Post COVID-19 condition and its potential impact on disability insurance business in the German market

An assessment from a medical insurance perspective with a blueprint which determinants have to be taken into account to calculate possible disability insurance (DI) claims

NOT IF, BUT HOW

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Content

1 Executive summary

– Post COVID-19 condition is a spectrum of symptoms that could potentially lead to disability claims.

– The proposed calculation basis of potential disability claims can serve as a blueprint for estimating the impact of future pandemics on life and health insurance business and is transferable to other markets.

– For Germany our best estimate shows an increase of 0.5% in DI claims per year (250 additional claims cases), the best-case scenario only shows an increase by 0.1% (50 additional claims cases).

– The best-case scenario up to now is confirmed by the current claims experience from our clients. The best estimate scenario is based on our projections of an acceleration of the pandemic in recent months. Still, we have no evidence so far that indicates the worst-case scenario to become relevant for our business.

– This paper reflects the current COVID-19 situation in Germany, but new variants and changes in pandemic measures will influence the course of this pandemic accordingly. Hence the probability which of the calculated scenarios will come to pass in the future might change.

Best estimate

Our expectation of future experience given all available, relevant experience and information.

2 Introduction

The coronavirus disease 2019 (COVID-19) pandemic has resulted in a growing population of individuals recovering from acute SARS-CoV-2 infection. Although the evidence base is limited, accumulating observational data suggest that these patients may experience a wide range of symptoms after recovery from acute illness, referred to by the current international WHO definition as post COVID-19 condition. Other frequently used terms include "long COVID" and "Post-Acute Sequelae of SARS-CoV-2 infection" (PASC).

This paper sheds light on current knowledge of post COVID-19 condition and its potential impact on the insurance business from a claims perspective. The aim was to estimate the potential number of claims from disability insurance holders in Germany by designing a calculation integrating available information on this pandemic, as of December 2021. This calculation could be transferable to other markets providing similar information and potentially serves as a blueprint for future pandemics.

Bear in mind that disability insurance in Germany (income protection) is generally considered as having a limitation of work capacity of at least 50% for at least six months which leads to a disability to perform one's own occupation, as long as no reasonable other occupation is carried out after having claimed disability. However, this is not a legal definition, but is only the established market standard. Variations are possible. One variation that may be applied to the insured is, that the limitation of work capacity also applies to other occupations that are generally reasonable for the insured.

3 Definition and description of post COVID-19 condition

A definition as to what the term post COVID-19 condition covers was only recently established (October 2021) by the WHO (World Health Organization, 2021). The following shows the exact wording:

Post COVID-19 condition occurs in individuals with **a history of probable or confirmed SARS-CoV-2** infection, **usually three months from the onset of COVID-19 with symptoms that last for at least two months and cannot be explained by an alternative diagnosis.** Common symptoms include **fatigue, shortness of breath, cognitive dysfunction** but also others (see table 3) which generally have an **impact on everyday functioning.** Symptoms may be new onset, following initial recovery from an acute COVID-19 episode, or **persist** from the initial illness. Symptoms may also **fluctuate** or **relapse** over time. A separate definition may be applicable for children.
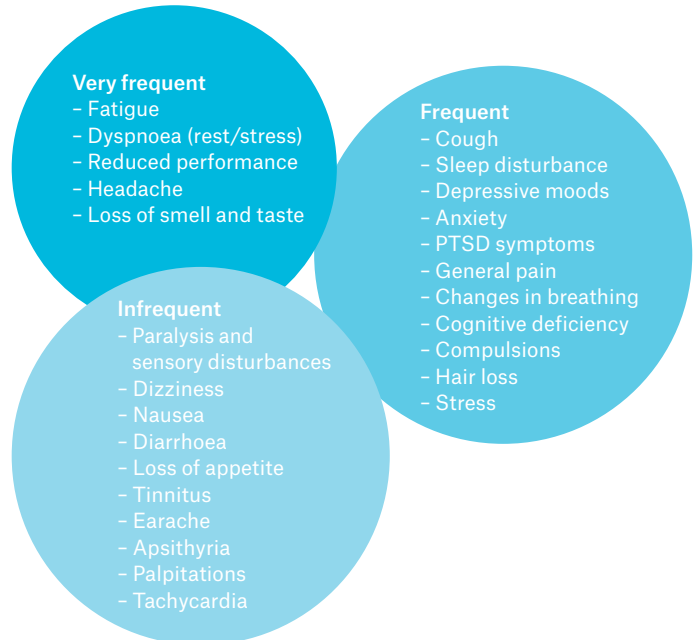
However, before this definition was published, there was no international consensus as to what exactly post COVID-19 condition or its related terms were. The term only summarised persistent physical and psychological symptoms following acute COVID-19 (Sivan and Taylor, 2020). As the available studies all stem from the time before the WHO definition was established the comparability of studies posed a challenge. Generally, there was agreement that there are the following stages of COVID-19 recovery:

– **Acute COVID-19:** symptoms of COVID-19 for up to four weeks following the onset of illness

– **Ongoing symptomatic COVID-19:** symptoms of COVID-19 from four to twelve weeks following the onset of illness

– **Post COVID-19:** symptoms that develop during or after COVID-19, continue for ≥12 weeks and cannot be explained by an alternative diagnosis

These stages reflect symptomatic recovery, and are not related to active viral infection and infectivity. The latter two stages were roughly seen as post COVID-19 condition (figure 1) and serve as basis for the studies and this paper.

