
          min          0.000000
          25%          0.000000
          50%          4.000000
          75%         17.000000
          max        179.000000
          Name: waiting_days, dtype: float64
```

what we have ?

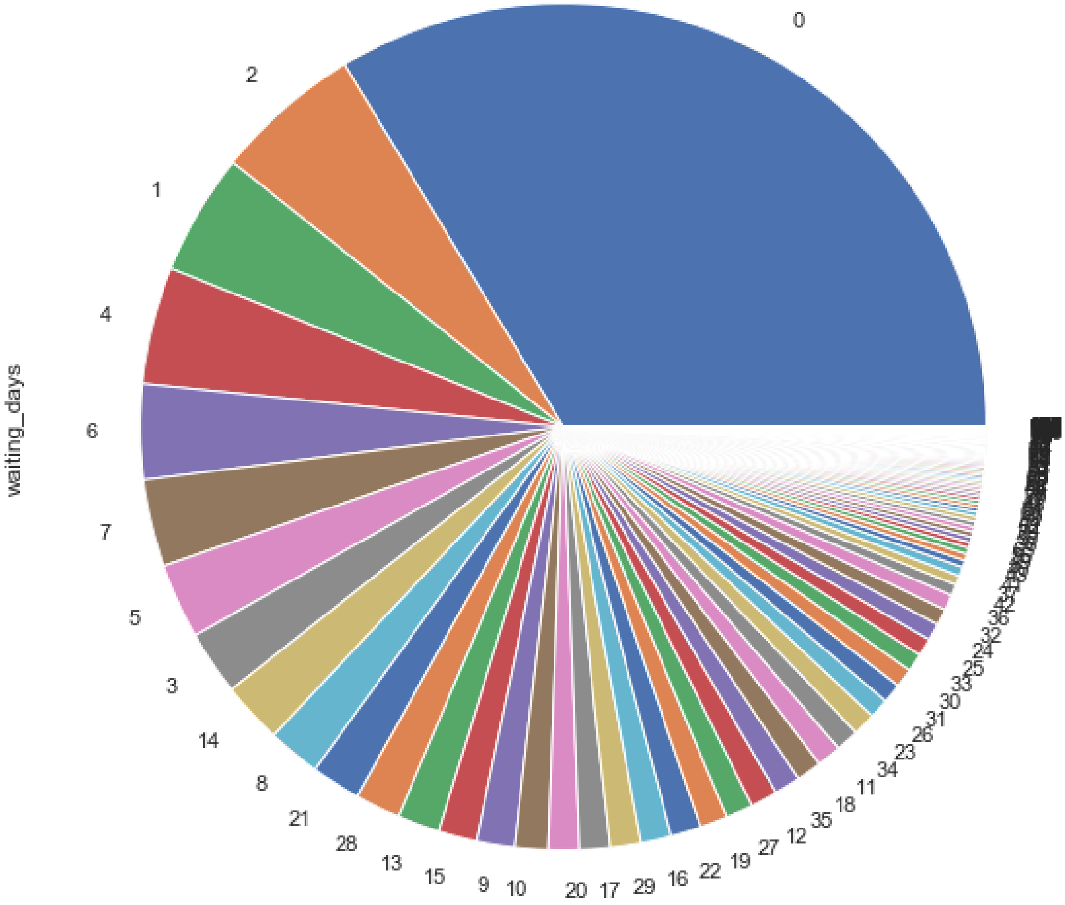
1. **The range of waiting days start from 0 day up to 179 day which mean more than 4 monthes !!! * The good news is that 75% of waiting days is 17 days or less**

28.0.1 To start analysis of relationshipe between waiting days and appointment attendens we need to answer

29 what are the amjor priods for waiting days ?

30 *1.visualize relationship*

```
In [128]: df.waiting_days.value_counts().plot(kind='pie',figsize=(25,10));
```



what are the Descriptive statistics of waiting days more than 17 day which is equal to 75% of waiting days of data

```
In [129]: df.query('waiting_days>17').describe()
```

```
Out[129]:         patient_id  appointment_id           age   scholarship  hypertension  \
          count  1.855300e+04    1.855300e+04  18553.000000  18553.000000  18553.000000
          mean   1.470247e+14    5.589674e+06     36.330405      0.083868      0.161753
          std    2.542109e+14    7.881323e+04     23.380833      0.277197      0.368234
          min    2.263866e+07    5.122866e+06      0.000000      0.000000      0.000000
          25%    4.335675e+12    5.551333e+06     16.000000      0.000000      0.000000
          50%    3.287563e+13    5.596419e+06     36.000000      0.000000      0.000000
          75%    9.493294e+13    5.639678e+06     55.000000      0.000000      0.000000
```

```
max    9.997482e+14    5.728757e+06    100.000000      1.000000      1.000000

           diabetes    alcoholism      handicap  sms_received  waiting_days  \
count  18553.000000  18553.000000  18553.000000  18553.000000  18553.000000
mean       0.052175      0.017787      0.012343      0.611276     34.063602
std        0.222385      0.132180      0.122451      0.487474     17.202653
min        0.000000      0.000000      0.000000      0.000000     18.000000
25%        0.000000      0.000000      0.000000      0.000000     22.000000
50%        0.000000      0.000000      0.000000      1.000000     29.000000
75%        0.000000      0.000000      0.000000      1.000000     37.000000
max        1.000000      1.000000      4.000000      1.000000    179.000000

       id_value_counts  no_show_count
count     18553.000000   18553.000000
mean          1.335094     223.901202
std           0.472036      96.222412
min           1.000000       1.000000
25%           1.000000     191.000000
50%           1.000000     222.000000
75%           2.000000     253.000000
max           2.000000     573.000000
```

filtering the data based on waiting days less than or equal 37 days which is equal to 93.75% of total data*

```
In [130]: df_37=df[df['waiting_days']<=37]
```

```
In [131]: no_show_mask_37=df_37[df_37['no_show']== 'No']
          no_show_mask_37.shape
```

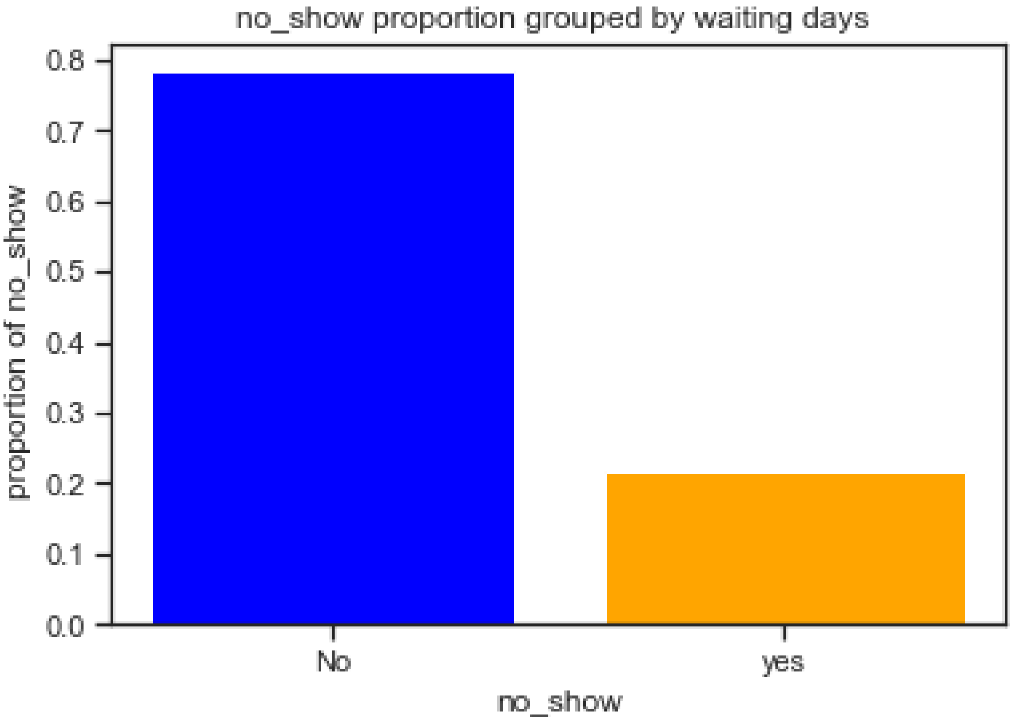
```
Out[131]: (54722, 20)
```

```
In [132]: print('Total number of patient who have waiting days upto 37 days are {} patient'.fo
          print('Number of patient who show up  :  {}  patient'.format(no_show_mask_37.shape[0
          print('percent of patient who show up {}'.format(no_show_mask_37.shape[0]/(df_37.wai
          print('percent of patient who were Not show up {} patient'.format((1-no_show_mask_37
```

```
Total number of patient who have waiting days upto 37 days are 69922 patient
Number of patient who show up  :  54722  patient
percent of patient who show up 78.2614913761048
percent of patient who were Not show up 21.738508623895203 patient
```

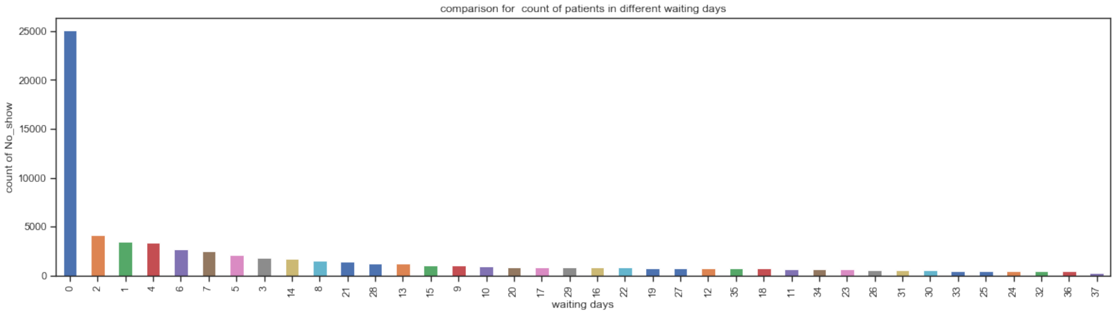
```
In [133]: mal_noshow_37=df[(df.waiting_days<37) & (df.no_show == 'No')].shape[0]
          mal_yesshow_37=df[(df.waiting_days<37) & (df.no_show =='Yes')].shape[0]
          total=mal_noshow_37+mal_yesshow_37
          proportion_no_37=mal_noshow_37/total
          proportion_yes_37=mal_yesshow_37/total
```

```
colors=['blue','orange']
plt.bar(["No", "yes"], [proportion_no_37, proportion_yes_37],color=colors)
plt.title("no_show proportion grouped by waiting days ")
plt.xlabel("no_show")
plt.ylabel("proportion of no_show ");
```



30.1 *count number of patients who book appointments according to waiting days*

```
In [134]: df_37.waiting_days.value_counts().plot(kind='bar',figsize=(20,5))
          plt.title('comparison for  count of patients in different waiting days')
          plt.xlabel('waiting days')
          plt.ylabel('count of No_show');
```



30.1.1 *find out trend lines of patient who show up and not show up according to waiting days*

30.2 *Trend lines of no_show according to patient's waiting days factor*

30.3 *Bulding up new column to follow no_show counts for every patient's waiting days*

```
In [135]: counts_no_yes=df.groupby('waiting_days').no_show.value_counts()
          counts_sorting=counts_no_yes.sort_values(ascending=True)
          counts_sorting_to_fram=counts_sorting.to_frame(name='no_show_count_waiting_days')
          merged = pd.merge(df, counts_sorting_to_fram, on='waiting_days',how='inner')
```

```
In [136]: merged.shape
```

```
Out[136]: (148973, 21)
```

```
In [137]: merged.drop_duplicates(['appointment_id'],inplace =True)
```

```
In [138]: merged.shape
```

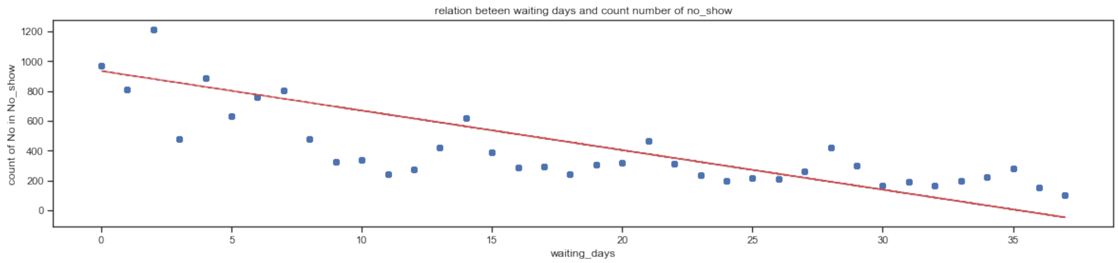
```
Out[138]: (74513, 21)
```

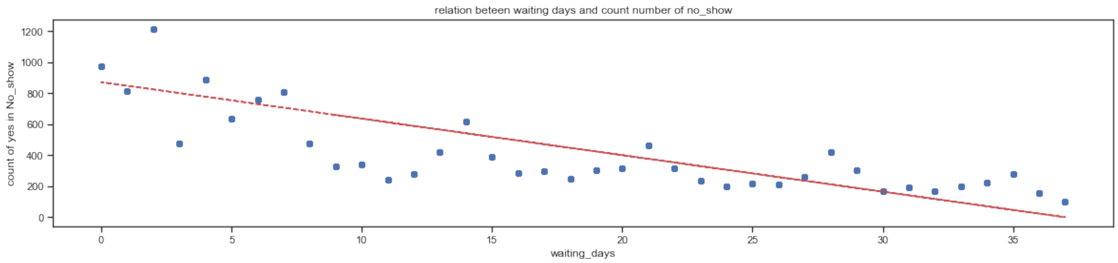
```
In [139]: df=merged
```

```
In [140]: df_37=df[df['waiting_days']<=37]
```

```
In [141]: df_no=df_37[df_37['no_show']=='No']
```

```
In [142]: df_no=df_37[df_37['no_show']=='No']
          plt.figure(figsize = (20,4))
          x = df_no['waiting_days']
          y = df_no['no_show_count_waiting_days']
          plt.title('relation beteen waiting days and count number of no_show')
          plt.xlabel('waiting_days')
          plt.ylabel('count of No in No_show')
          plt.scatter(x, y)
          z = np.polyfit(x, y, 1)
          p = np.poly1d(z)
          plt.plot(x,p(x),"r--")
          plt.show()


          df_no=df_37[df_37['no_show']=='Yes']
          plt.figure(figsize = (20,4))
          x = df_no['waiting_days']
          y = df_no['no_show_count_waiting_days']
          plt.title('relation beteen waiting days and count number of no_show')
          plt.xlabel('waiting_days')
          plt.ylabel('count of yes in No_show')
          plt.scatter(x, y)
          z = np.polyfit(x, y, 1)
          p = np.poly1d(z)
          plt.plot(x,p(x),"r--")
          plt.show()
```





from trend lines we see

30.3.1 1- in general count number of patients who show up is inversely proportional to their waiting days

30.3.2 2- there are some some periodes where the trend line is directrly proprtional to their waiting days

we want to slice this range according to different stageto study the relation between waiting days and no_show

31 *2.build intution*

32 clasify waiting days in to different groups

The will be divided into 2 groups where 0 day mean today or in other words schedual day is appointment day there are 11 group to cover the data range of waiting days A:(0:2)waiting dayes B:(3:6)waiting dayes C:(7:9)waiting dayes D:(10:13)waiting dayes E:(14:16)waiting dayes F:(17:20)waiting dayes G:(21:23)waiting dayes H:(24:27)waiting dayes I:(28:30)waiting dayes J:(31:34)waiting dayes K:(35:37)waiting dayes

---

33 comparison for different waiting days periodes versuse no_show

