main

May 5, 2025

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import plotly.express as px
```

[2]:
```
url = "https://covid.ourworldindata.org/data/owid-covid-data.csv"
df = pd.read_csv(url)
print(df.head())
```

```
  iso_code continent     location        date  total_cases  new_cases  \
0      AFG      Asia  Afghanistan  2020-01-05          0.0        0.0
1      AFG      Asia  Afghanistan  2020-01-06          0.0        0.0
2      AFG      Asia  Afghanistan  2020-01-07          0.0        0.0
3      AFG      Asia  Afghanistan  2020-01-08          0.0        0.0
4      AFG      Asia  Afghanistan  2020-01-09          0.0        0.0

   new_cases_smoothed  total_deaths  new_deaths  new_deaths_smoothed  …  \
0                 NaN           0.0         0.0                  NaN  …
1                 NaN           0.0         0.0                  NaN  …
2                 NaN           0.0         0.0                  NaN  …
3                 NaN           0.0         0.0                  NaN  …
4                 NaN           0.0         0.0                  NaN  …

   male_smokers  handwashing_facilities  hospital_beds_per_thousand  \
0           NaN                  37.746                         0.5
1           NaN                  37.746                         0.5
2           NaN                  37.746                         0.5
3           NaN                  37.746                         0.5
4           NaN                  37.746                         0.5

   life_expectancy  human_development_index  population  \
0            64.83                    0.511    41128772
1            64.83                    0.511    41128772
2            64.83                    0.511    41128772
3            64.83                    0.511    41128772
4            64.83                    0.511    41128772
```

```
   excess_mortality_cumulative_absolute  excess_mortality_cumulative  \
0                                   NaN                          NaN
1                                   NaN                          NaN
2                                   NaN                          NaN
3                                   NaN                          NaN
4                                   NaN                          NaN

   excess_mortality  excess_mortality_cumulative_per_million
0               NaN                                      NaN
1               NaN                                      NaN
2               NaN                                      NaN
3               NaN                                      NaN
4               NaN                                      NaN

[5 rows x 67 columns]
```

[3]:
```
df.columns
```

[3]:
```
Index(['iso_code', 'continent', 'location', 'date', 'total_cases', 'new_cases',
       'new_cases_smoothed', 'total_deaths', 'new_deaths',
       'new_deaths_smoothed', 'total_cases_per_million',
       'new_cases_per_million', 'new_cases_smoothed_per_million',
       'total_deaths_per_million', 'new_deaths_per_million',
       'new_deaths_smoothed_per_million', 'reproduction_rate', 'icu_patients',
       'icu_patients_per_million', 'hosp_patients',
       'hosp_patients_per_million', 'weekly_icu_admissions',
       'weekly_icu_admissions_per_million', 'weekly_hosp_admissions',
       'weekly_hosp_admissions_per_million', 'total_tests', 'new_tests',
       'total_tests_per_thousand', 'new_tests_per_thousand',
       'new_tests_smoothed', 'new_tests_smoothed_per_thousand',
       'positive_rate', 'tests_per_case', 'tests_units', 'total_vaccinations',
       'people_vaccinated', 'people_fully_vaccinated', 'total_boosters',
       'new_vaccinations', 'new_vaccinations_smoothed',
       'total_vaccinations_per_hundred', 'people_vaccinated_per_hundred',
       'people_fully_vaccinated_per_hundred', 'total_boosters_per_hundred',
       'new_vaccinations_smoothed_per_million',
       'new_people_vaccinated_smoothed',
       'new_people_vaccinated_smoothed_per_hundred', 'stringency_index',
       'population_density', 'median_age', 'aged_65_older', 'aged_70_older',
       'gdp_per_capita', 'extreme_poverty', 'cardiovasc_death_rate',
       'diabetes_prevalence', 'female_smokers', 'male_smokers',
       'handwashing_facilities', 'hospital_beds_per_thousand',
       'life_expectancy', 'human_development_index', 'population',
       'excess_mortality_cumulative_absolute', 'excess_mortality_cumulative',
       'excess_mortality', 'excess_mortality_cumulative_per_million'],
      dtype='object')
```

[4]:
```
df.head()
```

[4]:
```
  iso_code continent     location        date  total_cases  new_cases  \
0      AFG      Asia  Afghanistan  2020-01-05          0.0        0.0
1      AFG      Asia  Afghanistan  2020-01-06          0.0        0.0
2      AFG      Asia  Afghanistan  2020-01-07          0.0        0.0
3      AFG      Asia  Afghanistan  2020-01-08          0.0        0.0
4      AFG      Asia  Afghanistan  2020-01-09          0.0        0.0