Persistent physical symptoms following acute COVID-19 are common, and typically include fatigue, dyspnoea, chest pain, cognitive dysfunction/brainfog and cough. Patients recovering from COVID-19 may also have additional psychological (e.g. anxiety, depression) and cognitive (e.g. poor memory and concentration) symptoms. To date, the reported persisting symptoms include:
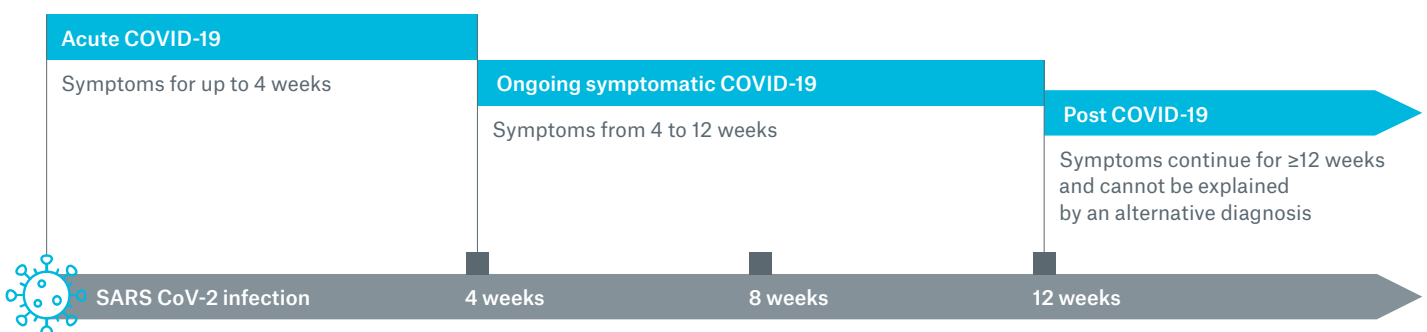
Figure 2: Prevalence of symptoms in post COVID-19 condition (adapted from: Goërtz et al., 2020; Wong et al., 2020; C. Huang et al., 2021; Cares-Marambio et al., 2021; Halpin, O'Connor and Sivan, 2021)

Very frequent
– Fatigue
– Dyspnoea (rest/stress)
– Reduced performance
– Headache
– Loss of smell and taste

Frequent
– Cough
– Sleep disturbance
– Depressive moods
– Anxiety
– PTSD symptoms
– General pain
– Changes in breathing
– Cognitive deficiency
– Compulsions
– Hair loss
– Stress

Infrequent
– Paralysis and sensory disturbances
– Dizziness
– Nausea
– Diarrhoea
– Loss of appetite
– Tinnitus
– Earache
– Apsithyria
– Palpitations
– Tachycardia

The time to symptom resolution appears to depend on the severity of the acute illness, the spectrum of symptoms experienced by the patient and pre-existing comorbidities (Stavem et al., 2021). Some symptoms resolve more quickly than others.

Clinical data suggest that patients especially with moderate to severe disease may experience symptoms for up to several weeks or even months, if not longer, following acute illness or hospital discharge. However, despite data suggesting a longer recovery for those with more severe disease, patients with mild disease can also develop post COVID-19 condition (Goërtz et al., 2020).

Figure 1: Stages and recovery of COVID-19 (adapted from Sivan and Taylor, 2020)

Acute COVID-19
Symptoms for up to 4 weeks

Ongoing symptomatic COVID-19
Symptoms from 4 to 12 weeks

Post COVID-19
Symptoms continue for ≥12 weeks and cannot be explained by an alternative diagnosis

SARS CoV-2 infection   4 weeks   8 weeks   12 weeks

4 Determinants of potential impact on DI business

To be able to assess post COVID-19 condition's impact on disability business, a number of determinants have to be taken into account. These determine the sequence of calculation steps and are shown in figure 3.

Figure 3: Best estimate scenario for DI claims due to post COVID-19 condition in Germany
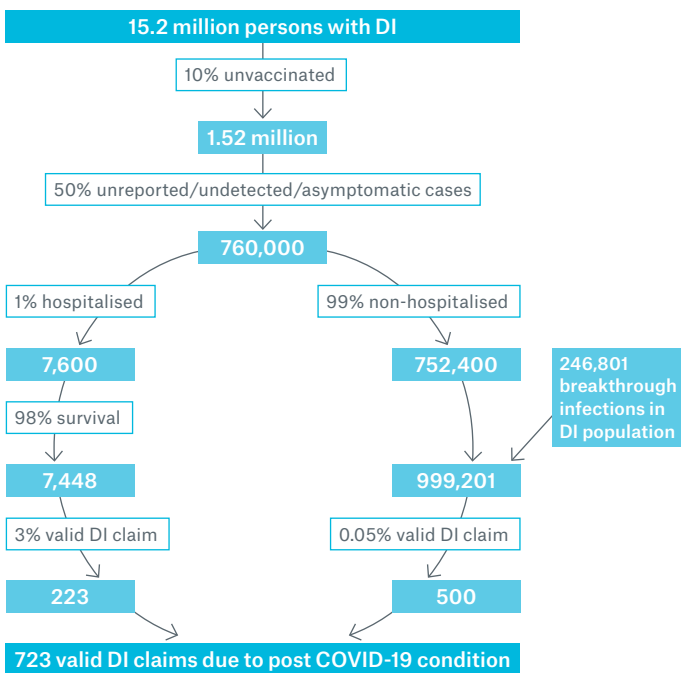
The different calculation steps are elaborated in section 4 of this paper. Starting from a population of 15.2 million DI insured persons, we estimate that at least 10% are unvaccinated and thus will get COVID-19. Among these 1.52 million infected, approximately 50% (760,000) are symptomatic and thus at risk for developing post COVID-19 condition. Only 1% of symptomatic cases will get hospitalised for severe COVID-19, and 99% will survive to discharge. 3% of these survivors, or 223 persons, will develop post COVID-19 condition with relevant disability for a claim. Of the 98% non-hospitalised symptomatic COVID-19 cases in addition to the documented breakthrough infections only 0.05% of cases will develop post COVID-19 condition with relevant disability for a claim. In total, an estimated 723 persons could develop a relevant disability due to post COVID-19 condition until the end of 2024.