```
In [143]: # Bin edges that will be used to "cut" the data into groups
          # we use -1 the start of sries to include  0 day
          bin_edges = [-1,3,7,10,14,17,21,24,28,31,35,38] # list for range of waiting days
          # Labels for different age_stage groups
          bin_names = ['A','B','C','D','E','F','G','H','I','J','K'] # Name each waiting period
          # Creates waiting_days_period column
          df['waiting_days_periodes'] = pd.cut(df['waiting_days'], bin_edges, labels=bin_names
          # Checks for successful creation of this column on 37 waiting days data frame
          df_37=df[df['waiting_days']<=37]
          df_37.head(100)
```

```
Out[143]:          patient_id  appointment_id gender schedule_day appointment_day  age  \
          1     91637474953513         5648860      M   2016-05-02      2016-05-11   34
          3     94791461376591         5626367      F   2016-04-27      2016-05-06   34
          5    885182199446541         5607910      M   2016-04-20      2016-04-29   34
          7     91581872616666         5605581      F   2016-04-20      2016-04-29   34
          9    274726472366828         5604145      F   2016-04-20      2016-04-29   34
          11      993367389881         5614782      F   2016-04-25      2016-05-04   34
          13      894684839917         5620979      M   2016-04-26      2016-05-05   34
          15    91396129147454         5625472      M   2016-04-27      2016-05-06   34
          17   275921642384699         5729723      F   2016-05-24      2016-06-02   34
          19    33796711324618         5675853      F   2016-05-09      2016-05-18   34
          21     3167613547214         5704998      F   2016-05-16      2016-05-25   34
          23     1872193747671         5701264      F   2016-05-16      2016-05-25   34
          25    38477668331677         5703404      F   2016-05-16      2016-05-25   34
          27    13582398467191         5733348      F   2016-05-24      2016-06-02   34
          29    84293276778177         5747829      F   2016-05-30      2016-06-08   34
          31    11444395356392         5655277      F   2016-05-03      2016-05-12   67
          33    44795641479699         5614358      F   2016-04-25      2016-05-04   67
          35       69751718234         5618518      F   2016-04-26      2016-05-05   67
          37      117611185643         5646477      F   2016-05-02      2016-05-11   67
          39   939418955234227         5649892      F   2016-05-03      2016-05-12   67
          41   524558268349535         5657267      F   2016-05-04      2016-05-13   67
          43   142388537216181         5738753      F   2016-05-25      2016-06-03   67
          45    48611852454666         5673393      F   2016-05-09      2016-05-18   67
          47    82842436595351         5730923      F   2016-05-24      2016-06-02   67
          49   816689882335756         5686605      M   2016-05-11      2016-05-20   67
          51     7651747371138         5732509      F   2016-05-24      2016-06-02   67
          53   296793351588828         5736729      F   2016-05-25      2016-06-03   67
          55     8649713541624         5736771      M   2016-05-25      2016-06-03   67
          57     3491696986429         5618959      F   2016-04-26      2016-05-05   63
          59     1634695362895         5621317      F   2016-04-26      2016-05-05   63
          ..               ...             ...    ...          ...             ...  ...
          141   59743452443258         5606011      F   2016-04-20      2016-04-29   27
          143  455744947621595         5609278      F   2016-04-20      2016-04-29   27
          145  319186789767291         5612797      M   2016-04-25      2016-05-04   27
```

```
147    7756471622192         5623811      M   2016-04-26        2016-05-05   27
149      75478617958         5620204      F   2016-04-26        2016-05-05   27
151   63977649132931         5619845      M   2016-04-26        2016-05-05   27
153   69926313571218         5659235      M   2016-05-04        2016-05-13   27
155   97465285388477         5740741      F   2016-05-25        2016-06-03   27
157     732726265216         5645639      F   2016-05-02        2016-05-11   27
159  436829378627619         5654037      M   2016-05-03        2016-05-12   27
161  938619879977766         5660243      F   2016-05-04        2016-05-13   27
163     821357996568         5676443      F   2016-05-09        2016-05-18   27
165  123811511437886         5701280      F   2016-05-16        2016-05-25   27
167  567736747316632         5739952      F   2016-05-25        2016-06-03   27
169  412286988986786         5730068      F   2016-05-24        2016-06-02   27
171   19814743688242         5739266      F   2016-05-25        2016-06-03   27
173   66375293129641         5747359      F   2016-05-30        2016-06-08   27
175   86418638498674         5618459      M   2016-04-26        2016-05-05   80
177    9998344157464         5650630      F   2016-05-03        2016-05-12   80
179   77912173774285         5743429      F   2016-05-30        2016-06-08   48
181  494954649811164         5644535      F   2016-05-02        2016-05-11   48
183   89821873624379         5672208      F   2016-05-09        2016-05-18   48
185   61519151647552         5625407      F   2016-04-27        2016-05-06   48
187    9287756745869         5733135      F   2016-05-24        2016-06-02   48
189    9289199839649         5643749      F   2016-05-02        2016-05-11   48
191  372671549587268         5646404      M   2016-05-02        2016-05-11   48
193   41126515579995         5650311      F   2016-05-03        2016-05-12   48
195    3439294511317         5678012      F   2016-05-10        2016-05-19   48
197    3896287636987         5677140      F   2016-05-09        2016-05-18   48
199      94553682868         5679642      F   2016-05-10        2016-05-19   48

          neighborhood  scholarship  hypertension  diabetes  \
1           VILA RUBIM            0             1         0
3          RESISTÊNCIA            1             0         0
5          JOANA DťARC            0             0         0
7               JABOUR            0             0         0
9       FORTE SÃO JOÃO            0             0         0
11      BENTO FERREIRA            0             0         0
13            DA PENHA            0             0         0
15    ILHA DO PRÍNCIPE            0             0         0
17    ILHA DO PRÍNCIPE            0             0         0
19      JARDIM CAMBURI            0             0         0
21              BONFIM            0             0         0
23             ITARARÉ            1             0         0
25             ITARARÉ            0             0         0
27      NOVA PALESTINA            0             1         0
29         CRUZAMENTO             0             0         0
31              JABOUR            0             1         0
33       SANTO ANTÔNIO            0             1         1
35    ILHA DO PRÍNCIPE            0             0         0
37        SANTA MARTHA            0             1         0
```

```
39    ILHA DO PRÍNCIPE            0             0         0
41          ANDORINHAS            0             1         0
43      JARDIM CAMBURI            0             0         0
45      BENTO FERREIRA            0             1         0
47        PRAIA DO SUÁ            0             1         1
49             MARUÍPE            0             0         0
51   MORADA DE CAMBURI            0             1         0
53   MORADA DE CAMBURI            0             1         1
55      JARDIM CAMBURI            0             0         0
57         SANTO ANDRÉ            0             1         1
59       SANTO ANTÔNIO            0             1         0
..                 ...          ...           ...       ...
141             BONFIM            1             0         0
143      SANTO ANTÔNIO            0             0         0
145           REDENÇÃO            0             0         0
147       SANTA MARTHA            0             1         0
149   ILHA DO PRÍNCIPE            1             0         0
151     NOVA PALESTINA            0             0         0
153              ROMÃO            0             0         0
155       SANTA MARTHA            0             0         0
157     GRANDE VITÓRIA            0             0         0
159   ILHA DO PRÍNCIPE            0             0         0
161           DA PENHA            0             0         0
163       SÃO BENEDITO            1             0         0
165        SANTO ANDRÉ            0             0         0
167  ILHA DAS CAIEIRAS            0             0         0
169      SANTOS DUMONT            0             0         0
171     BENTO FERREIRA            0             0         0
173           GURIGICA            1             0         0
175   ILHA DO PRÍNCIPE            0             1         0
177   ILHA DO PRÍNCIPE            0             1         0
179     ENSEADA DO SUÁ            0             0         0
181         VILA RUBIM            0             0         0
183     BENTO FERREIRA            0             1         0
185  ILHA DAS CAIEIRAS            0             0         0
187       SANTA TEREZA            0             0         0
189       SANTA MARTHA            1             0         0
191        MARIA ORTIZ            0             0         0
193   ILHA DO PRÍNCIPE            0             0         0
195         ANDORINHAS            0             1         1
197     JARDIM CAMBURI            0             0         0
199      SANTO ANTÔNIO            0             1         0

             ...           sms_received  no_show  schedule_day_week  \
1            ...                      1      Yes             Monday
3            ...                      1       No          Wednesday
5            ...                      1       No          Wednesday
7            ...                      1      Yes          Wednesday
```

```
9            ...                      1      Yes           Wednesday
11           ...                      1      Yes              Monday
13           ...                      1       No             Tuesday
15           ...                      1       No           Wednesday
17           ...                      1       No             Tuesday
19           ...                      0      Yes              Monday
21           ...                      1       No              Monday
23           ...                      1       No              Monday
25           ...                      1      Yes              Monday
27           ...                      1       No             Tuesday
29           ...                      1       No              Monday
31           ...                      1       No             Tuesday
33           ...                      1       No              Monday
35           ...                      0       No             Tuesday
37           ...                      1       No              Monday
39           ...                      0       No             Tuesday
41           ...                      0       No           Wednesday
43           ...                      1      Yes           Wednesday
45           ...                      0       No              Monday
47           ...                      0       No             Tuesday
49           ...                      0       No           Wednesday
51           ...                      1       No             Tuesday
53           ...                      1      Yes           Wednesday
55           ...                      1       No           Wednesday
57           ...                      1       No             Tuesday
59           ...                      1      Yes             Tuesday
..           ...                    ...      ...                 ...
141          ...                      1      Yes           Wednesday
143          ...                      1       No           Wednesday
145          ...                      1       No              Monday
147          ...                      1       No             Tuesday
149          ...                      1       No             Tuesday
151          ...                      1      Yes             Tuesday
153          ...                      0       No           Wednesday
155          ...                      1       No           Wednesday
157          ...                      1      Yes              Monday
159          ...                      1      Yes             Tuesday
161          ...                      0       No           Wednesday
163          ...                      0       No              Monday
165          ...                      1       No              Monday
167          ...                      1      Yes           Wednesday
169          ...                      1       No             Tuesday
171          ...                      1       No           Wednesday
173          ...                      0       No              Monday
175          ...                      1       No             Tuesday
177          ...                      0       No             Tuesday
179          ...                      1      Yes              Monday
181          ...                      1       No              Monday
```

```
183          ...                      0       No             Monday
185          ...                      1       No          Wednesday
187          ...                      1       No            Tuesday
189          ...                      1       No             Monday
191          ...                      1       No             Monday
193          ...                      1       No            Tuesday
195          ...                      0       No            Tuesday
197          ...                      0       No             Monday
199          ...                      0       No            Tuesday

    appointment_day_week waiting_days id_value_counts  no_show_count  \
1              Wednesday            9               2            259
3                 Friday            9               2            259
5                 Friday            9               1            259
7                 Friday            9               2            259
9                 Friday            9               2            259
11             Wednesday            9               1            259
13              Thursday            9               1            259
15                Friday            9               2            259
17              Thursday            9               2            259
19             Wednesday            9               2            259
21             Wednesday            9               1            259
23             Wednesday            9               1            259
25             Wednesday            9               1            259
27              Thursday            9               1            259
29             Wednesday            9               1            259
31              Thursday            9               1            111
33             Wednesday            9               1            111
35              Thursday            9               2            111
37             Wednesday            9               2            111
39              Thursday            9               2            111
41                Friday            9               1            111
43                Friday            9               1            111
45             Wednesday            9               1            111
47              Thursday            9               2            111
49                Friday            9               1            111
51              Thursday            9               2            111
53                Friday            9               1            111
55                Friday            9               1            111
57              Thursday            9               1            121
59              Thursday            9               1            121
..                   ...          ...             ...            ...
141               Friday            9               1            262
143               Friday            9               2            262
145            Wednesday            9               1            262
147             Thursday            9               2            262
149             Thursday            9               2            262
151             Thursday            9               1            262
```

```
153             Friday          9           2          262
155             Friday          9           2          262
157          Wednesday          9           1          262
159           Thursday          9           1          262
161             Friday          9           1          262
163          Wednesday          9           2          262
165          Wednesday          9           1          262
167             Friday          9           1          262
169           Thursday          9           2          262
171             Friday          9           2          262
173          Wednesday          9           1          262
175           Thursday          9           1           53
177           Thursday          9           1           53
179          Wednesday          9           2          189
181          Wednesday          9           2          189
183          Wednesday          9           2          189
185             Friday          9           1          189
187           Thursday          9           1          189
189          Wednesday          9           2          189
191          Wednesday          9           1          189
193           Thursday          9           1          189
195           Thursday          9           2          189
197          Wednesday          9           1          189
199           Thursday          9           1          189

                  age_stage  no_show_count_waiting_days  \
1                     Adult                         325
3                     Adult                         325
5                     Adult                         325
7                     Adult                         325
9                     Adult                         325
11                    Adult                         325
13                    Adult                         325
15                    Adult                         325
17                    Adult                         325
19                    Adult                         325
21                    Adult                         325
23                    Adult                         325
25                    Adult                         325
27                    Adult                         325
29                    Adult                         325
31      Young_Senior_Citizen                        325
33      Young_Senior_Citizen                        325
35      Young_Senior_Citizen                        325
37      Young_Senior_Citizen                        325
39      Young_Senior_Citizen                        325
41      Young_Senior_Citizen                        325
43      Young_Senior_Citizen                        325
```

