7_FOI_EDA

July 26, 2017

```
In [18]: %matplotlib inline
         import gc
         import pandas as pd
         import numpy as np
         import seaborn as sns
         import matplotlib.pyplot as plt
         from datetime import datetime

         df_FOI = pd.read_csv('FOI_BI.txt', sep='|', header=0, encoding='ISO-8859-1', error_bad

/Library/Frameworks/Python.framework/Versions/3.6/lib/python3.6/site-packages/IPython/core/inte
  interactivity=interactivity, compiler=compiler, result=result)
```

```
In [19]: col_name = list(df_FOI.columns.values)
         line_num = df_FOI.shape[0]
         print('In the MDR FOI data, there are {} records in total.'.format(line_num))
         print('Also deleting invalid columns (100% missing values).\n')
         bad_columns = []
         for b in col_name:
             n = df_FOI[b].isnull().sum()
             if n >= 0.95 * line_num:
                 del df_FOI[b]
                 bad_columns.append(b)
             else:
                 print(b, 'missing :', n, 'out of', line_num, ',', n/line_num)
         print('\nInvalid columns:', bad_columns)

In the MDR FOI data, there are 25846 records in total.
Also deleting invalid columns (100% missing values).

MDR_REPORT_KEY missing : 0 out of 25846 , 0.0
REPORT_NUMBER missing : 0 out of 25846 , 0.0
REPORT_SOURCE_CODE missing : 0 out of 25846 , 0.0
MANUFACTURER_LINK_FLAG_ missing : 0 out of 25846 , 0.0
DATE_RECEIVED missing : 0 out of 25846 , 0.0
ADVERSE_EVENT_FLAG missing : 1002 out of 25846 , 0.0387680879053
PRODUCT_PROBLEM_FLAG missing : 1486 out of 25846 , 0.0574943898476
```

```
DATE_REPORT missing : 2602 out of 25846 , 0.100673218293
DATE_OF_EVENT missing : 6659 out of 25846 , 0.257641414532
REPROCESSED_AND_REUSED_FLAG missing : 21536 out of 25846 , 0.833243055018
REPORTER_OCCUPATION_CODE missing : 2606 out of 25846 , 0.100827981119
HEALTH_PROFESSIONAL missing : 2380 out of 25846 , 0.0920838814517
INITIAL_REPORT_TO_FDA missing : 6304 out of 25846 , 0.243906213727
DATE_FACILITY_AWARE missing : 15346 out of 25846 , 0.593747581831
REPORT_DATE missing : 14055 out of 25846 , 0.543797879749
REPORT_TO_FDA missing : 7067 out of 25846 , 0.273427222781
DATE_REPORT_TO_FDA missing : 19853 out of 25846 , 0.768126595992
EVENT_LOCATION missing : 7497 out of 25846 , 0.290064226573
DATE_REPORT_TO_MANUFACTURER missing : 21404 out of 25846 , 0.828135881761
MANUFACTURER_CONTACT_F_NAME missing : 23555 out of 25846 , 0.911359591426
MANUFACTURER_CONTACT_L_NAME missing : 23555 out of 25846 , 0.911359591426
MANUFACTURER_CONTACT_STREET_1 missing : 22322 out of 25846 , 0.863653950321
MANUFACTURER_CONTACT_STREET_2 missing : 24239 out of 25846 , 0.937824034667
MANUFACTURER_CONTACT_CITY missing : 22313 out of 25846 , 0.863305733963
MANUFACTURER_CONTACT_STATE missing : 23813 out of 25846 , 0.921341793701
MANUFACTURER_CONTACT_ZIP_CODE missing : 22358 out of 25846 , 0.865046815755
MANUFACTURER_CONTACT_ZIP_EXT missing : 24311 out of 25846 , 0.940609765534
MANUFACTURER_CONTACT_COUNTRY missing : 22308 out of 25846 , 0.86311228043
MANUFACTURER_CONTACT_POSTAL missing : 22358 out of 25846 , 0.865046815755
MANUFACTURER_CONTACT_AREA_CODE missing : 22326 out of 25846 , 0.863808713147
MANUFACTURER_CONTACT_EXCHANGE missing : 22326 out of 25846 , 0.863808713147
MANUFACTURER_CONTACT_PHONE_NO missing : 22326 out of 25846 , 0.863808713147
MANUFACTURER_CONTACT_PCOUNTRY missing : 24349 out of 25846 , 0.942080012381
MANUFACTURER_CONTACT_PCITY missing : 22326 out of 25846 , 0.863808713147
MANUFACTURER_CONTACT_PLOCAL missing : 22326 out of 25846 , 0.863808713147
MANUFACTURER_G1_NAME missing : 22676 out of 25846 , 0.877350460419
MANUFACTURER_G1_STREET_1 missing : 22647 out of 25846 , 0.876228429931
MANUFACTURER_G1_CITY missing : 22763 out of 25846 , 0.880716551884
MANUFACTURER_G1_COUNTRY_CODE missing : 22688 out of 25846 , 0.877814748897
DATE_MANUFACTURER_RECEIVED missing : 14293 out of 25846 , 0.553006267894
DEVICE_DATE_OF_MANUFACTURE missing : 22351 out of 25846 , 0.864775980809
SINGLE_USE_FLAG missing : 13952 out of 25846 , 0.539812736981
PREVIOUS_USE_CODE missing : 13773 out of 25846 , 0.532887100518
EVENT_TYPE missing : 0 out of 25846 , 0.0
TYPE_OF_REPORT missing : 197 out of 25846 , 0.00762206917898
SOURCE_TYPE missing : 14009 out of 25846 , 0.542018107251
DATE_ADDED missing : 0 out of 25846 , 0.0
DATE_CHANGED missing : 0 out of 25846 , 0.0

Invalid columns: ['EVENT_KEY', 'NUMBER_DEVICES_IN_EVENT', 'NUMBER_PATIENTS_IN_EVENT', 'MANUFAC
```

```
In [20]: col_name = list(df_FOI.columns.values)
         for b in col_name:
             n = df_FOI[b].nunique()
```