1. We assume that all DI insured persons will either be vaccinated or get infected with SARS-CoV-2 in the following months to years.

2. One has to look at the vaccination rate in the subgroup of the DI insured population. We assume that mostly the unvaccinated DI insured population is at risk of getting infected and developing post COVID-19 condition.

3. Although the vaccinated DI insured population is effectively protected against the disease, waning immunity after vaccination and thus breakthrough infections, which can also lead to post COVID-19 conditions, should be taken into account. The speed of implementing booster vaccinations is crucial to prevent breakthrough infections and will be considered in our calculation.

4. Undetected and thus asymptomatic cases are hereby – according to the current knowledge – not at risk for developing post COVID-19 condition and have to be subtracted from the number at risk.

5. We differentiate between non-hospitalised and hospitalised COVID-19 cases and their respective risk of developing post COVID-19 condition. As current breakthrough infections are believed to cause only mild COVID-19, these numbers are added to non-hospitalised cases.

Furthermore, one has to consider whether figures from the general population also apply to an insured portfolio. Last but not least, the symptoms would have to be significant enough (and maybe objectifiable) to be accepted as a valid claim.

We end up with a best-case, a best estimate and a worst-case scenario for potential DI claims in the upcoming years, including those who already have occurred. As we expect to see potential claims in the next three years until the pandemic has potentially ended, we calculate the assumed yearly rise in DI claims for the German market.

We will provide more detailed insights into our considerations to the various parameters and their scientific background in the following section.

4.1 DI insured population

Post COVID-19 condition can affect all socioeconomic groups (Sudre et al., 2021). Nevertheless, people in a higher socioeconomic class, which reflects the insured population, are less affected by morbidity compared to lower socioeconomic classes. Among others, this favourable health status is due to better health care and often healthier lifestyle.

There is data confirming that COVID-19 generally affects the lower socioeconomic groups more often (Wachtler, 2020). Thus the assumption of a lower incidence of post COVID-19 condition in the insurance population can be derived.

What we do know from studies is that comorbidities could play a decisive role in developing post COVID-19 condition (Goërtz et al., 2020; Petek et al., 2021). As the insurance population is generally healthier than the general population, not only due to socioeconomic factors, but also, due to underwriting effects, the burden of comorbidities is significantly lower. Hence, the rate of developing post COVID-19 condition after the acute infection will also be lower. Petek et al. examined a young athletic population with the result that only 0.06% had symptoms after twelve weeks. The main symptom being loss of taste (~60%)

followed by shortness of breath (~20%). As symptoms seem to wane over time it is possible that virtually no DI relevant symptoms remain after twelve months. The study population was probably even healthier than the insured population, however, the insured population will be somewhere in between and rates of post COVID-19 condition can be assumed to be very low.

Conclusion

As a starting point for our calculation regarding the German DI market we take the latest number of **15.2 million disability insurance holders** in Germany (statista, VuMA; ID 250108) as basis. Assuming that all of these DI holders are in the age group 18–59, around 33% of persons in this age group in Germany have a disability insurance. For the following sections, we keep in mind that the various assumptions might be different in an insured population than in the general population.

4.2 Vaccination rate

By the end of December 2021, approximately 70% of the total population in Germany have been fully vaccinated (RKI, Wochenbericht 23.12.2021). In the age group of 18–59 years, this rate is as high as 77%. We believe that this rate differs in the DI population due to its higher socioeconomic status (SES), which is confirmed by recent studies from UK and Israel. In Israel, at the time of assessment, the vaccination rate was up to 10% higher in groups with higher SES (Equityhealth, Israel and Office for National Statistics UK, 2021). A study from the Gutenberg University of Mainz, Germany, showed that the willingness to get vaccinated was present in 84% of persons with a middle SES and up to 91% in persons with the highest SES (Gutenberg COVID-19 Study).

Conclusion

Since DI is rare in low-income groups, we thus estimate the **vaccination rate in the group of disability insurance holders** in Germany is at least **85% (worst-case)**, but will approximately reach at least **90% (best estimate) and possibly 95% (best-case)**. We take this rate to calculate the remaining number of unvaccinated disability insurance holders in Germany and thus might develop COVID-19 disease in the following months to years.

4.3 Breakthrough infection rate and booster vaccinations

Over the last months, an increasing number of breakthrough infections has been reported worldwide. This observation is due to two main reasons. Higher absolute infection numbers in the presence of lifted confinement measures will inevitably lead to higher absolute cases also in vaccinated persons, as the initial vaccine efficacy was obviously not 100%. The second, now imminent reason is the waning immunity of applied vaccines, as the vaccine efficacy for preventing infection is apparently decreasing substantially after six months (Chemaitelly H et al., 2021). Furthermore, new SARS-CoV-2 variants will emerge such as Omicron with increased immune evasion from current vaccines. More than 200,000 symptomatic breakthrough infections have been documented in the age group 18–59 until the end of December 2021 in Germany (RKI, Wochenbericht 23.12.2021), with roughly 30,000 per week. This corresponds to roughly 10,000 weekly breakthrough infections in the DI population.

Despite this development, the vast majority of symptomatic breakthrough infections (>99%) in the age group 18–59 are mild and thus not hospitalised. Nevertheless, even these mild infections in the vaccinated can potentially lead to roughly the same extent of post COVID-19 condition as in unvaccinated COVID-19 patients with mild course, especially in younger persons (Taquet et al., 2021 and Antonelli M et al., 2021) albeit with fewer number of symptoms. To restore vaccine efficacy and thus control infection rates, a strategy of booster vaccinations has now been implemented. In this regard, we assume that especially within the DI population, the willingness to receive this booster vaccination is as high as for the initial vaccinations. The speed of this implementation is essential, and will determine the number of breakthrough infections. The impact of the expected surge of Omicron on breakthrough infections is so far unclear. As the clinical course of COVID-19 with Omicron is apparently milder in general, and probably even milder with full vaccination, we assume that the rate of development of post COVID-19 condition is lower.

