Feature engineering for the dataset.

In [159]:
```
#import libraries.
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [160]:
```
data_frame=pd.read_csv('cancer_dataset.csv')
data_frame.head()
```

Out[160]:

	County	FIPS	45.5_objective	Adj.Death_rate	low_death_rate	upper_death_rate	avg_c
0	United States	0	No	46.0	45.9	46.1	157
1	Perry County, Kentucky	21193	No	125.6	108.9	144.2	
2	Powell County, Kentucky	21197	No	125.3	100.2	155.1	
3	North Slope Borough, Alaska	2185	No	124.9	73.0	194.7	
4	Owsley County, Kentucky	21189	No	118.5	83.1	165.5	

In [161]:
```
#we are removing the 'County' feature from dataframe.
data_frame.drop(['County'],axis=1,inplace=True)
```

In [162]:
```
#checking the categorical and numerical variables.
categorical_features=[]
numerical_features=[]
for cols in data_frame.columns:
    if data_frame[cols].dtype=='O':
        categorical_features.append(cols)
    else:
        numerical_features.append(cols)
```

In [163]:
```
print('Categorical features: ',categorical_features)
print('Numeircal features: ',numerical_features)
```

```
Categorical features:  ['45.5_objective', 'recent_trend', 'State']
Numeircal features:  ['FIPS', 'Adj.Death_rate', 'low_death_rate',
'upper_death_rate', 'avg_deaths', 'recent_5_year_trend', 'lower_tr
end', 'upper_trend']
```

In [164]:
```
data_frame.head()
```

Out[164]:

	FIPS	45.5_objective	Adj.Death_rate	low_death_rate	upper_death_rate	avg_deaths	rec
0	0	No	46.0	45.9	46.1	157376.0	
1	21193	No	125.6	108.9	144.2	43.0	
2	21197	No	125.3	100.2	155.1	18.0	
3	2185	No	124.9	73.0	194.7	5.0	
4	21189	No	118.5	83.1	165.5	8.0	

In [165]:
```
#handling missing values.
#first for categorical variables.
for cols in categorical_features:
    data_frame[cols].fillna('Missing',inplace=True)
```

In [166]:
```
data_frame[categorical_features].isnull().sum()
```

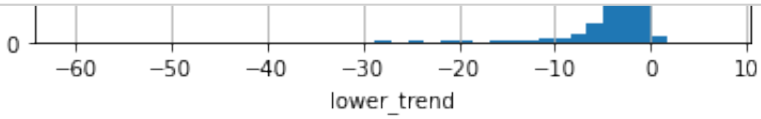
Out[166]:
```
45.5_objective    0
recent_trend      0
State             0
dtype: int64
```

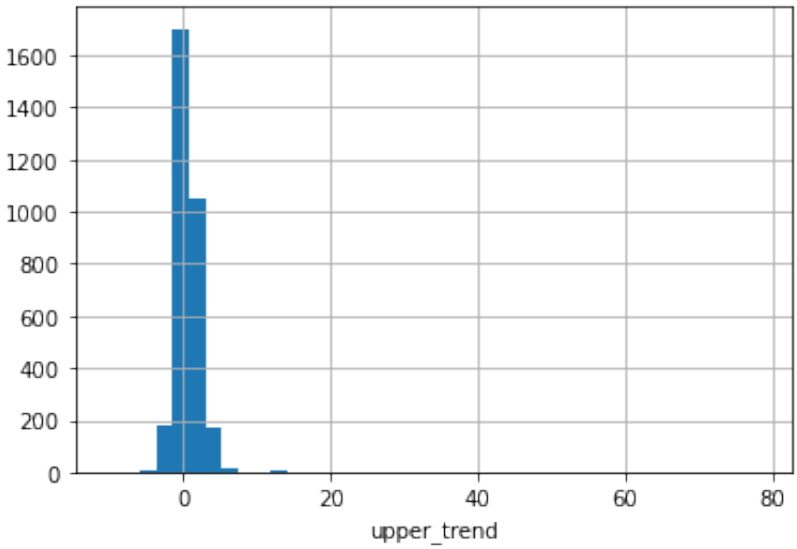
In [167]:
```
#now for numerical features.