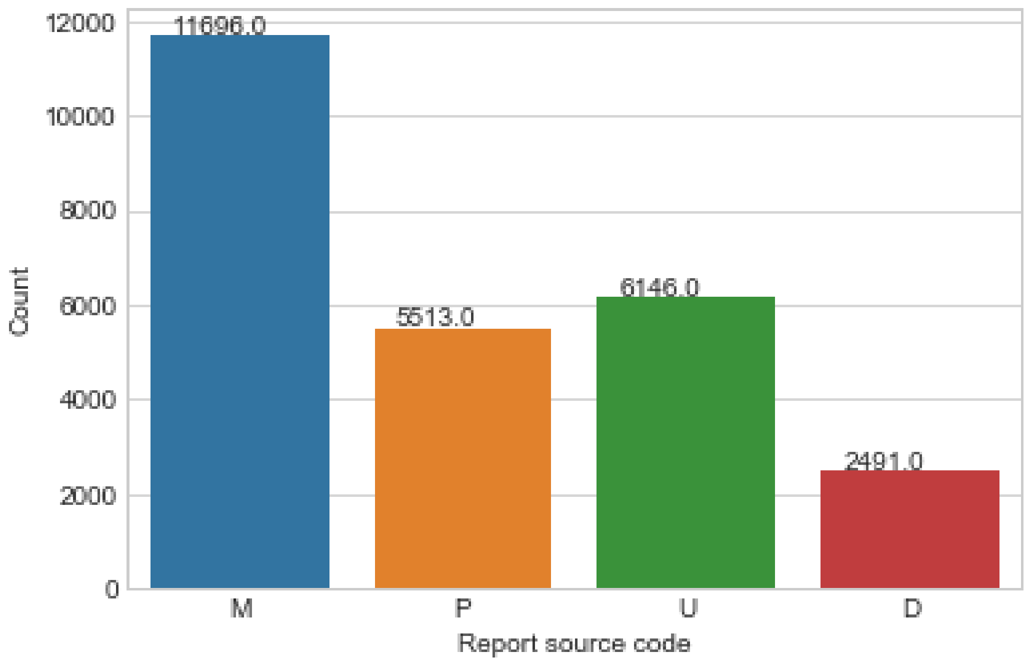
```
            print(b, 'unique value :', n)
```

```
MDR_REPORT_KEY unique value : 25836
REPORT_NUMBER unique value : 25821
REPORT_SOURCE_CODE unique value : 4
MANUFACTURER_LINK_FLAG_ unique value : 2
DATE_RECEIVED unique value : 4253
ADVERSE_EVENT_FLAG unique value : 3
PRODUCT_PROBLEM_FLAG unique value : 3
DATE_REPORT unique value : 4734
DATE_OF_EVENT unique value : 7106
REPROCESSED_AND_REUSED_FLAG unique value : 3
REPORTER_OCCUPATION_CODE unique value : 29
HEALTH_PROFESSIONAL unique value : 5
INITIAL_REPORT_TO_FDA unique value : 5
DATE_FACILITY_AWARE unique value : 4682
REPORT_DATE unique value : 2660
REPORT_TO_FDA unique value : 5
DATE_REPORT_TO_FDA unique value : 1977
EVENT_LOCATION unique value : 18
DATE_REPORT_TO_MANUFACTURER unique value : 1360
MANUFACTURER_CONTACT_F_NAME unique value : 122
MANUFACTURER_CONTACT_L_NAME unique value : 174
MANUFACTURER_CONTACT_STREET_1 unique value : 217
MANUFACTURER_CONTACT_STREET_2 unique value : 41
MANUFACTURER_CONTACT_CITY unique value : 111
MANUFACTURER_CONTACT_STATE unique value : 24
MANUFACTURER_CONTACT_ZIP_CODE unique value : 107
MANUFACTURER_CONTACT_ZIP_EXT unique value : 25
MANUFACTURER_CONTACT_COUNTRY unique value : 11
MANUFACTURER_CONTACT_POSTAL unique value : 122
MANUFACTURER_CONTACT_AREA_CODE unique value : 118
MANUFACTURER_CONTACT_EXCHANGE unique value : 118
MANUFACTURER_CONTACT_PHONE_NO unique value : 154
MANUFACTURER_CONTACT_PCOUNTRY unique value : 22
MANUFACTURER_CONTACT_PCITY unique value : 176
MANUFACTURER_CONTACT_PLOCAL unique value : 182
MANUFACTURER_G1_NAME unique value : 137
MANUFACTURER_G1_STREET_1 unique value : 154
MANUFACTURER_G1_CITY unique value : 101
MANUFACTURER_G1_COUNTRY_CODE unique value : 15
DATE_MANUFACTURER_RECEIVED unique value : 2321
DEVICE_DATE_OF_MANUFACTURE unique value : 612
SINGLE_USE_FLAG unique value : 4
PREVIOUS_USE_CODE unique value : 5
EVENT_TYPE unique value : 5
TYPE_OF_REPORT unique value : 7
SOURCE_TYPE unique value : 106
```

```
DATE_ADDED unique value : 3859
DATE_CHANGED unique value : 3779
```

```
In [25]: sns.set_style("whitegrid")
         print("""Report source code:
         P = Voluntary report
         U = User Facility report
         D = Distributor report
         M = Manufacturer report""")
         ax = sns.countplot(x='REPORT_SOURCE_CODE', data=df_FOI)
         plt.xlabel('Report source code')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

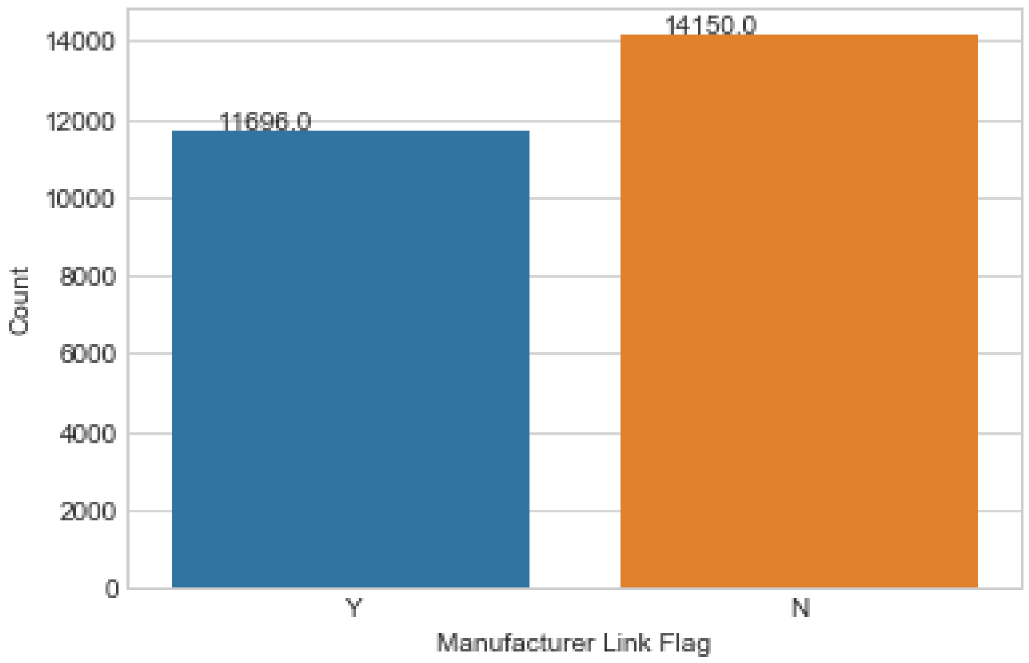
```
Report source code:
P = Voluntary report
U = User Facility report
D = Distributor report
M = Manufacturer report
```