Conclusion

Since booster vaccination programmes were on full capacity by end of December 2021, we expect that around 120,000 breakthrough infections in the DI population have occurred in our best-case scenario. This number increases to 250,000 if booster vaccination programmes have succeeded by the end of March 2022 in our best estimate scenario. This implicates a balanced impact of rising Omicron breakthrough infections with milder symptoms. In our worst-case scenario assuming an end of the booster campaign in May 2022, roughly 340,000 breakthrough infections have occurred. As >99% of breakthrough infections are mild and thus not hospitalised, the aforementioned numbers are added to the number of unvaccinated, symptomatic, non-hospitalised COVID-19 cases at risk for post COVID-19 condition (see section 4.5).

4.4 Estimated number of unreported/ undetected/asymptomatic cases

In our next step we take unreported and undetected cases into our considerations. These undetected asymptomatic cases are extremely unlikely to develop post COVID-19 features leading to DI claims.

While the number of detected COVID-19 infections are widely available, it is still largely unknown how many individuals may be already infected but are not aware of it because of the absence of symptoms. Some studies have used simulation-based approaches but are surrounded by uncertainty (Flaxman et al., 2020). Several studies have claimed that the number of undiagnosed cases is much higher than the number of diagnosed cases (Li et al., 2020, Vaughan et al., 2021).

A recent, extensive review estimating the worldwide pooled asymptomatic percentage of COVID-19 infections ended up with 35.1% (Sah et al., 2021). A German population-based study stated that 40% of people infected with COVID-19 are asymptomatic and thus untested (Gutenberg COVID-19 Study), albeit this estimation is biased as test capacities and infection numbers were both lower in the first wave. A current report from several German regions analysed the potential number of asymptomatic untested cases according to seroprevalence and actual positive tests and concluded that between one third and two thirds of all infections are undetected (Gornyk et al., 2021).

Conclusion

For the German market with a relatively high number of tests performed, especially in the work environment, we assume **40% unreported cases as worst-case scenario, 50% unreported cases as best estimate, and 60% as best-case scenario**. Based on the supposition that these cases will not develop post COVID-19 as they are asymptomatic, we additionally subtract this number from the number of unvaccinated persons with disability insurance. The proposed estimates are challenging, as the scientific literature on undetected cases is ambiguous and are based on previous waves of the pandemic with lower test capacities.

4.5 Rate of post COVID-19 condition and DI relevance

The prevalence and incidence of post COVID-19 condition is yet unclear. Until recently there was a lack of a consistent international definition of post COVID-19 condition in the medical literature and this hampered the integration of findings from different studies (see also above: Definition of post COVID-19 condition). As figure 4 demonstrates, studies have focused on different patient groups (hospitalised,

Figure 4: Differences in study features of prevalence of post COVID-19 condition (adapted from Raman et al., 2021)
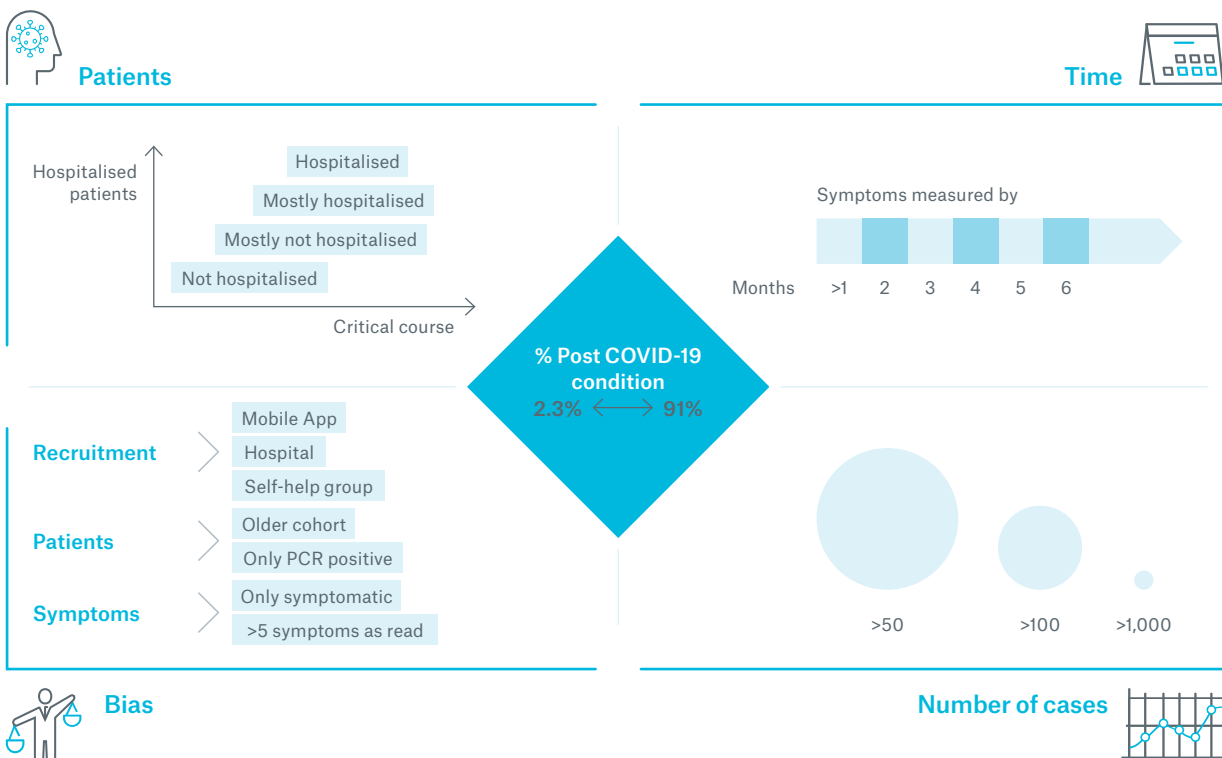
non-hospitalised or both), symptoms (asymptomatic or symptomatic) and time intervals (one month up to more than six months after acute infection) and used different sample sizes and different recruitment strategies (e.g. electronic health records, voluntarily responding to a telephone survey or using an app). Hence, the estimated prevalence of post COVID-19 condition varies widely, ranging from 2.3% to 91%.

