Intensive Care in Germany

Data Source

DIVI-Intensivregister monitors the ICU capacities of 1,300 hospitals in Germany.

Setup

```
In [1]:   # standard library
          import datetime
          import math
```

```
In [2]:   # third party
          import numpy as np
          import pandas as pd
          import matplotlib.pyplot as plt
          import requests
```

Date this Notebook was run

```
In [3]:   today = datetime.datetime.today().strftime('%Y-%m-%d')
          today
```

```
Out[3]:   '2021-07-28'
```

```
In [4]:   # style like ggplot in R
          plt.style.use('ggplot')
```

```
In [5]:   # Avoid cutting off part of the axis labels, see:
          # https://stackoverflow.com/questions/6774086/why-is-my-xlabel-cut-off-in-my-matplotlib-plot
          plt.rcParams.update({'figure.autolayout': True})
```

Get Data

```
In [6]:   timeline_data = "https://diviexchange.blob.core.windows.net/%24web/bundesland-zeitreihe.csv"
```

```
In [7]:   timeline_df = pd.read_csv(timeline_data)
```

```
In [8]:   timeline_df.tail(3)
```

Out[8]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
8429	2021-07-28T12:15:00+02:00	BAYERN	207	52	2817
8430	2021-07-28T12:15:00+02:00	HESSEN	97	38	1607
8431	2021-07-28T12:15:00+02:00	DEUTSCHLAND	1310	353	19217

Rename Columns

Convert datatype of date column

```
In [9]:   timeline_df["Datum"] = timeline_df["Datum"].str[:10]
          timeline_df.head()
```

Out[9]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Fr
0	2020-03-20	HAMBURG	11	6	24	
1	2020-03-20	SACHSEN_ANHALT	8	0	2	
2	2020-03-20	RHEINLAND_PFALZ	15	14	48	
3	2020-03-20	BADEN_WUERTTEMBERG	31	35	39	
4	2020-03-20	SAARLAND	4	1	7	

```
In [10]:  timeline_df.iloc[ : , [0]] = timeline_df.iloc[ : , [0]].apply(pd.to_datetime)
```

In [11]:
```python
timeline_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8432 entries, 0 to 8431
Data columns (total 13 columns):
 #   Column                                    Non-Null Count  Dtype
---  ------                                    --------------  -----
 0   Datum                                     8432 non-null   datetime64[ns]
 1   Bundesland                                8432 non-null   object
 2   Anzahl_Meldebereiche_Erwachsene           8432 non-null   int64
 3   Aktuelle_COVID_Faelle_Erwachsene_ITS      8432 non-null   int64
 4   Belegte_Intensivbetten_Erwachsene         8432 non-null   int64
 5   Freie_Intensivbetten_Erwachsene           8432 non-null   int64
 6   7_Tage_Notfallreserve_Erwachsene          8432 non-null   int64
 7   Freie_IV_Kapazitaeten_Gesamt              8432 non-null   int64
 8   Freie_IV_Kapazitaeten_Davon_COVID         8432 non-null   int64
 9   Betriebssituation_Regulaerer_Betrieb      8432 non-null   int64
 10  Betriebssituation_Teilweise_Eingeschraenkt 8432 non-null  int64
 11  Betriebssituation_Eingeschraenkt          8432 non-null   int64
 12  Betriebssituation_Keine_Angabe            8432 non-null   int64
dtypes: datetime64[ns](1), int64(11), object(1)
memory usage: 856.5+ KB
```

In [12]:
```python
federal_level = timeline_df[timeline_df.Bundesland=='DEUTSCHLAND']
federal_level.tail(3)
```

Out[12]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Inte
8397	2021-07-26	DEUTSCHLAND	1311	365	18584	
8414	2021-07-27	DEUTSCHLAND	1310	367	19011	
8431	2021-07-28	DEUTSCHLAND	1310	353	19217	

Used Beds (Adults)

In [13]:
```python
used_beds = federal_level.loc[ : , ['Datum', 'Belegte_Intensivbetten_Erwachsene']]
used_beds.columns = ['date', 'ICU beds in use (adults)']
used_beds.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
Int64Index: 496 entries, 16 to 8431
Data columns (total 2 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   date                    496 non-null    datetime64[ns]
 1   ICU beds in use (adults)  496 non-null  int64
dtypes: datetime64[ns](1), int64(1)
memory usage: 11.6 KB
```
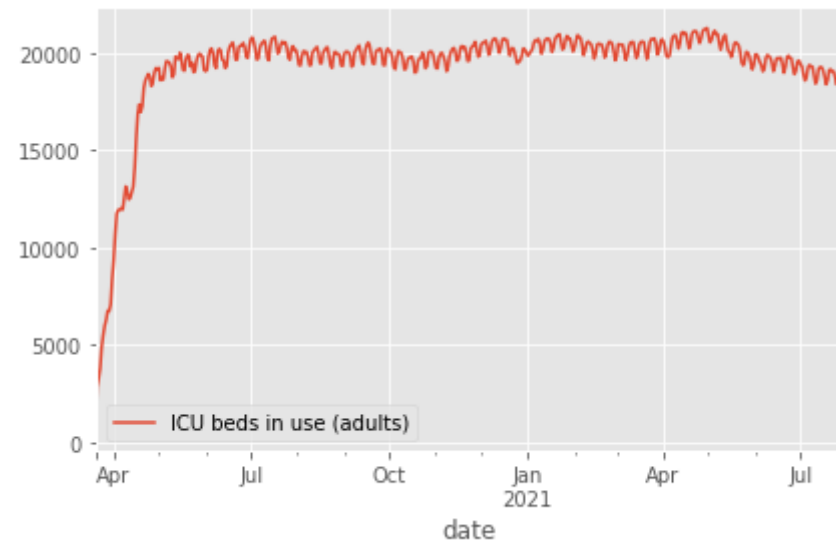
In [14]:
```python
used_beds.set_index('date', inplace=True)
```

