Covid

October 27, 2020

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as pl
```

[2]:
```
dataframe = pd.read_csv("https://github.com/owid/covid-19-data/raw/master/
↪public/data/owid-covid-data.csv")
#importing the data
```

[4]:
```
dataframe.info() #viewing the overall data
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 52873 entries, 0 to 52872
Data columns (total 41 columns):
 #   Column                            Non-Null Count  Dtype
---  ------                            --------------  -----
 0   iso_code                          52571 non-null  object
 1   continent                         52269 non-null  object
 2   location                          52873 non-null  object
 3   date                              52873 non-null  object
 4   total_cases                       49259 non-null  float64
 5   new_cases                         51979 non-null  float64
 6   new_cases_smoothed                51185 non-null  float64
 7   total_deaths                      40323 non-null  float64
 8   new_deaths                        51979 non-null  float64
 9   new_deaths_smoothed               51185 non-null  float64
 10  total_cases_per_million           48993 non-null  float64
 11  new_cases_per_million             51915 non-null  float64
 12  new_cases_smoothed_per_million    51120 non-null  float64
 13  total_deaths_per_million          40072 non-null  float64
 14  new_deaths_per_million            51915 non-null  float64
 15  new_deaths_smoothed_per_million   51120 non-null  float64
 16  total_tests                       20007 non-null  float64
 17  new_tests                         19844 non-null  float64
 18  total_tests_per_thousand          20007 non-null  float64
 19  new_tests_per_thousand            19844 non-null  float64
 20  new_tests_smoothed                22220 non-null  float64
 21  new_tests_smoothed_per_thousand   22220 non-null  float64
 22  tests_per_case                    20536 non-null  float64
```

```
 23  positive_rate                  20880 non-null  float64
 24  tests_units                    23217 non-null  object
 25  stringency_index               43997 non-null  float64
 26  population                     52571 non-null  float64
 27  population_density             50123 non-null  float64
 28  median_age                     47079 non-null  float64
 29  aged_65_older                  46373 non-null  float64
 30  aged_70_older                  46834 non-null  float64
 31  gdp_per_capita                 46455 non-null  float64
 32  extreme_poverty                30975 non-null  float64
 33  cardiovasc_death_rate          47052 non-null  float64
 34  diabetes_prevalence            48759 non-null  float64
 35  female_smokers                 36694 non-null  float64
 36  male_smokers                   36223 non-null  float64
 37  handwashing_facilities         22198 non-null  float64
 38  hospital_beds_per_thousand     42423 non-null  float64
 39  life_expectancy                51899 non-null  float64
 40  human_development_index        45419 non-null  float64
dtypes: float64(36), object(5)
memory usage: 16.5+ MB
```

[5]:
```
dataframe.handwashing_facilities.unique() # looking at the number of␣
↪handwashing stations
```

[5]:
```
array([   nan, 37.746, 26.664, 94.043, 83.241,  6.144, 11.035, 11.877,
       34.808, 97.164, 90.083, 25.383, 88.469, 79.807, 16.603, 19.351,
        2.735,  4.472, 47.964, 65.386, 15.574, 83.841, 85.198, 55.182,
       83.741, 80.635, 89.827,  7.96 , 41.047, 17.45 ,  7.876,  6.403,
       24.64 , 76.665, 77.159, 84.169, 22.863, 64.204, 59.55 , 94.576,
       66.425, 98.999, 24.651, 89.22 , 66.229, 49.839,  1.188, 87.202,
        2.117, 86.979, 50.54 , 95.803, 87.847, 52.232, 79.287, 71.18 ,
       12.227, 15.95 ,  8.704, 44.6  ,  8.978, 41.949, 47.782, 97.4  ,
       59.607, 78.463, 79.602,  4.617, 23.437, 20.859, 35.89 , 19.275,
       90.65 ,  9.831, 97.719, 41.34 , 67.779, 24.097, 70.598,  5.818,
       10.475, 90.67 , 72.704, 28.178, 89.443, 78.687, 47.953, 21.222,
       85.847, 49.542, 43.993, 13.938, 36.791, 60.13 ])
```

[6]:
```
dataframe.location.unique() #viewing the countries and world
```

[6]:
```
array(['Aruba', 'Afghanistan', 'Angola', 'Anguilla', 'Albania', 'Andorra',
       'United Arab Emirates', 'Argentina', 'Armenia',
       'Antigua and Barbuda', 'Australia', 'Austria', 'Azerbaijan',
       'Burundi', 'Belgium', 'Benin', 'Bonaire Sint Eustatius and Saba',
       'Burkina Faso', 'Bangladesh', 'Bulgaria', 'Bahrain', 'Bahamas',
       'Bosnia and Herzegovina', 'Belarus', 'Belize', 'Bermuda',
       'Bolivia', 'Brazil', 'Barbados', 'Brunei', 'Bhutan', 'Botswana',
       'Central African Republic', 'Canada', 'Switzerland', 'Chile',
```