```
45        Young_Senior_Citizen                         325
47        Young_Senior_Citizen                         325
49        Young_Senior_Citizen                         325
51        Young_Senior_Citizen                         325
53        Young_Senior_Citizen                         325
55        Young_Senior_Citizen                         325
57   Very_Young_Senior_Citizen                         325
59   Very_Young_Senior_Citizen                         325
..                         ...                         ...
141                      Adult                         325
143                      Adult                         325
145                      Adult                         325
147                      Adult                         325
149                      Adult                         325
151                      Adult                         325
153                      Adult                         325
155                      Adult                         325
157                      Adult                         325
159                      Adult                         325
161                      Adult                         325
163                      Adult                         325
165                      Adult                         325
167                      Adult                         325
169                      Adult                         325
171                      Adult                         325
173                      Adult                         325
175             Senior_Citizen                         325
177             Senior_Citizen                         325
179    Young_Middle_Aged_Adult                         325
181    Young_Middle_Aged_Adult                         325
183    Young_Middle_Aged_Adult                         325
185    Young_Middle_Aged_Adult                         325
187    Young_Middle_Aged_Adult                         325
189    Young_Middle_Aged_Adult                         325
191    Young_Middle_Aged_Adult                         325
193    Young_Middle_Aged_Adult                         325
195    Young_Middle_Aged_Adult                         325
197    Young_Middle_Aged_Adult                         325
199    Young_Middle_Aged_Adult                         325

    waiting_days_periodes
1                       C
3                       C
5                       C
7                       C
9                       C
11                      C
13                      C
```

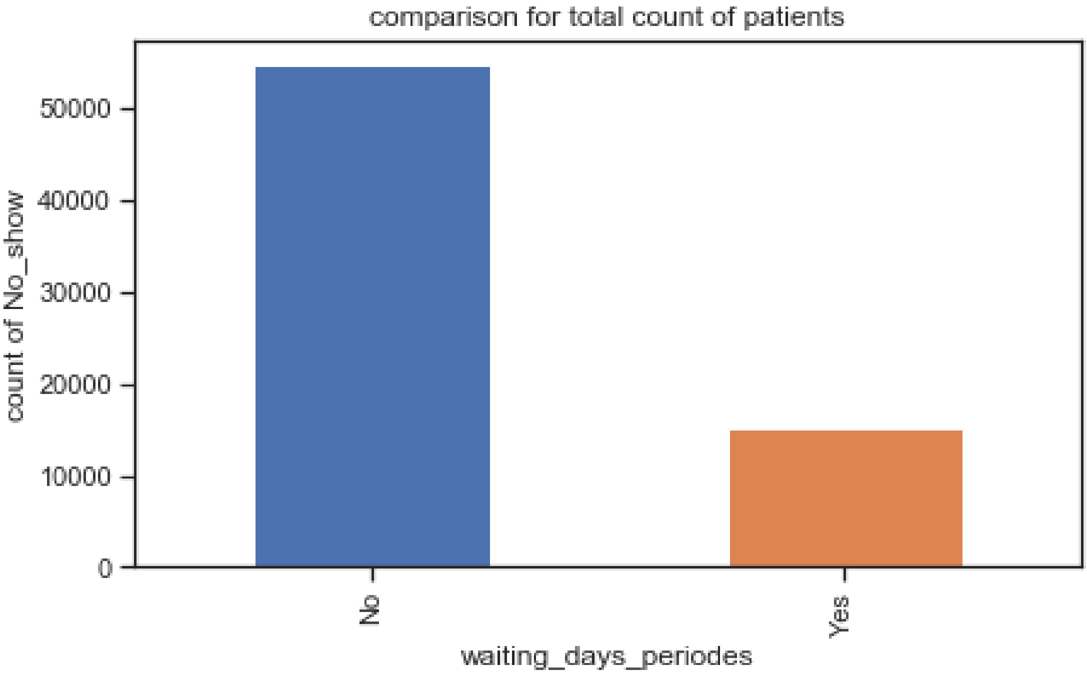
```
15                      C
17                      C
19                      C
21                      C
23                      C
25                      C
27                      C
29                      C
31                      C
33                      C
35                      C
37                      C
39                      C
41                      C
43                      C
45                      C
47                      C
49                      C
51                      C
53                      C
55                      C
57                      C
59                      C
..                    ...
141                     C
143                     C
145                     C
147                     C
149                     C
151                     C
153                     C
155                     C
157                     C
159                     C
161                     C
163                     C
165                     C
167                     C
169                     C
171                     C
173                     C
175                     C
177                     C
179                     C
181                     C
183                     C
185                     C
187                     C
```

```
189                    C
191                    C
193                    C
195                    C
197                    C
199                    C

[100 rows x 22 columns]
```

```
In [144]: df_37.groupby('no_show').waiting_days_periodes.count()
```

```
Out[144]: no_show
          No     54722
          Yes    15200
          Name: waiting_days_periodes, dtype: int64
```

```
In [145]: df_37.groupby('no_show').waiting_days_periodes.count().plot(kind ='bar',figsize=(7,4
          plt.title('comparison for total count of patients')
          plt.xlabel('waiting_days_periodes')
          plt.ylabel('count of No_show');
```

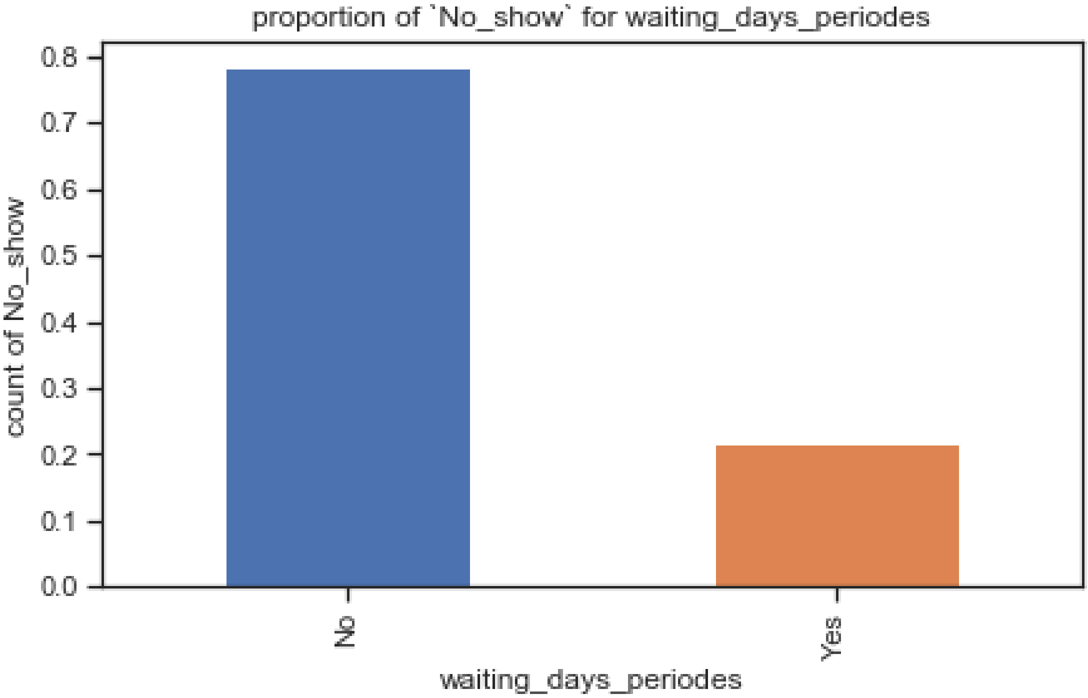


```
In [146]: print("proportion of `No_show` for waiting_days_periodes  => {}".format(df_37.groupb
```

```
proportion of `No_show` for waiting_days_periodes  => no_show
No     0.782615
```

```
Yes    0.217385
Name: waiting_days_periodes, dtype: float64
```

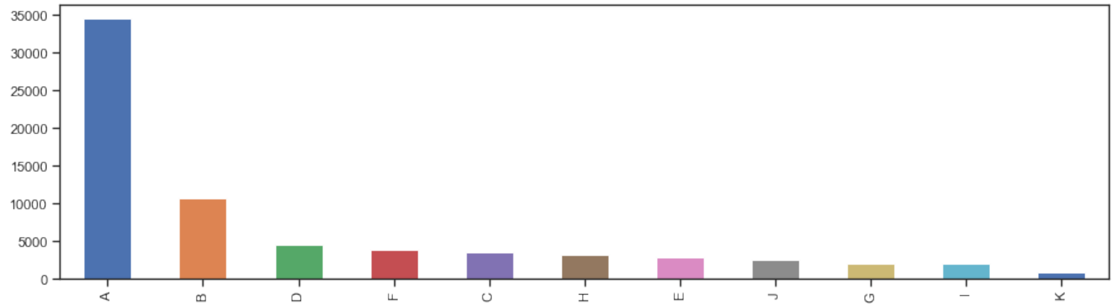
```
In [147]: (df_37.groupby('no_show').waiting_days_periodes.count()/df_37.waiting_days_periodes.c
          plt.title('proportion of `No_show` for waiting_days_periodes')
          plt.xlabel('waiting_days_periodes')
          plt.ylabel('count of No_show');
```



34 *sorting data sets for different waiting_days_periodes*

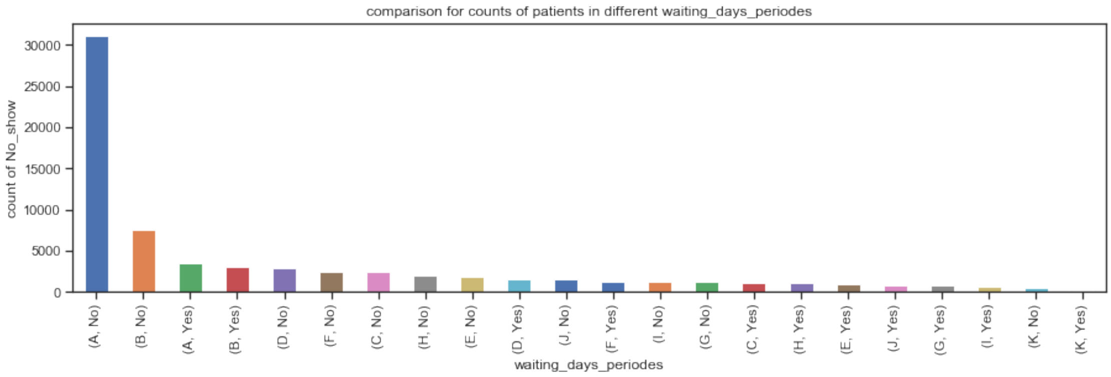
```
In [148]: df_37.waiting_days_periodes.value_counts()

Out[148]: A    34539
          B    10662
          D     4402
          F     3786
          C     3524
          H     3127
          E     2833
          J     2371
          G     1999
          I     1964
          K      715
          Name: waiting_days_periodes, dtype: int64
```

```
In [149]: df_37['waiting_days_periodes'].value_counts().plot(kind='bar',figsize=(15,4));
```



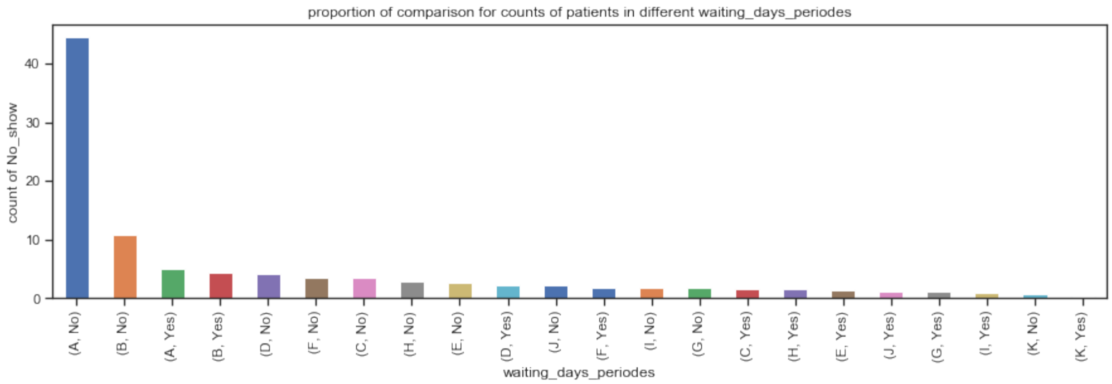
34.1 *comparison of counts of patients for no_show in different waiting_days_periodes*

```
In [150]: fr=df_37.groupby('waiting_days_periodes').no_show.value_counts();
          fr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
          plt.title('comparison for counts of patients in different waiting_days_periodes')
          plt.xlabel('waiting_days_periodes')
          plt.ylabel('count of No_show');
```



34.1.1 proportional comparison of counts of patients for no_show in different waiting_days_periodes

```
In [151]: tr=((df_37.groupby('waiting_days_periodes').no_show.value_counts())/df_37.age_stage.c
          tr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
          plt.title('proportion of comparison for counts of patients in different waiting_days_
          plt.xlabel('waiting_days_periodes')
          plt.ylabel('count of No_show');
```



neumerical proportional comparison for count of patients versus no_show in different waiting_days_periodes

```
In [152]: tr=((df_37.groupby('waiting_days_periodes').no_show.value_counts())/df_37.waiting_day
          tr.sort_values(ascending=False)
```

```
Out[152]: waiting_days_periodes  no_show
          A                      No         44.428077
          B                      No         10.844942
          A                      Yes         4.968393
          B                      Yes         4.403478
          D                      No          4.067389
          F                      No          3.511055
          C                      No          3.410944
          H                      No          2.884643
          E                      No          2.658677
          D                      Yes         2.228197
          J                      No          2.145248
          F                      Yes         1.903550
          I                      No          1.864935
          G                      No          1.787706
          C                      Yes         1.628958
          H                      Yes         1.587483
          E                      Yes         1.392981
          J                      Yes         1.245674
          G                      Yes         1.071194
          I                      Yes         0.943909
          K                      No          0.657876
                                 Yes         0.364692
          Name: no_show, dtype: float64
```

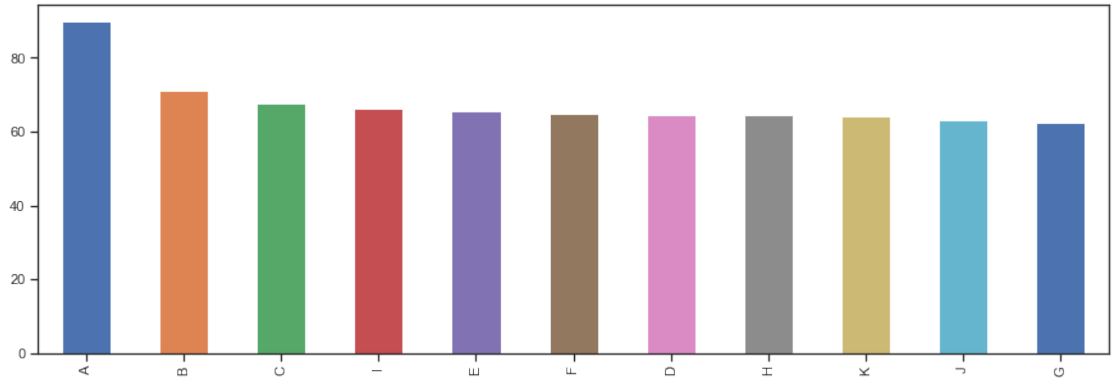
35 *3.creat more and describtive feture*

rankingof the percentage of the patients who will come to their appointment on time according to their waiting_days_periodes