   new_cases_smoothed  total_deaths  new_deaths  new_deaths_smoothed  …  \
0                 NaN           0.0         0.0                  NaN  …
1                 NaN           0.0         0.0                  NaN  …
2                 NaN           0.0         0.0                  NaN  …
3                 NaN           0.0         0.0                  NaN  …
4                 NaN           0.0         0.0                  NaN  …

   male_smokers  handwashing_facilities  hospital_beds_per_thousand  \
0           NaN                  37.746                         0.5
1           NaN                  37.746                         0.5
2           NaN                  37.746                         0.5
3           NaN                  37.746                         0.5
4           NaN                  37.746                         0.5

   life_expectancy  human_development_index  population  \
0            64.83                    0.511    41128772
1            64.83                    0.511    41128772
2            64.83                    0.511    41128772
3            64.83                    0.511    41128772
4            64.83                    0.511    41128772

   excess_mortality_cumulative_absolute  excess_mortality_cumulative  \
0                                   NaN                          NaN
1                                   NaN                          NaN
2                                   NaN                          NaN
3                                   NaN                          NaN
4                                   NaN                          NaN

   excess_mortality  excess_mortality_cumulative_per_million
0               NaN                                      NaN
1               NaN                                      NaN
2               NaN                                      NaN
3               NaN                                      NaN
4               NaN                                      NaN

[5 rows x 67 columns]
```

[5]:
```
df.isnull().sum()
```

[5]:
```
iso_code                                      0
continent                                 26525
location                                      0
date                                          0
total_cases                               17631
                                            …
population                                    0
excess_mortality_cumulative_absolute     416024
excess_mortality_cumulative              416024
excess_mortality                         416024
excess_mortality_cumulative_per_million  416024
Length: 67, dtype: int64
```

[6]:
```
#  Filter countries of interest
countries = ['Kenya', 'United States', 'India']
df_filtered = df[df['location'].isin(countries)].copy()

# Drop rows with missing dates or critical values (e.g., total_cases or␣
 ↪total_deaths)
df_filtered.dropna(subset=['date', 'total_cases', 'total_deaths'], inplace=True)

#  Convert date column to datetime
df_filtered['date'] = pd.to_datetime(df_filtered['date'])

#  Sort by country and date before interpolation
df_filtered.sort_values(by=['location', 'date'], inplace=True)

#  Handle missing numeric values by interpolating only numeric columns
numeric_cols = df_filtered.select_dtypes(include=['number']).columns
df_filtered[numeric_cols] = df_filtered[numeric_cols].
 ↪interpolate(method='linear')

#  Confirm result
print(df_filtered.head())
```

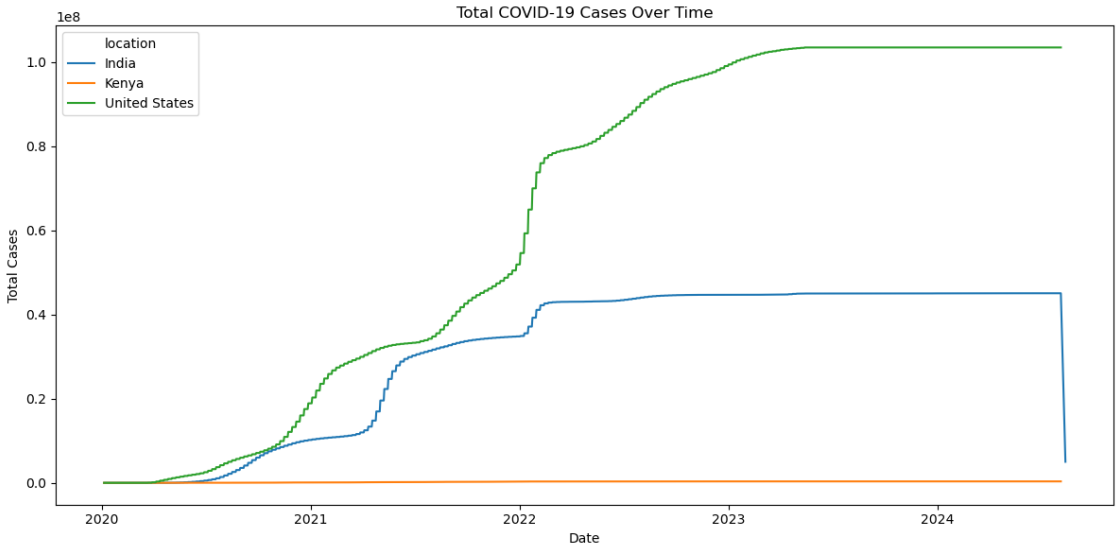
```
       iso_code continent location       date  total_cases  new_cases  \
173549      IND      Asia    India 2020-01-05          0.0        0.0
173550      IND      Asia    India 2020-01-06          0.0        0.0
173551      IND      Asia    India 2020-01-07          0.0        0.0
173552      IND      Asia    India 2020-01-08          0.0        0.0
173553      IND      Asia    India 2020-01-09          0.0        0.0

