

# 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]: '2021-11-01'
```

```
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_I
10061	2021-11-01T12:15:00+01:00	BADEN_WUERTTEMBERG	129	276	
10062	2021-11-01T12:15:00+01:00	NIEDERSACHSEN	121	126	
10063	2021-11-01T12:15:00+01:00	DEUTSCHLAND	1311	2052	

## 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	NORDRHEIN_WESTFALEN	55	35	86	
1	2020-03-20	SACHSEN	20	3	44	
2	2020-03-20	BREMEN	3	2	0	
3	2020-03-20	HESSEN	19	7	18	
4	2020-03-20	BAYERN	45	61	77	

```
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: 10064 entries, 0 to 10063
Data columns (total 13 columns):
#   Column                                     Non-Null Count  Dtype
---  -
0   Datum                                     10064 non-null  datetime64[ns]
1   Bundesland                               10064 non-null  object
2   Anzahl_Meldebereiche_Erwachsene         10064 non-null  int64
3   Aktuelle_COVID_Faelle_Erwachsene_ITS     10064 non-null  int64
4   Belegte_Intensivbetten_Erwachsene        10064 non-null  int64
5   Freie_Intensivbetten_Erwachsene          10064 non-null  int64
6   7_Tage_Notfallreserve_Erwachsene         10064 non-null  int64
7   Freie_IV_Kapazitaeten_Gesamt             10064 non-null  int64
8   Freie_IV_Kapazitaeten_Davon_COVID        10064 non-null  int64
9   Betriebssituation_Regulaerer_Betrieb     10064 non-null  int64
10  Betriebssituation_Teilweise_Eingeschraenkt 10064 non-null  int64
11  Betriebssituation_Eingeschraenkt         10064 non-null  int64
12  Betriebssituation_Keine_Angabe           10064 non-null  int64
dtypes: datetime64[ns](1), int64(11), object(1)
memory usage: 1022.2+ 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_Intensivbetten_Erwachsene
10029	2021-10-30	DEUTSCHLAND	1309	1930	19091	
10046	2021-10-31	DEUTSCHLAND	1309	1978	18823	
10063	2021-11-01	DEUTSCHLAND	1311	2052	18995	

## 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()`

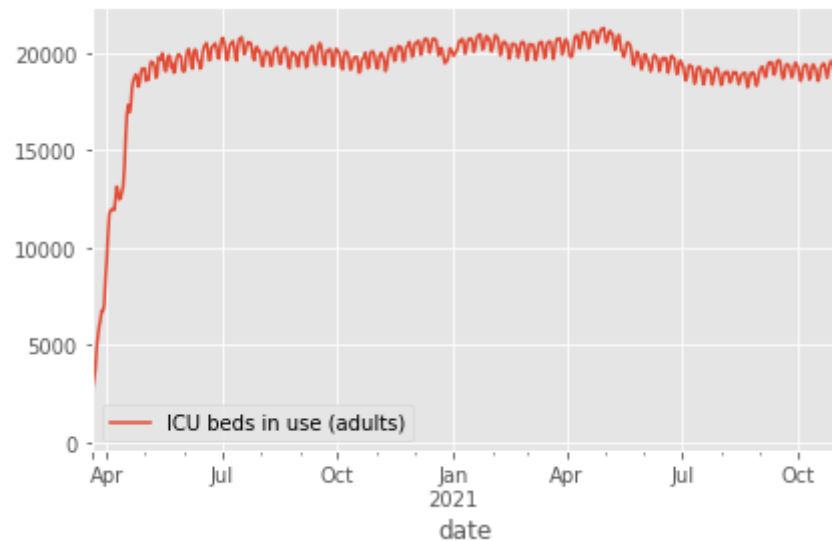
```
<class 'pandas.core.frame.DataFrame'>
```

```
Int64Index: 592 entries, 16 to 10063
Data columns (total 2 columns):
#   Column                                Non-Null Count  Dtype
---  -
0   date                                  592 non-null    datetime64[ns]
1   ICU beds in use (adults)             592 non-null    int64
dtypes: datetime64[ns](1), int64(1)
memory usage: 13.9 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: 592 entries, 2020-03-20 to 2021-11-01
```

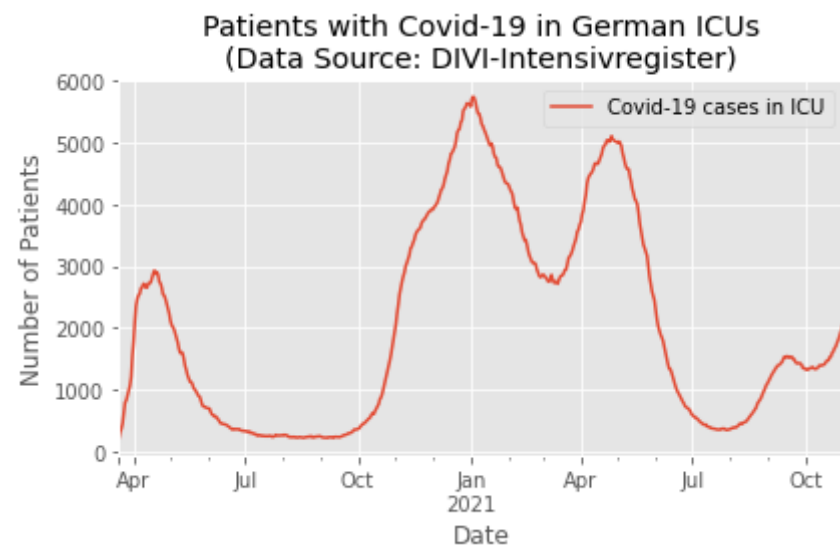
Data columns (total 1 columns):

#	Column	Non-Null Count	Dtype
0	Covid-19 cases in ICU	592 non-null	int64

dtypes: int64(1)

memory usage: 9.2 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

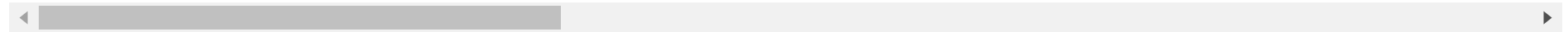
NRW ist the state in Germany with the highest number of inhabitants.