```
In [153]: ranking= df_37.query('no_show=="No"'). waiting_days_periodes.value_counts()
          rankin= df_37. waiting_days_periodes.value_counts()
          per1=ranking/rankin*100
          per1.sort_values(ascending=False)
```

```
Out[153]: A    89.941805
          B    71.121741
          C    67.678774
          I    66.395112
          E    65.619485
          F    64.844163
          D    64.606997
          H    64.502718
          K    64.335664
          J    63.264445
          G    62.531266
          Name: waiting_days_periodes, dtype: float64
```

```
In [154]: per1.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```



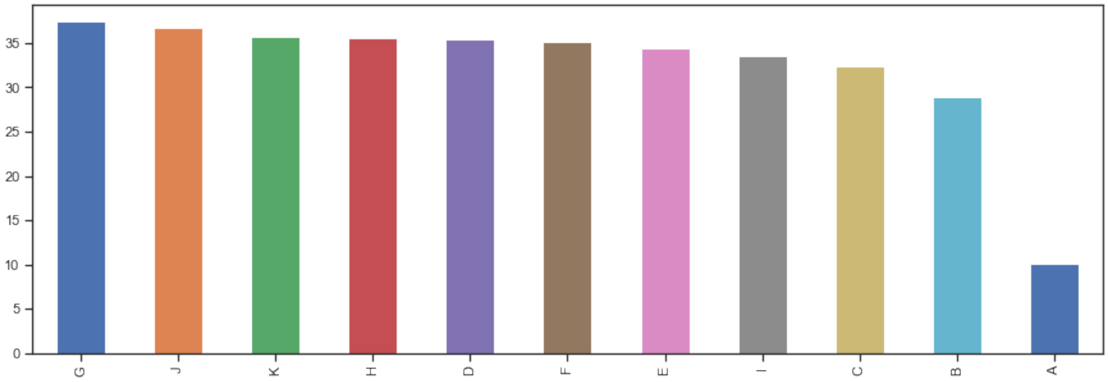
rankingof the percentage of the patients who will not come to their appointment on time according to their waiting_days_periodes

```
In [155]: ranking= df_37.query('no_show=="Yes"').waiting_days_periodes.value_counts()
          rankin= df_37.waiting_days_periodes.value_counts()
          per2=ranking/rankin*100
          per2.sort_values(ascending=False)
```

```
Out[155]: G    37.468734
          J    36.735555
          K    35.664336
          H    35.497282
          D    35.393003
          F    35.155837
          E    34.380515
```

```
I    33.604888
C    32.321226
B    28.878259
A    10.058195
Name: waiting_days_periodes, dtype: float64
```

```
In [156]: per2.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```



36 *4.conclusion :*

count number of patients who are bookig appointment in general is inversely proportional to their waiting days which is logic
1. patient who wait from 0:2 dayes they have commitment for no_show appointment date almost 90% * patient who wait from 3:6 dayes the commitment for no_show appointment date drpoed to 71,12% * patient who wait from 7:9 dayes they have commitment for no_show appointment date almost 67.67% ### surprse 1:
* patient who wait from 28:30 dayes have commitment for no_show appointment date almost 66.39% which is not logic so those patients need more investigation!!! * patient who wait from 14:16 dayes they have commitment for no_show appointment date almost 65.61% * patient who wait from 17:20 dayes they have commitment for no_show appointment date almost 64.84% ### surprise2:
* patient who wait from 10:13 dayes have commitment for no_show appointment date almost 64.60% which is not logic so those patients need more investigation!!!
* patient who wait from 24:27 dayes they have commitment for no_show appointment date almost 64.50% ### surprise3:
* patient who wait from 35:37 dayes they have commitment for no_show appointment date almost 64.33% which is not logic so those patients need more investigation!!!
* patient who wait from 31:34 dayes they have commitment for no_show appointment date almost 63.26% ### surprise4:
* patient who wait from 21:23 dayes they have commitment for no_show appointment date almost 62.53% which is not logic so those patients need more investigation!!!

37 *NOTES:*

1. patient who wait from 28:30 dayes have commitment for no_show appointment date almost 66.39%

- patient who wait from 10:13 dayes have commitment for no_show appointment date almost 64.60%
- patient who wait from 35:37 dayes they have commitment for no_show appointment date almost 64.33%

- patient who wait from 21:23 dayes they have commitment for no_show appointment date almost 62.53%

NOTE:
PERIOD BETWEEN 28:37 WAITING DAYS have commitment for no_show appointment date MORE THAN PERIOD BETWEEN 10:23 WAITING DAYS THAT MEAN ending and starting of month better than middel of the month may be that related to financial reasons

38 *3- gender study:*

Is there any relation between patients gender and their commitment to appointment attendens?

```
In [157]: df.head(3)
```

```
Out[157]:        patient_id  appointment_id gender schedule_day appointment_day  age  \
          0  91637474953513         5122866      M   2015-12-03      2016-05-02   34
          1  91637474953513         5648860      M   2016-05-02      2016-05-11   34
          3  94791461376591         5626367      F   2016-04-27      2016-05-06   34

              neighborhood  scholarship  hypertension  diabetes          ...           \
          0    VILA RUBIM            0             1         0          ...
          1    VILA RUBIM            0             1         0          ...
          3   RESISTÊNCIA            1             0         0          ...

             sms_received  no_show  schedule_day_week appointment_day_week waiting_days  \
          0             1      Yes           Thursday               Monday          151
          1             1      Yes             Monday            Wednesday            9
          3             1       No          Wednesday               Friday            9

            id_value_counts  no_show_count  age_stage  no_show_count_waiting_days  \
          0               2            259      Adult                           1
          1               2            259      Adult                         325
          3               2            259      Adult                         325

            waiting_days_periodes
          0                   NaN
          1                     C
          3                     C
```

```
[3 rows x 22 columns]
```

Note we have Nan values in waiting_dayes_periodes those NaN are for patient's waiting days more than 37 days here we need not to drop them

```
In [158]: df.gender.describe()
```

```
Out[158]: count     74513
          unique        2
          top           F
          freq      48113
          Name: gender, dtype: object
```

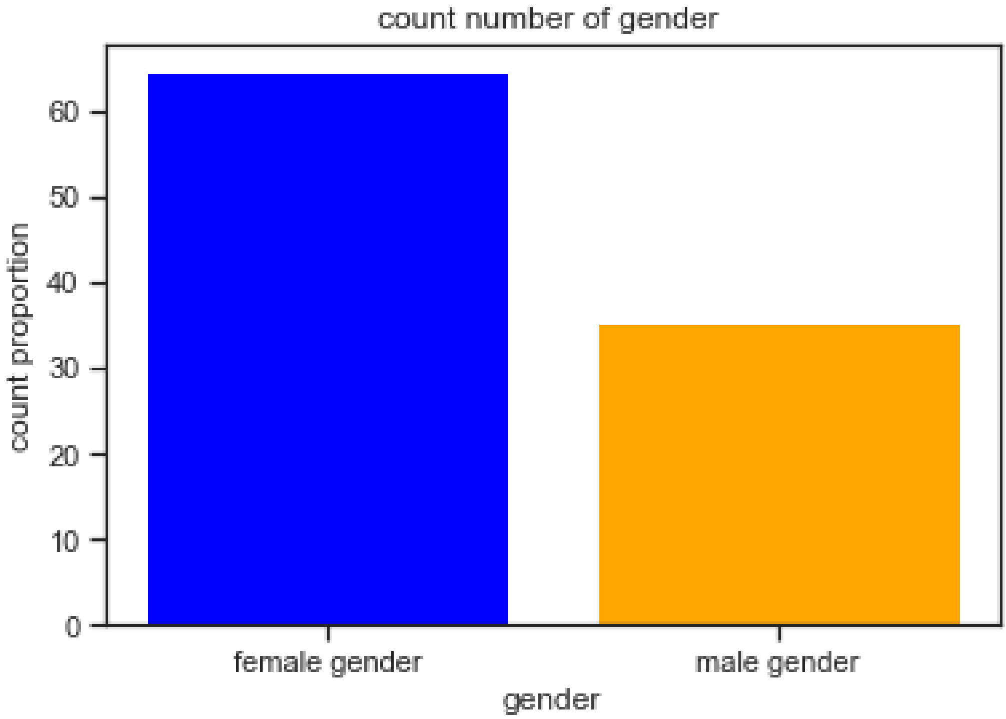
```
In [159]: df_fem=df[df['gender']=='F']
          df_mal=df[df['gender']=='M']
```

```
In [160]: f_count=df_fem.gender.count()
          m_count=df_mal.gender.count()
```

```
In [161]: print('Total number of patient according to gender who record Appointment Booking {}
          print('Number of femal patients :  ({})  patient'.format(df_fem.gender.count()))
          print('Number of male patients :  ({})  patient'.format(df_mal.gender.count()))
          print('percent of patient who are femals ({}) patient'.format(df_fem.gender.count()/
          print('percent of patient who are male ({}) patient'.format(df_mal.gender.count()/(d
```

```
Total number of patient according to gender who record Appointment Booking 74513 patient in cl
Number of femal patients :  (48113)  patient
Number of male patients :  (26400)  patient
percent of patient who are femals (64.5699408156966) patient
percent of patient who are male (35.43005918430341) patient
```

```
In [162]: total=df.gender.shape[0]
          f_count=df_fem.gender.count()
          m_count=df_mal.gender.count()
          proportion_f=df_fem.gender.count()/(df.gender.shape[0])*100
          proportion_m=df_mal.gender.count()/(df.gender.shape[0])*100
          colors=['blue','orange']
          plt.bar(["female gender", "male gender"], [proportion_f, proportion_m],color=colors)
          plt.title("count number of gender ")
          plt.xlabel("gender")
          plt.ylabel("count proportion");
```

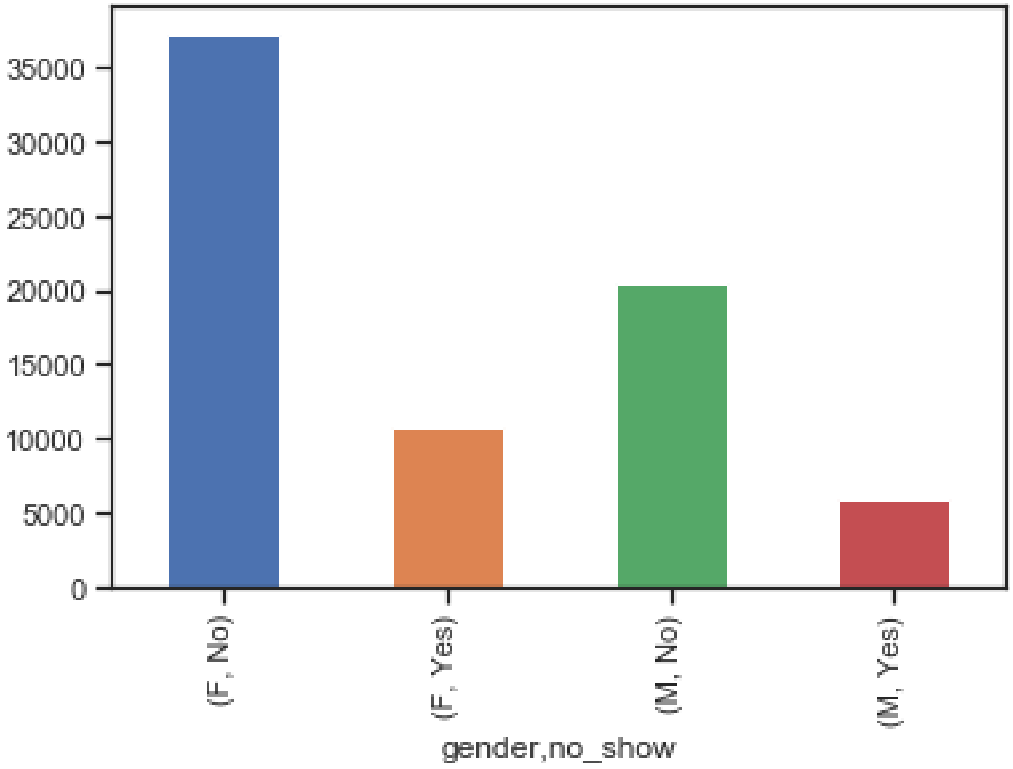


39 *3.1visualize relationship*

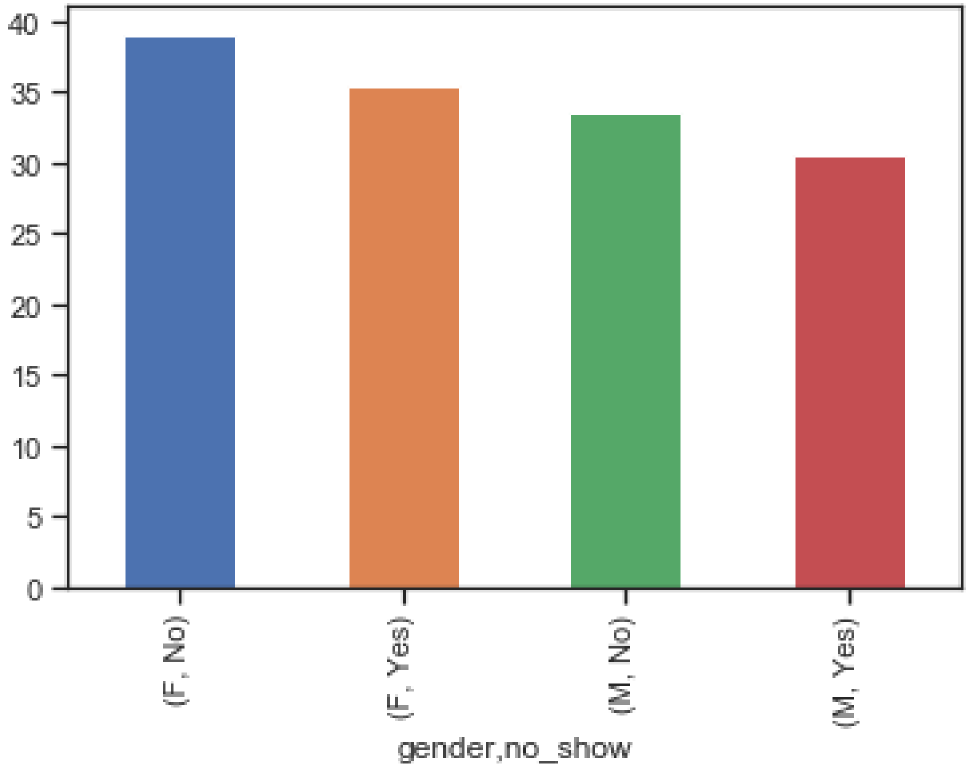
```
In [163]: df.groupby(['gender','no_show']).count().age
```