```
In [54]: print("""Manufacturer Link Flag:
         Y = Yes
         N = No""")
```

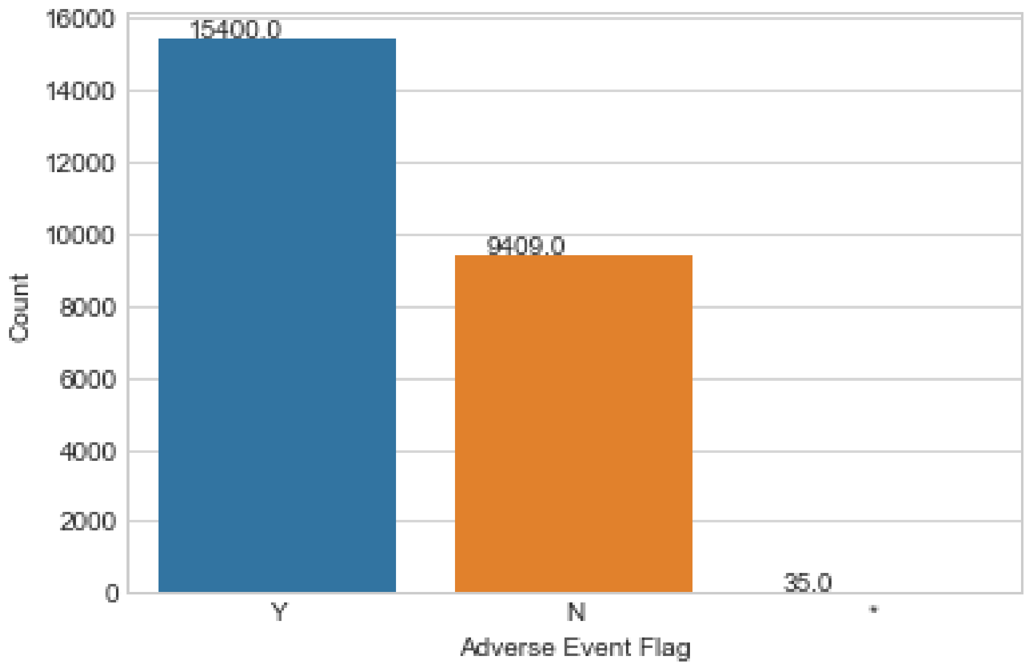
```
ax = sns.countplot(x='MANUFACTURER_LINK_FLAG_', data=df_FOI)
plt.xlabel('Manufacturer Link Flag')
plt.ylabel('Count')
for p in ax.patches:
    ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Manufacturer Link Flag:
Y = Yes
N = No
```



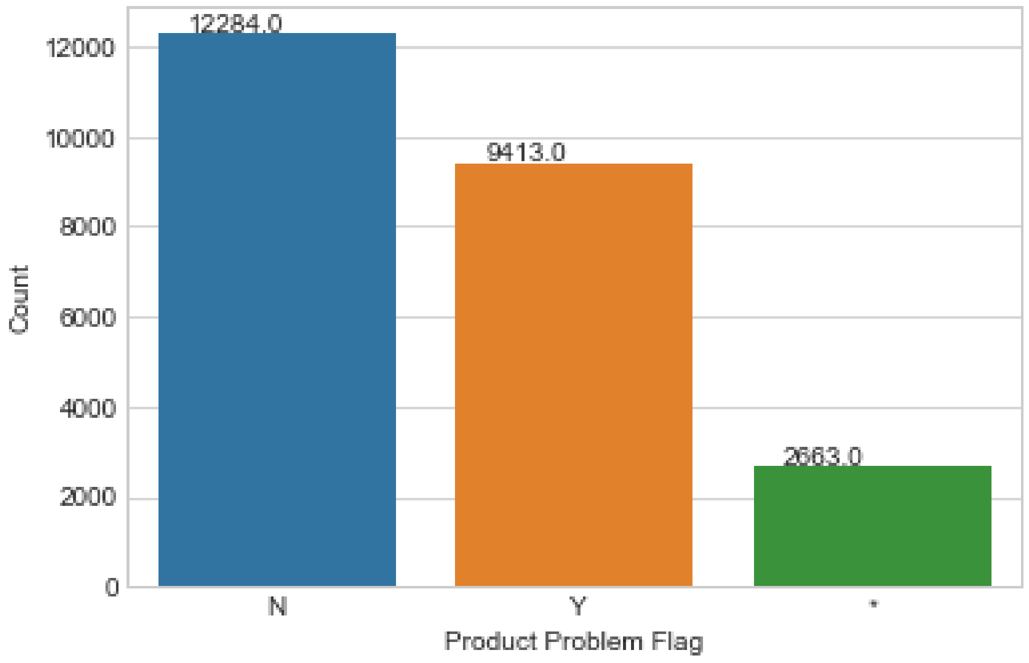
```
In [55]: print("""Adverse Event Flag:
         Y = Yes
         N = No
         * = Invalid""")
         ax = sns.countplot(x='ADVERSE_EVENT_FLAG', data=df_FOI)
         plt.xlabel('Adverse Event Flag')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Adverse Event Flag:
Y = Yes
N = No
* = Invalid
```



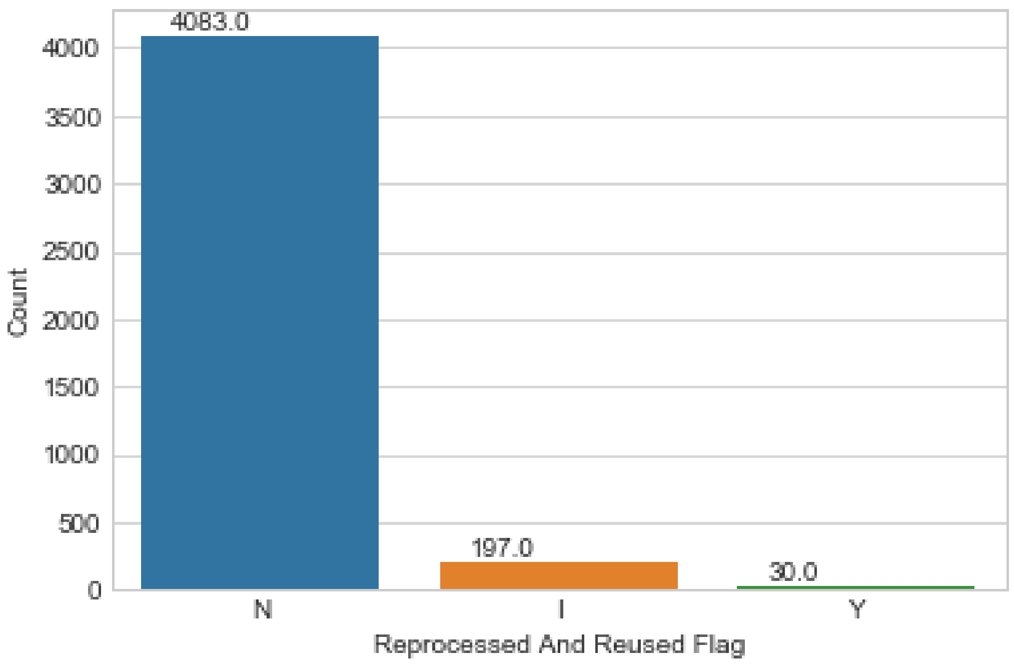
```
In [56]: print("""Product Problem Flag:
         Y = Yes
         N = No
         * = Invalid""")
         ax = sns.countplot(x='PRODUCT_PROBLEM_FLAG', data=df_FOI)
         plt.xlabel('Product Problem Flag')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Product Problem Flag:
Y = Yes
N = No
* = Invalid
```