```
       'China', "Cote d'Ivoire", 'Cameroon',
       'Democratic Republic of Congo', 'Congo', 'Colombia', 'Comoros',
       'Cape Verde', 'Costa Rica', 'Cuba', 'Curacao', 'Cayman Islands',
       'Cyprus', 'Czech Republic', 'Germany', 'Djibouti', 'Dominica',
       'Denmark', 'Dominican Republic', 'Algeria', 'Ecuador', 'Egypt',
       'Eritrea', 'Western Sahara', 'Spain', 'Estonia', 'Ethiopia',
       'Finland', 'Fiji', 'Falkland Islands', 'France', 'Faeroe Islands',
       'Gabon', 'United Kingdom', 'Georgia', 'Guernsey', 'Ghana',
       'Gibraltar', 'Guinea', 'Gambia', 'Guinea-Bissau',
       'Equatorial Guinea', 'Greece', 'Grenada', 'Greenland', 'Guatemala',
       'Guam', 'Guyana', 'Hong Kong', 'Honduras', 'Croatia', 'Haiti',
       'Hungary', 'Indonesia', 'Isle of Man', 'India', 'Ireland', 'Iran',
       'Iraq', 'Iceland', 'Israel', 'Italy', 'Jamaica', 'Jersey',
       'Jordan', 'Japan', 'Kazakhstan', 'Kenya', 'Kyrgyzstan', 'Cambodia',
       'Saint Kitts and Nevis', 'South Korea', 'Kuwait', 'Laos',
       'Lebanon', 'Liberia', 'Libya', 'Saint Lucia', 'Liechtenstein',
       'Sri Lanka', 'Lesotho', 'Lithuania', 'Luxembourg', 'Latvia',
       'Morocco', 'Monaco', 'Moldova', 'Madagascar', 'Maldives', 'Mexico',
       'Macedonia', 'Mali', 'Malta', 'Myanmar', 'Montenegro', 'Mongolia',
       'Northern Mariana Islands', 'Mozambique', 'Mauritania',
       'Montserrat', 'Mauritius', 'Malawi', 'Malaysia', 'Namibia',
       'New Caledonia', 'Niger', 'Nigeria', 'Nicaragua', 'Netherlands',
       'Norway', 'Nepal', 'New Zealand', 'Oman', 'Pakistan', 'Panama',
       'Peru', 'Philippines', 'Papua New Guinea', 'Poland', 'Puerto Rico',
       'Portugal', 'Paraguay', 'Palestine', 'French Polynesia', 'Qatar',
       'Romania', 'Russia', 'Rwanda', 'Saudi Arabia', 'Sudan', 'Senegal',
       'Singapore', 'Solomon Islands', 'Sierra Leone', 'El Salvador',
       'San Marino', 'Somalia', 'Serbia', 'South Sudan',
       'Sao Tome and Principe', 'Suriname', 'Slovakia', 'Slovenia',
       'Sweden', 'Swaziland', 'Sint Maarten (Dutch part)', 'Seychelles',
       'Syria', 'Turks and Caicos Islands', 'Chad', 'Togo', 'Thailand',
       'Tajikistan', 'Timor', 'Trinidad and Tobago', 'Tunisia', 'Turkey',
       'Taiwan', 'Tanzania', 'Uganda', 'Ukraine', 'Uruguay',
       'United States', 'Uzbekistan', 'Vatican',
       'Saint Vincent and the Grenadines', 'Venezuela',
       'British Virgin Islands', 'United States Virgin Islands',
       'Vietnam', 'Wallis and Futuna', 'Kosovo', 'Yemen', 'South Africa',
       'Zambia', 'Zimbabwe', 'World', 'International'], dtype=object)
```

[13]:
```
df = dataframe[(dataframe.location != 'International')
                        &(dataframe.location != 'World')
                    ]
```

[14]:
```
df.location.unique() #seeing the new data after it being cleaned up
```

[14]:
```
array(['Aruba', 'Afghanistan', 'Angola', 'Anguilla', 'Albania', 'Andorra',
       'United Arab Emirates', 'Argentina', 'Armenia',
```