In [15]:
```python
used_beds.plot()
```

Out[15]:
```
<AxesSubplot:xlabel='date'>
```


Covid-19 patients in ICU

In [16]:
```python
icu = federal_level.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
```

In [17]:
```python
icu.columns = ['date', 'Covid-19 cases in ICU']
icu.set_index('date', inplace=True)
icu.info()
```
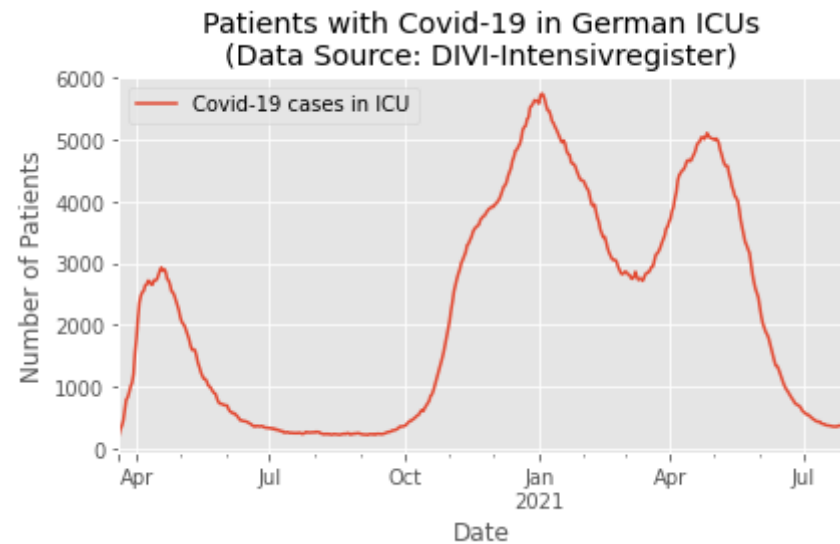
```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 496 entries, 2020-03-20 to 2021-07-28
```

```
Data columns (total 1 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   Covid-19 cases in ICU  496 non-null    int64
dtypes: int64(1)
memory usage: 7.8 KB
```

In [18]:
```python
icu_cases = icu.plot(
    title='Patients with Covid-19 in German ICUs\n(Data Source: DIVI-Intensivregister)',
xlabel='Date',
ylabel='Number of Patients')
```


In [19]:
```python
fig = icu_cases.get_figure()
fig.savefig('img/covid-19-patients-in-icu-germany.png')
```
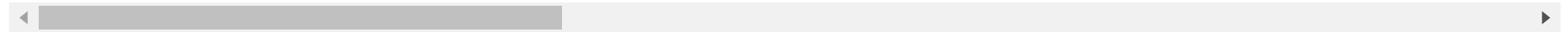
Situation in North Rhine-Westphalia

NRW ist the state in Germany with the highest number of inhabitants.

In [20]:
```python
nrw = timeline_df[timeline_df.Bundesland=='NORDRHEIN_WESTFALEN']
nrw.tail(2)
```

Out[20]:

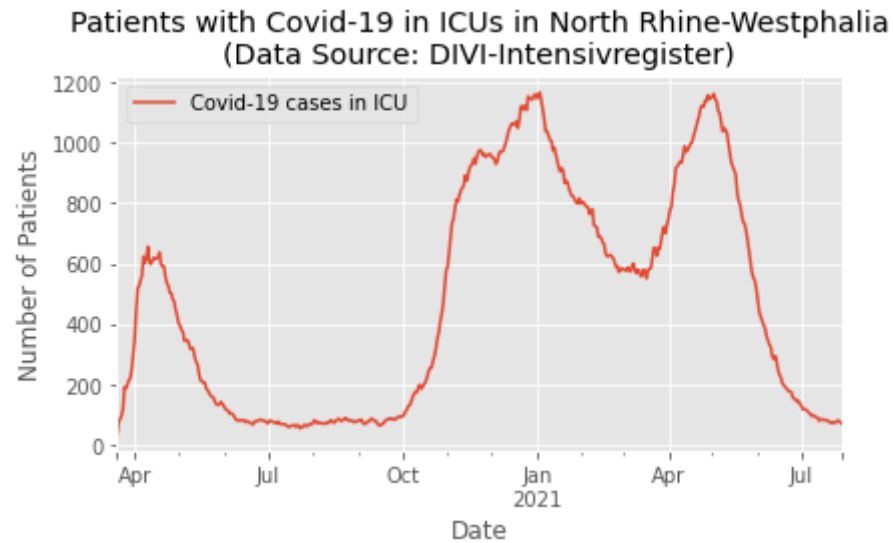| Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
8407	2021-07-27	NORDRHEIN_WESTFALEN	315	76	4607
8424	2021-07-28	NORDRHEIN_WESTFALEN	314	71	4598

