

The Impact of Long-COVID on Functioning – Results from a Community Survey in Patients After Mild and Moderate SARS-CoV-2-Infection in Germany

Christina Lemhöfer (✉ christina.lemhoefer@med.uni-jena.de)

Jena University Hospital: Universitätsklinikum Jena

Christian Sturm

Hannover Medical School: Medizinische Hochschule Hannover

Dana Loudovici-Krug

Jena University Hospital: Universitätsklinikum Jena

Norman Best

Jena University Hospital: Universitätsklinikum Jena

Christoph Gutenbrunner

Hannover Medical School: Medizinische Hochschule Hannover

Research

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Abstract

Background

In COVID-19 survivors a relatively high number of long-term symptoms have been observed. Besides impact on quality of life, these symptom (*now called long-COVID*) may have an impact on functioning and may hinder affected people to participate in social life. However, little is known if and to what extent patients with mild and moderate COVID-19 who did not need hospitalization or intensive care develop such a syndrome.

Methods

A cross-sectional study in 1027 patients with mild or moderate COVID-19 has been performed in two communities in Bavaria, Germany. The Rehabilitation-Needs-Survey (*RehabNeS*) that includes Short Form 36 health questionnaire (*SF-36*) on health-related quality of life, was performed. Descriptive statistics were calculated.

Results

97.5 % of patients reported one symptom in infection phase such as fatigue, respiratory problems, limitations of the sense of taste and smell, as well as fear and anxiety and other symptoms. In this phase 84.1% of participants experienced activity limitations and participation restrictions such as carrying out daily routine, handling stress, getting household tasks done, care/support for others, and relaxing and leisure.

61.9% of participants reported persisting symptoms after more than 3 months after infection. These were among others fatigue, sleep disturbances, respiratory problems pain, fears and anxiety, and restrictions in movement. 49% of the participants reported on activity limitations and participation restrictions. Predominately these were handling stress, carrying out daily routine, looking after one's health, relaxing and leisure activities as well as doing house work.

The impact on quality of life and vocational performance were rather low.

Conclusion

The results show that long-term symptoms after mild and moderate COVID-19 are common and lead to limitations of activities and participation. However, it seems that in most cases they are not very severe and do not lead to frequent or severe issues with quality of live or work ability.

Introduction And Background

Corona Virus infections are known to lead to Severe Acute Respiratory Syndromes (*SARS*) (1, 2). When a novel Corona Virus has been detected in Wuhan, China, severe courses of the disease leading to the need

of intensive care, artificial respiration or Extra-Corporal Membrane Oxygenation (*ECMO*) have been observed (3). More than one year after the first detection of the Severe Acute Respiratory Syndrome Corona Virus Type 2 (*SARS-CoV-2*) more data about the severity and course of the Infection is available. According to epidemiological data the Corona Virus Disease first observed in 2019 (*COVID-19*) leads to severe airway disease in around 15% (3, 4), and around 5% develop critical illness mostly requiring artificial ventilation (4). Around 80% of patients are asymptomatic or develop only mild or moderate symptoms (5). Worldwide around 2% of infected patients died from COVID-Infections or related complications (6), however, reported death rates due to methodological differences vary within wide ranges. Risk factors for severe courses are old age, metabolic and renal disease, cardiovascular diseases, and obesity (7, 8).

Around 6 months after the description of COVID-19 Chinese researchers published observations that even weeks or months after the acute lung disease long-term functional symptoms can be observed in a relatively high number of COVID-19 survivors (9). Some of these symptoms can be seen as “non-specific”, other can be interpreted result from infection or immune response in other organs or organ system such as kidney, cardiovascular system as well as brain and the peripheral nervous system (9). Frequently observed symptoms are fatigue, headache, dyspnea and anosmia (10, 11). Of course, pulmonary symptoms like coughing and dyspnea and reduced cardiopulmonary performance are observed too in patients with the so-called post-COVID-Syndrome, frequently also called Long-COVID (12).

Besides impact on quality of life (*QoL*), long-COVID has an impact on functioning and may hinder affected people to participate in social life. This may include unfitness for work with impact on personal income and society productivity. For example, people with severe fatigue will not be able to work with machines, drive vehicles or do office work. If alterations of smell and taste occur work in restaurants may not be possible any more, and alterations of motor functions may be a barrier for many jobs in the field of trade. These examples show that Long-COVID may be an indication for rehabilitation interventions (13). This includes acute, post-acute and long-term rehabilitation (14–16).