```
'Antigua and Barbuda', 'Australia', 'Austria', 'Azerbaijan',
'Burundi', 'Belgium', 'Benin', 'Bonaire Sint Eustatius and Saba',
'Burkina Faso', 'Bangladesh', 'Bulgaria', 'Bahrain', 'Bahamas',
'Bosnia and Herzegovina', 'Belarus', 'Belize', 'Bermuda',
'Bolivia', 'Brazil', 'Barbados', 'Brunei', 'Bhutan', 'Botswana',
'Central African Republic', 'Canada', 'Switzerland', 'Chile',
'China', "Cote d'Ivoire", 'Cameroon',
'Democratic Republic of Congo', 'Congo', 'Colombia', 'Comoros',
'Cape Verde', 'Costa Rica', 'Cuba', 'Curacao', 'Cayman Islands',
'Cyprus', 'Czech Republic', 'Germany', 'Djibouti', 'Dominica',
'Denmark', 'Dominican Republic', 'Algeria', 'Ecuador', 'Egypt',
'Eritrea', 'Western Sahara', 'Spain', 'Estonia', 'Ethiopia',
'Finland', 'Fiji', 'Falkland Islands', 'France', 'Faeroe Islands',
'Gabon', 'United Kingdom', 'Georgia', 'Guernsey', 'Ghana',
'Gibraltar', 'Guinea', 'Gambia', 'Guinea-Bissau',
'Equatorial Guinea', 'Greece', 'Grenada', 'Greenland', 'Guatemala',
'Guam', 'Guyana', 'Hong Kong', 'Honduras', 'Croatia', 'Haiti',
'Hungary', 'Indonesia', 'Isle of Man', 'India', 'Ireland', 'Iran',
'Iraq', 'Iceland', 'Israel', 'Italy', 'Jamaica', 'Jersey',
'Jordan', 'Japan', 'Kazakhstan', 'Kenya', 'Kyrgyzstan', 'Cambodia',
'Saint Kitts and Nevis', 'South Korea', 'Kuwait', 'Laos',
'Lebanon', 'Liberia', 'Libya', 'Saint Lucia', 'Liechtenstein',
'Sri Lanka', 'Lesotho', 'Lithuania', 'Luxembourg', 'Latvia',
'Morocco', 'Monaco', 'Moldova', 'Madagascar', 'Maldives', 'Mexico',
'Macedonia', 'Mali', 'Malta', 'Myanmar', 'Montenegro', 'Mongolia',
'Northern Mariana Islands', 'Mozambique', 'Mauritania',
'Montserrat', 'Mauritius', 'Malawi', 'Malaysia', 'Namibia',
'New Caledonia', 'Niger', 'Nigeria', 'Nicaragua', 'Netherlands',
'Norway', 'Nepal', 'New Zealand', 'Oman', 'Pakistan', 'Panama',
'Peru', 'Philippines', 'Papua New Guinea', 'Poland', 'Puerto Rico',
'Portugal', 'Paraguay', 'Palestine', 'French Polynesia', 'Qatar',
'Romania', 'Russia', 'Rwanda', 'Saudi Arabia', 'Sudan', 'Senegal',
'Singapore', 'Solomon Islands', 'Sierra Leone', 'El Salvador',
'San Marino', 'Somalia', 'Serbia', 'South Sudan',
'Sao Tome and Principe', 'Suriname', 'Slovakia', 'Slovenia',
'Sweden', 'Swaziland', 'Sint Maarten (Dutch part)', 'Seychelles',
'Syria', 'Turks and Caicos Islands', 'Chad', 'Togo', 'Thailand',
'Tajikistan', 'Timor', 'Trinidad and Tobago', 'Tunisia', 'Turkey',
'Taiwan', 'Tanzania', 'Uganda', 'Ukraine', 'Uruguay',
'United States', 'Uzbekistan', 'Vatican',
'Saint Vincent and the Grenadines', 'Venezuela',
'British Virgin Islands', 'United States Virgin Islands',
'Vietnam', 'Wallis and Futuna', 'Kosovo', 'Yemen', 'South Africa',
'Zambia', 'Zimbabwe'], dtype=object)
```

[15]:
```
df.handwashing_facilities.unique() #getting numbers from new data set
```

[15]:
```
array([   nan, 37.746, 26.664, 94.043, 83.241,  6.144, 11.035, 11.877,
       34.808, 97.164, 90.083, 25.383, 88.469, 79.807, 16.603, 19.351,
        2.735,  4.472, 47.964, 65.386, 15.574, 83.841, 85.198, 55.182,
       83.741, 80.635, 89.827,  7.96 , 41.047, 17.45 ,  7.876,  6.403,
       24.64 , 76.665, 77.159, 84.169, 22.863, 64.204, 59.55 , 94.576,
       66.425, 98.999, 24.651, 89.22 , 66.229, 49.839,  1.188, 87.202,
        2.117, 86.979, 50.54 , 95.803, 87.847, 52.232, 79.287, 71.18 ,
       12.227, 15.95 ,  8.704, 44.6  ,  8.978, 41.949, 47.782, 97.4  ,
       59.607, 78.463, 79.602,  4.617, 23.437, 20.859, 35.89 , 19.275,
       90.65 ,  9.831, 97.719, 41.34 , 67.779, 24.097, 70.598,  5.818,
       10.475, 90.67 , 72.704, 28.178, 89.443, 78.687, 47.953, 21.222,
       85.847, 49.542, 43.993, 13.938, 36.791])
```

[16]:
```
df['location'].head(10)
```

[16]:
```
0    Aruba
1    Aruba
2    Aruba
3    Aruba
4    Aruba
5    Aruba
6    Aruba
7    Aruba
8    Aruba
9    Aruba
Name: location, dtype: object
```

[ ]:
```

```

[20]:
```
df.groupby('location').handwashing_facilities.min().
 ↪sort_values(ascending=False).iloc[1:10] #looking at min values
```

[20]:
```
location
Serbia                    97.719
Oman                      97.400
Bosnia and Herzegovina    97.164
Maldives                  95.803
Iraq                      94.576
Armenia                   94.043
Thailand                  90.670
El Salvador               90.650
Belize                    90.083
Name: handwashing_facilities, dtype: float64
```

[ ]:
```

```

[19]:
```
df.groupby('location').handwashing_facilities.max().
 ↪sort_values(ascending=False).iloc[1:10]
```

[19]:
```
location
Serbia                     97.719
Oman                       97.400
Bosnia and Herzegovina     97.164
Maldives                   95.803
Iraq                       94.576
Armenia                    94.043
Thailand                   90.670
El Salvador                90.650
Belize                     90.083
Name: handwashing_facilities, dtype: float64
```

[28]:
```
total_max = df.groupby('location').total_cases.max().
 ↪sort_values(ascending=False).iloc[1:10]
#looking at cases max
```

[35]:
```
df.groupby('location').population_density.max().sort_values(ascending=False).
 ↪iloc[1:10]
#viewing if population density has a correlation
#result: no similar countries with most cases and density
```

[35]:
```
location
Singapore                     7915.731
Hong Kong                     7039.714
Gibraltar                     3457.100
Bahrain                       1935.907
Maldives                      1454.433
Malta                         1454.037
Bermuda                       1308.820
Bangladesh                    1265.036
Sint Maarten (Dutch part)     1209.088
Name: population_density, dtype: float64
```

[27]:
```
df.describe()
```

[27]:

	total_cases	new_cases	new_cases_smoothed	total_deaths	\
count	4.869100e+04	51613.000000	50824.000000	39781.000000	
mean	7.126040e+04	844.667894	831.155719	3166.584224	
std	4.319899e+05	4846.531305	4723.250632	14464.209161	
min	1.000000e+00	-8261.000000	-552.000000	1.000000	
25%	1.440000e+02	0.000000	0.714000	11.000000	
50%	1.797000e+03	12.000000	17.286000	74.000000	
75%	1.724150e+04	192.000000	200.857000	613.000000	
max	8.704524e+06	97894.000000	93198.571000	225735.000000	

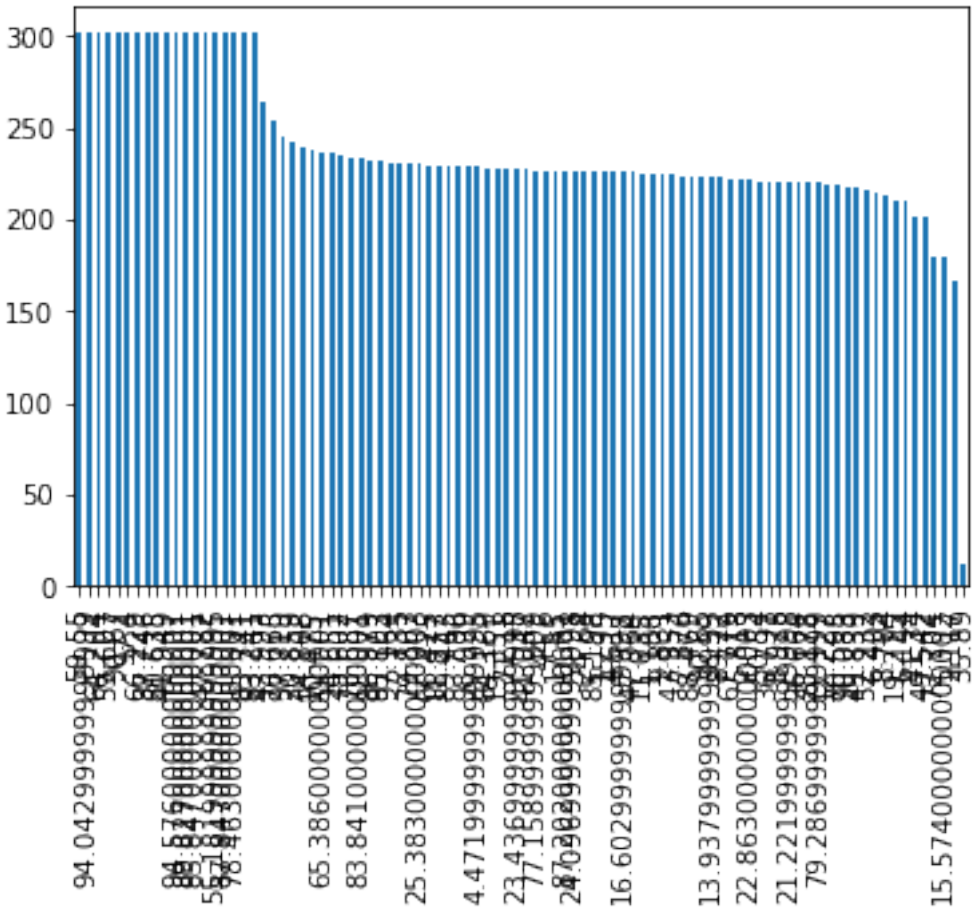
```
         new_deaths  new_deaths_smoothed  total_cases_per_million  \
count  51613.000000         50824.000000             48691.000000
mean      22.492337            22.512157              2602.304369
std      124.789333           115.002189              5133.853732
min    -1918.000000          -232.143000                 0.001000
25%        0.000000             0.000000                76.188000
50%        0.000000             0.286000               499.162000
75%        3.000000             3.429000              2904.073500
max     4928.000000          2715.143000             55976.186000