◄ ▬▬▬▬▬▬▬▬▬▬ ►

In [21]:
```python
icu_nrw = nrw.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
icu_nrw.columns = ['date', 'Covid-19 cases in ICU']
icu_nrw.set_index('date', inplace=True)
icu_nrw.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 496 entries, 2020-03-20 to 2021-07-28
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  496 non-null    int64
dtypes: int64(1)
memory usage: 7.8 KB
```

In [22]:
```python
icu_cases_nrw = icu_nrw.plot(
    title='Patients with Covid-19 in ICUs in North Rhine-Westphalia\n(Data Source: DIVI-Intensivregister)',
xlabel='Date',
ylabel='Number of Patients')
```

Patients with Covid-19 in ICUs in North Rhine-Westphalia
(Data Source: DIVI-Intensivregister)

Situation in Rhineland-Palatinate

In [23]:
```
rlp = timeline_df[timeline_df.Bundesland=='RHEINLAND_PFALZ']
rlp.tail(2)
```
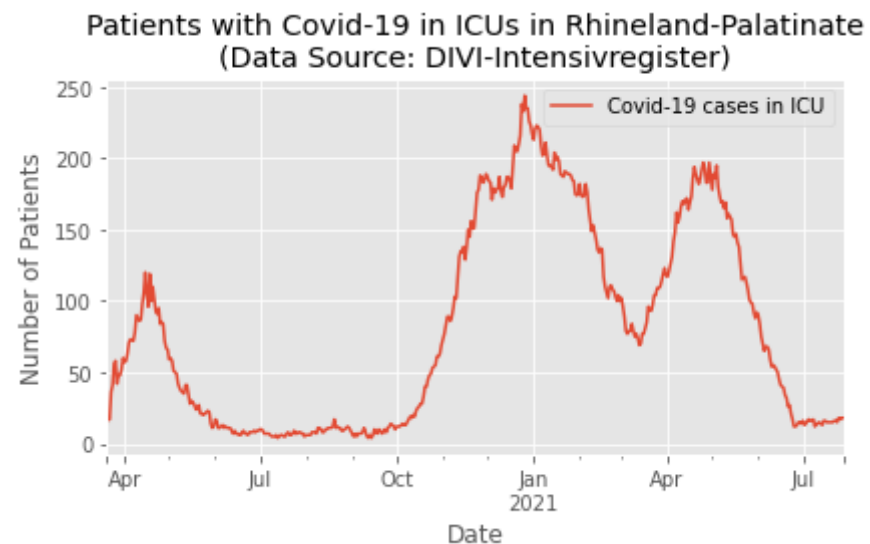
Out[23]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_
8400	2021-07-27	RHEINLAND_PFALZ	76	18	792	
8417	2021-07-28	RHEINLAND_PFALZ	76	18	809	

In [24]:
```
icu_rlp = rlp.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
icu_rlp.columns = ['date', 'Covid-19 cases in ICU']
icu_rlp.set_index('date', inplace=True)
icu_rlp.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 496 entries, 2020-03-20 to 2021-07-28
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  496 non-null    int64
```

```
dtypes: int64(1)
memory usage: 7.8 KB
```

In [25]:
```python
icu_cases_rlp = icu_rlp.plot(
    title='Patients with Covid-19 in ICUs in Rhineland-Palatinate\n(Data Source: DIVI-Intensivregister)',
xlabel='Date',
ylabel='Number of Patients')
```


Situation in Saxony

Saxonia had high case numbers during the pandemic.

In [26]:
```python
saxonia = timeline_df[timeline_df.Bundesland=='SACHSEN']
saxonia.tail(2)
```

Out[26]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Intensiv
8409	2021-07-27	SACHSEN	77	16	1249	
8426	2021-07-28	SACHSEN	77	16	1239	

In [27]:
```python
icu_saxonia = saxonia.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
```

```
icu_saxonia.columns = ['date', 'Covid-19 cases in ICU']
icu_saxonia.set_index('date', inplace=True)
icu_saxonia.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 496 entries, 2020-03-20 to 2021-07-28
Data columns (total 1 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   Covid-19 cases in ICU  496 non-null    int64
dtypes: int64(1)
memory usage: 7.8 KB
```

In [28]:
```
icu_cases_saxonia = icu_saxonia.plot(
    title='Patients with Covid-19 in ICUs in Saxonia\n(Data Source: DIVI-Intensivregister)',
xlabel='Date',
ylabel='Number of Patients')
```