

# 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]: '2021-09-29'
```

```
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
9500	2021-09-29T12:15:00+02:00	NORDRHEIN_WESTFALEN	314	343	
9501	2021-09-29T12:15:00+02:00	HAMBURG	24	37	
9502	2021-09-29T12:15:00+02:00	DEUTSCHLAND	1315	1351	

## 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
0	2020-03-20	SACHSEN_ANHALT	8	0	2	
1	2020-03-20	SCHLESWIG_HOLSTEIN	13	7	16	
2	2020-03-20	SAARLAND	4	1	7	
3	2020-03-20	BAYERN	45	61	77	
4	2020-03-20	BERLIN	22	9	114	

```
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: 9503 entries, 0 to 9502
Data columns (total 13 columns):
#   Column                                     Non-Null Count  Dtype
---  -
0   Datum                                     9503 non-null   datetime64[ns]
1   Bundesland                               9503 non-null   object
2   Anzahl_Meldebereiche_Erwachsene          9503 non-null   int64
3   Aktuelle_COVID_Faelle_Erwachsene_ITS     9503 non-null   int64
4   Belegte_Intensivbetten_Erwachsene        9503 non-null   int64
5   Freie_Intensivbetten_Erwachsene          9503 non-null   int64
6   7_Tage_Notfallreserve_Erwachsene         9503 non-null   int64
7   Freie_IV_Kapazitaeten_Gesamt             9503 non-null   int64
8   Freie_IV_Kapazitaeten_Davon_COVID        9503 non-null   int64
9   Betriebssituation_Regulaerer_Betrieb     9503 non-null   int64
10  Betriebssituation_Teilweise_Eingeschraenkt 9503 non-null   int64
11  Betriebssituation_Eingeschraenkt         9503 non-null   int64
12  Betriebssituation_Keine_Angabe           9503 non-null   int64
dtypes: datetime64[ns](1), int64(11), object(1)
memory usage: 965.3+ KB
```

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
9468	2021-09-27	DEUTSCHLAND	1315	1424		18870
9485	2021-09-28	DEUTSCHLAND	1315	1403		19339
9502	2021-09-29	DEUTSCHLAND	1315	1351		19485

## 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'>
```

```

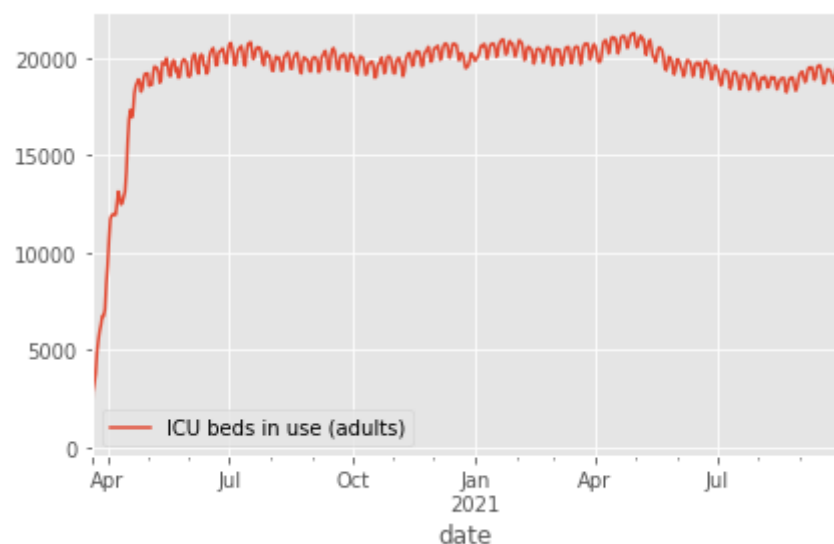
Int64Index: 559 entries, 16 to 9502
Data columns (total 2 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   date                                  559 non-null    datetime64[ns]
1   ICU beds in use (adults)             559 non-null    int64
dtypes: datetime64[ns](1), int64(1)
memory usage: 13.1 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()
```

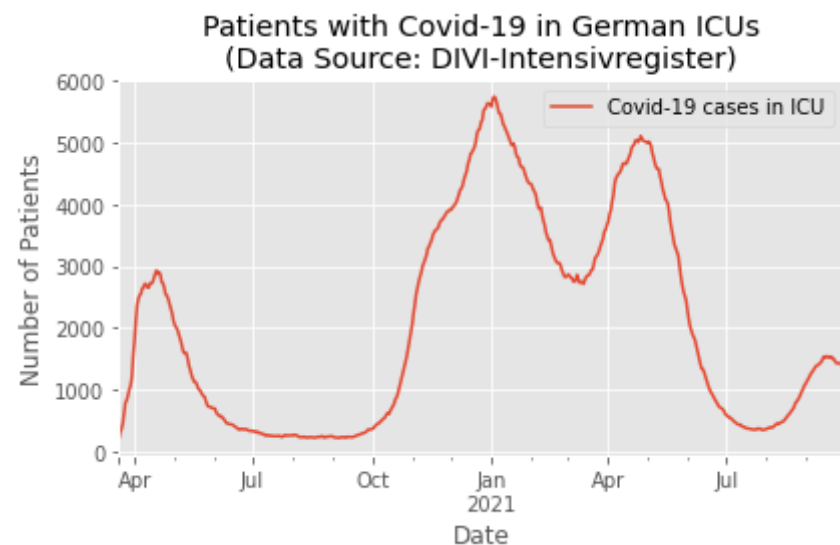
```