        new_cases_smoothed  total_deaths  new_deaths  new_deaths_smoothed  \
173549                 NaN           0.0         0.0                  NaN
173550                 NaN           0.0         0.0                  NaN
173551                 NaN           0.0         0.0                  NaN
173552                 NaN           0.0         0.0                  NaN
```

```
173553                NaN           0.0         0.0                   NaN

        …  male_smokers  handwashing_facilities  hospital_beds_per_thousand  \
173549  …          20.6                   59.55                        0.53
173550  …          20.6                   59.55                        0.53
173551  …          20.6                   59.55                        0.53
173552  …          20.6                   59.55                        0.53
173553  …          20.6                   59.55                        0.53

        life_expectancy  human_development_index  population  \
173549            69.66                    0.645  1417173120
173550            69.66                    0.645  1417173120
173551            69.66                    0.645  1417173120
173552            69.66                    0.645  1417173120
173553            69.66                    0.645  1417173120

        excess_mortality_cumulative_absolute  excess_mortality_cumulative  \
173549                                   NaN                          NaN
173550                                   NaN                          NaN
173551                                   NaN                          NaN
173552                                   NaN                          NaN
173553                                   NaN                          NaN

        excess_mortality  excess_mortality_cumulative_per_million
173549               NaN                                      NaN
173550               NaN                                      NaN
173551               NaN                                      NaN
173552               NaN                                      NaN
173553               NaN                                      NaN

[5 rows x 67 columns]
```

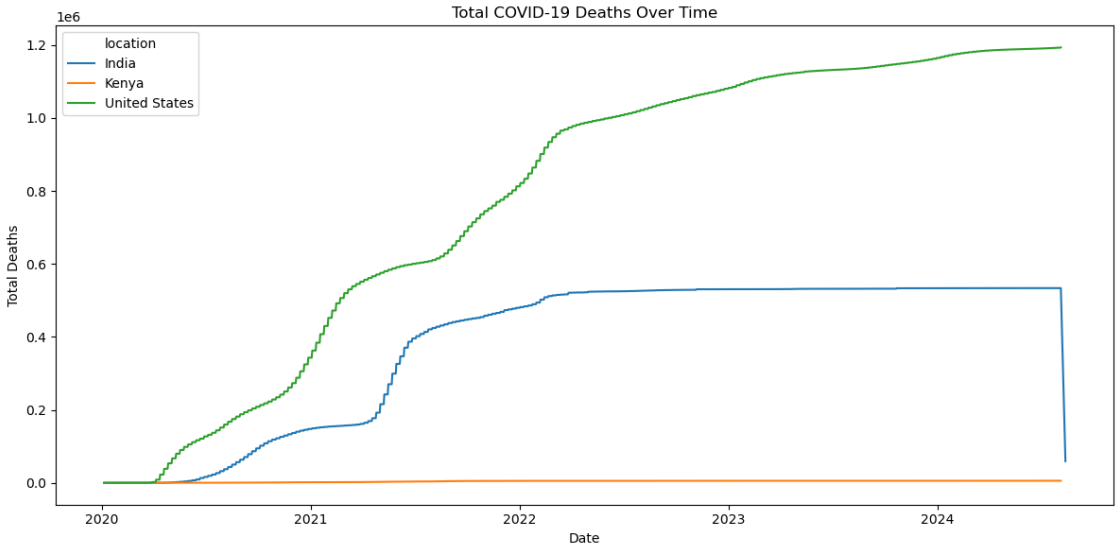
[7]:
```python
# Filter countries
countries = ['Kenya', 'United States', 'India']
df = df[df['location'].isin(countries)].copy()