In order to evaluate the prevalence of post COVID-19 condition in a reliable way, it is crucial to have an appropriate comparative group with only a few studies meeting these criteria at this timepoint.

Another important factor is that symptoms of post COVID-19 condition seems to improve with time, hence, we focused on data with a follow-up period of at least six months – as so far available.

Post COVID-19 condition can occur in patients with severe, moderate and mild disease. There is increasing evidence that patients suffering from multiple acute symptoms and more severe symptoms are prone to suffer from post COVID-19 condition later on (Sudre et al., 2021). Therefore, we should distinguish between non-hospitalised cases with mild to moderate symptoms and hospitalised cases with severe and/or life-threatening symptoms.

The number of hospitalised patients amongst all COVID-19 patients is generally stated to be 5–10%. It is also stated that the 10% are likely overestimated, as these patients are sometimes initially hospitalised due to reasons independent of COVID-19 and COVID-19 is then diagnosed incidentally during hospitalisation. The risk of hospitalisation is clearly increased by the presence of comorbidities. To make our analysis more precise we took a closer look on the hospitalisation rate of age-group 18–65 years: according to Robert Koch Institute in Germany the number of hospitalised patients in this age group amongst all COVID-19 patients is stated with 2.85% so far (RKI, Wochenbericht 25.11.2021) leading to a large amount of non-hospitalised patients of 97.15% in this age group.

Conclusion

Assuming that the DI population has a lower prevalence of comorbidities and thus lower likelihood to develop severe COVID-19 with subsequent hospitalisation, we consider a hospitalisation rate of 0.5% for our best-case scenario, 1% for the best estimate scenario and 2.85% for the worst-case scenario.

4.5.1 Non-hospitalised COVID-19 cases
The picture in patients with acute infection but without hospitalisation was unclear initially, as the majority of research efforts focused on hospitalised patients only.

Only a few studies concerning post COVID-19 condition with longer follow-up on this highly relevant population are available so far.

A study from Switzerland (Martinez et al., 2021) stated that persistent symptoms at three and twelve months after COVID-19 infection were reported by 26.5% and 13.5% of participants, respectively. A Swedish study from Havervall et al., 2021, shows one of the longest follow-ups with eight months: Comparing 323 seropositive (evidence of COVID-19 infection) with 1,072 seronegative (no evidence of COVID-19 infection) health care professionals, after two months 26.0% vs. 8.9% and after eight months 14.9% vs. 3.4% reported at least one moderate to severe symptom (see table 1). The five most common moderate to severe long-term symptoms were anosmia, fatigue, ageusia, dyspnoea and sleeping disorders:

Table 1: The five most common moderate to severe long-term symptoms in seropositive and seronegative participants (Havervall et al., 2021)

	No. (%)	
	Seropositive (n = 323)	Seronegative (n = 1,072)
Any symptoms		
≥2	84 (26.0)	95 (8.9)
≥4	69 (21.4)	77 (7.2)
≥8	48 (14.9)	36 (3.4)
Anosmia		
≥2	47 (14.6)	6 (6.06)
≥4	35 (10.8)	4 (0.4)
≥8	29 (9.0)	1 (0.1)
Fatigue		
≥2	27 (8.4)	57 (5.3)
≥4	22 (6.8)	47 (4.4)
≥8	13 (4.0)	16 (1.5)
Ageusia		
≥2	25 (7.7)	6 (0.6)
≥4	17 (5.3)	3 (0.3)
≥8	12 (3.7)	1 (0.1)
Dyspnoea		
≥2	14 (4.3)	12 (1.1)
≥4	11 (3.4)	10 (10.9)
≥8	6 (1.9)	3 (0.3)
Sleeping disorder		
≥2	10 (3.1)	21 (2.0)
≥4	9 (2.8)	19 (1.8)
≥8	7 (2.2)	9 (0.8)

From our perspective, it is crucial to identify symptoms and their respective grade of severity which are likely to impair the functional status of the patient leading to disability. It is important to mention that a significant number of the above-mentioned symptoms would likely not have led to valid disability claims.

To identify the impact of symptoms on work status, again, data from the study from Havervall et al. helps us: of the sero-positive participants (median age of 43 years), 8% reported that their long-term symptoms moderately to markedly disrupted their work life, compared with 4% of the seronegative participants (median age of 47 years).

According to data from the study from Switzerland (Martinez et al., 2021) after three months less than 1,2% (three of 260 participants, age range 30–39 years) reported not having regained at least 50% of their pre-COVID-19 level of health. After twelve months all participants reported having regained at least 60% of their pre-COVID-19 level of health. This hints at a possible mid-term recovery from post COVID-19 condition which would enable reactivation in case of a DI claim.

There are other investigations (Davis HE et al., 2021), stating higher numbers of post COVID-19 cases not having returned to their former working status, that must be treated with caution as they have much shorter follow-up times and do not distinguish between hospitalised and non-hospitalised patients.