Little is known if and to what extent patients with mild and moderate COVID-19 who did not need hospitalization or intensive care suffer from Post-COVID and how much quality of life is affected. From the point of view of rehabilitation, an estimation of rehabilitation needs is of interest. In order to answer these questions a community survey in patients after mild and moderate SARS-CoV-2-Infection in Germany have been performed.

Material And Methods

For this cross-sectional study, a new written survey instrument was developed in a cooperation between the University Hospital Jena (*Institute for Physiotherapy*), the Hannover Medical School (*Department of Rehabilitation Medicine*) and the last author in her work for the Association of Statutory Health Insurance Physicians of Bavaria; a new written survey instrument was developed in early summer 2020. The Rehabilitation-Needs-Survey (*RehabNeS*) includes, in addition to the established Short Form 36 health

questionnaire (*SF-36*) on health-related quality of life, a newly created questionnaire, the Rehabilitation-Needs-Questionnaire (RehabNeQ) with eleven dimensions and a total of 57 items that evaluates the rehabilitation needs of COVID-19 sufferers and additionally asks about satisfaction with the actors of the health care system and treatment in the context of infection (17).

After the positive vote of the ethics committee of the medical faculty of the Friedrich Schiller University Jena (*registration number 2020-1834-Bef*), contact was made with two Bavarian community public health departments. The contents of the questionnaire and the aim of the study were explained and a cooperation was agreed upon. Subsequently, a selection of the positively tested SARS-CoV-2 infected persons was carried out by the public health departments by the cut-off date 18.07.2020. Patients under 18 years of age as well as residents of dementia homes were excluded. The study center then sent 1027 prepaid envelopes containing the questionnaires to the health departments. The local staff addressed and mailed the envelopes. There was no transmission of personal data to the study center. Additional respondents were included by direct approach in the course of medical care by the first author after informed consent. Patients did not receive a reminder letter. The costs of the material resources were covered by the participating universities.

The questionnaires were returned anonymized in a prepaid envelope to the Institute of Physiotherapy of Jena University Hospital. The data are refurbished in a descriptive way regarding the absolute and percentage frequency. The patients were asked to specify their health problems on a scale of 1 to 5, where 1 means no problem and 5 means an extreme problem. With regard to the analysis presented here, the specifications were summarized as 2 to 5. Furthermore they should state if the problem still exists. The same questions were asked referring to the patients' activity and participation. Moreover, the SF-36 was evaluated using the official scoring system (18). The calculated values are related to the results of the German norm sample.

Results

Sample characteristics. For evaluation 365 completely filled-in questionnaires could be used. 216 (59.2%) of respondents were female, 148 (40.5%) were male. One respondent did not specify gender. The mean age of participants were 49.8 (+/- 16.9) years and 82% were within the age range of 18–64 where in Germany remunerative employment (*or job training*) is common. The marital status, education level and living situation were similar to German average population. The majority of participants (93.7%) stated that the acute infection has been occurring more than three months before the survey.

Symptoms and Activity and Participation during the infection phase. 97.5 % of patients reported one symptom and 84% experienced activity limitations and participation restrictions in infection phase. The participants reported most frequently experienced (Fig. 1a): Lassitude/fatigue (81.1%), respiratory problems (60.5%), limitations of the sense of taste (60.5%) and smell (68.6%), Fears and anxiety (55.3%), sleep problems (53.7%), bowel dysfunction (44.9%), pain (40.5%), circulatory problems or disorders

(38.4%), restrictions on movement (36.9%), muscular problems (25.8%), and bladder dysfunction (18.4%). 69,9% of the subjects experienced shortness of breath during physical exertion resp. activity.

With regard to activities and participation during the infection phase in the following dimensions problems were reported (Fig. 1b): "daily routine" (67,1%), "handling stress" (62.5%), "getting household tasks done" (49.3%) and "care/support for others" (49.3%), "relaxing, having pleasure" (48.2%), "looking after your health" (46.9%), "having intimate relationships" (42.5%), "interaction with people" (40.0%), "getting where you want to go" (32.1%), "using hands and fingers" (28%), "use of public transportation" (25.5%), and "use of private transportation" (25.4%)

Symptoms and Activity and Participation at the time of survey

Summing up the number of symptoms, 226 participants (61.9%) of the total sample report long-term symptoms. In 48 cases one (13.2%), in 33 cases two (9.0%), in 33 cases three (9.0%), and in 112 cases four or more symptoms (30.7%) were reported (Fig. 2a).