# Clean data
df = df[['location', 'date', 'total_cases', 'new_cases', 'total_deaths']]
df.dropna(subset=['date'], inplace=True)
df['date'] = pd.to_datetime(df['date'])
df.sort_values(by=['location', 'date'], inplace=True)
df[['total_cases', 'new_cases', 'total_deaths']] = df[['total_cases',␣
 ↪'new_cases', 'total_deaths']].interpolate()
```

[8]:
```python
plt.figure(figsize=(12, 6))
sns.lineplot(data=df, x='date', y='total_cases', hue='location')
plt.title('Total COVID-19 Cases Over Time')
```

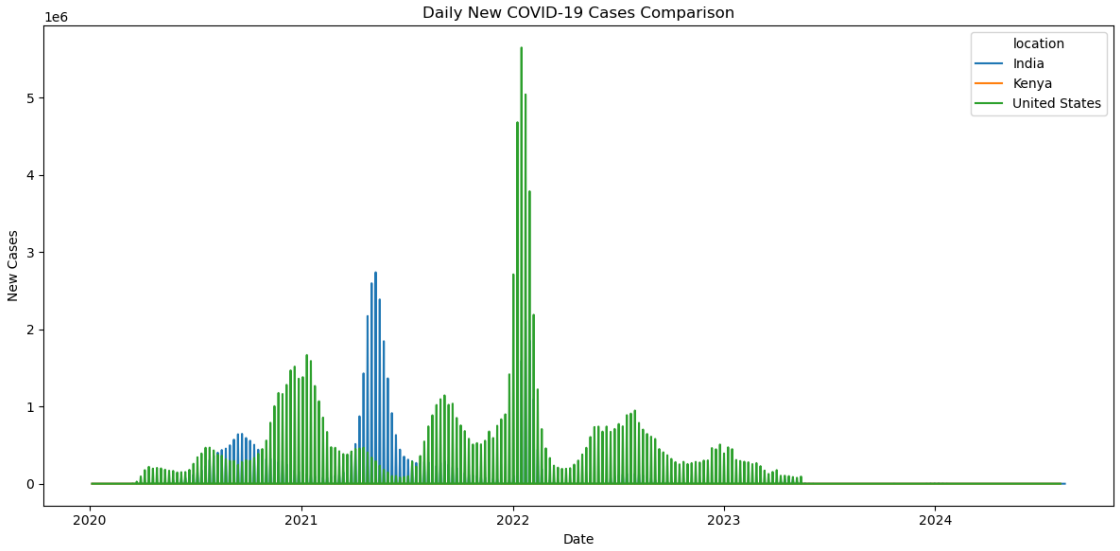
```
plt.xlabel('Date')
plt.ylabel('Total Cases')
plt.tight_layout()
plt.show()
```



