Intensive Care in Germany

Data Source

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

Setup

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

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

Date this Notebook was run

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

```
Out[3]:    '2021-08-10'
```

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

```python
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

```python
In [6]:    timeline_data = "https://diviexchange.blob.core.windows.net/%24web/bundesland-zeitreihe.csv"
```
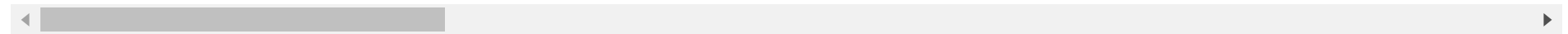
```
In [7]:    timeline_df = pd.read_csv(timeline_data)
```

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

Out[8]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_E
8650	2021-08-10T12:15:00+02:00	SACHSEN_ANHALT	42	3	
8651	2021-08-10T12:15:00+02:00	NORDRHEIN_WESTFALEN	313	122	
8652	2021-08-10T12:15:00+02:00	DEUTSCHLAND	1313	437	

3 rows × 21 columns

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	BADEN_WUERTTEMBERG	31	35	39	
1	2020-03-20	HAMBURG	11	6	24	
2	2020-03-20	BREMEN	3	2	0	
3	2020-03-20	SACHSEN	20	3	44	
4	2020-03-20	BRANDENBURG	20	2	50	

5 rows × 21 columns

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

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8653 entries, 0 to 8652
Data columns (total 21 columns):
 #   Column                                    Non-Null Count  Dtype
---  ------                                    --------------  -----
 0   Datum                                     8653 non-null   datetime64[ns]
 1   Bundesland                                8653 non-null   object
 2   Anzahl_Meldebereiche_Erwachsene           8653 non-null   int64
 3   Aktuelle_COVID_Faelle_Erwachsene_ITS      8653 non-null   int64
 4   Belegte_Intensivbetten_Erwachsene         8653 non-null   int64
 5   Freie_Intensivbetten_Erwachsene           8653 non-null   int64
 6   7_Tage_Notfallreserve_Erwachsene          8653 non-null   int64
 7   Freie_IV_Kapazitaeten_Gesamt              8653 non-null   int64
 8   Freie_IV_Kapazitaeten_Davon_COVID         8653 non-null   int64
 9   Betriebssituation_Regulaerer_Betrieb      8653 non-null   int64
 10  Betriebssituation_Teilweise_Eingeschraenkt 8653 non-null  int64
 11  Betriebssituation_Eingeschraenkt          8653 non-null   int64
 12  Betriebssituation_Keine_Angabe            8653 non-null   int64
 13  Stratum_17_Minus                          8653 non-null   int64
 14  Stratum_18_Bis_29                         8653 non-null   int64
 15  Stratum_30_Bis_39                         8653 non-null   int64
 16  Stratum_40_Bis_49                         8653 non-null   int64
 17  Stratum_50_Bis_59                         8653 non-null   int64
 18  Stratum_60_Bis_69                         8653 non-null   int64
 19  Stratum_70_Bis_79                         8653 non-null   int64
 20  Stratum_80_Plus                           8653 non-null   int64
dtypes: datetime64[ns](1), int64(19), object(1)
memory usage: 1.4+ MB
```

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
8618	2021-08-08	DEUTSCHLAND	1313	429	18466	
8635	2021-08-09	DEUTSCHLAND	1313	450	18534	

|	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Inte
8652	2021-08-10	DEUTSCHLAND	1313	437	18857	

3 rows × 21 columns
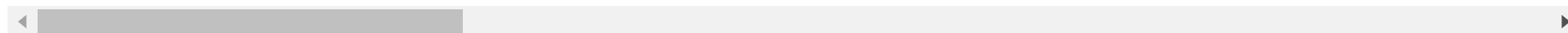
Used Beds (Adults)