```
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
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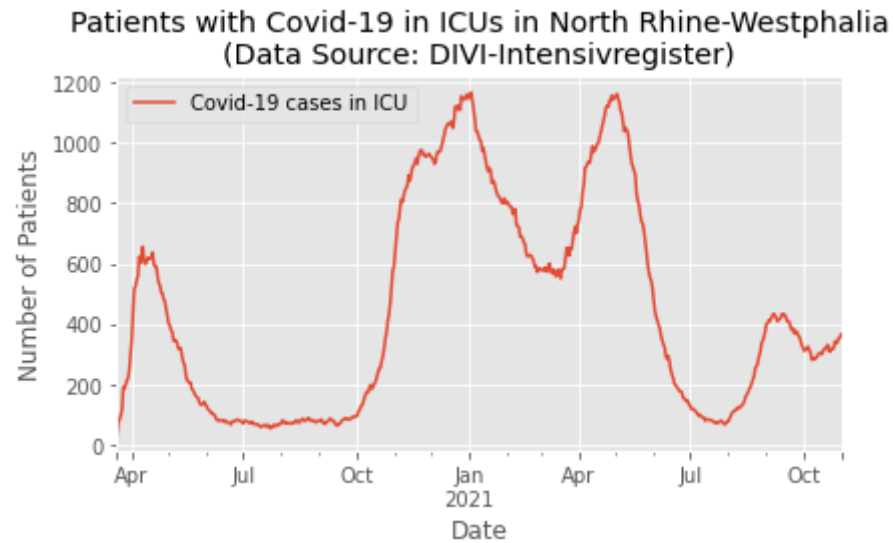
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
10030	2021-10-31	NORDRHEIN_WESTFALEN	312	354	4603
10047	2021-11-01	NORDRHEIN_WESTFALEN	312	365	4643



```
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: 592 entries, 2020-03-20 to 2021-11-01
Data columns (total 1 columns):
#   Column          Non-Null Count  Dtype
---  ---
0   Covid-19 cases in ICU  592 non-null    int64
dtypes: int64(1)
memory usage: 9.2 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]:
```

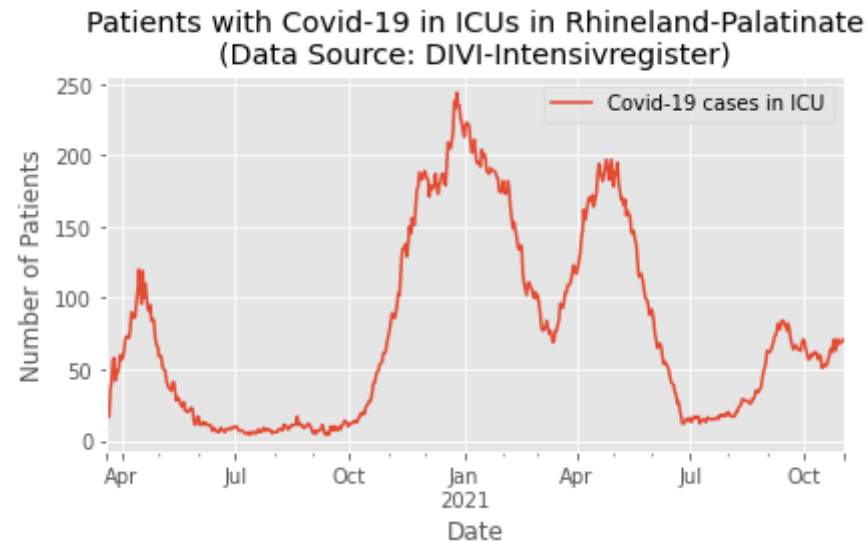
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_Intensivbetten_Erwachsene
<b>10036</b>	2021-10-31	RHEINLAND_PFALZ	77	69	792	
<b>10053</b>	2021-11-01	RHEINLAND_PFALZ	77	71	788	

```
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: 592 entries, 2020-03-20 to 2021-11-01
Data columns (total 1 columns):
#   Column          Non-Null Count  Dtype
---  -
0   Covid-19 cases in ICU  592 non-null    int64
```

dtypes: int64(1)  
memory usage: 9.2 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_Intens
10031	2021-10-31	SACHSEN	78	184	1122	
10048	2021-11-01	SACHSEN	79	198	1135	

```
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: 592 entries, 2020-03-20 to 2021-11-01  
Data columns (total 1 columns):  
#   Column                Non-Null Count  Dtype  
---  ---  
0   Covid-19 cases in ICU  592 non-null   int64  
dtypes: int64(1)  
memory usage: 9.2 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')
```