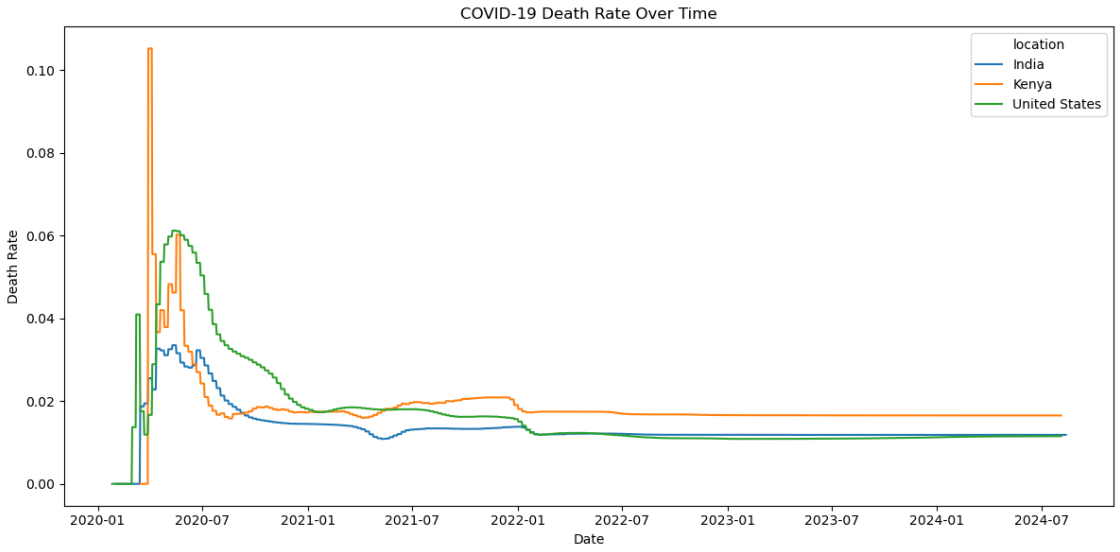
[9]:
```
plt.figure(figsize=(12, 6))
sns.lineplot(data=df, x='date', y='total_deaths', hue='location')
plt.title('Total COVID-19 Deaths Over Time')
plt.xlabel('Date')
plt.ylabel('Total Deaths')
plt.tight_layout()
plt.show()
```



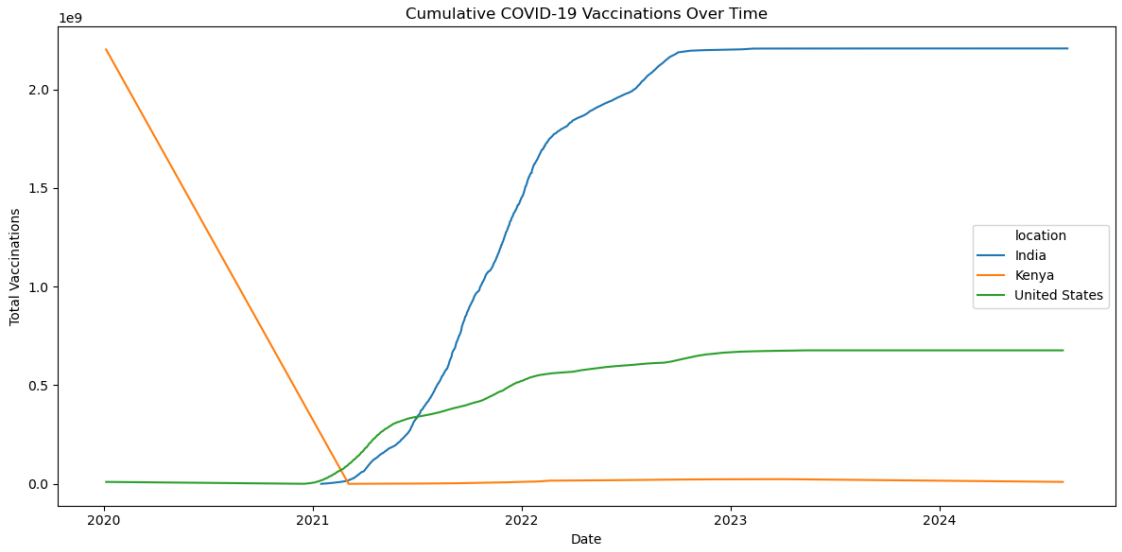
[10]:
```
plt.figure(figsize=(12, 6))
sns.lineplot(data=df, x='date', y='new_cases', hue='location')
plt.title('Daily New COVID-19 Cases Comparison')
plt.xlabel('Date')
plt.ylabel('New Cases')
plt.tight_layout()
plt.show()
```



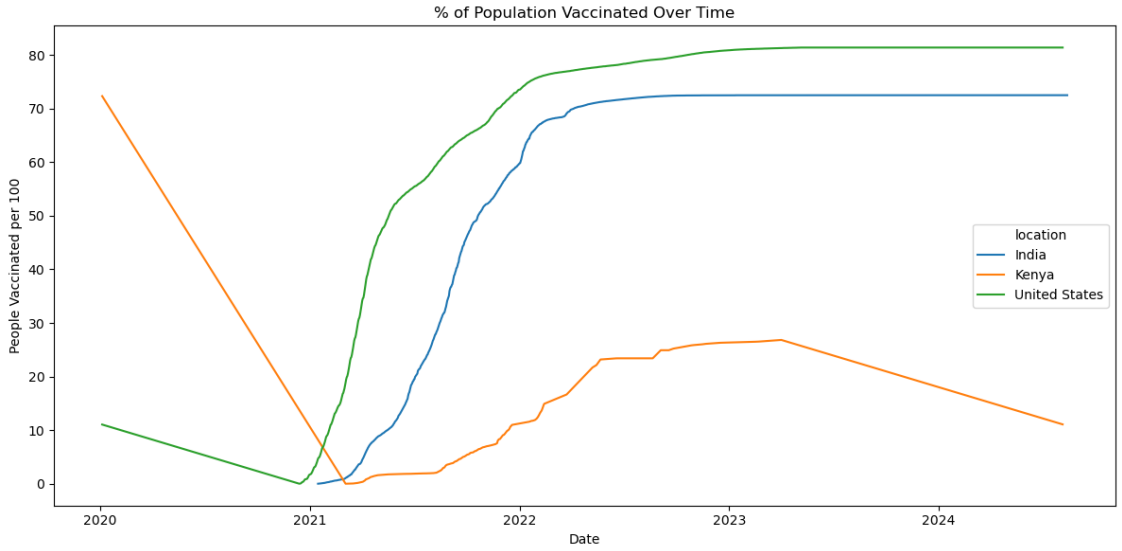
[11]:
```
df['death_rate'] = df['total_deaths'] / df['total_cases']