       new_cases_per_million  new_cases_smoothed_per_million  \
count           51613.000000                    50824.000000
mean               31.478524                       30.502448
std               112.281096                       77.437669
min             -2212.545000                     -269.978000
25%                 0.000000                        0.208000
50%                 1.880000                        3.471000
75%                22.218000                       25.103750
max              8652.658000                     2472.188000

       total_deaths_per_million  …  gdp_per_capita  extreme_poverty  \
count              39781.000000  …    46153.000000     30673.000000
mean                  87.009752  …    20772.812607        12.336648
std                  171.660670  …    20425.804680        19.444164
min                    0.001000  …      661.240000         0.100000
25%                    3.473000  …     5321.444000         0.500000
50%                   18.026000  …    13913.839000         1.800000
75%                   73.826000  …    31400.840000        18.100000
max                 1237.551000  …   116935.600000        77.600000

       cardiovasc_death_rate  diabetes_prevalence  female_smokers  \
count           46750.000000         48457.000000    36392.000000
mean              252.220346             8.053628       10.802742
std               117.776840             4.170617       10.511085
min                79.370000             0.990000        0.100000
25%               155.898000             5.310000        1.900000
50%               240.208000             7.110000        6.300000
75%               318.991000            10.390000       19.600000
max               724.417000            23.360000       44.000000

       male_smokers  handwashing_facilities  hospital_beds_per_thousand  \
count  35921.000000            21896.000000                42121.000000
mean      32.623496               52.129872                    3.099639
std       13.497778               31.833114                    2.527981
min        7.700000                1.188000                    0.100000
25%       21.400000               20.859000                    1.300000
```

```
50%       31.400000              52.232000                    2.500000
75%       41.100000              83.741000                    4.200000
max       78.100000              98.999000                   13.800000

       life_expectancy  human_development_index
count     51597.000000             45419.000000
mean         73.979884                 0.723251
std           7.410511                 0.153115
min          53.280000                 0.354000
25%          69.870000                 0.601000
50%          75.400000                 0.754000
75%          79.380000                 0.847000
max          86.750000                 0.953000