38.1% of cases did not report any long-term symptoms. The distribution of persisting symptoms was as follows Lassitude/fatigue (37.5%), sleep problems (30.1%), respiratory problems (26.0%), pain (26.0%), Fears and anxiety (24.9%), restrictions on movement (18.4%), alterations of smell (17.3%) an taste (16.2%), cardiovascular problems (15.1%), bowel dysfunction (14.0%), muscular problems (12.0%), and bladder dysfunction (7.9%).

Summing up the number of reported problems in activity and participation in the long-term phase, 179 participants (49.0%) of the total sample report long-term activity limitations and participation restrictions. In 56 cases one (15.3%), in 23 cases two (6.3%), in 24 cases 3 (6.6%) and in 76 cases four or more (20.8%) problems were reported (Fig. 2b). The number of persisting problems after more than three months were: "handling stress" (23.8%), "daily routine" (18.1%), "looking after your health" (15.3%), "relaxing, having pleasure" (15.1%), "getting household tasks done" (12.9%), "care/support for others" (12.1%), "having intimate relationships" (11.8%), "using hands and fingers" (9.6%), "interaction with others" (7.7%), "use of public transportation" (5.8%), "getting where you want to go" (5.5%), and "use of private transportation" (2.7%). According to physical exertion, still 37.7% stated shortness of breath meanwhile.

Quality of Life. Overall score of quality of life in most cases was very good (25.6%) or good (52.6%). Average quality of life was scored in 17.5%. Bad (3.9%) or very bad (0.3%) QoL was stated in only a few cases. The mean values in SF-36 questionnaire in the physical sum score was with 49.2 points in the range of normal population (48.4 points) (Fig. 3a). Mental sum score was slightly reduced (45.7 vs. 50.9 in normal population). Reduced average scores were found in particular in the dimensions "role physical" (70.8 vs. 82.4), "vitality" (54.6 vs. 60.0), social function" (74.5 vs. 86.4), "role emotional" (69.5 vs. 89.1),

and “mental health” (69.2 vs. 72.5). In the subgroup of participants in between 18 and 64 years of age that numbers did not differ much (Table 1).

Table 1
Results of SF-36 in participants in working age (18–64 years)

	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Under 65 years (n = 291)	86.7	76.8	78.2	68.7	55.6	76.5	74.5	70.4	50.8	46.3
In total (n = 365)	82.4	70.8	76.3	66.5	54.6	74.5	69.5	69.2	49.2	45.7
PF = physical function, RP = role Physical, BP = bodily Pain, GH = general helath, V = vitality, SF = social function, RE = role emotional, MH = mental helath, PCS = physical component Scale, MCS = mental component scale										

Rehabilitation need/unfitness for work. From the 291 participants in the age of 10–64 ($n = 291$) 255 (87.6%) of participants declared to be in remunerative employment, 5 (1.7%) were seeking for a job and 21 (7.7%) did not have an remunerative employment or received pension payment. Only 2.4% of those who had a job have been classified by the doctors being “unfit for work” (*according to German social regulations*).

Discussion

Overall, the results show that patients three months after mild and moderate COVID-19 show at least one symptom in 61,9% of cases. As these symptoms are addressed as related to the SARS-CoV-2 infection they can be addressed as Long-COVID (11, 19–21). This percentage is similar to findings by Jacobsen et al. (22) but clearly lower as been reported by Huang et al. (9). The reason for this difference may be that Huang et al. had a higher number of severe and critical cases in their sample. Patients with longer artificial respiration periods and Intensive care treatment may develop SARS-CoV-2 independent symptoms, as described as Post-Intensive Care-Syndrome (*PICS*) (23).

The symptom profile from our study demonstrates that – besides effects symptoms related to pneumonia – non-specific symptom are dominating such as fatigue, mental symptoms and pain. Additionally a number of symptoms may be related to alterations of the nervous system. This is congruent with findings from Wang et al. (24) and Lenzen-Schulte (21). This profile shows similarities with the long-term symptoms of other severe diseases like cancer or auto-immune syndromes (25). One explanation for these similarities may be that in COVID-19 after the primary lung infection as second phase of the disease has been observed. This symptoms of the phase can be explained by a hyper-immune response (26). However the mechanisms of Long-COVID need to be elucidated further.