plt.figure(figsize=(12, 6))
sns.lineplot(data=df, x='date', y='death_rate', hue='location')
plt.title('COVID-19 Death Rate Over Time')
plt.xlabel('Date')
plt.ylabel('Death Rate')
plt.tight_layout()
plt.show()
```



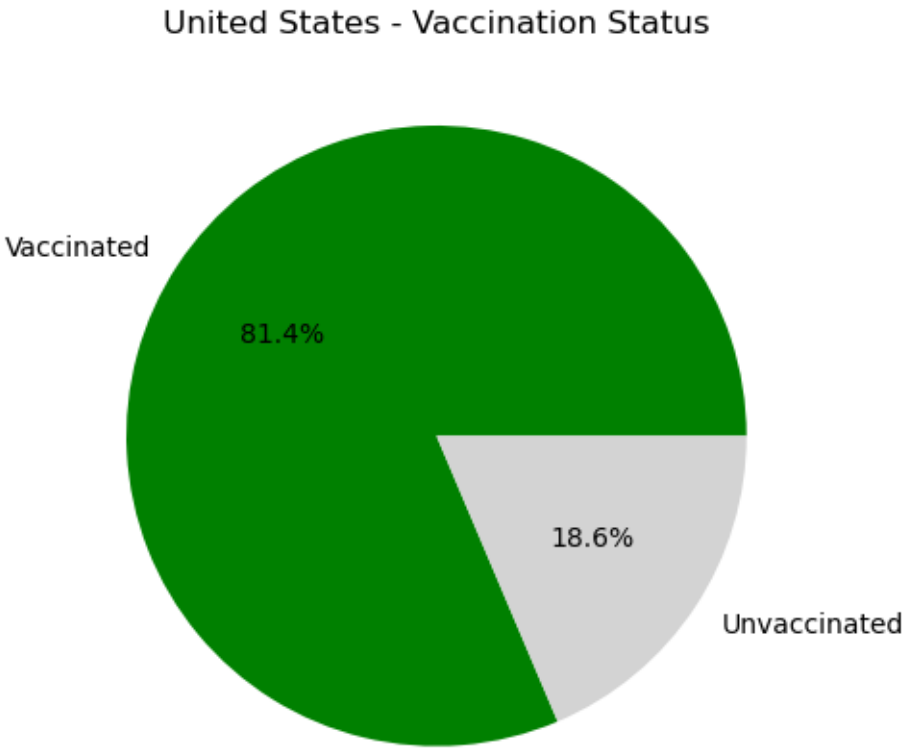
[12]:
```
url = "https://covid.ourworldindata.org/data/owid-covid-data.csv"
df = pd.read_csv(url)