[8 rows x 36 columns]
```

[ ]:

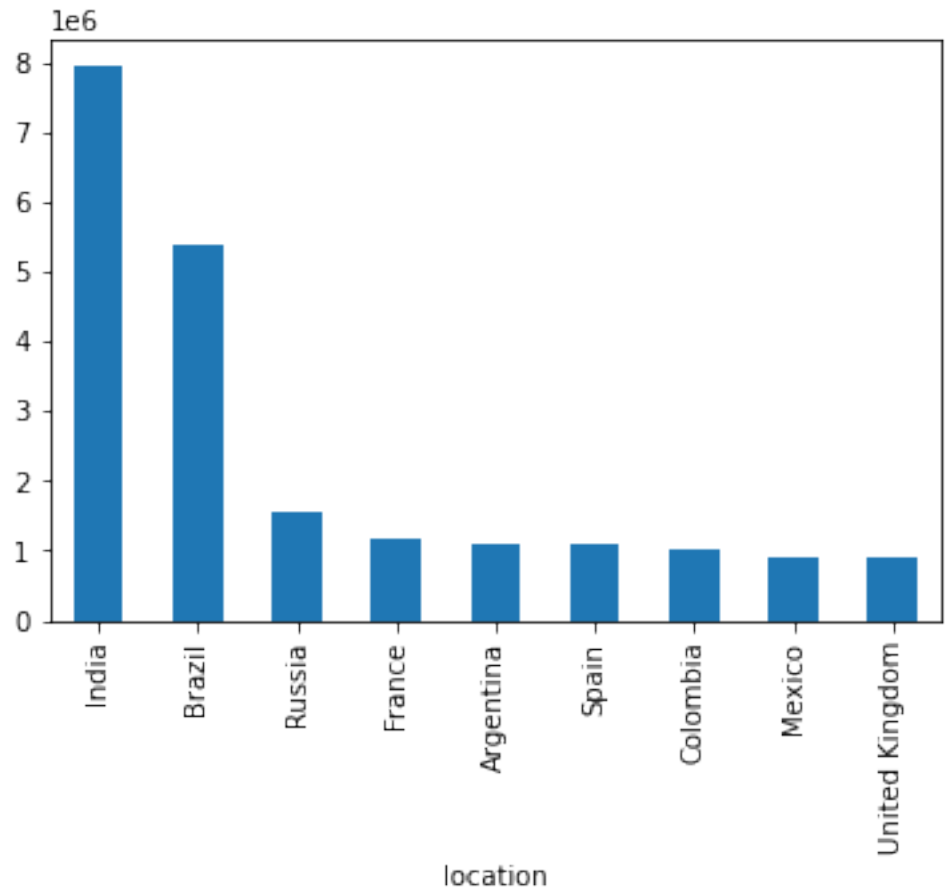
[32]:
```
pd.value_counts(df["handwashing_facilities"]).plot.bar()
```

[32]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff8d08d4700>
```



[48]:
```
total_max.plot(x= 'location', y='total_cases', kind= 'bar')
#messing around with a bar graph
```

[48]: <matplotlib.axes._subplots.AxesSubplot at 0x7ff8d03ebe50>



[47]:
```
df.corr() #looking at the correlation of everything in teh data set
```

[47]:

	total_cases	new_cases	new_cases_smoothed	\
total_cases	1.000000	0.841949	0.867768	
new_cases	0.841949	1.000000	0.980825	
new_cases_smoothed	0.867768	0.980825	1.000000	
total_deaths	0.910993	0.764430	0.783014	
new_deaths	0.592009	0.730192	0.722780	
new_deaths_smoothed	0.657350	0.768107	0.786833	
total_cases_per_million	0.263493	0.195790	0.199255	
new_cases_per_million	0.099621	0.161193	0.137968	
new_cases_smoothed_per_million	0.144408	0.195391	0.194340	
total_deaths_per_million	0.273941	0.207921	0.210628	
new_deaths_per_million	0.084014	0.116865	0.112675	
new_deaths_smoothed_per_million	0.136195	0.171391	0.176385	
total_tests	0.935689	0.761913	0.773019	
new_tests	0.914756	0.905663	0.914507	
total_tests_per_thousand	0.111900	0.060844	0.059316	
new_tests_per_thousand	0.091810	0.077323	0.074209	

new_tests_smoothed	0.892340	0.864100	0.879060
new_tests_smoothed_per_thousand	0.089194	0.070857	0.069192
tests_per_case	-0.037098	-0.042904	-0.042721
positive_rate	0.038953	0.095841	0.095793
stringency_index	0.052751	0.095572	0.096065
population	0.308769	0.373536	0.382461
population_density	-0.019002	-0.019545	-0.019854
median_age	0.066413	0.058989	0.056818
aged_65_older	0.055864	0.050191	0.047378
aged_70_older	0.052667	0.046519	0.043502
gdp_per_capita	0.069860	0.046491	0.045280
extreme_poverty	-0.071829	-0.060010	-0.059338
cardiovasc_death_rate	-0.068436	-0.064372	-0.064462
diabetes_prevalence	0.035326	0.031783	0.033658
female_smokers	0.040547	0.033802	0.031024
male_smokers	-0.073605	-0.079544	-0.082188
handwashing_facilities	0.052219	0.047316	0.046337
hospital_beds_per_thousand	-0.027051	-0.034168	-0.037258
life_expectancy	0.048015	0.040126	0.038544
human_development_index	0.093660	0.080514	0.079272

	total_deaths	new_deaths	\
total_cases	0.910993	0.592009	
new_cases	0.764430	0.730192	
new_cases_smoothed	0.783014	0.722780	
total_deaths	1.000000	0.639454	
new_deaths	0.639454	1.000000	
new_deaths_smoothed	0.712564	0.915875	
total_cases_per_million	0.260665	0.142126	
new_cases_per_million	0.111746	0.105190	
new_cases_smoothed_per_million	0.146368	0.143097	
total_deaths_per_million	0.415523	0.213277	
new_deaths_per_million	0.108466	0.353600	
new_deaths_smoothed_per_million	0.180939	0.348282	
total_tests	0.841018	0.479555	
new_tests	0.828787	0.612653	
total_tests_per_thousand	0.097982	-0.005617	
new_tests_per_thousand	0.093418	0.015202	
new_tests_smoothed	0.796592	0.572695	
new_tests_smoothed_per_thousand	0.085682	0.003774	
tests_per_case	-0.049380	-0.045187	
positive_rate	0.067203	0.212362	
stringency_index	0.040180	0.119794	
population	0.260864	0.274401	
population_density	-0.029762	-0.025882	
median_age	0.124697	0.072055	
aged_65_older	0.128378	0.067233	