```
In [57]: print("""Reprocessed And Reused Flag:
         Y = Yes
         N = No
         * = Invalid""")
         ax = sns.countplot(x='REPROCESSED_AND_REUSED_FLAG', data=df_FOI)
         plt.xlabel('Reprocessed And Reused Flag')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Reprocessed And Reused Flag:
Y = Yes
N = No
* = Invalid
```



```
In [39]: print("""Reporter Occupation Code:
         * = INVALID DATA
         000 = OTHER
         001 = PHYSICIAN
         002 = NURSE
         OHP = HEALTH PROFESSIONAL
         OLP = LAY USER/PATIENT
         CST = ?
         100 = OTHER HEALTH CARE PROFESSIONAL
         102 = DENTAL HYGIENIST
         105 = MEDICAL TECHNOLOGIST
         109 = PHARMACIST
         112 = PHYSICIAN ASSISTANT
         115 = SPEECH THERAPIST
         300 = OTHER CAREGIVERS
         301 = DENTAL ASSISTANT
         303 = MEDICAL ASSISTANT
         304 = NURSING ASSISTANT
         305 = PATIENT
         306 = PATIENT FAMILY MEMBER OR FRIEND
         401 = BIOMEDICAL ENGINEER
         403 = MEDICAL EQUIPMENT COMPANY TECHNICIAN/REPRESENTATIVE
         405 = SERVICE PERSONNEL
         500 = RISK MANAGER
         600 = ATTORNEY
```

