

# 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]: '2021-09-05'
```

```
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_Erwachse
9092	2021-09-05T12:15:00+02:00	BERLIN	53	70	9
9093	2021-09-05T12:15:00+02:00	NIEDERSACHSEN	120	104	14
9094	2021-09-05T12:15:00+02:00	DEUTSCHLAND	1315	1272	187

## 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_Erwachse
0	2020-03-20	SCHLESWIG_HOLSTEIN	13	7	1
1	2020-03-20	RHEINLAND_PFALZ	15	14	4
2	2020-03-20	SAARLAND	4	1	1
3	2020-03-20	BADEN_WUERTTEMBERG	31	35	1
4	2020-03-20	MECKLENBURG_VORPOMMERN	10	1	1

```
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: 9095 entries, 0 to 9094
Data columns (total 13 columns):
#   Column                                     Non-Null Count  Dtype
---  -
0   Datum                                     9095 non-null   datetime64[ns]
1   Bundesland                               9095 non-null   object
2   Anzahl_Meldebereiche_Erwachsene          9095 non-null   int64
3   Aktuelle_COVID_Faelle_Erwachsene_ITS     9095 non-null   int64
4   Belegte_Intensivbetten_Erwachsene        9095 non-null   int64
5   Freie_Intensivbetten_Erwachsene          9095 non-null   int64
6   7_Tage_Notfallreserve_Erwachsene         9095 non-null   int64
7   Freie_IV_Kapazitaeten_Gesamt             9095 non-null   int64
8   Freie_IV_Kapazitaeten_Davon_COVID        9095 non-null   int64
9   Betriebssituation_Regulaerer_Betrieb     9095 non-null   int64
10  Betriebssituation_Teilweise_Eingeschraenkt 9095 non-null   int64
11  Betriebssituation_Eingeschraenkt         9095 non-null   int64
12  Betriebssituation_Keine_Angabe           9095 non-null   int64
dtypes: datetime64[ns](1), int64(11), object(1)
memory usage: 923.8+ 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
9060	2021-09-03	DEUTSCHLAND	1316	1207		19279
9077	2021-09-04	DEUTSCHLAND	1314	1251		18985
9094	2021-09-05	DEUTSCHLAND	1315	1272		18749

## 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: 535 entries, 16 to 9094

Data columns (total 2 columns):

#	Column	Non-Null Count	Dtype
0	date	535 non-null	datetime64[ns]
1	ICU beds in use (adults)	535 non-null	int64

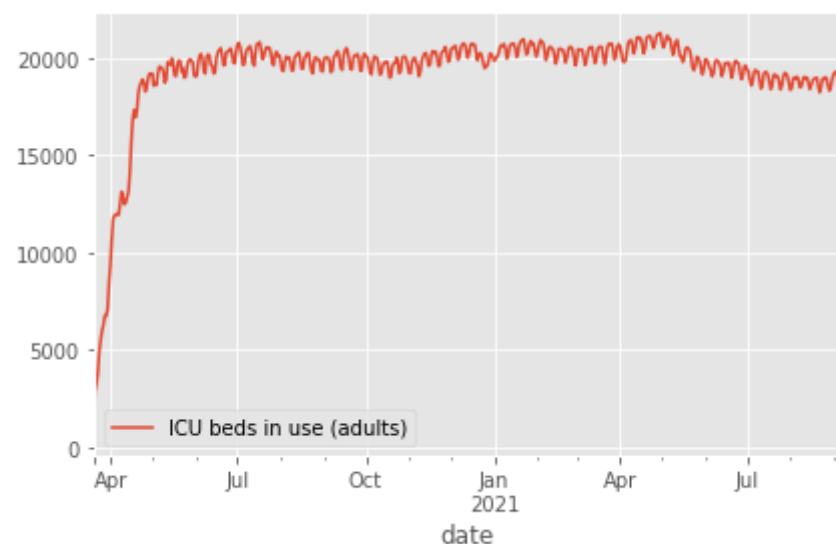
dtypes: datetime64[ns](1), int64(1)

memory usage: 12.5 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: 535 entries, 2020-03-20 to 2021-09-05

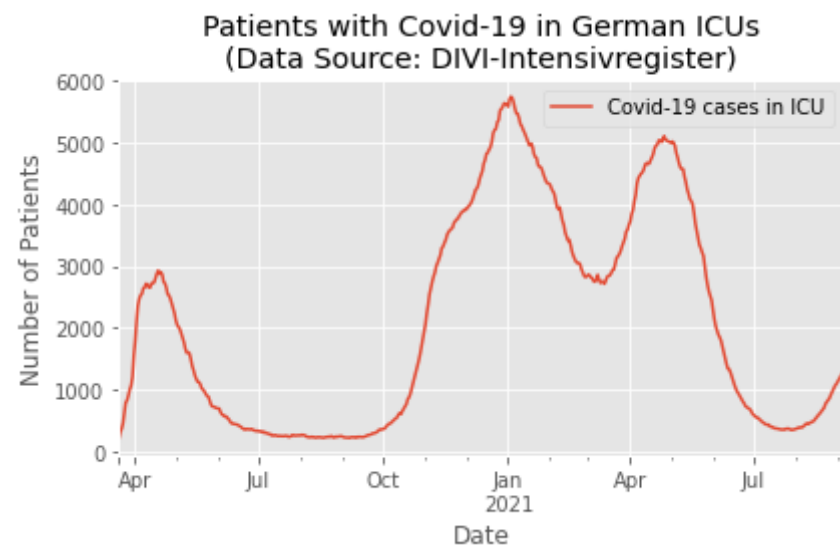
Data columns (total 1 columns):

#	Column	Non-Null Count	Dtype
0	Covid-19 cases in ICU	535 non-null	int64

dtypes: int64(1)

memory usage: 8.4 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

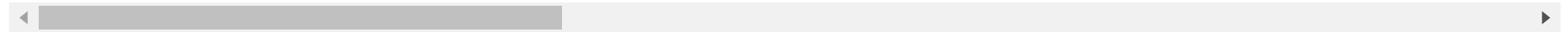
NRW ist the state in Germany with the highest number of inhabitants.

```
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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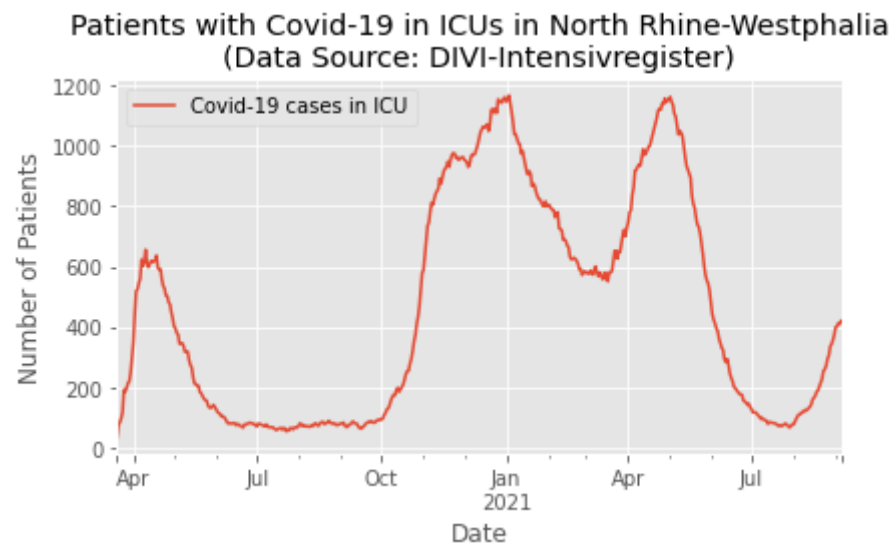
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene
9069	2021-09-04	NORDRHEIN_WESTFALEN	314	410	4671
9086	2021-09-05	NORDRHEIN_WESTFALEN	315	420	4635



```
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: 535 entries, 2020-03-20 to 2021-09-05
Data columns (total 1 columns):
#   Column          Non-Null Count  Dtype
---  -
0   Covid-19 cases in ICU  535 non-null    int64
dtypes: int64(1)
memory usage: 8.4 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]:
```

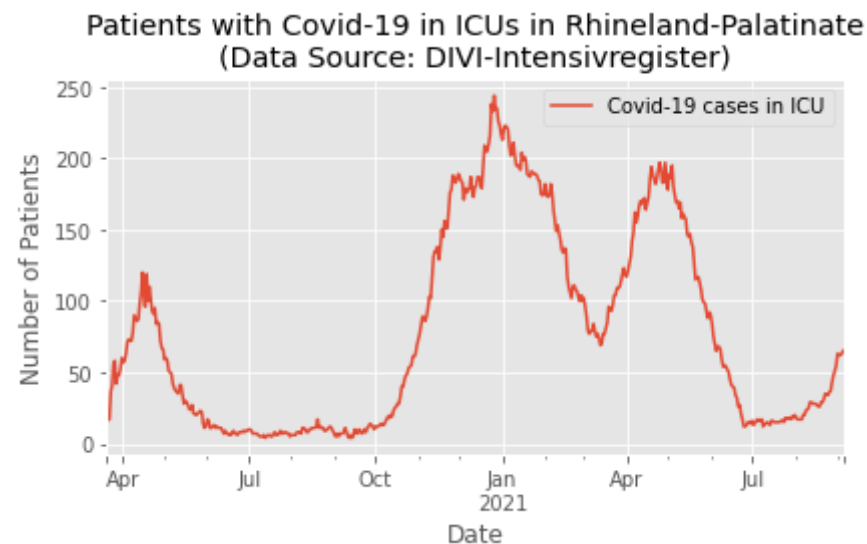
	Datum	Bundesland	Anzahl_Meldebereiche_Erwachsene	Aktuelle_COVID_Faelle_Erwachsene_ITS	Belegte_Intensivbetten_Erwachsene	Freie_
9062	2021-09-04	RHEINLAND_PFALZ	77	63		777
9079	2021-09-05	RHEINLAND_PFALZ	77	65		781

```
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: 535 entries, 2020-03-20 to 2021-09-05
Data columns (total 1 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Covid-19 cases in ICU  535 non-null   int64
```

dtypes: int64(1)  
memory usage: 8.4 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_Intensivbetten_Erwachsene
9067	2021-09-04	SACHSEN	79	24	1210	
9084	2021-09-05	SACHSEN	79	24	1198	

```
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: 535 entries, 2020-03-20 to 2021-09-05  
Data columns (total 1 columns):  
#   Column                Non-Null Count  Dtype  
---  ---  
0   Covid-19 cases in ICU  535 non-null   int64  
dtypes: int64(1)  
memory usage: 8.4 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')
```