aged_70_older	0.129870	0.065403
gdp_per_capita	0.109822	0.053911
extreme_poverty	-0.116942	-0.086793
cardiovasc_death_rate	-0.144064	-0.098738
diabetes_prevalence	0.026215	0.026863
female_smokers	0.095537	0.045536
male_smokers	-0.104110	-0.096741
handwashing_facilities	0.116434	0.093445
hospital_beds_per_thousand	-0.028402	-0.039476
life_expectancy	0.108862	0.061579
human_development_index	0.158215	0.101955

	new_deaths_smoothed	total_cases_per_million	\
total_cases	0.657350	0.263493	
new_cases	0.768107	0.195790	
new_cases_smoothed	0.786833	0.199255	
total_deaths	0.712564	0.260665	
new_deaths	0.915875	0.142126	
new_deaths_smoothed	1.000000	0.158186	
total_cases_per_million	0.158186	1.000000	
new_cases_per_million	0.104784	0.435595	
new_cases_smoothed_per_million	0.153708	0.627124	
total_deaths_per_million	0.241931	0.590000	
new_deaths_per_million	0.239184	0.187681	
new_deaths_smoothed_per_million	0.380771	0.296306	
total_tests	0.529080	0.228296	
new_tests	0.663467	0.180727	
total_tests_per_thousand	-0.005316	0.508445	
new_tests_per_thousand	0.014708	0.402493	
new_tests_smoothed	0.628527	0.185608	
new_tests_smoothed_per_thousand	0.005063	0.441898	
tests_per_case	-0.047661	-0.071458	
positive_rate	0.218046	0.152023	
stringency_index	0.128535	0.038760	
population	0.299056	-0.045883	
population_density	-0.028227	0.054461	
median_age	0.077723	0.178015	
aged_65_older	0.072755	0.070140	
aged_70_older	0.070757	0.069289	
gdp_per_capita	0.058627	0.379321	
extreme_poverty	-0.093659	-0.242430	
cardiovasc_death_rate	-0.108223	-0.200361	
diabetes_prevalence	0.029513	0.128207	
female_smokers	0.049265	0.098052	
male_smokers	-0.104938	-0.044786	
handwashing_facilities	0.101128	0.294176	
hospital_beds_per_thousand	-0.043943	0.015554	

life_expectancy	0.066623	0.271611
human_development_index	0.110552	0.273630

	new_cases_per_million \
total_cases	0.099621
new_cases	0.161193
new_cases_smoothed	0.137968
total_deaths	0.111746
new_deaths	0.105190
new_deaths_smoothed	0.104784
total_cases_per_million	0.435595
new_cases_per_million	1.000000
new_cases_smoothed_per_million	0.717471
total_deaths_per_million	0.262458
new_deaths_per_million	0.227299
new_deaths_smoothed_per_million	0.273032
total_tests	0.119425
new_tests	0.126278
total_tests_per_thousand	0.320563
new_tests_per_thousand	0.353896
new_tests_smoothed	0.128593
new_tests_smoothed_per_thousand	0.359180
tests_per_case	-0.083668
positive_rate	0.328647
stringency_index	0.120435
population	-0.027745
population_density	0.019137
median_age	0.143297
aged_65_older	0.086016
aged_70_older	0.082670
gdp_per_capita	0.198514
extreme_poverty	-0.181298
cardiovasc_death_rate	-0.122440
diabetes_prevalence	0.088617
female_smokers	0.115008
male_smokers	-0.007199
handwashing_facilities	0.249764
hospital_beds_per_thousand	0.033280
life_expectancy	0.142958
human_development_index	0.181439