<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 559 entries, 2020-03-20 to 2021-09-29

```

```
Data columns (total 1 columns):
#      Column              Non-Null Count  Dtype
---  -
0     Covid-19 cases in ICU  559 non-null    int64
dtypes: int64(1)
memory usage: 8.7 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

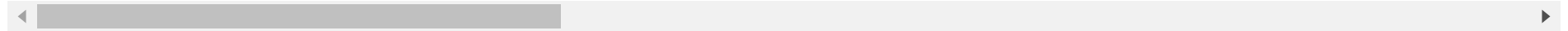
NRW ist the state in Germany with the highest number of inhabitants.

```
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
-------	------------	---------------------------------	--------------------------------------	-----------------------------------

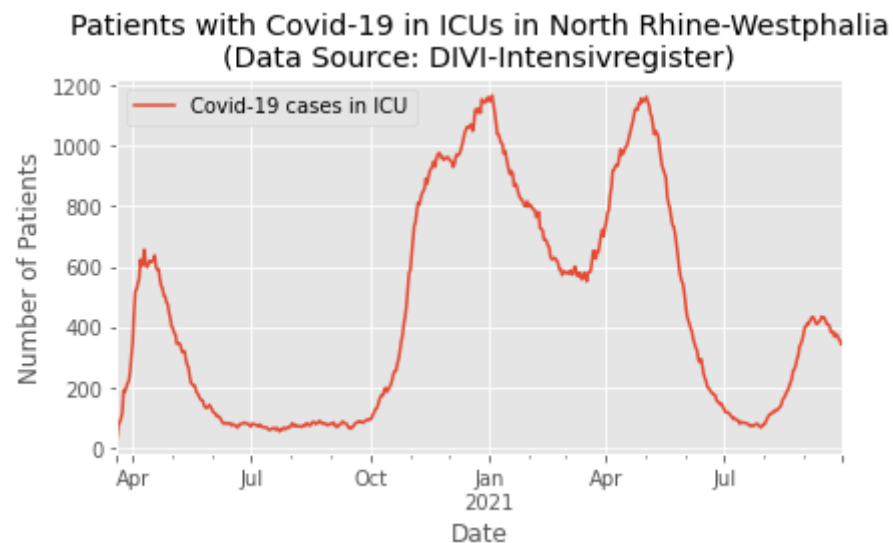
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
9483	2021-09-28	NORDRHEIN_WESTFALEN	314	358	4617
9500	2021-09-29	NORDRHEIN_WESTFALEN	314	343	4677



```
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: 559 entries, 2020-03-20 to 2021-09-29
Data columns (total 1 columns):
#   Column          Non-Null Count  Dtype
---  -
0   Covid-19 cases in ICU  559 non-null    int64
dtypes: int64(1)
memory usage: 8.7 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]:
```

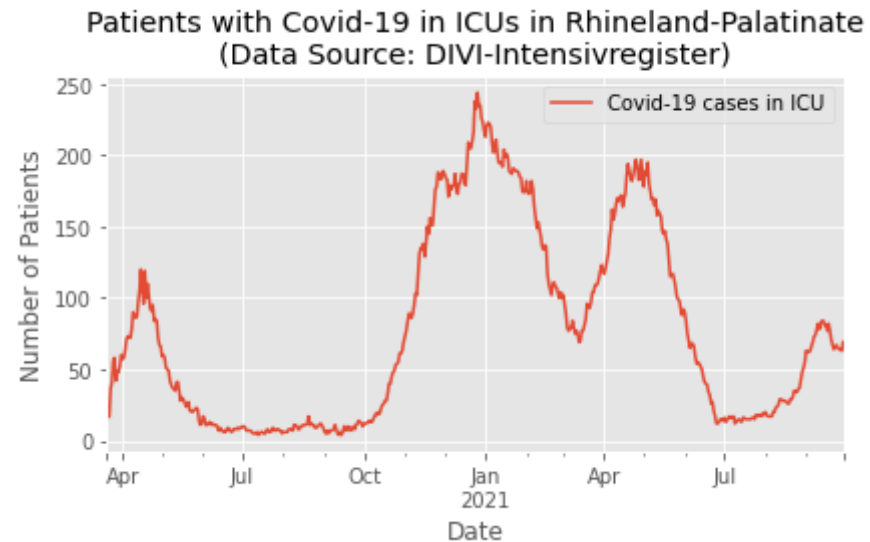
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_
9480	2021-09-28	RHEINLAND_PFALZ	77	63		811
9498	2021-09-29	RHEINLAND_PFALZ	77	69		814

```
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: 559 entries, 2020-03-20 to 2021-09-29
Data columns (total 1 columns):
#   Column          Non-Null Count  Dtype
---  -
0   Covid-19 cases in ICU  559 non-null    int64
```

dtypes: int64(1)  
memory usage: 8.7 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]: saxoniam = timeline_df[timeline_df.Bundesland=='SACHSEN']
          saxoniam.tail(2)
```

```
Out[26]:
```

	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Intensivbetten_Erwachsene
9479	2021-09-28	SACHSEN	79	43	1247	
9496	2021-09-29	SACHSEN	79	39	1266	

```
In [27]: icu_saxonia = saxoniam.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: 559 entries, 2020-03-20 to 2021-09-29  
Data columns (total 1 columns):  
#   Column                Non-Null Count  Dtype  
---  ---  
0   Covid-19 cases in ICU  559 non-null   int64  
dtypes: int64(1)  
memory usage: 8.7 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')
```