A further report from Switzerland (Bundesamt für Sozialversicherung, Schweiz, 2021) looking at invalidity data stated that twelve months after the initial COVID-19 infection a proportion of only 0.17% claimed for disability (1,364 claimants/82,6123 infected). The report did not investigate how many of these claims were eventually accepted as valid. However, this low number of claimants is also reflected by feedback coming from German primary insurers. A recent survey amongst 13 major German primary insurers showed that throughout the complete duration of the pandemic fewer than 50 claims for post COVID-19 condition have been submitted (as of September 2021). Relating this to the estimated total of processed DI claims throughout the pandemic, which amounts to roughly 90,000 (~60,000 processed DI cases per year, ~1.5 years of the pandemic) the additional number of potential claims is actually even negligible (0.05%).

Conclusion

Available data for post COVID-19 condition in non-hospitalised individuals is diverse and still accompanied with large uncertainty. In light of currently reported numbers of DI claims from Switzerland and German primary insurers, we assume that **0.5% (worst-case scenario), 0.05% (best estimate) and 0.03% (best-case scenario)** of non-hospitalised COVID-19 cases will suffer a markedly disruption of work life through post COVID-19 condition meaning to become a valid disability claim.

4.5.2 Hospitalised COVID-19 cases

The fraction of hospitalised patients amongst all COVID-19 patients in DI holders is quite low (best estimate 1%, see above). Nevertheless, severe COVID-19 can lead to in-hospital death. Hence the number of deaths has to be subtracted from the number of hospitalised COVID-19 patients. The survivors are then at risk for developing post COVID-19 condition. We deduct that the reported COVID-19 deaths in the age group 18–59 occur all in-hospital (in contrast to e.g. nursing homes for elderly patients). The in-hospital death rate from COVID-19 is accordingly at 5% for this age group (RKI, Wochenbericht 25.11.2021). As we consider the DI population as healthier with less comorbidities, the death rate for the best-case scenario is set at 3%, the best estimate is set at 2% and the worst-case scenario at 1%.

The probability of getting post COVID-19 condition features in hospitalised patients is higher than in non-hospitalised individuals. A study investigating hospitalised COVID-19 survivors at 6-month follow-up stated a quite high proportion of 76% of patients with at least one remaining symptom. Post COVID-19 patients were mainly troubled with fatigue or muscle weakness, anxiety, depression or sleep difficulties (C. Huang et al., 2021).

The largest retrospective cohort study so far is based on linked electronic health records data from 81 million patients, primarily in the United States of America (Taquet et al., 2021): among COVID-19 survivors (mean age: 46.3), 64% of hospitalised patients had one or more symptoms recorded between month three and six after COVID-19 infection.

We should be careful in transferring these prevalences to the insurance population, as this data is not yet adjusted for comorbidities that might have been a reason for non-eligibility for disability cover. We have to keep in mind that it is well known that hospitalisation and severe illness (irrespective of COVID-19) can cause health effects like severe weakness and exhaustion during the recovery period (e.g. post-intensive care syndrome). Therefore, these symptoms are associated to the COVID-19 pandemic but cannot be deemed specific for post COVID-19 condition itself.

Taking a closer look at the impact on work capability, the study from C. Huang et al., highlights the impact on daily activities and other potentially disabling consequences six months after hospitalisation in the following table 2:

Table 2: Health-related quality of life (C. Huang et al., 2021)

Mobility: problems with walking around	113/1,622 (7%)
Personal care: problems with washing or dishing	11/1,622 (1%)
Usual activity: problems with usual activity	25/1,611 (2%)
Pain or discomfort	431/1,616 (27%)
Anxiety or depression	367//1,617 (23%)

Interestingly, taking the investigators additional look on work status before and after COVID-19 infection, only 3.8% of hospitalised patients have not returned to original work due to decreased physical function after twelve months (L. Huang et al., 2021).

A further study looked at the impact of the symptoms on daily life rather than the simple presence of symptoms (Taboada et al., 2021). This study used a functional status scale grade and additionally distinguished between ICU (Intensive Care Unit) and non-ICU COVID-19 patients. However, all of the studied patients were hospitalised (table 3). As one can see from these tables, the vast majority of patients (>75%) either had no limitations at all or the symptoms were so mild, that the impact on daily activities was negligible. Less than 10% – less than 25% in ICU patients and less than 7% in non-ICU

patients – had persisting limitations in daily life activities. Regarding the higher numbers in ICU patients, we should be very careful in our interpretation and transfer to the DI market because one should keep in mind that the majority of these patients has significant comorbidities that might have led to a decline of DI cover at the stage of underwriting. This is also the case for another observational study – the PHOSP-COVID study (Evans RA et al., 2021) –, which reported a new disability in 20% of hospitalised COVID-19 survivors (assessed by the Washington Group Short Set of Functioning) and an experienced health-related change in occupation in 19%, six months after discharge. This means that the majority of studies of hospitalised patients might not be applicable for our analysis, as comorbidities are frequent and associated with future development of post COVID-19 condition and lack of recovery from it.

Conclusion

Similar to non-hospitalised patients, one can find varying data regarding prevalence of post COVID-19 condition in hospitalised patients and its impact on work capacity. Taking the so far available data we considered the most applicable numbers for a DI insured population. Based on the number of hospitalised cases subtracted by the number of COVID-19 deaths, we assume a rate of 10% (worst-case scenario), 3% (best estimate) and 2% (best-case scenario) of hospitalised patients to develop post COVID-19 condition.