	new_cases_smoothed_per_million \
total_cases	0.144408
new_cases	0.195391
new_cases_smoothed	0.194340
total_deaths	0.146368
new_deaths	0.143097

```
new_deaths_smoothed                                0.153708
total_cases_per_million                            0.627124
new_cases_per_million                              0.717471
new_cases_smoothed_per_million                     1.000000
total_deaths_per_million                           0.333873
new_deaths_per_million                             0.265621
new_deaths_smoothed_per_million                    0.394760
total_tests                                        0.137097
new_tests                                          0.142409
total_tests_per_thousand                           0.348536
new_tests_per_thousand                             0.367167
new_tests_smoothed                                 0.146981
new_tests_smoothed_per_thousand                    0.391379
tests_per_case                                    -0.093030
positive_rate                                      0.370019
stringency_index                                   0.152410
population                                        -0.038102
population_density                                 0.023557
median_age                                         0.159901
aged_65_older                                      0.089577
aged_70_older                                      0.085319
gdp_per_capita                                     0.227764
extreme_poverty                                   -0.208712
cardiovasc_death_rate                             -0.153033
diabetes_prevalence                                0.116950
female_smokers                                     0.132183
male_smokers                                      -0.013391
handwashing_facilities                             0.294005
hospital_beds_per_thousand                         0.029898
life_expectancy                                    0.196458
human_development_index                            0.220967

                                 total_deaths_per_million  …  \
total_cases                                      0.273941  …
new_cases                                        0.207921  …
new_cases_smoothed                               0.210628  …
total_deaths                                     0.415523  …
new_deaths                                       0.213277  …
new_deaths_smoothed                              0.241931  …
total_cases_per_million                          0.590000  …
new_cases_per_million                            0.262458  …
new_cases_smoothed_per_million                   0.333873  …
total_deaths_per_million                         1.000000  …
new_deaths_per_million                           0.216052  …
new_deaths_smoothed_per_million                  0.364244  …
total_tests                                      0.274244  …
new_tests                                        0.241499  …
```

```
total_tests_per_thousand                    0.208741  …
new_tests_per_thousand                      0.195892  …
new_tests_smoothed                          0.242344  …
new_tests_smoothed_per_thousand             0.191764  …
tests_per_case                             -0.080626  …
positive_rate                               0.082643  …
stringency_index                           -0.051057  …
population                                 -0.028197  …
population_density                         -0.024569  …
median_age                                  0.291655  …
aged_65_older                               0.310024  …
aged_70_older                               0.322438  …
gdp_per_capita                              0.282312  …
extreme_poverty                            -0.258657  …
cardiovasc_death_rate                      -0.307682  …
diabetes_prevalence                        -0.067840  …
female_smokers                              0.305491  …
male_smokers                               -0.104884  …
handwashing_facilities                      0.263976  …
hospital_beds_per_thousand                  0.045304  …
life_expectancy                             0.340106  …
human_development_index                     0.336861  …

                            gdp_per_capita  extreme_poverty  \
total_cases                       0.069860        -0.071829
new_cases                         0.046491        -0.060010
new_cases_smoothed                0.045280        -0.059338
total_deaths                      0.109822        -0.116942
new_deaths                        0.053911        -0.086793
new_deaths_smoothed               0.058627        -0.093659
total_cases_per_million           0.379321        -0.242430
new_cases_per_million             0.198514        -0.181298
new_cases_smoothed_per_million    0.227764        -0.208712
total_deaths_per_million          0.282312        -0.258657
new_deaths_per_million            0.066491        -0.121377
new_deaths_smoothed_per_million   0.100490        -0.176949
total_tests                       0.096119        -0.057008
new_tests                         0.090282        -0.048606
total_tests_per_thousand          0.477220        -0.209806
new_tests_per_thousand            0.503764        -0.220315
new_tests_smoothed                0.093949        -0.054533
new_tests_smoothed_per_thousand   0.538266        -0.236257
tests_per_case                    0.030601        -0.068193
positive_rate                    -0.158301         0.065564
stringency_index                 -0.185554         0.015376
population                       -0.071186        -0.031828
population_density                0.300043        -0.025178
```

median_age	0.630701	-0.693633
aged_65_older	0.483500	-0.568454
aged_70_older	0.475848	-0.551062
gdp_per_capita	1.000000	-0.497718
extreme_poverty	-0.497718	1.000000
cardiovasc_death_rate	-0.479492	0.191783
diabetes_prevalence	0.240242	-0.420077
female_smokers	0.344893	-0.398832
male_smokers	-0.110304	-0.192942
handwashing_facilities	0.654423	-0.767047
hospital_beds_per_thousand	0.278567	-0.425909
life_expectancy	0.684450	-0.750749
human_development_index	0.755392	-0.768519

	cardiovasc_death_rate	diabetes_prevalence	\
total_cases	-0.068436	0.035326	
new_cases	-0.064372	0.031783	
new_cases_smoothed	-0.064462	0.033658	
total_deaths	-0.144064	0.026215	
new_deaths	-0.098738	0.026863	
new_deaths_smoothed	-0.108223	0.029513	
total_cases_per_million	-0.200361	0.128207	
new_cases_per_million	-0.122440	0.088617	
new_cases_smoothed_per_million	-0.153033	0.116950	
total_deaths_per_million	-0.307682	-0.067840	
new_deaths_per_million	-0.107247	-0.000562	
new_deaths_smoothed_per_million	-0.159067	-0.002434	
total_tests	0.014520	0.092432	
new_tests	0.010850	0.100419	
total_tests_per_thousand	-0.132791	0.147415	
new_tests_per_thousand	-0.155710	0.124710	
new_tests_smoothed	-0.001389	0.099458	
new_tests_smoothed_per_thousand	-0.173915	0.151951	
tests_per_case	-0.071292	-0.007406	
positive_rate	0.050203	0.119026	
stringency_index	0.072007	0.079080	
population	0.017449	0.031001	
population_density	-0.177535	0.011914	
median_age	-0.338581	0.154064	
aged_65_older	-0.338003	-0.070513	
aged_70_older	-0.350589	-0.102834	
gdp_per_capita	-0.479492	0.240242	
extreme_poverty	0.191783	-0.420077	
cardiovasc_death_rate	1.000000	0.042174	
diabetes_prevalence	0.042174	1.000000	
female_smokers	-0.189431	-0.098694	
male_smokers	0.437215	0.162834	

handwashing_facilities	-0.038977	0.562801
hospital_beds_per_thousand	0.002022	-0.106187
life_expectancy	-0.494998	0.271163
human_development_index	-0.440872	0.247534