```
        999 = UNKNOWN
        NI = NO INFORMATION
        UNK = UNKNOWN""")
        df_FOI['REPORTER_OCCUPATION_CODE'].value_counts()
```

```
Reporter Occupation Code:
* = INVALID DATA
000 = OTHER
001 = PHYSICIAN
002 = NURSE
OHP = HEALTH PROFESSIONAL
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100 = OTHER HEALTH CARE PROFESSIONAL
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304 = NURSING ASSISTANT
305 = PATIENT
306 = PATIENT FAMILY MEMBER OR FRIEND
401 = BIOMEDICAL ENGINEER
403 = MEDICAL EQUIPMENT COMPANY TECHNICIAN/REPRESENTATIVE
405 = SERVICE PERSONNEL
500 = RISK MANAGER
600 = ATTORNEY
999 = UNKNOWN
NI = NO INFORMATION
UNK = UNKNOWN
```
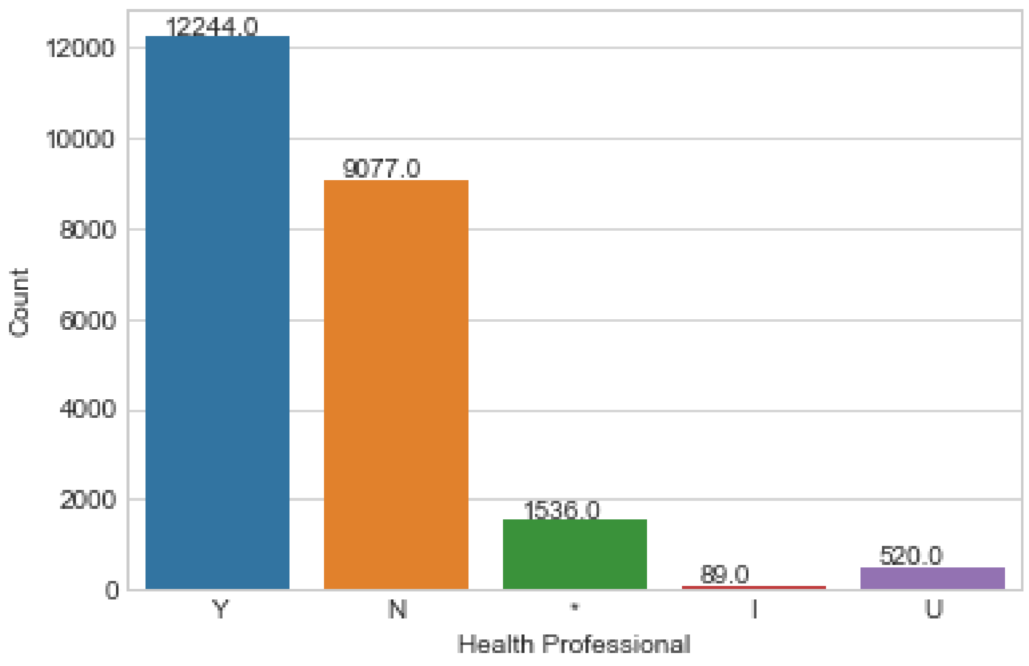

```
Out[39]: 001    5964
         600    4665
         500    2489
         002    2469
         000    2460
         305    2290
         *      1723
         UNK     762
         NI      143
         100     136
         306      50
         401      24
         999      18
```