Table 3: Functional status before and six months after COVID-19 (Taboada et al. 2021)

Post-COVID-19 functional status scale grade	Before COVID-19	6 months after COVID-19		Before COVID-19			6 months after COVID-19		
				ICU patients	Non-ICU patients		ICU patients	Non-ICU patients	
	n = 183	n = 183	P value	n = 32	n = 151	P value	n = 32	n = 151	P value
0: No limitations in my everyday life.	155 (84.7)	81 (44.3)	<0.001	31 (96.9)	124 (82.1)	<0.153	6 (18.8)	75 (49.7)	<0.001
1: Negligible limitations (still have persistent symptoms).	19 (10.4)	57 (31.1)		1 (3.1)	18 (11.9)		8 (25.0)	49 (32.5)	
2: Limitations in my everyday life, occasionally need avoid or reduce usual activities.	3 (1.6)	27 (14.8)		0 (0.0)	3 (2.0)		10 (31.1)	17 (11.3)	
3: Limitations in my everyday life, and I am not able to perform all usual activities.	5 (2.7)	12 (6.6)		0 (0.0)	5 (3.3)		6 (18.8)	6 (4.0)	
4: Severe limitations. I am dependent from another person due to symptoms.	1 (0.5)	6 (3.3)		0 (0.0)	1 (0.7)		2 (6.3)	4 (2.6)	

Data are expressed as No (%). Functional status was measured using the post-COVID-19 functional status scale.
ICU = intensive care unit

4.6 Calculation design

Additionally to the overview as presented in figure 3, table 4 lists all calculation steps.

Admittedly, the total number of potential DI claims may seem high for the worst-case scenario. The best estimate scenario is very much closer to the best-case scenario.

Assuming that the pandemic will have ended by the end of 2024 (meaning COVID-19 will have become an endemic disease), our calculations would mean a best estimate of less than 750 potential claims for the whole period and thus less than 250 potential claims per year for the whole German market. The best-case scenario implies roughly 150 claims in the whole period and thus only 50 potential claims per year. The worst-case scenario assumes a maximum of 12,000 in total and thus 4,000 claims per year due to post COVID-19 condition.

Table 4: Calculation of the impact of post COVID-19 condition on disability insurance. Three different scenarios for the development of potential disability insurance claims due to post COVID-19 cases are shown. The different calculation steps are elaborated on in section 4 of this paper.

			Best-case scenario	Best estimate	Worst-case scenario
1	**Persons with DI in Germany**		**15,200,000**	**15,200,000**	**15,200,000**
2	Rate of persons with DI in age group 18–59		33.21%	33.21%	33.21%
3	Vaccination rate in persons with DI		95%	90%	85%
4	**Number of unvaccinated persons with DI**	row 1 x (100%–row 3)	**760,000**	**1,520,000**	**2,280,000**
5	Rate of unreported/undetected/asymptomatic cases = asymptomatic and will not develop post COVID-19 condition		60%	50%	40%
6	**Unvaccinated persons with DI with symptomatic infection**	row 4 x (100%–row 5)	**304000**	**760,000**	**1,368,000**
7	Rate of non-hospitalised symptomatic COVID-19 cases in DI population		99.50%	99.00%	97.15%
8	Estimated breakthrough infections in age group 18–59		357,129	743,172	1,010,433
9	**Estimated absolute breakthrough infections in persons with DI**	row 2 x row 8	**118,599**	**246,801**	**335,556**
10	**Non-hospitalised symptomatic COVID-19 cases with DI**	row 6 x row 7	**302,480**	**752,400**	**1,329,012**
11	**Non-hospitalised symptomatic COVID-19 cases with DI plus breakthrough infections**	row 9 + row 10	**421,079**	**999,201**	**1,664,568**
12	Rate of valid DI claims among non-hospitalised symptomatic COVID-19 cases		0.03%	0.05%	0.50%
13	**Potential DI claims among non-hospitalised symptomatic COVID-19 cases**	row 11 x row 12	**126**	**500**	**8,323**
14	Rate of hospitalised COVID-19 cases in DI population		0.50%	1.00%	2.85%
15	**Hospitalised COVID-19 cases with DI**	row 6 x row 14	**1,520**	**7,600**	**38,988**
16	Rate of death in hospitalized COVID-19 cases with DI		3%	2%	1%
17	**Hospitalised COVID-19 cases alive**	row 4 x (100%–row 5)	**1,474**	**7,448**	**38,598**
18	Rate of valid DI claims among hospitalised COVID-19 cases		2%	3%	10%
19	**Potential DI claims among hospitalised COVID-19 cases**	row 17 x row 18	**29**	**223**	**3,860**
20	**Potential DI claims due to post COVID-19 condition until the end of 2024**	row 13 + row 19	**156**	**723**	**12,183**

DI = disability insurance

5 Limitations

First and most importantly our calculation and interpretation of the available medical scientific studies are based on the specific product features and market environment of the disability product in Germany. Still the determinants of the calculation could be used for other DI products or markets.

Several of our considerations could be impacted by future scientific observations from this pandemic and actual claim numbers. A major factor potentially reducing both the number of claims and the duration of payment is the recovery from post COVID-19 condition over time. Reactivation after granting disability is essential to limiting costs. As current reports hint at the constant improvement of symptoms of post COVID-19 condition, it is likely that a substantial number of claims could be reactivated once the disability falls below a certain level. Since these reports have a limited follow-up, one has to await studies with longer, and notably, complete follow-up of representative patient groups similar to the DI population.

The scientific literature of post COVID-19 condition and other crucial factors such as the impact of breakthrough infection and vaccination on symptoms of post COVID-19 condition is extremely heterogeneous and rapidly evolving. There is a wide range of findings both on a national and international level. Applying the appropriate study to our estimations is vital, and future studies on this topic with larger patient numbers and longer follow-up will potentially change our numbers.

These scientific reports from general populations are further biased from our insurance perspective, as the severity of symptoms and their potential relevance for granting DI could be fundamentally different in a dedicated DI population. Finally, the symptoms would have to be significant enough (and maybe objectifiable) to be accepted as a valid claim.

6 Discussion

Post COVID-19 condition is an emerging health risk which will affect the insurance business in various ways. In this paper we have analysed the current COVID-19 situation and present our medical insurance view on the potential impact of post COVID-19 condition on DI. Hereby we present an adjustable calculation for estimating the number of possible DI claims. It considers two major components of this pandemic: vaccination, including rate and efficacy, and infection, differentiating disease courses and likelihood of developing post COVID-19 condition.