```
Out[163]: gender  no_show
          F       No         37263
                  Yes        10850
          M       No         20522
                  Yes         5878
          Name: age, dtype: int64
```

```
In [164]: %matplotlib inline
          df.groupby(['gender','no_show']).count().age.plot(kind='bar');
```



```
In [165]: df.groupby(['gender','no_show']).age.mean()

Out[165]: gender  no_show
          F       No         39.074336
                  Yes        35.392995
          M       No         33.506042
                  Yes        30.577067
          Name: age, dtype: float64

In [166]: %matplotlib inline
          df.groupby(['gender','no_show']).mean().age.plot(kind='bar');
```



```
In [167]: df_fem.describe()
```

```
Out[167]:          patient_id  appointment_id           age   scholarship  hypertension  \
           count  4.811300e+04    4.811300e+04  48113.000000  48113.000000  48113.000000
           mean   1.465371e+14    5.670341e+06     38.244154      0.120778      0.210941
           std    2.546707e+14    7.501131e+04     22.607687      0.325873      0.407981
           min    3.921700e+04    5.134197e+06      0.000000      0.000000      0.000000
           25%    4.175523e+12    5.633821e+06     20.000000      0.000000      0.000000
           50%    3.177683e+13    5.676820e+06     38.000000      0.000000      0.000000
           75%    9.452868e+13    5.722532e+06     56.000000      0.000000      0.000000
           max    9.999816e+14    5.790484e+06    115.000000      1.000000      1.000000

                      diabetes    alcoholism      handicap  sms_received  waiting_days  \
           count  48113.000000  48113.000000  48113.000000  48113.000000  48113.000000
           mean       0.075634      0.014570      0.015651      0.348617     11.494253
           std        0.264415      0.119824      0.133481      0.476537     16.434606
           min        0.000000      0.000000      0.000000      0.000000      0.000000
           25%        0.000000      0.000000      0.000000      0.000000      0.000000
           50%        0.000000      0.000000      0.000000      0.000000      5.000000
           75%        0.000000      0.000000      0.000000      1.000000     18.000000
           max        1.000000      1.000000      4.000000      1.000000    179.000000
```

```
       id_value_counts  no_show_count  no_show_count_waiting_days
count     48113.000000   48113.000000                48113.000000
mean          1.394654     217.605491                  664.309417
std           0.488781      87.657422                  344.939596
min           1.000000       1.000000                    1.000000
25%           1.000000     189.000000                  317.000000
50%           1.000000     222.000000                  805.000000
75%           2.000000     253.000000                  971.000000
max           2.000000     573.000000                 1215.000000
```

```
In [168]: df_mal.describe()
```

```
Out[168]:         patient_id  appointment_id           age   scholarship  hypertension  \
          count  2.640000e+04    2.640000e+04  26400.000000  26400.000000  26400.000000
          mean   1.479267e+14    5.672167e+06     32.853902      0.049091      0.162689
          std    2.540771e+14    7.302544e+04     24.656537      0.216062      0.369089
          min    4.374100e+04    5.122866e+06      0.000000      0.000000      0.000000
          25%    4.277600e+12    5.636682e+06      9.000000      0.000000      0.000000
          50%    3.324355e+13    5.677842e+06     31.000000      0.000000      0.000000
          75%    9.555055e+13    5.723331e+06     54.000000      0.000000      0.000000
          max    9.999465e+14    5.790466e+06    100.000000      1.000000      1.000000

                     diabetes    alcoholism      handicap  sms_received  waiting_days  \
          count  26400.000000  26400.000000  26400.000000  26400.000000  26400.000000
          mean       0.060492      0.040606      0.024205      0.312197     10.871098
          std        0.238401      0.197380      0.173812      0.463398     15.866111
          min        0.000000      0.000000      0.000000      0.000000      0.000000
          25%        0.000000      0.000000      0.000000      0.000000      0.000000
          50%        0.000000      0.000000      0.000000      0.000000      4.000000
          75%        0.000000      0.000000      0.000000      1.000000     17.000000
          max        1.000000      1.000000      4.000000      1.000000    179.000000

                 id_value_counts  no_show_count  no_show_count_waiting_days
          count     26400.000000   26400.000000                26400.000000
          mean          1.357765     230.625114                  677.964962
          std           0.479352     103.719052                  344.448951
          min           1.000000       1.000000                    1.000000
          25%           1.000000     191.000000                  317.000000
          50%           1.000000     222.000000                  811.000000
          75%           2.000000     255.000000                  971.000000
          max           2.000000     573.000000                 1215.000000
```

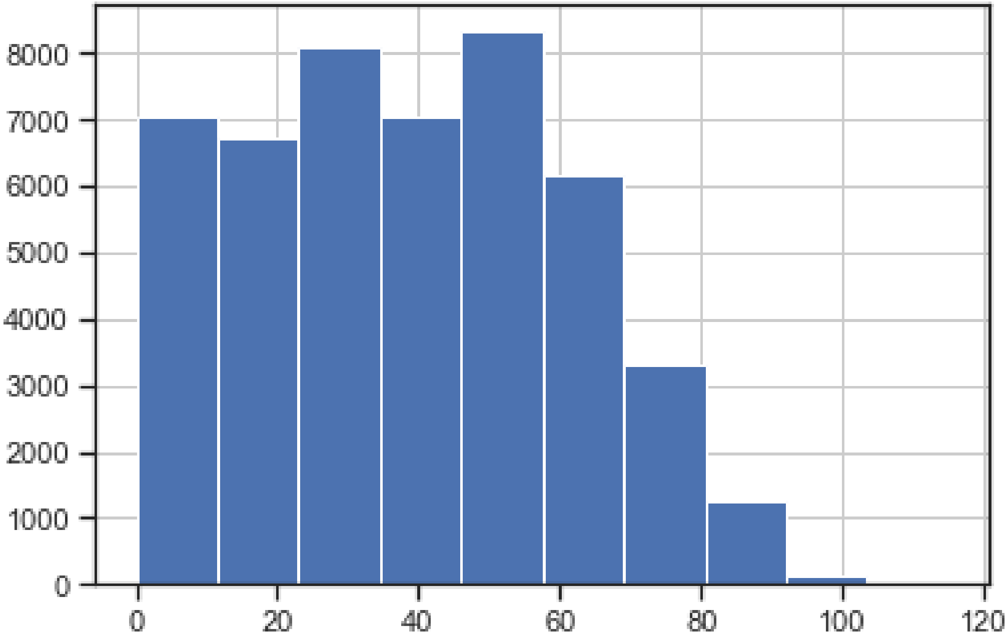
index	femal geder	male gender
age mean	38.24	32.8
age range	0 upto 115	0 upto 100
75% of data under age of	56	54

40 3.2build intution

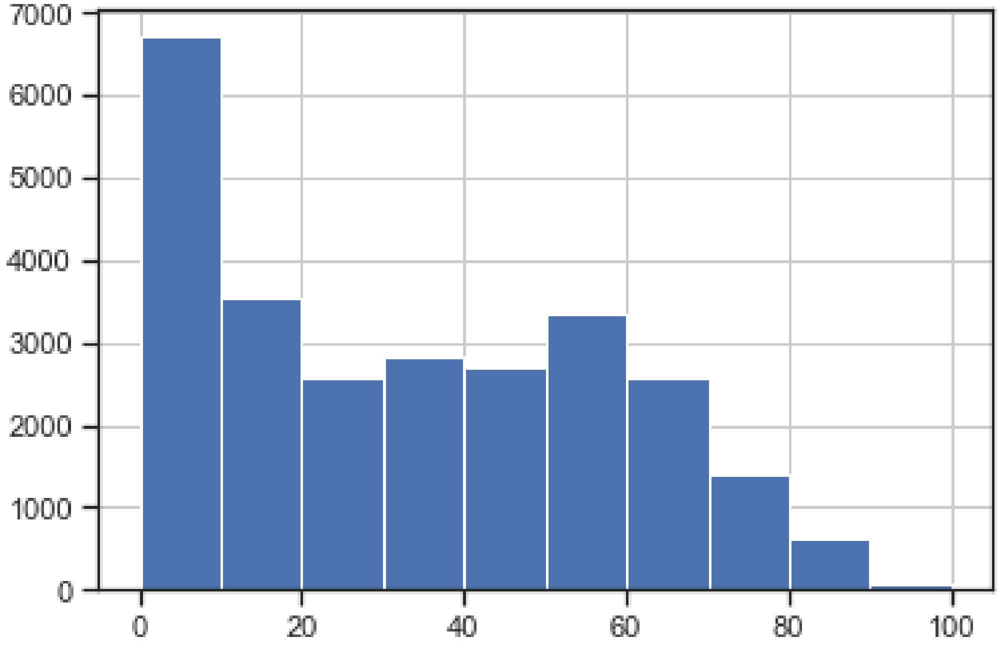
---

41 what is age distribution for both males and females

```
In [169]: # female age distribution
          df_fem.age.hist();
```



```
In [170]: #male age distribution
          df_mal.age.hist();
```



Note

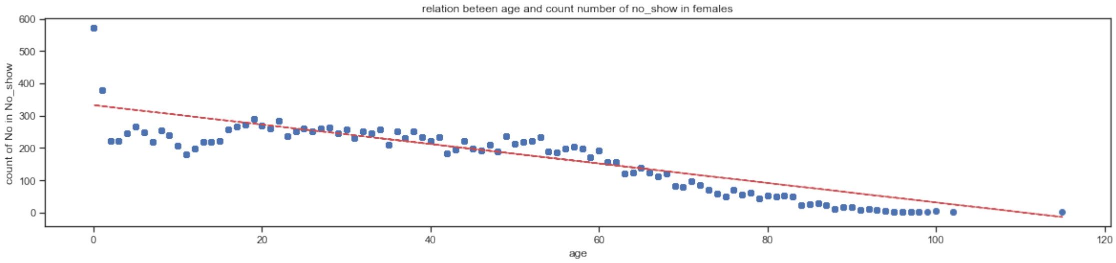
1. in general females are more healthy than males in data we have where the age mean in femals greater than males and max.age in females greater than male

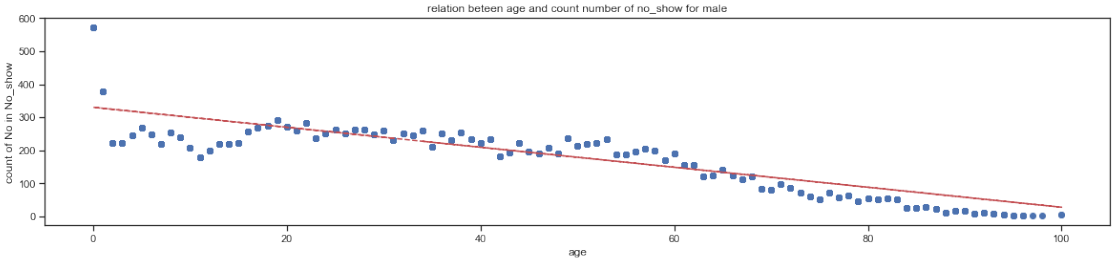
- age distribution for male and females clarify that Females are more concerned with their health more than males
- To study if there is any relation between gender versuse no_show we will clasify this two groups according to their age

what is the trend comparison between females and males who are show up according to their ages

```
In [171]: #femal trend
          df_fem_no=df[(df.no_show == 'No') & (df.gender =='F')]
          plt.figure(figsize = (20,4))
          x = df_fem_no['age']
          y = df_fem_no['no_show_count']
          plt.title('relation beteen age and count number of no_show in females')
          plt.xlabel('age')
          plt.ylabel('count of No in No_show')
          plt.scatter(x, y)
          z = np.polyfit(x, y, 1)
          p = np.poly1d(z)
          plt.plot(x,p(x),"r--")
          plt.show()
```

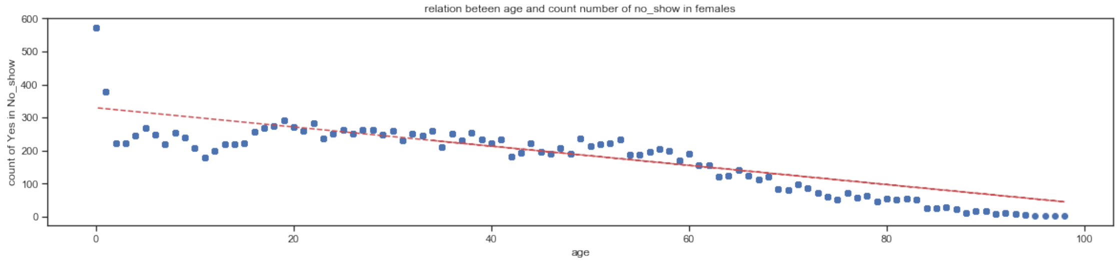
```
#male trend
df_mal_no=df[(df.no_show == 'No') & (df.gender =='M')]
plt.figure(figsize = (20,4))
x = df_mal_no['age']
y = df_mal_no['no_show_count']
plt.title('relation beteen age and count number of no_show for male')
plt.xlabel('age')
plt.ylabel('count of No in No_show')
plt.scatter(x, y)
z = np.polyfit(x, y, 1)
p = np.poly1d(z)
plt.plot(x,p(x),"r--")
plt.show()
```

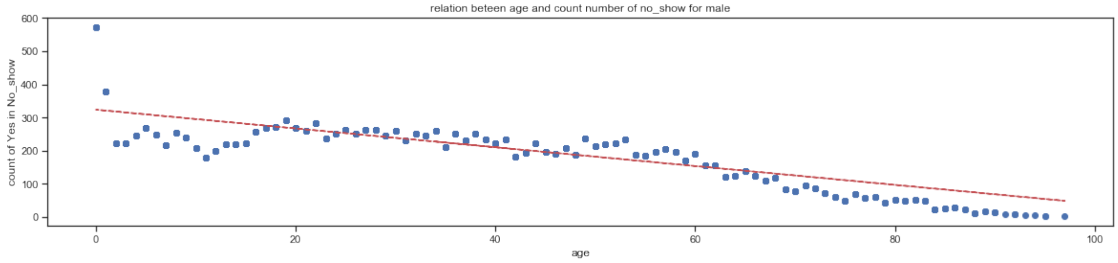




what is the trend comparison between females and males who are not show up according to their ages

```
In [172]: #femal trend
          df_fem_yes=df[(df.no_show == 'Yes') & (df.gender =='F')]
          plt.figure(figsize = (20,4))
          x = df_fem_yes['age']
          y = df_fem_yes['no_show_count']
          plt.title('relation beteen age and count number of no_show in females')
          plt.xlabel('age')
          plt.ylabel('count of Yes in No_show')
          plt.scatter(x, y)
          z = np.polyfit(x, y, 1)
          p = np.poly1d(z)
          plt.plot(x,p(x),"r--")
          plt.show()

