Intensive Care in Germany

Data Source

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

Setup

```python
In [29]:   # standard library
           import datetime
           import math
```

```python
In [30]:   # third party
           import numpy as np
           import pandas as pd
           import matplotlib.pyplot as plt
           import requests
```

Date this Notebook was run

```python
In [31]:   today = datetime.datetime.today().strftime('%Y-%m-%d')
           today
```

```
Out[31]:   '2021-09-19'
```

```python
In [32]:   # style like ggplot in R
           plt.style.use('ggplot')
```

```python
In [33]:   # 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 [34]:   timeline_data = "https://diviexchange.blob.core.windows.net/%24web/bundesland-zeitreihe.csv"
```

```
In [35]:   timeline_df = pd.read_csv(timeline_data)
```

```
In [36]:   timeline_df.tail(3)
```

Out[36]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
9330	2021-09-19T12:15:00+02:00	BREMEN	11	13	152
9331	2021-09-19T12:15:00+02:00	BAYERN	206	278	2661
9332	2021-09-19T12:15:00+02:00	DEUTSCHLAND	1312	1530	18671

Rename Columns

Convert datatype of date column

```
In [37]:   timeline_df["Datum"] = timeline_df["Datum"].str[:10]
           timeline_df.head()
```

Out[37]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Fr
0	2020-03-20	SCHLESWIG_HOLSTEIN	13	7	16	
1	2020-03-20	HAMBURG	11	6	24	
2	2020-03-20	BADEN_WUERTTEMBERG	31	35	39	
3	2020-03-20	SACHSEN	20	3	44	
4	2020-03-20	RHEINLAND_PFALZ	15	14	48	

```
In [38]:   timeline_df.iloc[ : , [0]] = timeline_df.iloc[ : , [0]].apply(pd.to_datetime)
```

In [39]:
```python
timeline_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9333 entries, 0 to 9332
Data columns (total 13 columns):
 #   Column                                  Non-Null Count  Dtype
---  ------                                  --------------  -----
 0   Datum                                   9333 non-null   datetime64[ns]
 1   Bundesland                              9333 non-null   object
 2   Anzahl_Meldebereiche_Erwachsene         9333 non-null   int64
 3   Aktuelle_COVID_Faelle_Erwachsene_ITS    9333 non-null   int64
 4   Belegte_Intensivbetten_Erwachsene       9333 non-null   int64
 5   Freie_Intensivbetten_Erwachsene         9333 non-null   int64
 6   7_Tage_Notfallreserve_Erwachsene        9333 non-null   int64
 7   Freie_IV_Kapazitaeten_Gesamt            9333 non-null   int64
 8   Freie_IV_Kapazitaeten_Davon_COVID       9333 non-null   int64
 9   Betriebssituation_Regulaerer_Betrieb    9333 non-null   int64
 10  Betriebssituation_Teilweise_Eingeschraenkt  9333 non-null   int64
 11  Betriebssituation_Eingeschraenkt        9333 non-null   int64
 12  Betriebssituation_Keine_Angabe          9333 non-null   int64
dtypes: datetime64[ns](1), int64(11), object(1)
memory usage: 948.0+ KB
```

In [40]:
```python
federal_level = timeline_df[timeline_df.Bundesland=='DEUTSCHLAND']
federal_level.tail(3)
```

Out[40]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Inte
9298	2021-09-17	DEUTSCHLAND	1313	1534	19441	
9315	2021-09-18	DEUTSCHLAND	1314	1515	18999	
9332	2021-09-19	DEUTSCHLAND	1312	1530	18671	

Used Beds (Adults)

In [41]:
```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: 549 entries, 16 to 9332
Data columns (total 2 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   date                   549 non-null    datetime64[ns]
 1   ICU beds in use (adults)  549 non-null  int64
dtypes: datetime64[ns](1), int64(1)
memory usage: 12.9 KB
```
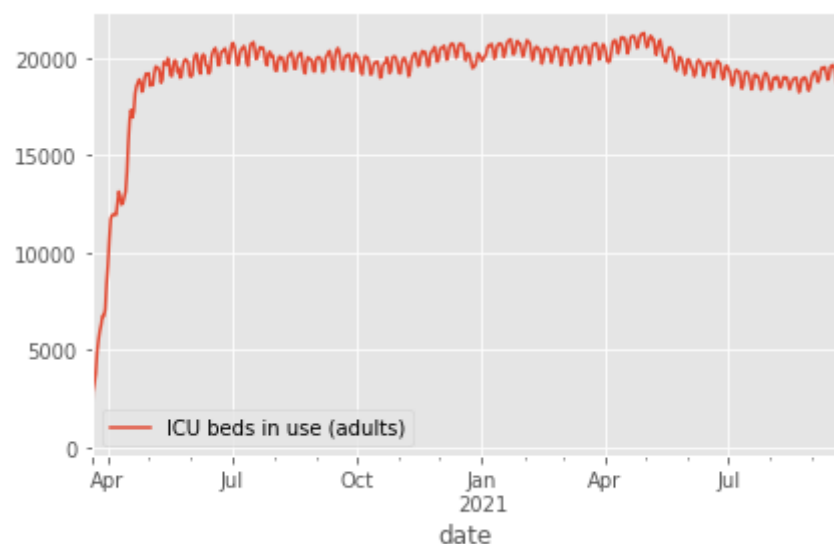
In [42]:
```python
used_beds.set_index('date', inplace=True)
```

In [43]:
```python
used_beds.plot()
```

Out[43]: <AxesSubplot:xlabel='date'>

Covid-19 patients in ICU

In [44]:
```python
icu = federal_level.loc[ : , ['Datum', 'Aktuelle_COVID_Faelle_Erwachsene_ITS']]
```
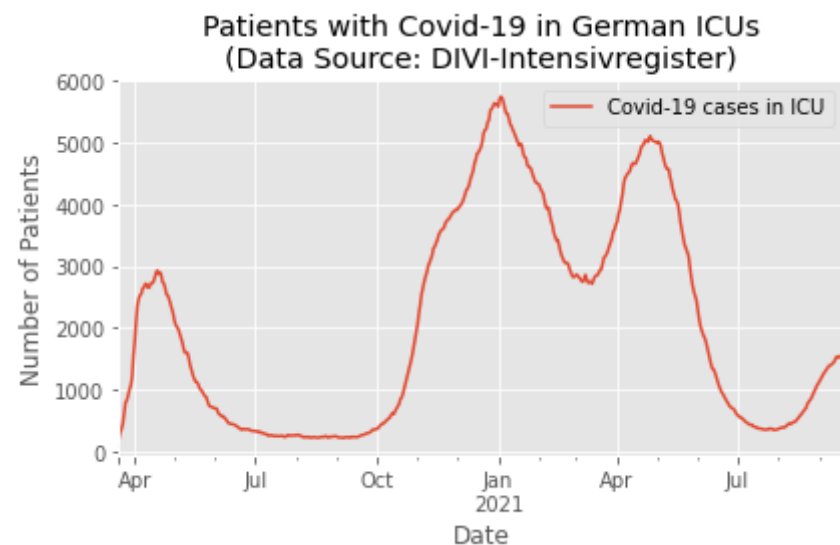
In [45]:
```python
icu.columns = ['date', 'Covid-19 cases in ICU']
icu.set_index('date', inplace=True)
icu.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 549 entries, 2020-03-20 to 2021-09-19
```

```
Data columns (total 1 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   Covid-19 cases in ICU  549 non-null    int64
dtypes: int64(1)
memory usage: 8.6 KB
```

In [46]:
```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 [47]:
```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 [48]:
```python
nrw = timeline_df[timeline_df.Bundesland=='NORDRHEIN_WESTFALEN']
nrw.tail(2)
```

Out[48]:

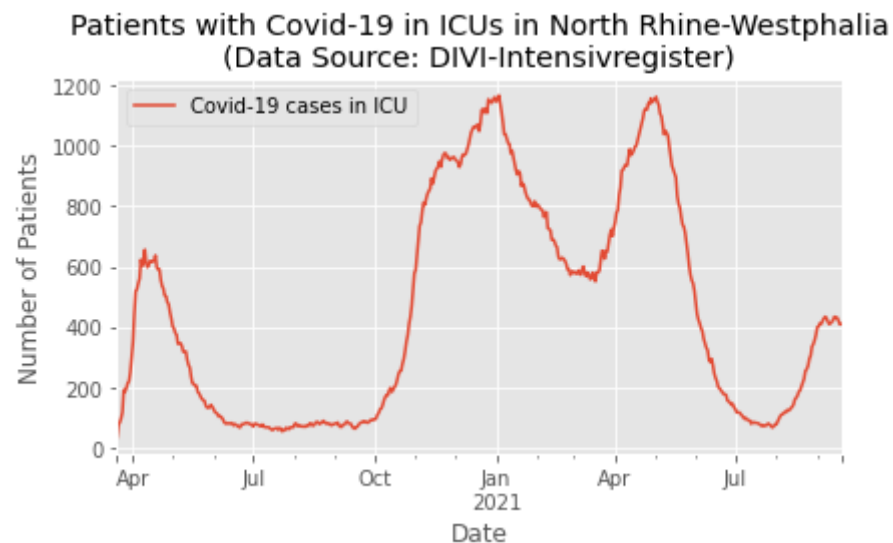| Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
9307	2021-09-18	NORDRHEIN_WESTFALEN	312	409	4587
9325	2021-09-19	NORDRHEIN_WESTFALEN	311	409	4497

```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: 549 entries, 2020-03-20 to 2021-09-19
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  549 non-null    int64
dtypes: int64(1)
memory usage: 8.6 KB
```

In [50]:
```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 [51]:
```python
rlp = timeline_df[timeline_df.Bundesland=='RHEINLAND_PFALZ']
rlp.tail(2)
```
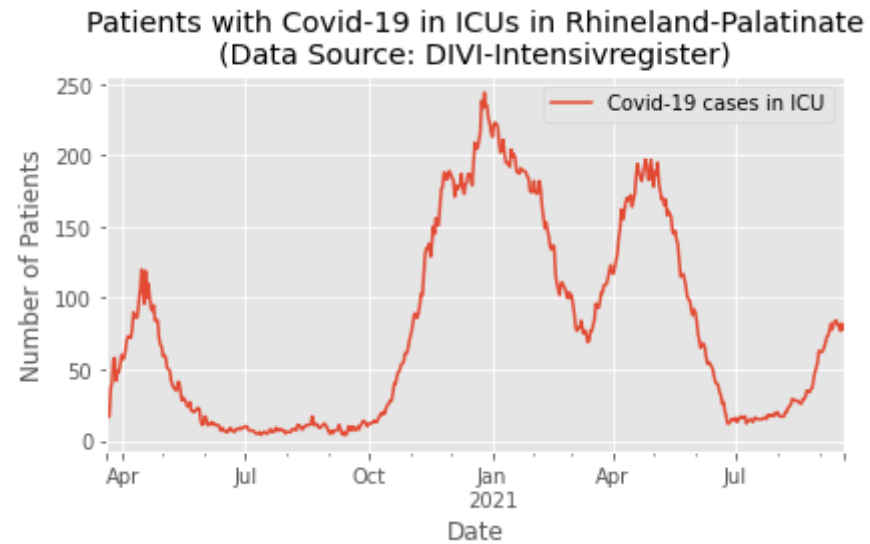
Out[51]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_
9303	2021-09-18	RHEINLAND_PFALZ	77	82	787	
9320	2021-09-19	RHEINLAND_PFALZ	77	78	782	

In [52]:
```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: 549 entries, 2020-03-20 to 2021-09-19
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  549 non-null    int64
```

```
dtypes: int64(1)
memory usage: 8.6 KB
```

In [53]:
```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 [54]:
```python
saxonia = timeline_df[timeline_df.Bundesland=='SACHSEN']
saxonia.tail(2)
```

Out[54]:

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Intensiv
9302	2021-09-18	SACHSEN	79	36	1226	
9319	2021-09-19	SACHSEN	79	37	1192	

In [55]:
```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: 549 entries, 2020-03-20 to 2021-09-19
Data columns (total 1 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   Covid-19 cases in ICU  549 non-null    int64
dtypes: int64(1)
memory usage: 8.6 KB
```

In [56]:
```
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')
```