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: 509 entries, 16 to 8652
Data columns (total 2 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   date                      509 non-null    datetime64[ns]
 1   ICU beds in use (adults)  509 non-null    int64
dtypes: datetime64[ns](1), int64(1)
memory usage: 11.9 KB
```

In [14]:
```python
used_beds.set_index('date', inplace=True)
```

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

Out[15]:
```
<AxesSubplot:xlabel='date'>
```
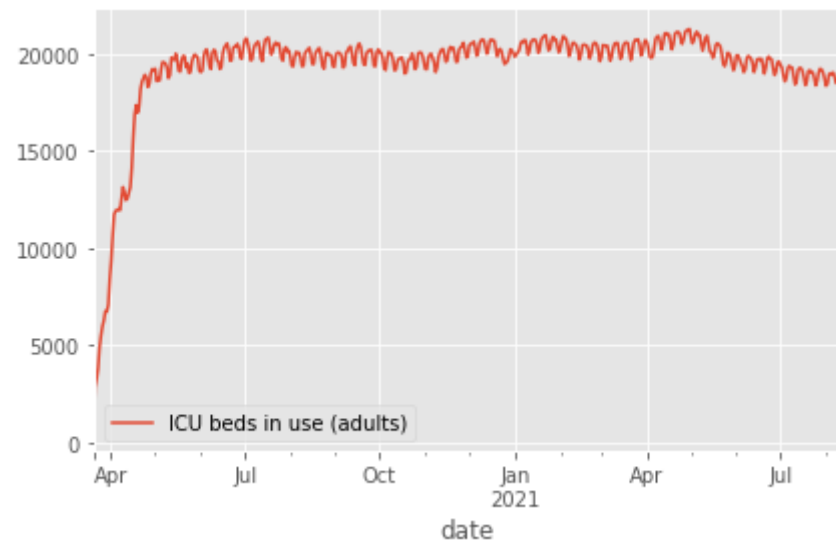
Covid-19 patients in ICU

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: 509 entries, 2020-03-20 to 2021-08-10
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  509 non-null    int64
dtypes: int64(1)
memory usage: 8.0 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')
```
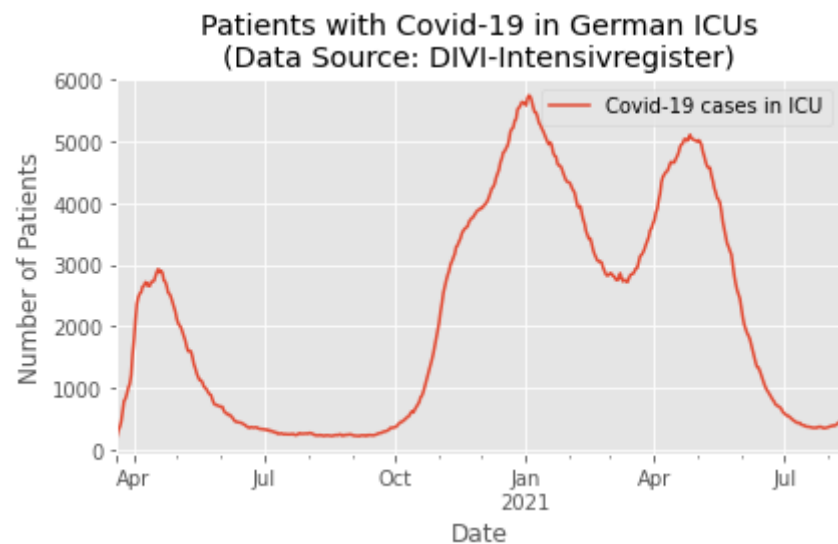
```
In [19]:   fig = icu_cases.get_figure()
           fig.savefig('img/covid-19-patients-in-icu-germany.png')
```

Situation in North Rhine-Westphalia

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

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

Out[20]:

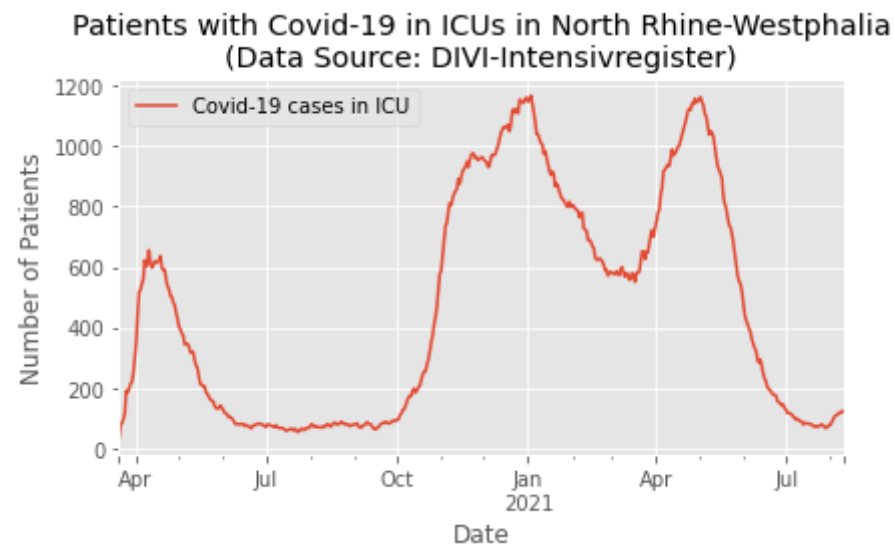|	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
8634	2021-08-09	NORDRHEIN_WESTFALEN	313	124	4490
8651	2021-08-10	NORDRHEIN_WESTFALEN	313	122	4550