          #male trend
          df_mal_yes=df[(df.no_show == 'Yes') & (df.gender =='M')]
          plt.figure(figsize = (20,4))
          x = df_mal_yes['age']
          y = df_mal_yes['no_show_count']
          plt.title('relation beteen age and count number of no_show for male')
          plt.xlabel('age')
          plt.ylabel('count of Yes in No_show')
          plt.scatter(x, y)
          z = np.polyfit(x, y, 1)
          p = np.poly1d(z)
          plt.plot(x,p(x),"r--")
          plt.show()
```





Note

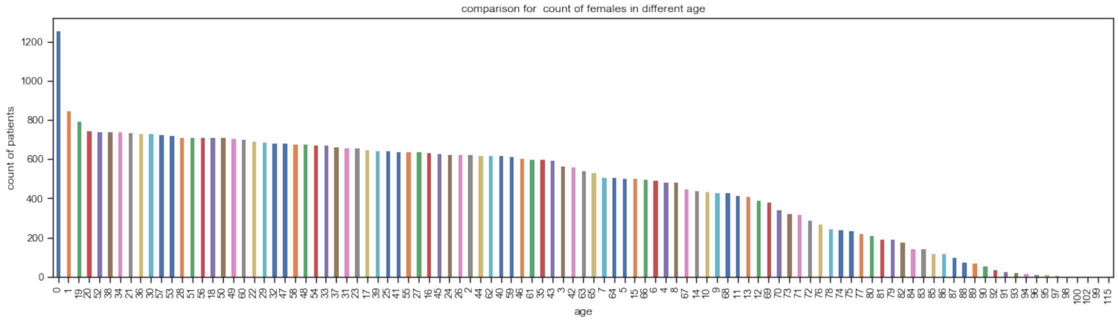
1. trend lines slope for females are inverversely proportional to show up and not show up

- trend lines for males are inverversely proportional to show up and not show up

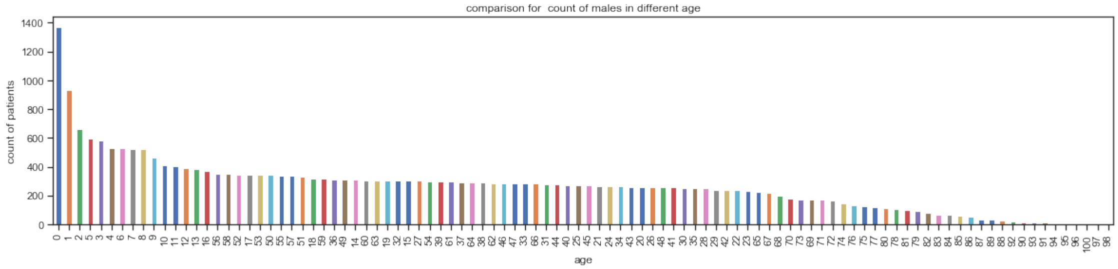
- There is a clear difference between the two genders in their numbers compared to the same age period

does gender in different age stage affects their commitment to show up on the appointement date?

```
In [173]: #the count number of females in different age stage
          df_fem.age.value_counts().plot('bar',figsize=(20,5))
          plt.title('comparison for  count of females in different age')
          plt.xlabel('age')
          plt.ylabel('count of patients');
```



```
In [174]: #the count number of males in different age stage
          df_mal.age.value_counts().plot(kind='bar',figsize=(20,4))
          plt.title('comparison for  count of males in different age')
          plt.xlabel('age')
          plt.ylabel('count of patients');
```



42 *count of patients in every age stage are completly different*

we going to make deep analysis for different age stage according to their gender

43 3.3creat more and describtive feture

44 age stages

1. Fetus (Unborn)

- Newborn (Birth - 1 month)
- Baby (1 month and 1 day - 2 years)
- Toddler (3 - 5)
- Kids (6 - 9)
- Pre-Teen (10 - 12)
- Teenager (13 - 17)
- Young Adult (18 - 20)
- Adult (21 - 39)
- Young Middle-Aged Adult (40 - 49)
- Middle-Aged Adult (50 - 54)
- Very Young Senior Citizen (55 - 64)
- Young Senior Citizen (65 - 74)
- Senior Citizen (75 - 84)
- Old Senior Citizen (85+)

comparison for different age stages versuse no_show in different gender

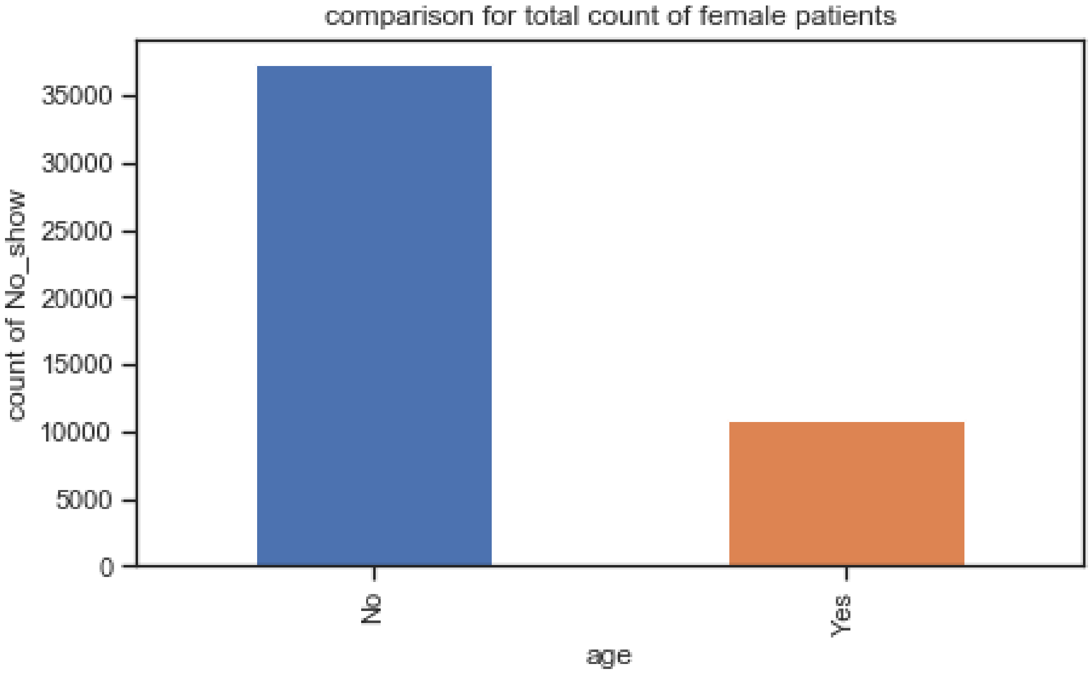
---

45 femal study:

```
In [175]: df_fem.groupby('no_show').age_stage.count()
```

```
Out[175]: no_show
          No      37263
          Yes     10850
          Name: age_stage, dtype: int64
```

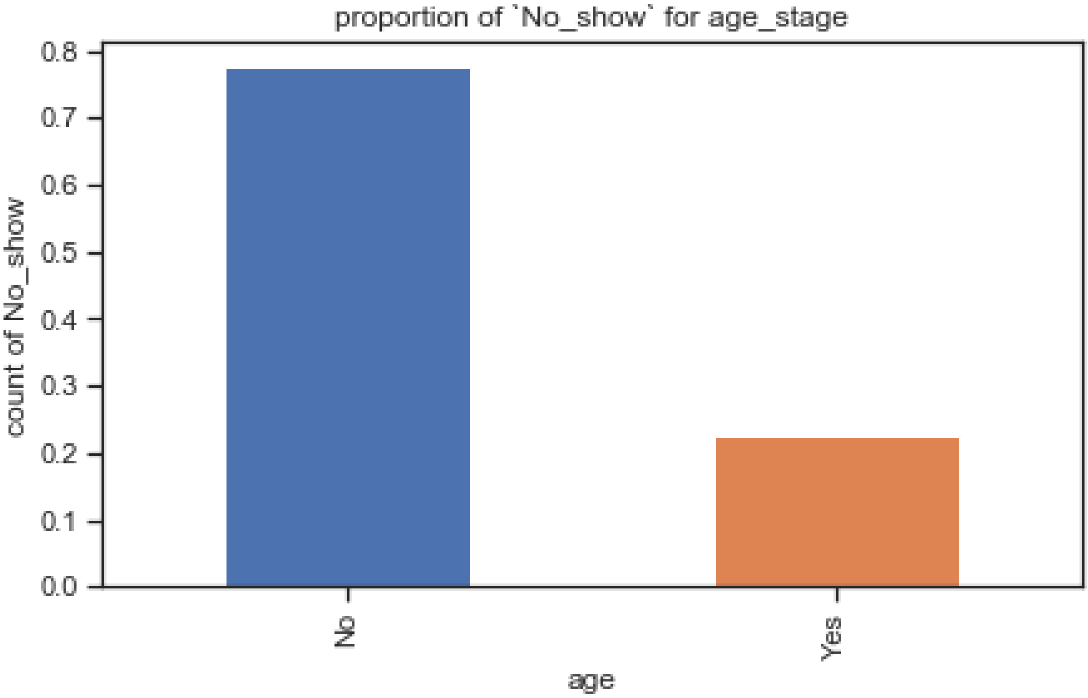
```
In [176]: df_fem.groupby('no_show').age_stage.count().plot(kind ='bar',figsize=(7,4))
          plt.title('comparison for total count of female patients')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



```
In [177]: print("proportion of `No_show` for age_stage  => {}".format(df_fem.groupby('no_show'
```

```
proportion of `No_show` for age_stage  => no_show
No     0.774489
Yes    0.225511
Name: age_stage, dtype: float64
```

```
In [178]: (df_fem.groupby('no_show').age_stage.count()/df_fem.age_stage.count()).plot(kind ='ba
          plt.title('proportion of `No_show` for age_stage')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```

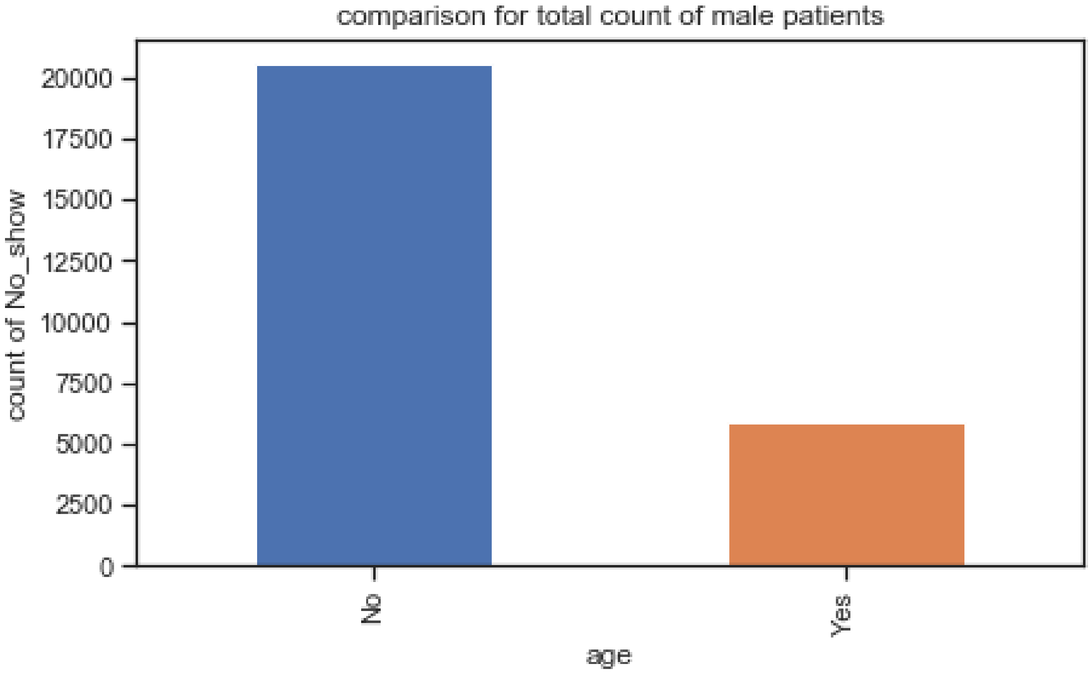


46 male study:

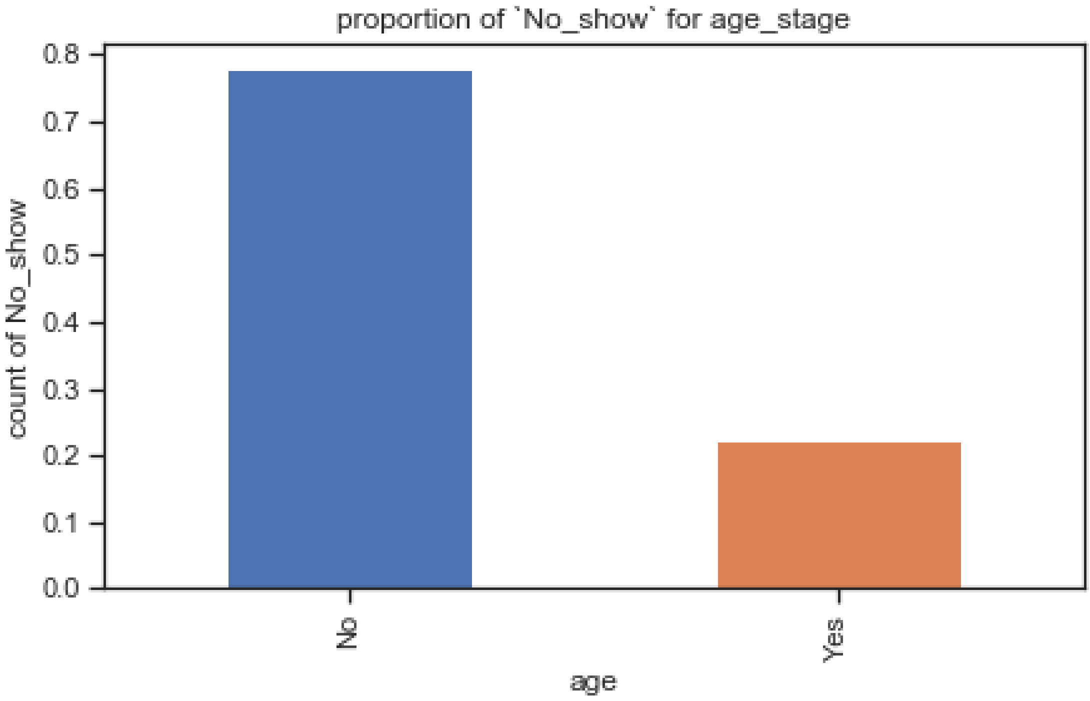
```
In [179]: df_mal.groupby('no_show').age_stage.count()
```

```
Out[179]: no_show
          No     20522
          Yes     5878
          Name: age_stage, dtype: int64
```