# Filter relevant countries
countries = ['Kenya', 'United States', 'India']
df_vax = df[df['location'].isin(countries)][[
    'location', 'date', 'total_vaccinations', 'people_vaccinated_per_hundred',␣
 ↪'population'
]].copy()

# Clean up
df_vax.dropna(subset=['date'], inplace=True)
df_vax['date'] = pd.to_datetime(df_vax['date'])
df_vax.sort_values(by=['location', 'date'], inplace=True)
df_vax[['total_vaccinations', 'people_vaccinated_per_hundred']] = df_vax[[
    'total_vaccinations', 'people_vaccinated_per_hundred'
]].interpolate()

plt.figure(figsize=(12, 6))
sns.lineplot(data=df_vax, x='date', y='total_vaccinations', hue='location')
plt.title('Cumulative COVID-19 Vaccinations Over Time')
plt.xlabel('Date')
plt.ylabel('Total Vaccinations')
plt.tight_layout()
plt.show()
```

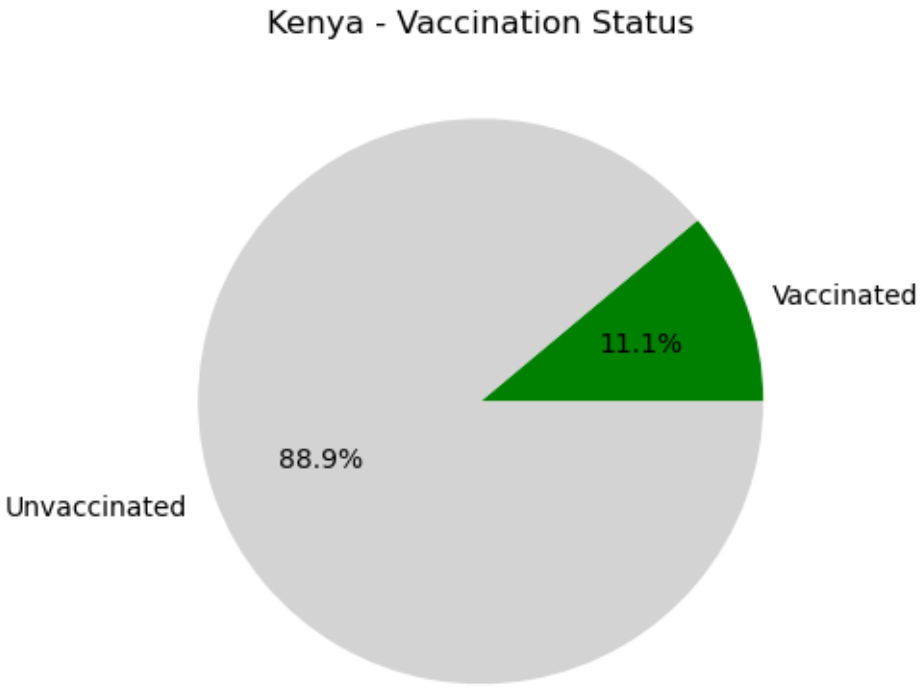


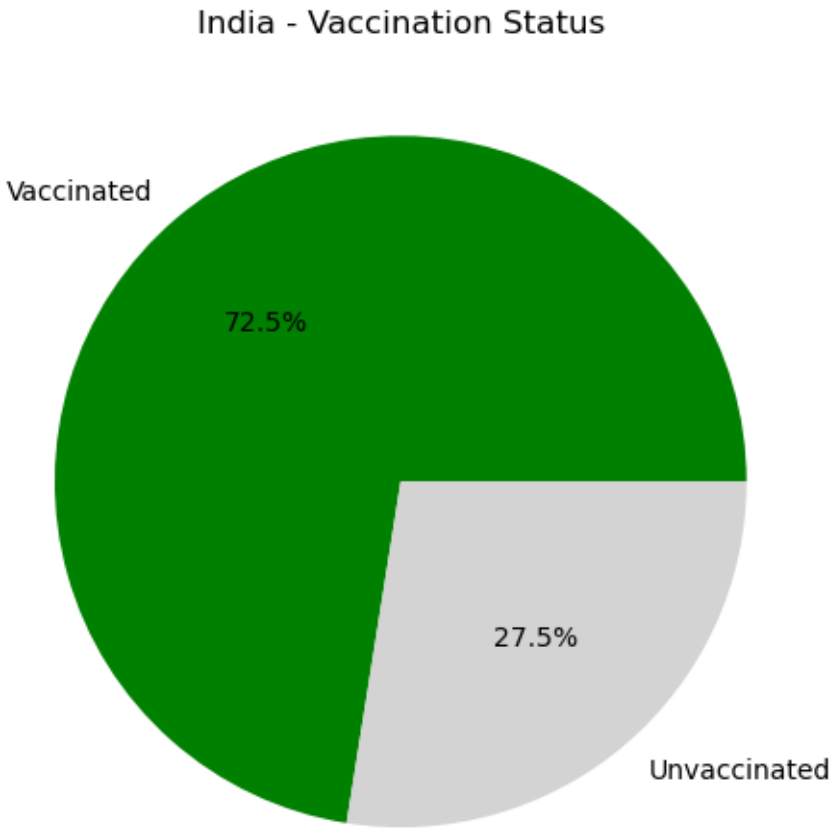
[13]:
```
plt.figure(figsize=(12, 6))
sns.lineplot(data=df_vax, x='date', y='people_vaccinated_per_hundred',␣
 ↪hue='location')
plt.title('% of Population Vaccinated Over Time')
plt.xlabel('Date')
plt.ylabel('People Vaccinated per 100')
plt.tight_layout()
plt.show()
```



[14]:
```
# Get the most recent vaccination percentage
latest_vax = df_vax.sort_values('date').groupby('location').tail(1)