	female_smokers	male_smokers	\
total_cases	0.040547	-0.073605	
new_cases	0.033802	-0.079544	
new_cases_smoothed	0.031024	-0.082188	
total_deaths	0.095537	-0.104110	
new_deaths	0.045536	-0.096741	
new_deaths_smoothed	0.049265	-0.104938	
total_cases_per_million	0.098052	-0.044786	
new_cases_per_million	0.115008	-0.007199	
new_cases_smoothed_per_million	0.132183	-0.013391	
total_deaths_per_million	0.305491	-0.104884	
new_deaths_per_million	0.110731	-0.047989	
new_deaths_smoothed_per_million	0.155210	-0.071195	
total_tests	0.053011	-0.004740	
new_tests	0.047120	-0.020875	
total_tests_per_thousand	0.164963	0.026704	
new_tests_per_thousand	0.192132	0.020184	
new_tests_smoothed	0.063235	-0.022319	
new_tests_smoothed_per_thousand	0.194557	0.017042	
tests_per_case	-0.028191	0.005587	
positive_rate	-0.193338	-0.114655	
stringency_index	-0.189484	-0.040319	
population	-0.133906	0.035413	
population_density	-0.066630	-0.000568	
median_age	0.680270	0.190647	
aged_65_older	0.774867	0.087758	
aged_70_older	0.778346	0.088238	
gdp_per_capita	0.344893	-0.110304	
extreme_poverty	-0.398832	-0.192942	
cardiovasc_death_rate	-0.189431	0.437215	
diabetes_prevalence	-0.098694	0.162834	
female_smokers	1.000000	0.177382	
male_smokers	0.177382	1.000000	
handwashing_facilities	0.266021	0.335684	
hospital_beds_per_thousand	0.487219	0.345966	
life_expectancy	0.523000	0.054582	
human_development_index	0.573898	0.083001	

	handwashing_facilities	\
total_cases	0.052219	
new_cases	0.047316	
new_cases_smoothed	0.046337	

total_deaths	0.116434
new_deaths	0.093445
new_deaths_smoothed	0.101128
total_cases_per_million	0.294176
new_cases_per_million	0.249764
new_cases_smoothed_per_million	0.294005
total_deaths_per_million	0.263976
new_deaths_per_million	0.104773
new_deaths_smoothed_per_million	0.189763
total_tests	0.029016
new_tests	0.029783
total_tests_per_thousand	0.324369
new_tests_per_thousand	0.391435
new_tests_smoothed	0.031173
new_tests_smoothed_per_thousand	0.402904
tests_per_case	0.108685
positive_rate	0.044594
stringency_index	0.113095
population	0.040036
population_density	0.085360
median_age	0.783346
aged_65_older	0.632638
aged_70_older	0.630011
gdp_per_capita	0.654423
extreme_poverty	-0.767047
cardiovasc_death_rate	-0.038977
diabetes_prevalence	0.562801
female_smokers	0.266021
male_smokers	0.335684
handwashing_facilities	1.000000
hospital_beds_per_thousand	0.441046
life_expectancy	0.825678
human_development_index	0.842737

	hospital_beds_per_thousand	life_expectancy	\
total_cases	-0.027051	0.048015	
new_cases	-0.034168	0.040126	
new_cases_smoothed	-0.037258	0.038544	
total_deaths	-0.028402	0.108862	
new_deaths	-0.039476	0.061579	
new_deaths_smoothed	-0.043943	0.066623	
total_cases_per_million	0.015554	0.271611	
new_cases_per_million	0.033280	0.142958	
new_cases_smoothed_per_million	0.029898	0.196458	
total_deaths_per_million	0.045304	0.340106	
new_deaths_per_million	0.006488	0.103934	
new_deaths_smoothed_per_million	0.006908	0.162017	

total_tests	0.010401	0.031479
new_tests	-0.008788	0.026869
total_tests_per_thousand	0.084997	0.296960
new_tests_per_thousand	0.097463	0.326203
new_tests_smoothed	-0.002329	0.038315
new_tests_smoothed_per_thousand	0.069440	0.345892
tests_per_case	-0.011145	0.089895
positive_rate	-0.264836	-0.200251
stringency_index	-0.183079	-0.140433
population	-0.043312	-0.035884
population_density	0.328169	0.207196
median_age	0.661741	0.849103
aged_65_older	0.651092	0.731059
aged_70_older	0.652528	0.718253
gdp_per_capita	0.278567	0.684450
extreme_poverty	-0.425909	-0.750749
cardiovasc_death_rate	0.002022	-0.494998
diabetes_prevalence	-0.106187	0.271163
female_smokers	0.487219	0.523000
male_smokers	0.345966	0.054582
handwashing_facilities	0.441046	0.825678
hospital_beds_per_thousand	1.000000	0.465983
life_expectancy	0.465983	1.000000
human_development_index	0.538400	0.913589

	human_development_index
total_cases	0.093660
new_cases	0.080514
new_cases_smoothed	0.079272
total_deaths	0.158215
new_deaths	0.101955
new_deaths_smoothed	0.110552
total_cases_per_million	0.273630
new_cases_per_million	0.181439
new_cases_smoothed_per_million	0.220967
total_deaths_per_million	0.336861
new_deaths_per_million	0.125723
new_deaths_smoothed_per_million	0.181338
total_tests	0.098284
new_tests	0.093286
total_tests_per_thousand	0.351194
new_tests_per_thousand	0.379162
new_tests_smoothed	0.101183
new_tests_smoothed_per_thousand	0.402099
tests_per_case	0.069522
positive_rate	-0.216824
stringency_index	-0.172363

```
population                          -0.024289
population_density                   0.149532
median_age                           0.886772
aged_65_older                        0.760137
aged_70_older                        0.747496
gdp_per_capita                       0.755392
extreme_poverty                     -0.768519
cardiovasc_death_rate               -0.440872
diabetes_prevalence                  0.247534
female_smokers                       0.573898
male_smokers                         0.083001
handwashing_facilities               0.842737
hospital_beds_per_thousand           0.538400
life_expectancy                      0.913589
human_development_index              1.000000

[36 rows x 36 columns]
```

[46]:
```
column1 = df["total_cases"]
column2 = df["handwashing_facilities"]
correlation = column1. corr(column2)
print(correlation)

#looking at the exact correlation between total cases and handwashing stations
```

```
0.052218559942789955
```

[ ]:

[ ]: