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]:
```
'2021-08-12'
```

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_E
8684	2021-08-12T12:15:00+02:00	BERLIN	53	51	
8685	2021-08-12T12:15:00+02:00	BADEN_WUERTTEMBERG	128	50	
8686	2021-08-12T12:15:00+02:00	DEUTSCHLAND	1311	467	

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	Freie_Intens
0	2020-03-20	BREMEN	3	2	0	
1	2020-03-20	SACHSEN	20	3	44	
2	2020-03-20	HESSEN	19	7	18	
3	2020-03-20	BRANDENBURG	20	2	50	
4	2020-03-20	THUERINGEN	7	0	0	

5 rows × 21 columns

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

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8687 entries, 0 to 8686
Data columns (total 21 columns):
 #   Column                                  Non-Null Count  Dtype
---  ------                                  --------------  -----
 0   Datum                                   8687 non-null   datetime64[ns]
 1   Bundesland                              8687 non-null   object
 2   Anzahl_Meldebereiche_Erwachsene         8687 non-null   int64
 3   Aktuelle_COVID_Faelle_Erwachsene_ITS    8687 non-null   int64
 4   Belegte_Intensivbetten_Erwachsene       8687 non-null   int64
 5   Freie_Intensivbetten_Erwachsene         8687 non-null   int64
 6   7_Tage_Notfallreserve_Erwachsene        8687 non-null   int64
 7   Freie_IV_Kapazitaeten_Gesamt            8687 non-null   int64
 8   Freie_IV_Kapazitaeten_Davon_COVID       8687 non-null   int64
 9   Betriebssituation_Regulaerer_Betrieb    8687 non-null   int64
 10  Betriebssituation_Teilweise_Eingeschraenkt  8687 non-null  int64
 11  Betriebssituation_Eingeschraenkt        8687 non-null   int64
 12  Betriebssituation_Keine_Angabe          8687 non-null   int64
 13  Stratum_17_Minus                        8687 non-null   int64
 14  Stratum_18_Bis_29                       8687 non-null   int64
 15  Stratum_30_Bis_39                       8687 non-null   int64
 16  Stratum_40_Bis_49                       8687 non-null   int64
 17  Stratum_50_Bis_59                       8687 non-null   int64
 18  Stratum_60_Bis_69                       8687 non-null   int64
 19  Stratum_70_Bis_79                       8687 non-null   int64
 20  Stratum_80_Plus                         8687 non-null   int64
dtypes: datetime64[ns](1), int64(19), object(1)
memory usage: 1.4+ MB
```

In [12]:
```
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
8652	2021-08-10	DEUTSCHLAND	1313	438	18860	
8669	2021-08-11	DEUTSCHLAND	1313	449	19013	

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Inte
8686	2021-08-12	DEUTSCHLAND	1311	467	18932	

3 rows × 21 columns

Used Beds (Adults)

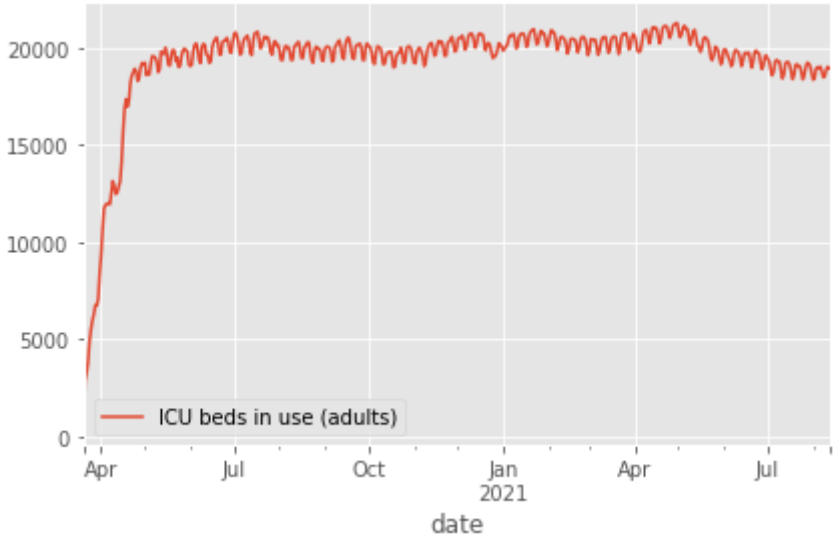
In [13]:
```
used_beds = federal_level.loc[ : , ['Datum', 'Belegte_Intensivbetten_Erwachsene']]
used_beds.columns = ['date', 'ICU beds in use (adults)']
used_beds.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 511 entries, 16 to 8686
Data columns (total 2 columns):
 #   Column                    Non-Null Count  Dtype         
---  ------                    --------------  -----         
 0   date                      511 non-null    datetime64[ns]
 1   ICU beds in use (adults)  511 non-null    int64         
dtypes: datetime64[ns](1), int64(1)
memory usage: 12.0 KB
```