for _, row in latest_vax.iterrows():
    vaccinated = row['people_vaccinated_per_hundred']
    unvaccinated = 100 - vaccinated
    plt.figure(figsize=(5, 5))
    plt.pie([vaccinated, unvaccinated],
            labels=['Vaccinated', 'Unvaccinated'],
            autopct='%1.1f%%',
            colors=['green', 'lightgray'])
    plt.title(f"{row['location']} - Vaccination Status")
    plt.tight_layout()
    plt.show()
```

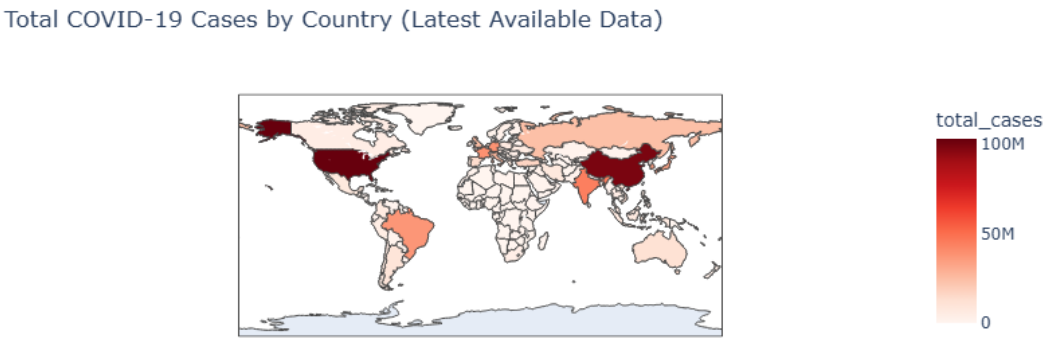



Kenya - Vaccination Status
Vaccinated
11.1%
88.9%
Unvaccinated



[17]:
```
# Load the dataset
df = pd.read_csv("https://covid.ourworldindata.org/data/owid-covid-data.csv")

# Convert 'date' to datetime
df['date'] = pd.to_datetime(df['date'])

# Get latest data per country
latest_df = df.sort_values('date').groupby('iso_code', as_index=False).last()

# Filter out aggregate rows (e.g., continents, World)
latest_df = latest_df[latest_df['iso_code'].str.len() == 3]

# Create choropleth
fig = px.choropleth(
    latest_df,
    locations='iso_code',
    color='total_cases',
    hover_name='location',
```

```
    color_continuous_scale='Reds',
    title='Total COVID-19 Cases by Country (Latest Available Data)'
)

fig.show()
```



[ ]: