Post-COVID conditions in hospitalized COVID-19 patients in Germany

Scarlette Pacis[1], Ulf Maywald[2], Thomas Wilke[3], Marco Ghiani[3]

1. Cytel Inc, Berlin, Germany, 2. AOK PLUS, Dresden, Germany,
3. Institut für Pharmakoökonomie und Arzneimittellogistik e.V. (IPAM), Wismar, Germany

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Overview

Research Questions

To identify commonly diagnosed incident health conditions following COVID-19 hospitalization in the German context.

Method

Post-COVID conditions were identified as incident ICD-10-GM inpatient or outpatient diagnoses occurring in the 31-180 days after COVID-19 discharge date that did not occur in the 1-year baseline period before COVID-19 hospitalization, excluding diagnoses due to pregnancy and external causes of morbidity.

Highlights

- Respiratory symptoms following COVID-19 hospitalization were the most common conditions, followed by heart disease and urinary complications.
- Patients who were older, female, and treated in the ICU were more likely to experience post-COVID conditions.
- Time to first post-COVID condition diagnosis was shorter among patients with inpatient-only post-COVID conditions compared to those with outpatient-only post-COVID conditions.
- Patients that were also officially diagnosed with post-COVID condition (ICD-10-GM: U09.9!) experienced similar health problems.

Background

"Post-COVID" conditions include a wide range of new health problems following COVID-19 infection that can last three or more months after the first onset of post-COVID symptoms.[1] Commonly reported symptoms include fatigue, dyspnea, cognitive and mental impairments, smell and taste dysfunctions, chest and joint pains, cough, headache, and other gastrointestinal and cardiovascular disorders.[1,2]

Although post-COVID conditions were more common in severe COVID-19 cases, symptoms were also experienced by those who initially had mild or asymptomatic COVID-19 cases.[3]

The ICD-10-GM code for post-COVID (U09.9!) became effective on 01 January 2021, but may not identify all post-COVID symptoms.

Currently, there is lacking evidence of post-COVID conditions in the German context. We used claims data from AOK PLUS, a large regional sickness fund covering ≈3.7 million inhabitants in Saxony and Thuringia, to describe incident diagnoses following COVID-19 hospitalization.

Methods

Inpatient cases of confirmed COVID-19 (ICD-10-GM code U07.1) between 01 January 2020 to 30 June 2021 with minimum 1 year of baseline and 60 days follow-up were included. The index COVID-19 date was defined as the hospital discharge date.

Post-COVID conditions were identified as incident ICD-10-GM inpatient or outpatient diagnoses occurring in the 31-180 days (1-6 months) after COVID-19 discharge date that did not occur in the 1-year baseline period before COVID-19 hospitalization, excluding diagnoses due to pregnancy (ICD-10-GM O00-O99), perinatal conditions (ICD-10-GM P00-P96), congenital malformations (ICD-10-GM Q00-Q99), external causes of injury, morbidity, or mortality (ICD-10-GM S00-Y84), and factors influencing contact with health services (ICD-10-GM Z00-Z99).

OPS codes were used to identify ICU stays (8-980, 8-98f) and intubation procedures (8-70*, 8-71*). ICD-10-GM codes were used to identify patients diagnosed with post-COVID condition (U09.9!) among patients meeting the inclusion criteria and diagnosed with COVID-19 in 2021.

Results

PATIENTS

Identified patients with post-COVID conditions are described in **Figure 1**. A total of 28,980 confirmed inpatient COVID-19 patients from 01 January 2020 to 30 June 2021 were identified, of which 18,251 patients had a minimum of 1-year baseline and 60 days of follow-up. Post-COVID conditions were identified in 12,162 patients.

Most patients had post-COVID conditions that were diagnosed in only outpatient conditions (n=7,926, 65.2%). Fewer patients (946, 7.8%) received diagnoses of post-COVID conditions in only inpatient settings. Post-COVID conditions were diagnosed in both inpatient and outpatient settings for 3,290 patients (27.0%).

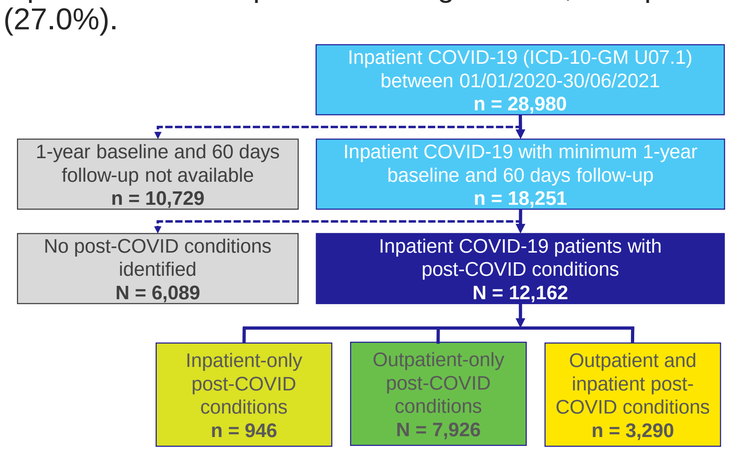

Figure 1: Patients with post-COVID conditions

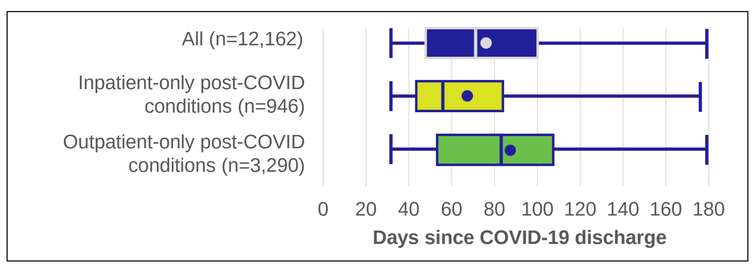

Figure 2: Time from index to first post-COVID condition

BASELINE CHARACTERISTICS

Baseline characteristics at COVID-19 hospitalization discharge date are shown in **Table 1.** Patients who were treated in the ICU *(p=0.003)* or had longer hospital stays *(p<0.001)* were more likely to have post-COVID conditions compared to those with less severe hospitalizations. Among ICU patients, intubated patients were not more likely to have post-COVID conditions *(p=0.498).* Patients with post-COVID conditions were also more likely to be older (mean age 70.0 vs. 65.0, p<0.001) and female (p<0.001).

Table 1: Baseline characteristics at discharge date

Baseline characteristics	All inpatient COVID-19 (n = 18,251)	Post-COVID conditions (n = 12,162)	No Post-COVID conditions (n = 6,089)	p-value*
Female | n (%)	9,835 (53.9)	6,668 (54.9)	3,167 (52.0)	*<0.001*
Age | mean (SD)	68.3 (18.6)	70.0 (17.7)	65.1 (19.9)	*<0.001*
Age < 45 | n (%)	2,055 (11.3)	1,076 (8.9)	979 (16.1)	*<0.001*
Age 45-64 | n (%)	4,343 (23.8)	2,713 (22.3)	1,630 (26.8)	-
Age 65-75 | n (%)	3,476 (19.1)	2,344 (19.3)	1,132 (18.6)	-
Age 75-85 | n (%)	5,047 (27.7)	3,631 (29.9)	1,416 (23.3)	-
Age 85+ | n (%)	3,330 (18.2)	2,398 (19.7)	932 (15.3)	-
ICU | n (%)	741 (4.1)	531 (4.4)	210 (3.4)	*0.003*
Intubation among ICU cases | n (%)	480 (64.8)	340 (64.0)	140 (66.7)	*0.498*
Length of hospital stay (days) | mean (SD)	12.7 (15.1)	13.8 (16.2)	10.5 (12.3)	*<0.001*

*between patients with (n=12,162) and without (n=6,089) post-COVID conditions

TIME TO FIRST POST-COVID CONDITION

The mean number of days from COVID-19 discharge date to the first post-COVID condition identified (**Figure 2)** was 78.1 days (median: 73, IQR: 49-100). Mean days to diagnosis was shorter *(p<0.001)* among patients with inpatient-only post-COVID conditions (mean: 67.8, median: 58, IQR: 42-82) compared to patients with outpatient-only post-COVID conditions (mean: 85.2, median: 82, IQR: 57-107).

Table 2: Top 5 most frequent conditions (n=12,162)

Post-COVID conditions (ICD-10-GM)	Post-COVID conditions (n = 12,162)	Confirmed cases (U09.9!) (n = 2,245)
Respiratory symptoms (J00–J99)	2,512 (20.7)	462 (20.6)
Heart disease (I20–I52)	2,226 (18.3)	337 (15.0)
Urinary complications (N30–N39; R30–R39)	2,206 (18.1)	298 (13.3)
Nervous or musculoskeletal symptoms (R2–R29)	1,331 (10.9)	171 (7.6)
Renal insufficiency (N17–N19)	901 (7.4)	119 (5.3)

IDENTIFIED POST-COVID CONDITIONS

The most frequent post-COVID conditions are shown in **Table 2.** Among the main study population (n=12,162), respiratory symptoms were most common (J00–J99, 20.7%), with 6.7% experiencing respiratory failure (J96). Heart disease (I20–I52) and urinary complications (N30–N39, R30–R39) were also frequently diagnosed (18.3% and 18.1%, respectively), most commonly heart failure (I50, 5.7%) and urinary incontinence (R32, 7.0%). Symptoms affecting the nervous or musculoskeletal systems (R25–R29) were diagnosed in 10.9% of patients, including gait/mobility disorders (R26, 6.6%). Renal complications (N17–N19) were found in 7.4% of patients, with 5.2% newly diagnosed with chronic kidney disease.

DIAGNOSIS OF POST-COVID CONDITION (U09.9!)

Of patients diagnosed with COVID-19 in 2021, only 2,245 (21.5%) were diagnosed with post-COVID condition (U09.9!). The most frequent post-COVID symptoms among these patients are also shown in **Table 2.** The percentage of patients with respiratory symptoms are similar to the main study population, but percentages were slightly lower for other conditions.

Conclusion

Claims data can be used to identify incident post-COVID health conditions, although may overestimate the number of symptoms directly related to COVID-19.

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Disclosure

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Abbreviations

COVID: Severe acute respiratory syndrome coronavirus 2; ICD-10-GM: International classification of diseases Germany; ICU: Intensive care unit; IQR: Interquartile range; OPS: Operations and procedures codes; SD: Standard deviation

Contact information

scarlette.pacis@cytel.com

www.cytel.com

Cytel

IPAM
INSTITUT FÜR PHARMAKOÖKONOMIE UND ARZNEIMITTELLOGISTIK
AN-INSTITUT DER HOCHSCHULE WISMAR