```
In [180]: df_mal.groupby('no_show').age_stage.count().plot(kind ='bar',figsize=(7,4))
          plt.title('comparison for total count of male patients')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



```
In [181]: print("proportion of `No_show` for age_stage  => {}".format(df_mal.groupby('no_show')

proportion of `No_show` for age_stage  => no_show
No     0.777348
Yes    0.222652
Name: age_stage, dtype: float64


In [182]: (df_mal.groupby('no_show').age_stage.count()/df_mal.age_stage.count()).plot(kind ='ba
          plt.title('proportion of `No_show` for age_stage')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



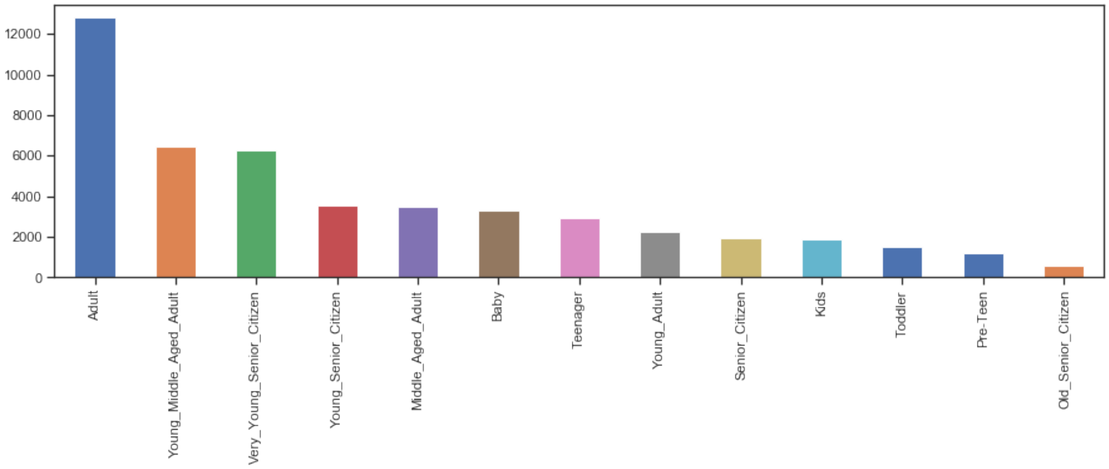
sorting data sets for different age stages

47 femal study

```
In [183]: df_fem.age_stage.value_counts()
```

```
Out[183]: Adult                          12788
          Young_Middle_Aged_Adult         6440
          Very_Young_Senior_Citizen       6251
          Young_Senior_Citizen            3520
          Middle_Aged_Adult               3498
          Baby                            3296
          Teenager                        2939
          Young_Adult                     2281
          Senior_Citizen                  1941
          Kids                            1867
          Toddler                         1488
          Pre-Teen                        1224
          Old_Senior_Citizen               580
          Name: age_stage, dtype: int64
```

```
In [184]: df_fem['age_stage'].value_counts().plot(kind='bar',figsize=(15,4));
```

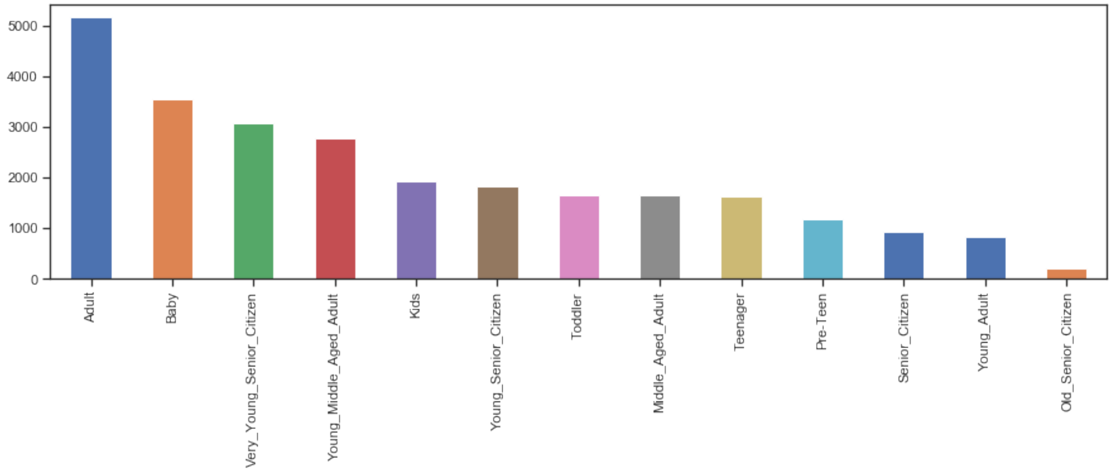


48 male study

```
In [185]: df_mal.age_stage.value_counts()
```

```
Out[185]: Adult                        5153
          Baby                         3547
          Very_Young_Senior_Citizen    3065
          Young_Middle_Aged_Adult      2777
          Kids                         1918
          Young_Senior_Citizen         1830
          Toddler                      1657
          Middle_Aged_Adult            1656
          Teenager                     1640
          Pre-Teen                     1178
          Senior_Citizen                928
          Young_Adult                   834
          Old_Senior_Citizen            217
          Name: age_stage, dtype: int64
```

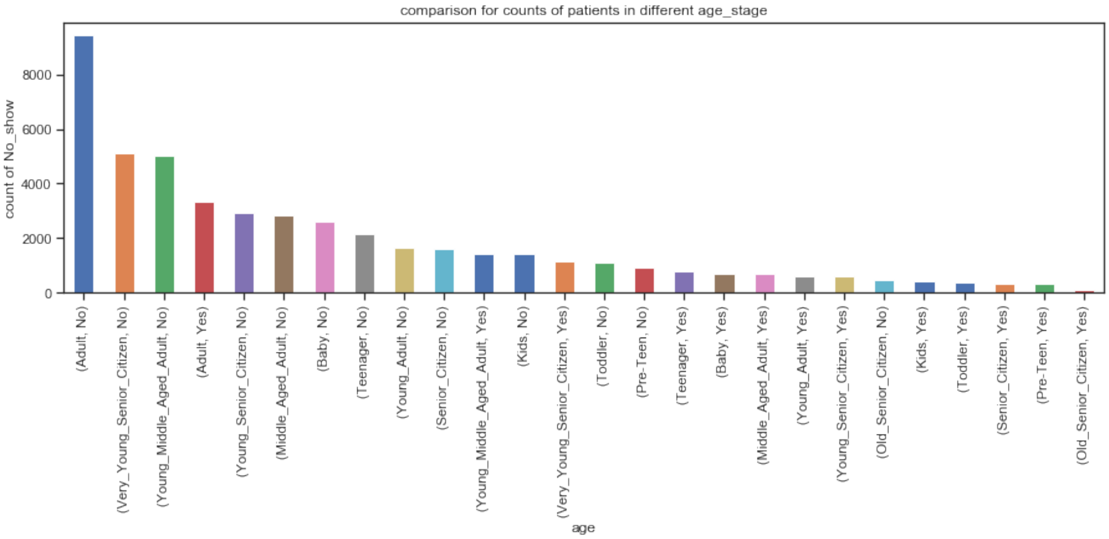
```
In [186]: df_mal['age_stage'].value_counts().plot(kind='bar',figsize=(15,4));
```



comparison of counts of patients for no_show in different age_stage

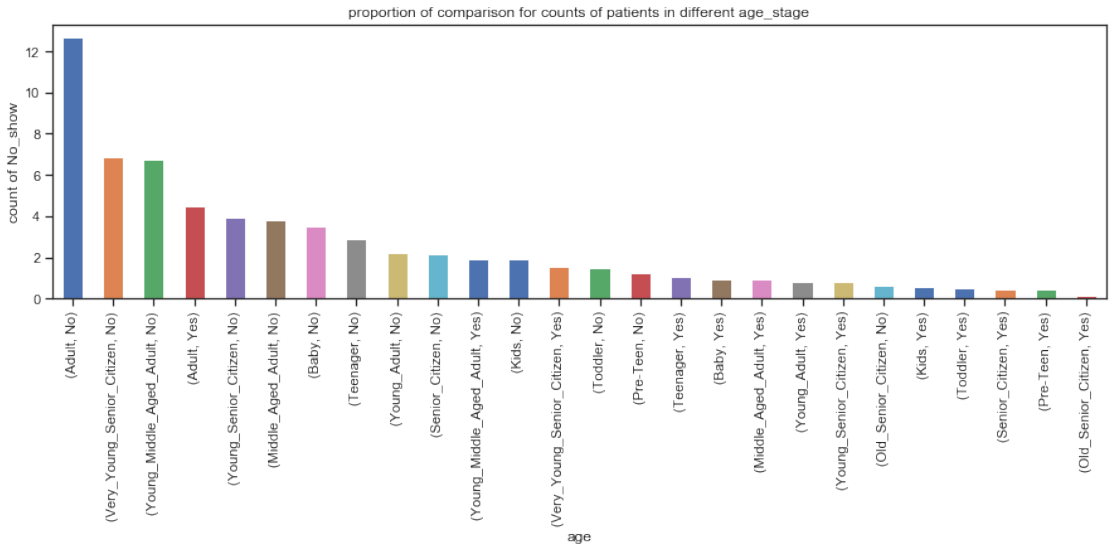
49 femal study

```
In [187]: fr=df_fem.groupby('age_stage').no_show.value_counts();
          fr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
          plt.title('comparison for counts of patients in different age_stage')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



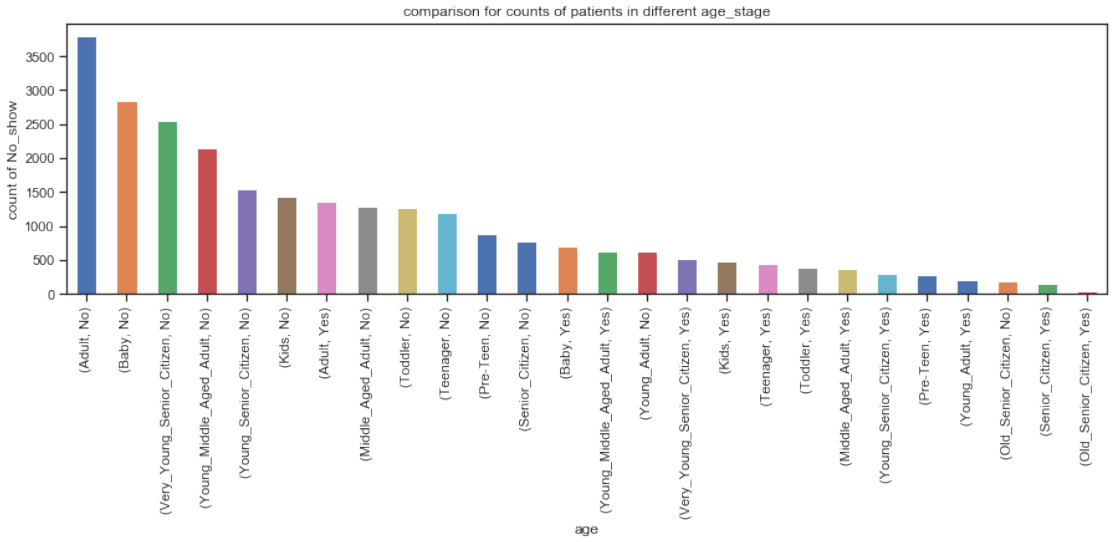
proportional comparison of counts of females for no_show in different age_stage

```
In [188]: tr=((df_fem.groupby('age_stage').no_show.value_counts())/df.age_stage.count())*100
          tr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
          plt.title('proportion of comparison for counts of patients in different age_stage')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



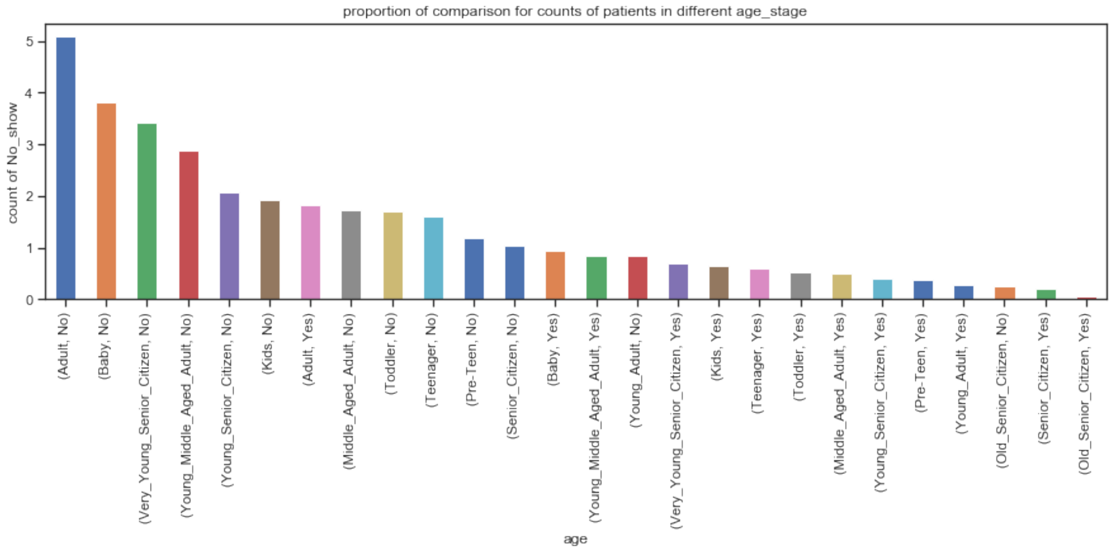
50 male study

```
In [189]: fr=df_mal.groupby('age_stage').no_show.value_counts();
          fr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
          plt.title('comparison for counts of patients in different age_stage')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



proportional comparison of counts of males for no_show in different age_stage

```
In [190]: tr=((df_mal.groupby('age_stage').no_show.value_counts())/df.age_stage.count())*100
          tr.sort_values(ascending=False).plot(kind='bar',figsize=(15,4))
          plt.title('proportion of comparison for counts of patients in different age_stage')
          plt.xlabel('age')
          plt.ylabel('count of No_show');
```



neumerical proportional comparison for count of patients versus no_show in different age_stage

51 femal study

```
In [191]: tr=((df_fem.groupby('age_stage').no_show.value_counts())/df_fem.age_stage.count())*1
          tr.sort_values(ascending=False)
```

```
Out[191]: age_stage                  no_show
          Adult                      No         19.628791
          Very_Young_Senior_Citizen  No         10.618752
          Young_Middle_Aged_Adult    No         10.402594
          Adult                      Yes         6.950304
          Young_Senior_Citizen       No          6.085673
          Middle_Aged_Adult          No          5.873672
          Baby                       No          5.422651
          Teenager                   No          4.449941
          Young_Adult                No          3.456446
          Senior_Citizen             No          3.335897
          Young_Middle_Aged_Adult    Yes         2.982562
          Kids                       No          2.961777
          Very_Young_Senior_Citizen  Yes         2.373579
          Toddler                    No          2.307069
          Pre-Teen                   No          1.899694
          Teenager                   Yes         1.658595
          Baby                       Yes         1.427889
          Middle_Aged_Adult          Yes         1.396712
          Young_Adult                Yes         1.284476
          Young_Senior_Citizen       Yes         1.230437
          Old_Senior_Citizen         No          1.005965
          Kids                       Yes         0.918671
          Toddler                    Yes         0.785650
          Senior_Citizen             Yes         0.698356
          Pre-Teen                   Yes         0.644317
          Old_Senior_Citizen         Yes         0.199530
          Name: no_show, dtype: float64
```