In Germany, around 60,000 DI claims are processed per year, and around 50,000 claims are granted (GDV, 2019). If we apply our worst-case scenario of around 4,000 potential DI claims per year due to post COVID-19 condition, the total number of granted DI claims could potentially increase by 8% to 54,000 cases. In our best estimate with 250 DI claims per year, this impact is mitigated to an increase of 0.5%. In the best-case scenario with only 50 additional claims per year, the increase is only 0.1%.

There are several factors that could modify this impact. These factors add to complexity of our estimation. At this point we want to emphasise that the best estimate is far closer to the best-case scenario and a worst-case scenario seems highly unlikely.

1. The majority of symptoms reported for post COVID-19 condition such as fatigue, depression and anxiety could be related to general effects of the COVID-19 pandemic, including mental health effects from isolation and worsening economic situations. Therefore, we considered particularly scientific reports with control groups for our calculations. Additionally an increase of DI claims irrespective of a COVID-19 infection, due to the overall impact of the pandemic, e.g. isolation or the tense economic situation is possible. This however, was beyond the scope of this paper.

2. The impact of vaccination on the development and severity of post COVID-19 condition is under debate. In general, we assume that every person in Germany will be either vaccinated or infected during the ongoing pandemic. This assumption is supported by current considerations to introduce compulsory vaccination in several countries. A number of studies have shown a positive impact on post COVID-19 condition by several mechanisms. Vaccinations are effective in preventing symptomatic and reduce especially the risk of severe forms of COVID-19 by more than 90%, thus preventing post COVID-19 condition which is more frequently found after severe COVID-19 cases. This observation has been implemented into our calculation, as we exclude vaccinated persons from the potential group at risk for post COVID-19 condition. We still consider reported symptomatic breakthrough infections as potentially at risk for post COVID-19 condition, although being virtually exclusive mild infections. There is currently uncertainty whether Omicron breakthrough infections will have the same impact as Delta breakthrough infections, as clinical course in general is milder, but infection rates are substantially higher. We have assumed therefore a balanced effect which is represented in our best estimate scenario. Furthermore, vaccinations can reduce viral transmission. With decreasing SARS-CoV-2 infections, one can expect not only acute COVID-19, but also post COVID-19 condition to decrease over time. With compulsory vaccination, post COVID-19 conditions could become rare in the working population. Nevertheless, the efficacy of preventing viral transmission is substantially reduced by emerging SARS-CoV-2 variants.

This is probably the greatest concern and contributing factor to rising cases of acute COVID-19 and possibly post COVID-19 condition. As a consequence, booster vaccination has become an effective countermeasure now implemented world-wide (Bar-On et al., 2021). Notably, COVID-19 reinfections with a different SARS-CoV-2 variant other than the initial variant are apparently taking a mild course in virtually all cases (Abu-Raddad et al., 2021). Therefore, the impact of new variants, including the novel Omicron variant (WHO, Update on Omicron, 2021), on the clinical course of disease and thus post COVID-19 condition seems to be limited for now in the presence of otherwise effective vaccines and booster options.

3. Several COVID-19 specific antiviral treatments such as monoclonal antibodies and viral enzyme inhibitors have been recently approved and introduced in clinical practice. For now, these drugs are intended for use in persons at high risk for developing severe course of COVID-19, e.g. with comorbidities and certain age, after careful consideration. Thus, a limited use of these drugs in specific sub-populations of COVID-19 patients will probably not substantially impact the number of cases with post COVID-19 condition in the DI population during the current wave. However, these drugs could play a major role for future waves of COVID-19 when widely available with a favourable risk profile.

4. The potential acceptance rate of claims for post COVID-19 condition is controversially debated. For most symptoms, currently only a few objective diagnostic criteria are proposed, including comprehensive neurophysiologic measurements that are not widely available or performed. Even obvious symptoms such as dyspnoea are difficult to objectify. Notably, a recent study could not find even in severe, hospitalised patients a relevant impairment of lung function tests after several months (Wu et al., 2021). Clinical experience and the majority of studies show that symptoms will improve, emphasising further follow-up of more than 1 year after the infection. Even in case of valid disability claims, spontaneous recovery is possible and should trigger reassessment. Overall, the degree of impaired work and daily life after a confirmed COVID-19 infection will be the guiding factor to decide for DI, and the causative, objective link of these symptoms to post COVID-19 condition might not be decisive.

5. Current studies probably overestimate the impact of post COVID-19 condition on disability. Preliminary data for cases with longer follow-up shows that spontaneous recovery is likely and thus significant and lasting health-related impairment of work life is rare. This assumption is supported by first experiences with COVID-19 related DI claims from primary insurers in the market. This makes our worst-case not very likely. In addition, as post COVID-19 condition is anticipated to be significant higher in insured with relevant comorbidities a substantial part of valid claims could be expected to be paid even without post COVID-19 condition in the future.

We believe that post COVID-19 condition will lead to a manageable rise in DI claims in the near future. The number of claims will be influenced by several factors, including vaccination rate and severity of cases. Approaching the third year of the pandemic amidst the fourth wave in Germany, we advocate constant monitoring of the situation, as crucial parameters such as vaccine efficacy, emerging SARS-CoV-2 variants and confinement policies are contributing to the dynamic impact of COVID-19 on insurance business. This document can only offer an analysis of the current status quo and must be reviewed periodically. Notably, this paper does not cover the impact of economic decline or country-specific confinement measures on the disability insurance business.

In summary, we provide the best estimate of disability insurance claims due to post COVID-19 condition in the German market using an adjustable calculation integrating relevant and available pandemic-related information. As the pandemic and post COVID-19 condition is present world-wide, this calculation can be transferred to all relevant markets providing comparable information. The value of this calculation should be validated in the coming years and will than serve as a blueprint for estimating the impact of future pandemics on life and health insurance business.

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