```
109        8
1          8
OHP        6
CST        3
105        3
303        3
2          3
301        2
102        2
OLP        2
112        2
304        1
115        1
300        1
405        1
403        1
Name: REPORTER_OCCUPATION_CODE, dtype: int64
```

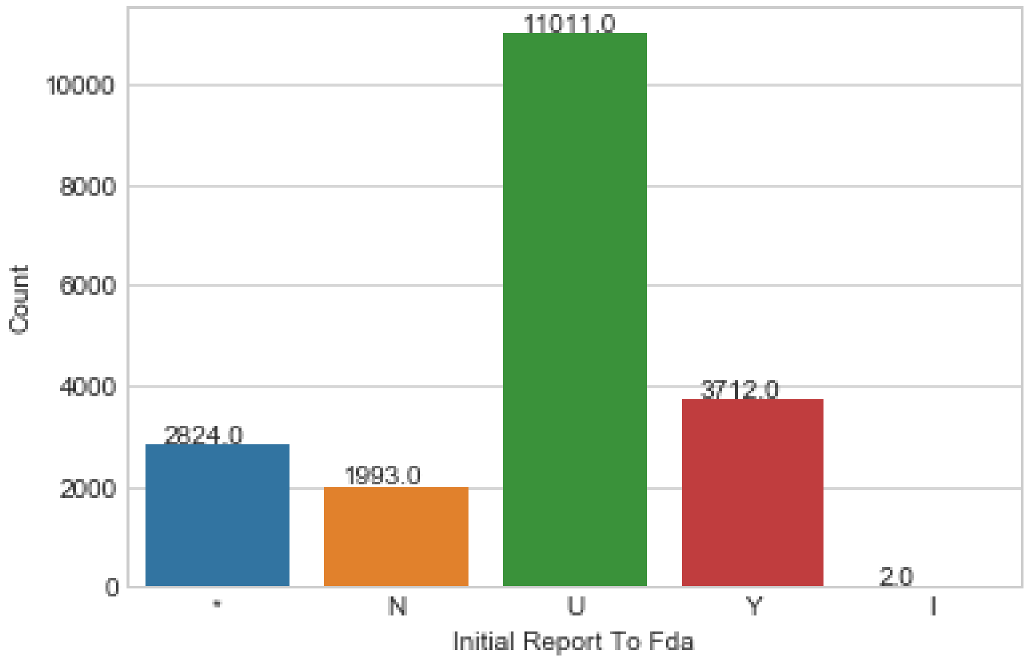
```
In [58]: print("""Health Professional:
         Y = Yes
         U = Unknown;
         N = No;
         I = No information at this time
         * = Invalid""")
         ax = sns.countplot(x='HEALTH_PROFESSIONAL', data=df_FOI)
         plt.xlabel('Health Professional')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Health Professional:
Y = Yes
U = Unknown;
N = No;
I = No information at this time
* = Invalid
```



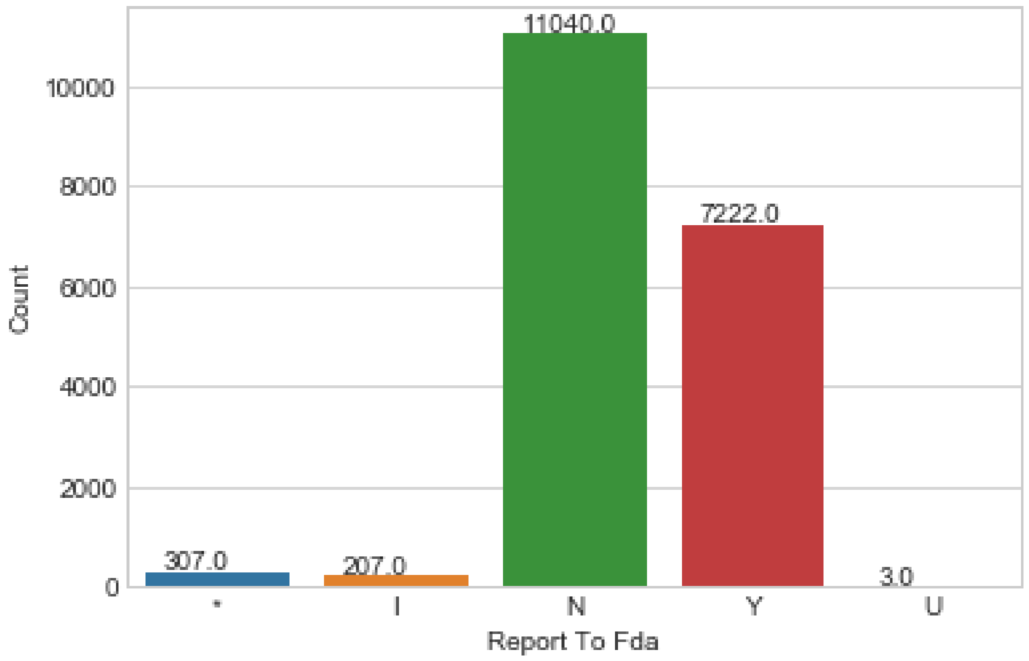
```
In [59]: print("""Initial Report To Fda:
         Y = Yes
         U = Unknown;
         N = No;
         I = No information at this time
         * = Invalid""")
         ax = sns.countplot(x='INITIAL_REPORT_TO_FDA', data=df_FOI)
         plt.xlabel('Initial Report To Fda')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Initial Report To Fda:
Y = Yes
U = Unknown;
N = No;
I = No information at this time
* = Invalid
```



```
In [60]: print("""Report To Fda:
         Y = Yes
         U = Unknown;
         N = No;
         I = No information at this time
         * = Invalid""")
         ax = sns.countplot(x='REPORT_TO_FDA', data=df_FOI)
         plt.xlabel('Report To Fda')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Report To Fda:
Y = Yes
U = Unknown;
N = No;
I = No information at this time
* = Invalid
```



```
In [47]: print("""Event Location:
         * = INVALID DATA
         000 = OTHER
         001 = HOSPITAL
         002 = HOME
         003 = NURSING HOME
         004 = OUTPATIENT TREATMENT FACILITY
         005 = OUTPATIENT DIAGNOSTIC FACILITY
         006 = AMBULATORY SURGICAL FACILITY
         500 = HOSPITAL
         508 = OPERATING ROOM
         509 = OUTPATIENT CLINIC/SURGERY
         600 = AMBULATORY HEALTH CARE FACILITY
         601 = AMBULATORY SURGICAL CENTER
         999 = UNKNOWN
         NI/I = NO INFORMATION
         UNK/U = UNKNOWN""")
         df_FOI['EVENT_LOCATION'].value_counts()
```