for cols in numerical_features:
    median=data_frame[cols].median()
    data_frame[cols].fillna(median,inplace=True)
```

In [168]:
```
data_frame[numerical_features].isnull().sum()
```

Out[168]:
```
FIPS                  0
Adj.Death_rate        0
low_death_rate        0
upper_death_rate      0
avg_deaths            0
recent_5_year_trend   0
lower_trend           0
upper_trend           0
dtype: int64
```

In [169]:
```
#tranforming continous data.
continous_data=[]
for cols in numerical_features:
    if len(data_frame[cols].unique())>25:
        continous_data.append(cols)
        data_frame[cols].hist(bins=40)
        plt.xlabel(cols)
        plt.show()
```





In [170]:
```
#'FIPS', 'Adj.Death_rate','low_death_rate','upper_death_rate','avg_
#these features are need to be tranformed.
```

In [171]:
```
features_trans=['FIPS', 'Adj.Death_rate','low_death_rate','upper_de
transformed_features=[]
for cols in features_trans:
    if 0 in data_frame[cols].unique():
        pass
    else:
        transformed_features.append(cols)
        data_frame[cols]=np.log(data_frame[cols])
```

In [172]:
```
data_frame.head()
```

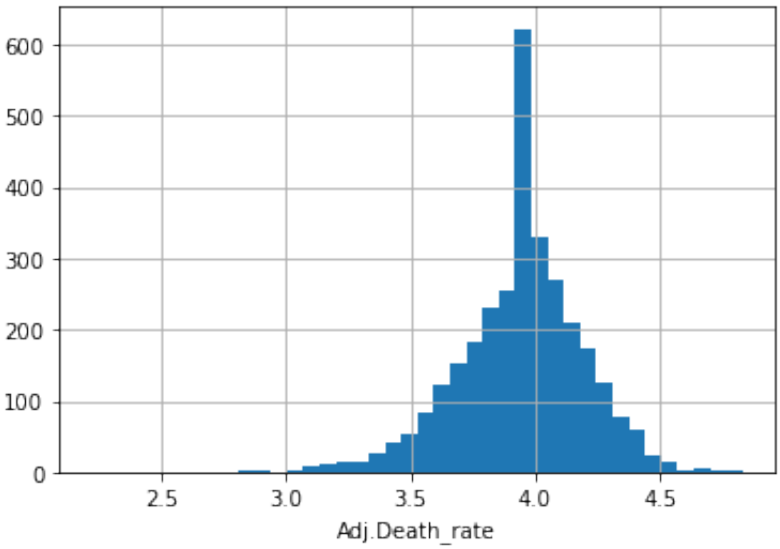
Out[172]:

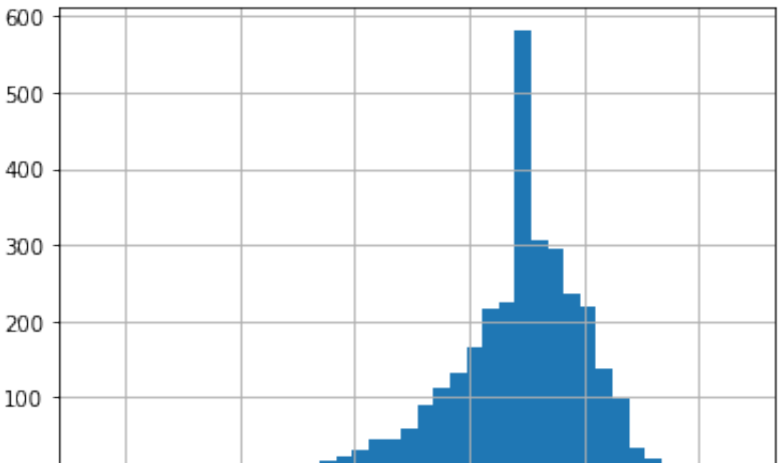
	FIPS	45.5_objective	Adj.Death_rate	low_death_rate	upper_death_rate	avg_deaths	rec
0	0	No	3.828641	3.826465	3.830813	11.966393	
1	21193	No	4.833102	4.690430	4.971201	3.761200	
2	21197	No	4.830711	4.607168	5.044070	2.890372	
3	2185	No	4.827513	4.290459	5.271460	1.609438	
4	21189	No	4.774913	4.420045	5.108971	2.079442	

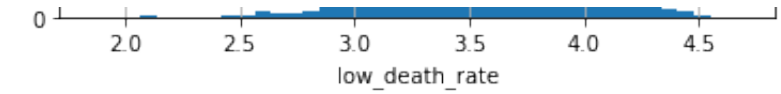
In [173]:
```
print('Features transformed: ',transformed_features)
```

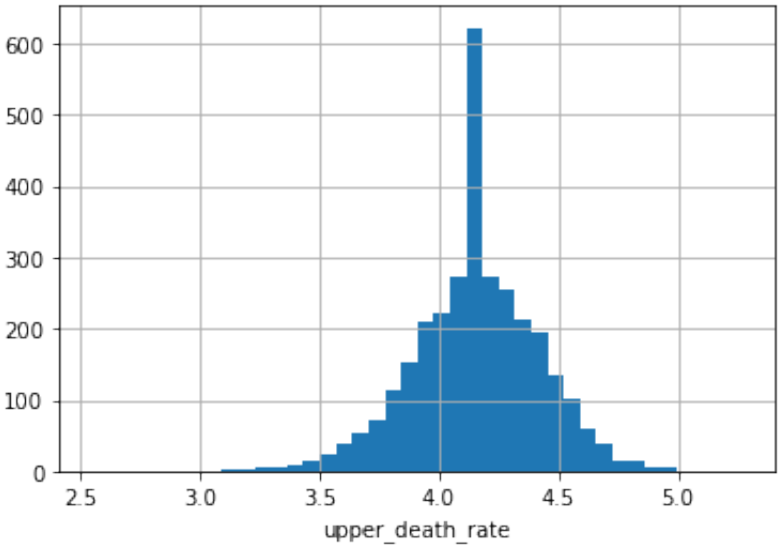
```
Features transformed:  ['Adj.Death_rate', 'low_death_rate', 'upper
_death_rate', 'avg_deaths']
```

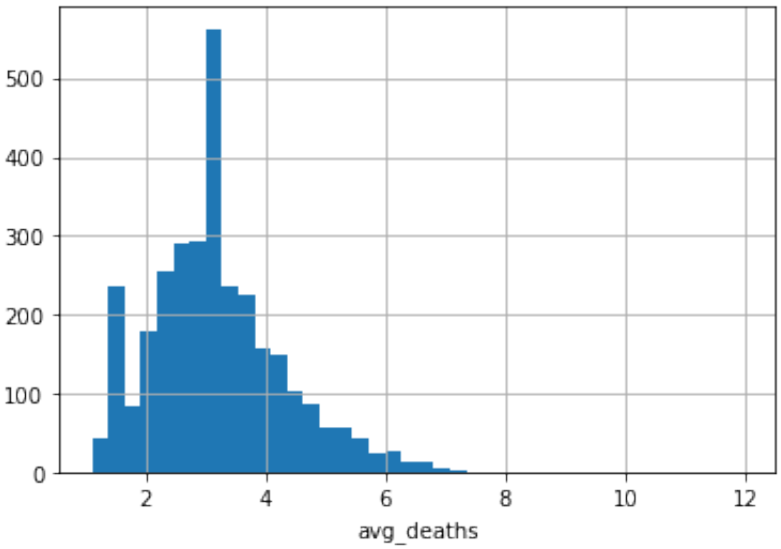
In [174]:
```
for cols in transformed_features:
    data_frame[cols].hist(bins=40)
    plt.xlabel(cols)
    plt.show()
```











In [175]:
```
#handling categorical variables.
#checking out rare categories.
for cols in categorical_features:
    if cols!='State':
        percentage=data_frame.groupby(cols)['FIPS'].count()/len(dat
        percentage_index=percentage[percentage>0.1].index
        data_frame[cols]=np.where(data_frame[cols].isin(percentage_
```

In [176]:
```
data_frame[categorical_features].head(20)
```

Out[176]:

	45.5_objective	recent_trend	State
0	No	falling	United States
1	No	stable	Kentucky
2	No	stable	Kentucky
3	No	Missing	Alaska
4	No	stable	Kentucky
5	No	falling	Florida
6	No	Rare_var	Kentucky
7	No	stable	Kentucky
8	No	stable	Kentucky
9	No	stable	Kentucky
10	No	stable	Kentucky
11	No	stable	Arkansas
12	No	stable	Tennessee
13	No	stable	Kentucky
14	No	stable	Kentucky
15	No	stable	Missouri
16	No	stable	Missouri
17	No	stable	Kentucky
18	No	Missing	Alaska
19	No	stable	Kentucky

In [177]:
```
#'State' feature need not to contain Rare_var because all the categ
```

In [178]:
```
#now, converting categorical features into numeric features.
#checking the number of categories in features.
for cols in categorical_features:
    print(cols,': ',len(data_frame[cols].value_counts()))
```

```
45.5_objective :  3
recent_trend :  4
State :  52
```

In [179]:
```
for cols in categorical_features:
    rank=data_frame[cols].value_counts(ascending=True).index
    mapping={k:i for i,k in enumerate(rank,0)}
    data_frame[cols]=data_frame[cols].map(mapping)
```

In [180]:
```
data_frame.head()
```

Out[180]:

	FIPS	45.5_objective	Adj.Death_rate	low_death_rate	upper_death_rate	avg_deaths	rec
0	0	2	3.828641	3.826465	3.830813	11.966393	
1	21193	2	4.833102	4.690430	4.971201	3.761200	
2	21197	2	4.830711	4.607168	5.044070	2.890372	
3	2185	2	4.827513	4.290459	5.271460	1.609438	
4	21189	2	4.774913	4.420045	5.108971	2.079442	

In [181]:
```
#normalizing the data.
#using mixmax scaler.
from sklearn.preprocessing import MinMaxScaler
```

In [182]:
```
scaler=MinMaxScaler()
x=data_frame.iloc[:,1:-1]
scaler.fit(x)
```

Out[182]:
```
MinMaxScaler()
```

In [187]:
```
transformed_data=scaler.transform(x)
transformed_data_frame=pd.DataFrame(scaler.transform(x),columns=x.c
transformed_data_frame
```

Out[187]:

	45.5_objective	Adj.Death_rate	low_death_rate	upper_death_rate	avg_deaths	recent_
0	1.0	0.615723	0.695157	0.470742	1.000000	0.6
1	1.0	1.000000	1.000000	0.889692	0.244998	1.0
2	1.0	0.999085	0.970622	0.916463	0.164869	1.0
3	1.0	0.997862	0.858874	1.000000	0.047004	0.3
4	1.0	0.977739	0.904597	0.940306	0.090251	1.0
...	...	...	...	...	...	
3136	0.0	0.667016	0.671307	0.591267	0.179053	0.3
3137	0.0	0.667016	0.671307	0.591267	0.179053	0.3
3138	0.0	0.667016	0.671307	0.591267	0.179053	0.3
3139	0.0	0.667016	0.671307	0.591267	0.179053	0.3
3140	0.0	0.667016	0.671307	0.591267	0.179053	0.3

3141 rows × 9 columns

In [190]:
```
final_data_frame=pd.concat([data_frame[['FIPS']].reset_index(drop=T
final_data_frame.head()
```

Out[190]:

	FIPS	45.5_objective	Adj.Death_rate	low_death_rate	upper_death_rate	avg_deaths	rec
0	0	1.0	0.615723	0.695157	0.470742	1.000000	
1	21193	1.0	1.000000	1.000000	0.889692	0.244998	
2	21197	1.0	0.999085	0.970622	0.916463	0.164869	
3	2185	1.0	0.997862	0.858874	1.000000	0.047004	
4	21189	1.0	0.977739	0.904597	0.940306	0.090251	

In [191]:
```
final_data_frame.to_csv('final_data.csv',index=False)
```