52 male study

```
In [192]: tr=((df_mal.groupby('age_stage').no_show.value_counts())/df_mal.age_stage.count())*1
          tr.sort_values(ascending=False)
```

```
Out[192]: age_stage                  no_show
          Adult                      No         14.367424
          Baby                       No         10.753788
```

```
Very_Young_Senior_Citizen  No         9.643939
Young_Middle_Aged_Adult    No         8.121212
Young_Senior_Citizen       No         5.833333
Kids                       No         5.458333
Adult                      Yes        5.151515
Middle_Aged_Adult          No         4.837121
Toddler                    No         4.821970
Teenager                   No         4.530303
Pre-Teen                   No         3.375000
Senior_Citizen             No         2.931818
Baby                       Yes        2.681818
Young_Middle_Aged_Adult    Yes        2.397727
Young_Adult                No         2.386364
Very_Young_Senior_Citizen  Yes        1.965909
Kids                       Yes        1.806818
Teenager                   Yes        1.681818
Toddler                    Yes        1.454545
Middle_Aged_Adult          Yes        1.435606
Young_Senior_Citizen       Yes        1.098485
Pre-Teen                   Yes        1.087121
Young_Adult                Yes        0.772727
Old_Senior_Citizen         No         0.674242
Senior_Citizen             Yes        0.583333
Old_Senior_Citizen         Yes        0.147727
Name: no_show, dtype: float64
```

ranking of the percentage of the patients who will come to their appointment on time according to their age

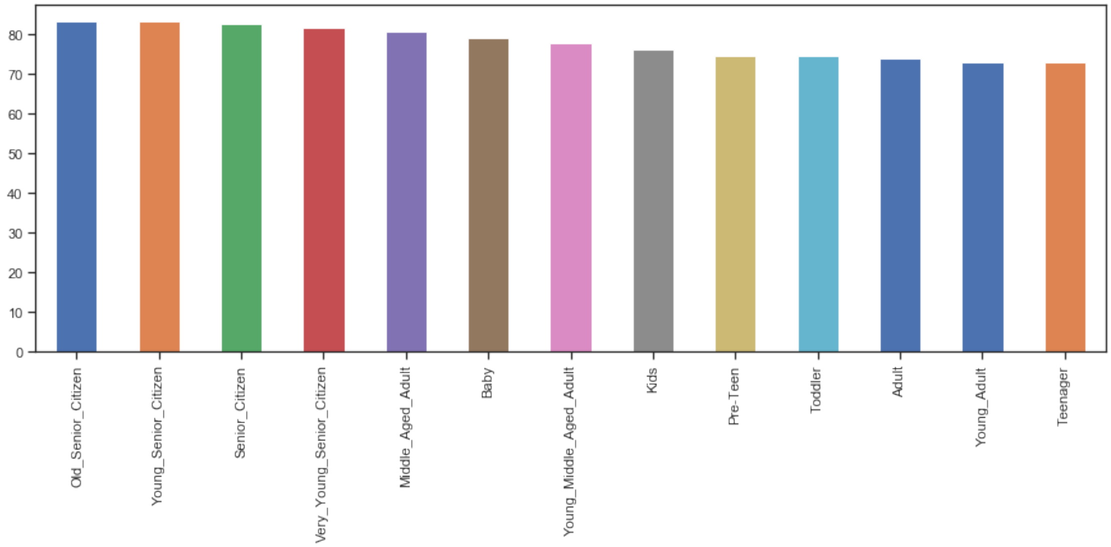
53 femal study

In [193]:
```
ranking= df_fem.query('no_show=="No"').age_stage.value_counts()
rankin= df_fem.age_stage.value_counts()
per=ranking/rankin*100
per.sort_values(ascending=False)
```

Out[193]:
```
Old_Senior_Citizen           83.448276
Young_Senior_Citizen         83.181818
Senior_Citizen               82.689335
Very_Young_Senior_Citizen    81.730923
Middle_Aged_Adult            80.789022
Baby                         79.156553
Young_Middle_Aged_Adult      77.717391
Kids                         76.325656
Pre-Teen                     74.673203
Toddler                      74.596774
```

```
Adult                          73.850485
Young_Adult                    72.906620
Teenager                       72.847907
Name: age_stage, dtype: float64
```

```
In [194]: per.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```

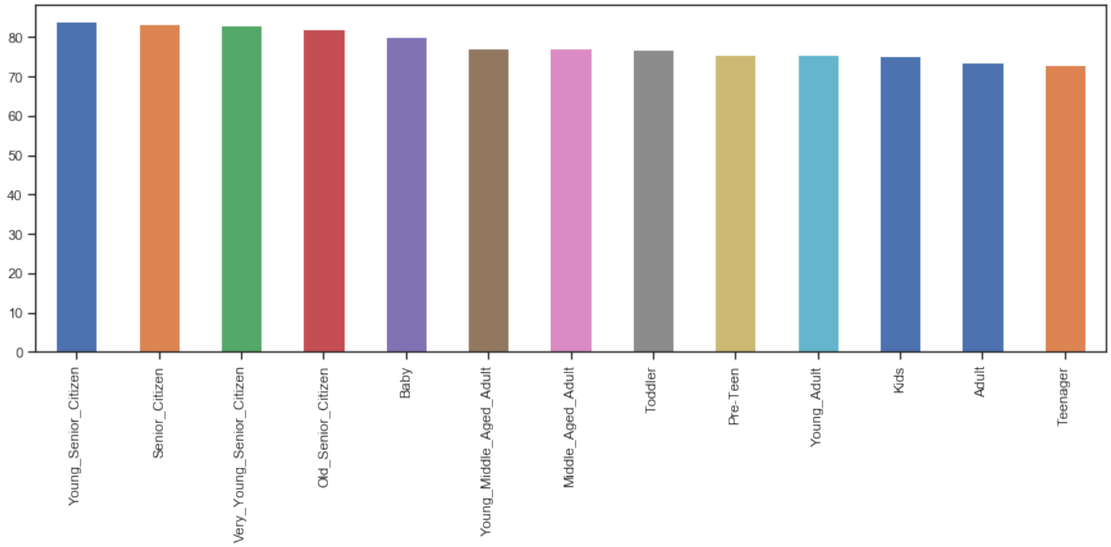


54 male study

```
In [195]: ranking= df_mal.query('no_show=="No"').age_stage.value_counts()
          rankin= df_mal.age_stage.value_counts()
          per=ranking/rankin*100
          per.sort_values(ascending=False)
```

```
Out[195]: Young_Senior_Citizen           84.153005
          Senior_Citizen                 83.405172
          Very_Young_Senior_Citizen      83.066884
          Old_Senior_Citizen             82.027650
          Baby                           80.039470
          Young_Middle_Aged_Adult        77.205618
          Middle_Aged_Adult              77.113527
          Toddler                        76.825588
          Pre-Teen                       75.636672
          Young_Adult                    75.539568
          Kids                           75.130344
          Adult                          73.607607
          Teenager                       72.926829
          Name: age_stage, dtype: float64
```

```
In [196]: per.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```



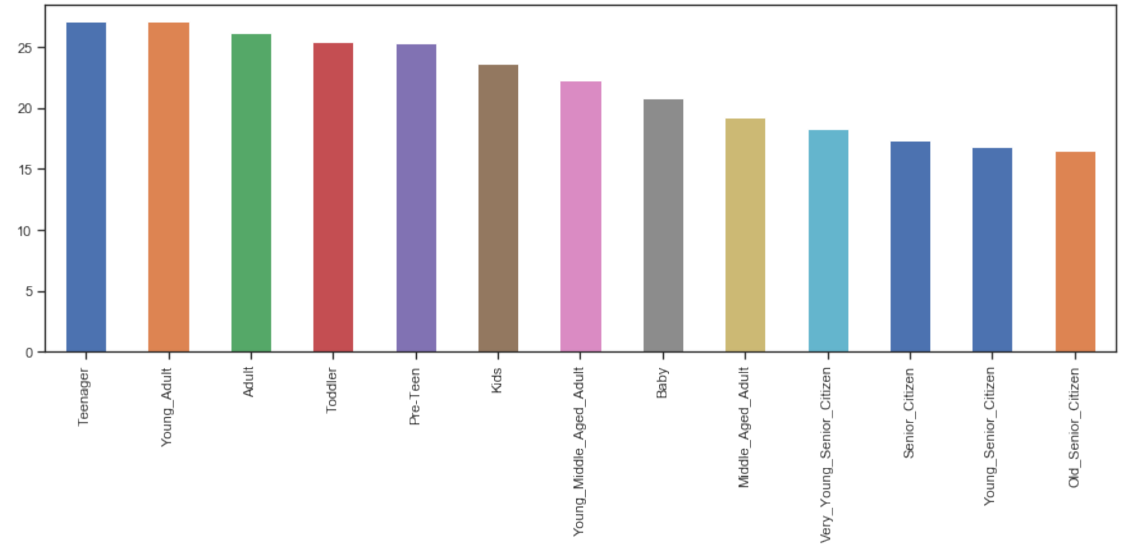
ranking of the percentage of the patients who will not come to their appointment on time according to their age

55 femal study

```
In [197]: ranking= df_fem.query('no_show=="Yes"').age_stage.value_counts()
          rankin= df_fem.age_stage.value_counts()
          per=ranking/rankin*100
          per.sort_values(ascending=False)
```

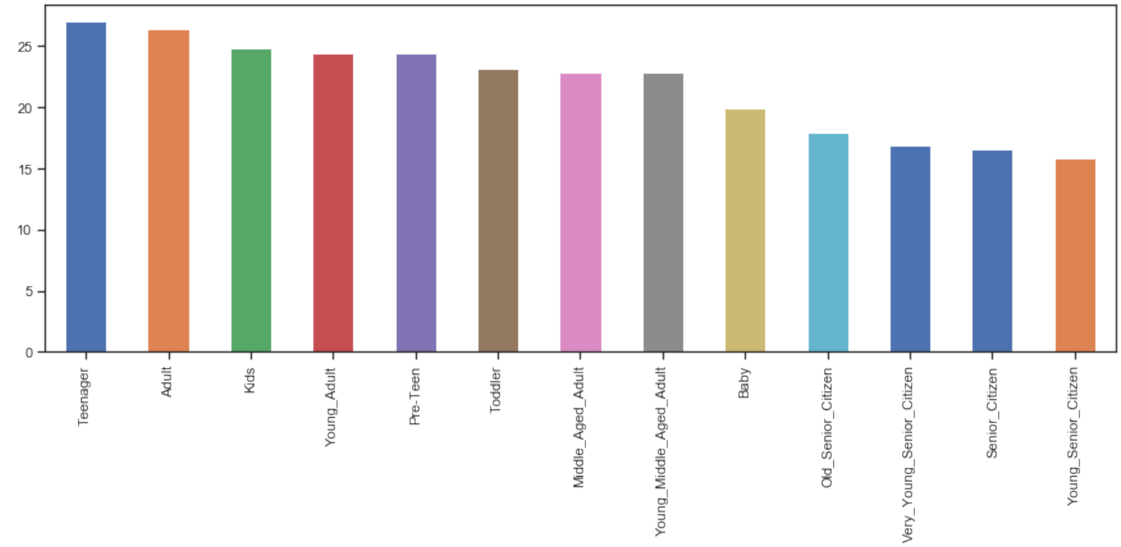
```
Out[197]: Teenager                     27.152093
          Young_Adult                  27.093380
          Adult                        26.149515
          Toddler                      25.403226
          Pre-Teen                     25.326797
          Kids                         23.674344
          Young_Middle_Aged_Adult      22.282609
          Baby                         20.843447
          Middle_Aged_Adult            19.210978
          Very_Young_Senior_Citizen    18.269077
          Senior_Citizen               17.310665
          Young_Senior_Citizen         16.818182
          Old_Senior_Citizen           16.551724
          Name: age_stage, dtype: float64
```

```
In [198]: per.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```



56 male study

```
In [199]: ranking= df_mal.query('no_show=="Yes"').age_stage.value_counts()
          rankin= df_mal.age_stage.value_counts()
          per=ranking/rankin*100
          per.sort_values(ascending=False)

Out[199]: Teenager                     27.073171
          Adult                        26.392393
          Kids                         24.869656
          Young_Adult                  24.460432
          Pre-Teen                     24.363328
          Toddler                      23.174412
          Middle_Aged_Adult            22.886473
          Young_Middle_Aged_Adult      22.794382
          Baby                         19.960530
          Old_Senior_Citizen           17.972350
          Very_Young_Senior_Citizen    16.933116
          Senior_Citizen               16.594828
          Young_Senior_Citizen         15.846995
          Name: age_stage, dtype: float64

In [200]: per.sort_values(ascending=False).plot(kind='bar',figsize=(15,5));
```



57 *3.4conclusion :*

age stage	age in years	% of expected commitment for appointment date in females (no_show==NO)	% of expected commitment for appointment date in males (no_show==NO)
Baby	1 month and 1 day - 2 years	79.156	80.039
Toddler	3 - 5	74.596	76.825
Kids	6 - 9	76.325	75.130
Pre-Teen	10 - 12	74.673	75.636
Teenage	13 - 17	72.847	72968
Young Adult	18 - 20	72.906	75.539
Adult	21 - 39	73.850	73.607
Young Middle-Aged Adult	40 - 49	77.717	77.205
Middle-Aged Adult	50 - 54	80.789	77.113
Very Young Senior Citizen	55 - 64	81.730	83.066

age stage	age in years	% of expected commitment for appointment date in females (no_show==NO)	% of expected commitment for appointment date in males (no_show==NO)
Young Senior Citizen	65 - 74	83.181	84.153
Senior Citizen	75 - 84	82.689	83.405
Old Senior Citizen	85+	83.448	82.027

1. % of expected commitment for appointment date for age stage from 0 upto 20 years old in males greater than females except in for age stage from 6:9 years

- % of expected commitment for appointment date for age stage from 55 upto 84 years old in males greater than females ___
- % of expected commitment for appointment date for age stage from 21 upto 54 years old in males greater than females
- % of expected commitment for appointment date for age stage from +85 years old in females greater than males

58 final conclusion

---

age ,waiting days and gender of patient affect % of expected commitment for appointment date