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

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

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



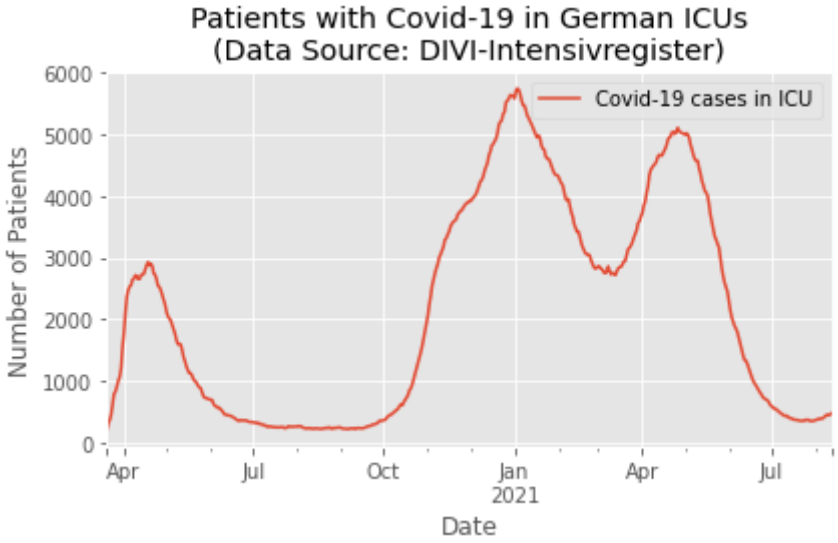
Covid-19 patients in ICU

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

In [17]:
```
icu.columns = ['date', 'Covid-19 cases in ICU']
icu.set_index('date', inplace=True)
icu.info()
```

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 511 entries, 2020-03-20 to 2021-08-12
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  511 non-null    int64
dtypes: int64(1)
memory usage: 8.0 KB
```

In [18]:
```
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
8666	2021-08-11	NORDRHEIN_WESTFALEN	313	125	4561
8683	2021-08-12	NORDRHEIN_WESTFALEN	313	131	4526

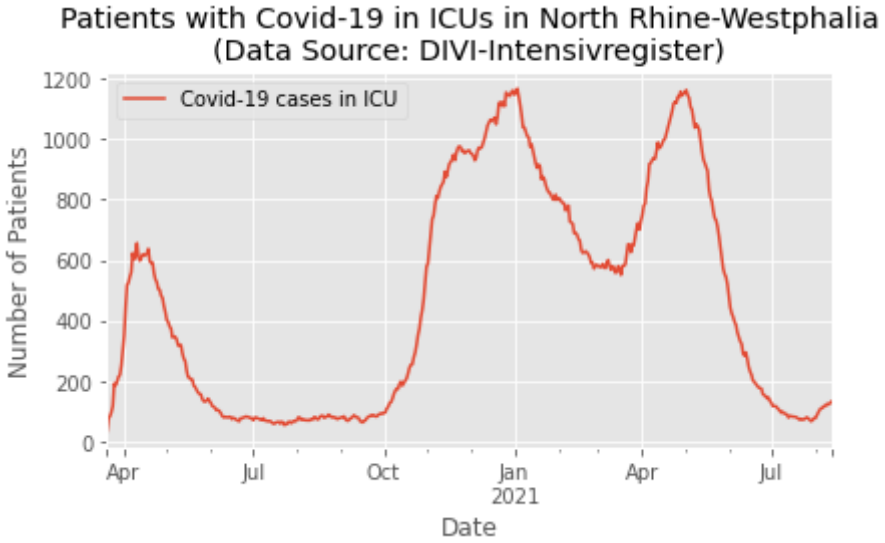
2 rows × 21 columns

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

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

```
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 511 entries, 2020-03-20 to 2021-08-12
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  511 non-null    int64
dtypes: int64(1)
memory usage: 8.0 KB
```

In [22]:
```
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]:
```
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_
8660	2021-08-11	RHEINLAND_PFALZ	77	25	792	

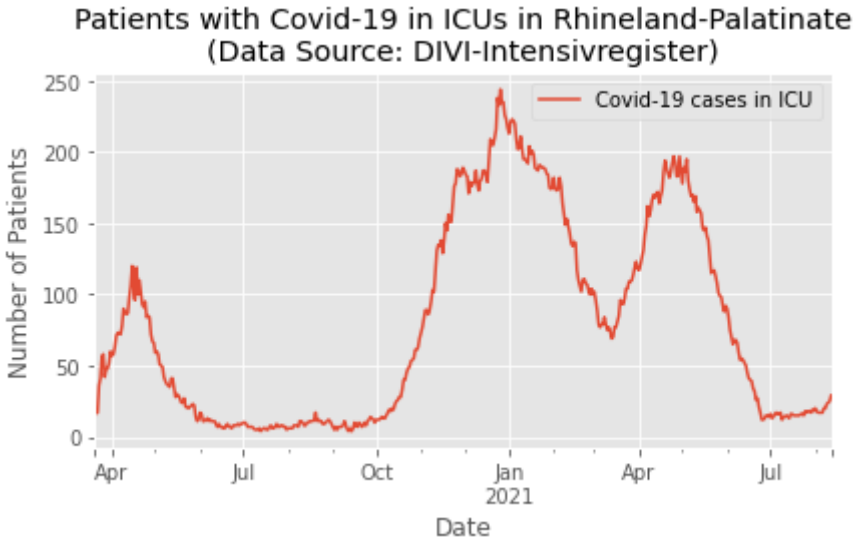
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_
8678	2021-08-12	RHEINLAND_PFALZ	77	29	807	

2 rows × 21 columns

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: 511 entries, 2020-03-20 to 2021-08-12
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  511 non-null    int64
dtypes: int64(1)
memory usage: 8.0 KB
```

In [25]:
```
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]:
```
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
8655	2021-08-11	SACHSEN	78	16	1171	
8670	2021-08-12	SACHSEN	77	15	1189	

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: 511 entries, 2020-03-20 to 2021-08-12
```

```
Data columns (total 1 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   Covid-19 cases in ICU  511 non-null    int64
dtypes: int64(1)
memory usage: 8.0 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')
```