```
Event Location:
* = INVALID DATA
000 = OTHER
001 = HOSPITAL
002 = HOME
003 = NURSING HOME
```

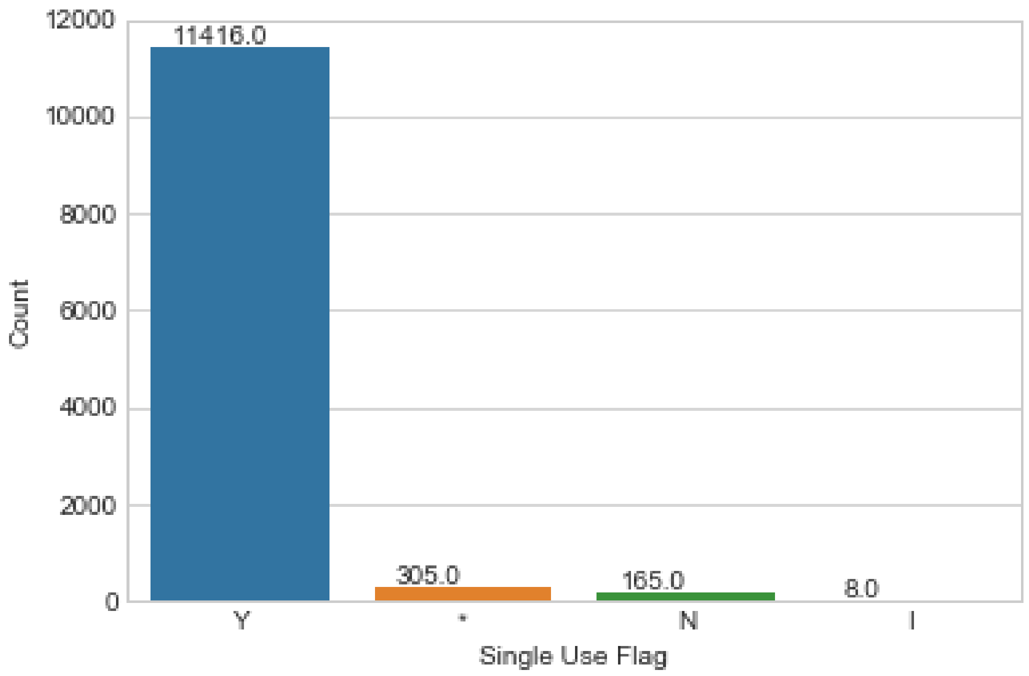
```
004 = OUTPATIENT TREATMENT FACILITY
005 = OUTPATIENT DIAGNOSTIC FACILITY
006 = AMBULATORY SURGICAL FACILITY
500 = HOSPITAL
508 = OPERATING ROOM
509 = OUTPATIENT CLINIC/SURGERY
600 = AMBULATORY HEALTH CARE FACILITY
601 = AMBULATORY SURGICAL CENTER
999 = UNKNOWN
NI/I = NO INFORMATION
UNK/U = UNKNOWN
```

```
Out[47]: UNK    4906
         001    3710
         006    3153
         *      2585
         999    1395
         000     761
         NI      728
         002     684
         I       311
         005      47
         004      36
         601      13
         600       6
         508       5
         500       5
         003       2
         U         1
         509       1
         Name: EVENT_LOCATION, dtype: int64
```

```
In [61]: print("""Single Use Flag:
         Y = Yes
         N = No
         I = No information at this time
         * = Invalid""")
         ax = sns.countplot(x='SINGLE_USE_FLAG', data=df_FOI)
         plt.xlabel('Single Use Flag')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

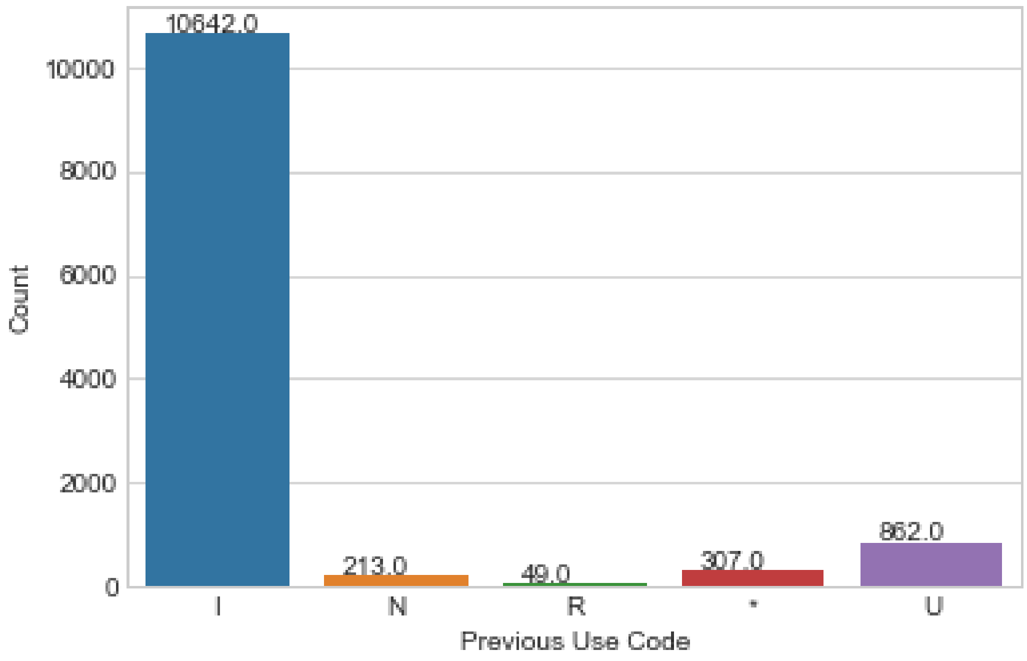
```
Single Use Flag:
Y = Yes
N = No
I = No information at this time
```

```
* = Invalid
```