2 rows × 21 columns
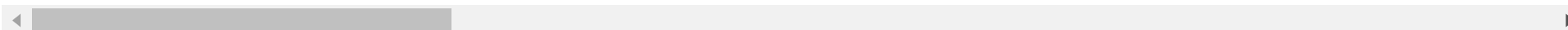
```
In [21]:   icu_nrw = nrw.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
           icu_nrw.columns = ['date', 'Covid-19 cases in ICU']
```

```python
icu_nrw.set_index('date', inplace=True)
icu_nrw.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 509 entries, 2020-03-20 to 2021-08-10
Data columns (total 1 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Covid-19 cases in ICU  509 non-null    int64
dtypes: int64(1)
memory usage: 8.0 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')
```


## Situation in Rhineland-Palatinate

In [23]:
```python
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_
8624	2021-08-09	RHEINLAND_PFALZ	77	23	739	

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_
8641	2021-08-10	RHEINLAND_PFALZ	77	24	763	

2 rows × 21 columns

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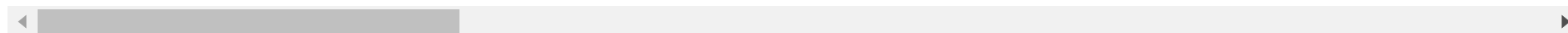
In [24]:
```python
icu_rlp = rlp.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
icu_rlp.columns = ['date', 'Covid-19 cases in ICU']
icu_rlp.set_index('date', inplace=True)
icu_rlp.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 509 entries, 2020-03-20 to 2021-08-10
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  509 non-null    int64
dtypes: int64(1)
memory usage: 8.0 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')
```

Patients with Covid-19 in ICUs in Rhineland-Palatinate
(Data Source: DIVI-Intensivregister)
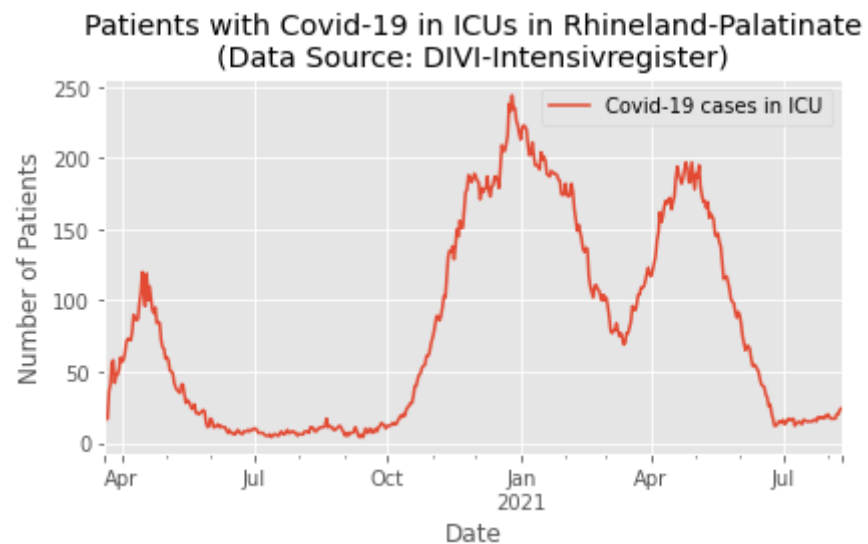
Situation in Saxony

Saxonia had high case numbers during the pandemic.

```
In [26]: 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_Intensi
8622	2021-08-09	SACHSEN	78	16	1191	
8639	2021-08-10	SACHSEN	78	15	1190	

2 rows × 21 columns

```
In [27]: 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: 509 entries, 2020-03-20 to 2021-08-10
```

```
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  509 non-null    int64
dtypes: int64(1)
memory usage: 8.0 KB
```

In [28]:
```python
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')
```