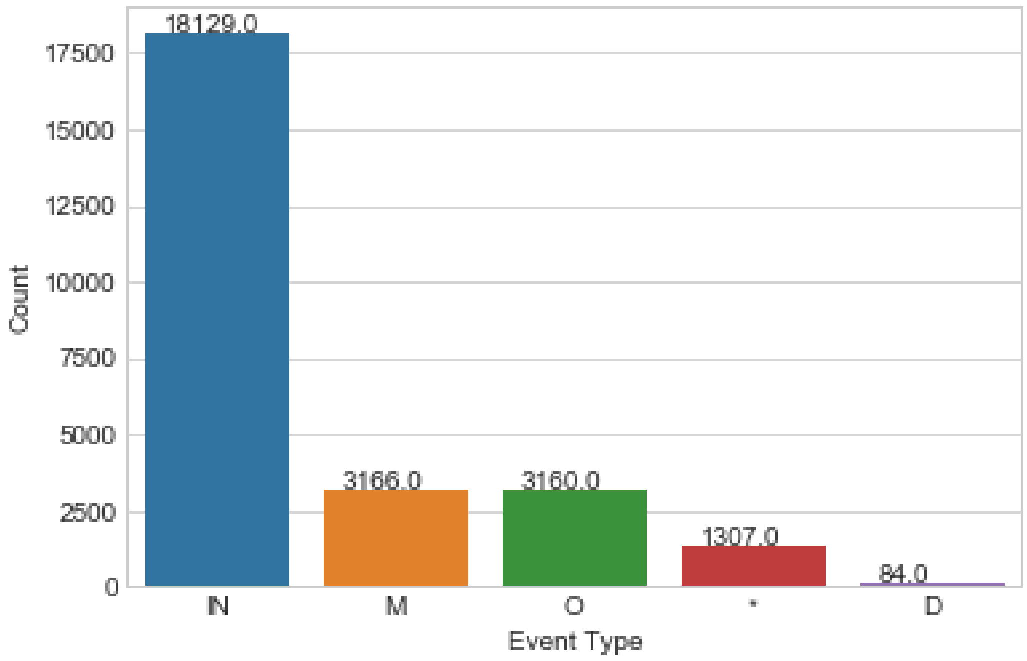
```
In [62]: print("""Previous Use Code:
         I = No information at this time
         N = No
         R = Device was returned to manufacturer
         * = No answer provided
         U = Unknown""")
         ax = sns.countplot(x='PREVIOUS_USE_CODE', data=df_FOI)
         plt.xlabel('Previous Use Code')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Previous Use Code:
I = No information at this time
N = No
R = Device was returned to manufacturer
* = No answer provided
U = Unknown
```



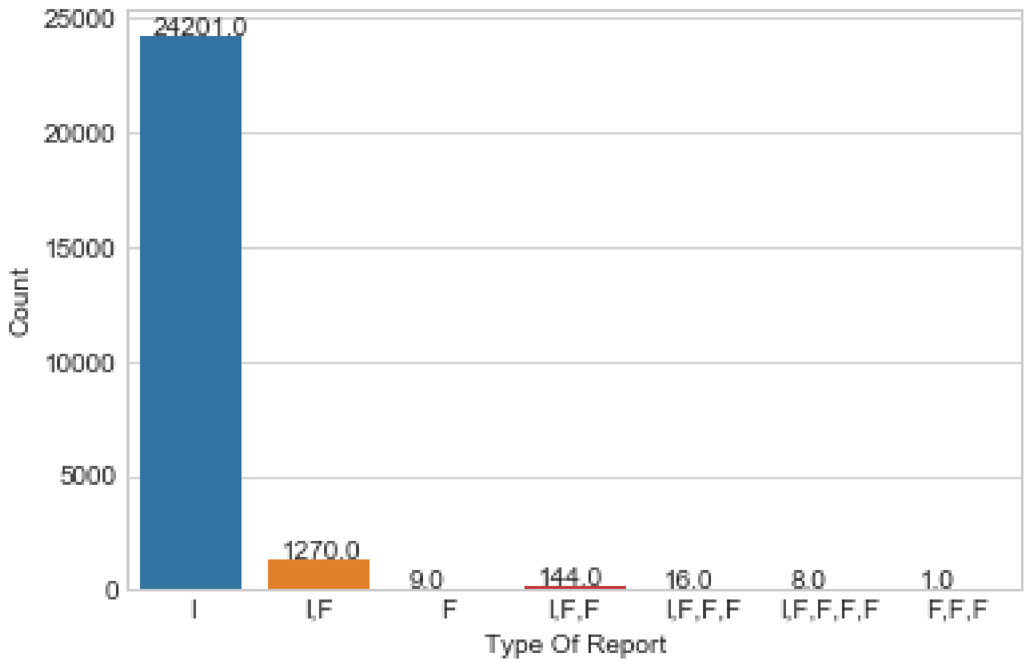
```
In [53]: print("""Event Type:
         D = Death
         IN = Injury
         IL = Injury
         IJ = Injury
         M = Malfunction
         O = Other
         * = No answer provided""")
         ax = sns.countplot(x='EVENT_TYPE', data=df_FOI)
         plt.xlabel('Event Type')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Event Type:
D = Death
IN = Injury
IL = Injury
IJ = Injury
M = Malfunction
O = Other
* = No answer provided
```



```
In [64]: print("""Type Of Report:
         I = Initial submission
         F = Followup
         X = Extra copy received
         O = Other information submitted""")
         ax = sns.countplot(x='TYPE_OF_REPORT', data=df_FOI)
         plt.xlabel('Type Of Report')
         plt.ylabel('Count')
         for p in ax.patches:
             ax.annotate('{:.1f}'.format(p.get_height()), (p.get_x()+0.1, p.get_height()+50))
```

```
Type Of Report:
I = Initial submission
F = Followup
X = Extra copy received
O = Other information submitted
```



```
In [66]: print("Event Location: showing top 30")
         df_FOI['SOURCE_TYPE'].value_counts().nlargest(30)

Event Location: showing top 30


Out[66]: 04                                4063
         00                                2627
         08                                1733
         05                                1721
         06                                 340
         99                                 227
         07                                 178
         05,06                              115
         05,08                               88
         FOREIGN,HEALTH PROFESSIONAL,L       84
         05,07                               53
         01,05                               49
         01,05,06,07                         38
         02,04                               35
         03,05                               35
         04,05                               27
         00,05                               25
         05,06,07                            24
         01,03,05                            23
```

```
COMPANY REPRESENTATIVE,HEALTH      23
HEALTH PROFESSIONAL,LITERATUR      21
FOREIGN,HEALTH PROFESSIONAL        18
05,HEALTH PROFESSIONAL             17
COMPANY REPRESENTATIVE,FOREIG      15
02,04,05                           12
01,07                              11
00,01                              11
HEALTH PROFESSIONAL                11
01,05,07                           10
*                                   9
Name: SOURCE_TYPE, dtype: int64
```

```
In [ ]:
```