Date on the impact of Long-COVID on functioning are scarce. An Italian study described that about half of the Post-COVID-19 patients had severe impairments in physical functioning and activities of daily

living at hospital discharge (27). Jacobson et al. (22) showed that 46% of the mildly affected patients and 73% of the hospitalized patients had an activity impairment due to the disease 3-4 months after their initial COVID-19 diagnosis. This is consistent with our findings that 49% of respondents reported at least one limitation of activities and/or restrictions in participation.

However, the mean levels of quality of life domains seems to be relatively close to the normal population. This shows that mild and moderate courses of the SARS-CoV-2 infection causes much less long-term alterations as compared with severe and critical causes as well as other SARS diseases (9). Nevertheless, the relatively young population of our survey show some conspicuous results. At the level of scales, SF-36 showed deficits of physical role, and slightly stronger in the scales of social function and emotional role. This may be related to findings that mental disorders are frequently seen in patients after SARS-CoV-2 infection (11, 28). The effects described are not as significant when the 18-64 age group is considered separately. However, the strongest deviations compared to the normal population also exist in the scales emotional role and social function. The long-term impact on activity and participation concerns only the minority of participants ranging from around 3 to 24 percent. The profile of alterations seems to relate to the above mentioned non-specific symptoms and mental problem and handling stress (24%) and managing daily demands (18%) are dominating. Another result has not been reported yet are problems with intimate relationships (12%).

The need for rehabilitation was not explicitly in the focus of the used questionnaire. However, the observed symptoms, activity limitations and participation restrictions suggest that a relevant need for rehabilitation is existent in the population of mild and severe SARS-CoV-2 infections. With regard to the symptom level the percentages of persons who need rehabilitation intervention can be estimated to 15-35%. The detected impact on functioning results in a relatively lower percentage in need for rehabilitation (*estimated around 10-25%*). Unfitness to work also occurs in the population of the survey, however their percentage is relatively low (*around 5%*). This can be seen as a sign that the people after mild and moderate COVID-19 may compensate the remaining problems relatively good. From the point of view of work performance the percentage of people in need of rehabilitation may only be around 5%.

The main **limitation** of the study is that it has been performed without a control group with matched samples. Due to the urgency and organizational problem it was not possible to recruit an appropriate control group. Another limitation is that we could not differentiate severity of the SARS-COV-2 infection because we had to use an anonymous data sampling approach. Also no detailed information about the possible phenomenon of presentism at the work place. It also can be discussed if a more sensitive questionnaire of life questionnaire could have made it possible to derive more differentiated profiles.

In **conclusion**, this retrospective questionnaire-bases survey show that patients with mild and moderate SARS-CoV-2 infection in the early phase of the disease the most frequent symptoms were fatigue, respiratory problems, limitations of the sense of taste and smell, fears and anxiety together with a broad range of other symptoms. In this phase, 84% of participants reported limitations of activity and participation, consisting mostly of carrying out daily routine, handling stress, doing household taking care

for or support others as well as problems with leisure activities. At the time of survey that was around 3 months after the acute infection, 61.9% of participants reported at least one remaining symptoms such as fatigue, sleep disturbances, respiratory problems, pain, fears and anxiety and movement restrictions. Around 1/2 of the patients (49%) reported at least one activity limitations and participation restrictions such as handling stress, carrying out daily routine, looking after own health, relaxing and leisure activities carrying out house work.

Despite of these high numbers of symptoms and activity and participation the overall quality of life, as analyzed with the SF-36 Health Survey questionnaire showed relatively small reduction of mean values as compared to the German normal sample. This is also the case in the population in working age. Only a small group of patients with mild and moderate COVID-19 experiences long-term unfitnes for work.

These results show that long-term symptoms after mild and moderate COVID-19 are common and lead to limitations of activities and participation. However, it seem that in most cases they are not very severe and do not lead to frequent or severe issues with quality of live or work ability.

Declarations

Ethics approval and consent to participate

positive vote of the ethics committee of the medical faculty of the Friedrich Schiller University Jena (registration number 2020-1834-Bef)

Consent for publication

'Not applicable

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests

Funding

Not applicable

Authors' contributions

CS, CL and BN developed Survey Instrument, CS and NB were responsible for conducting the survey , DLK analyzed and interpreted the data, and CG and CL was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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Figures

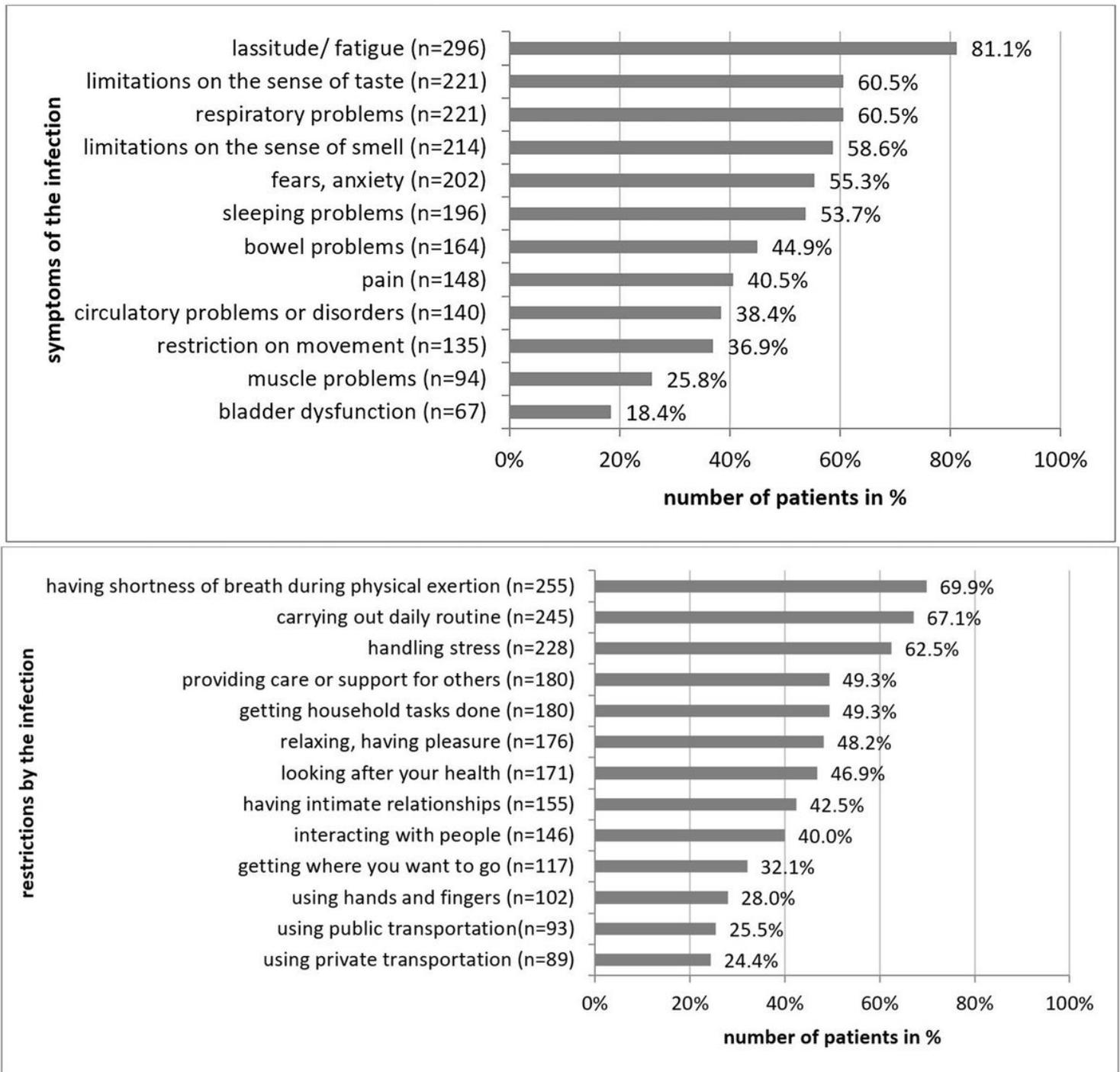


Figure 1

a: Symptoms early after infection. b: Problems in activity and participation during the infection phase.

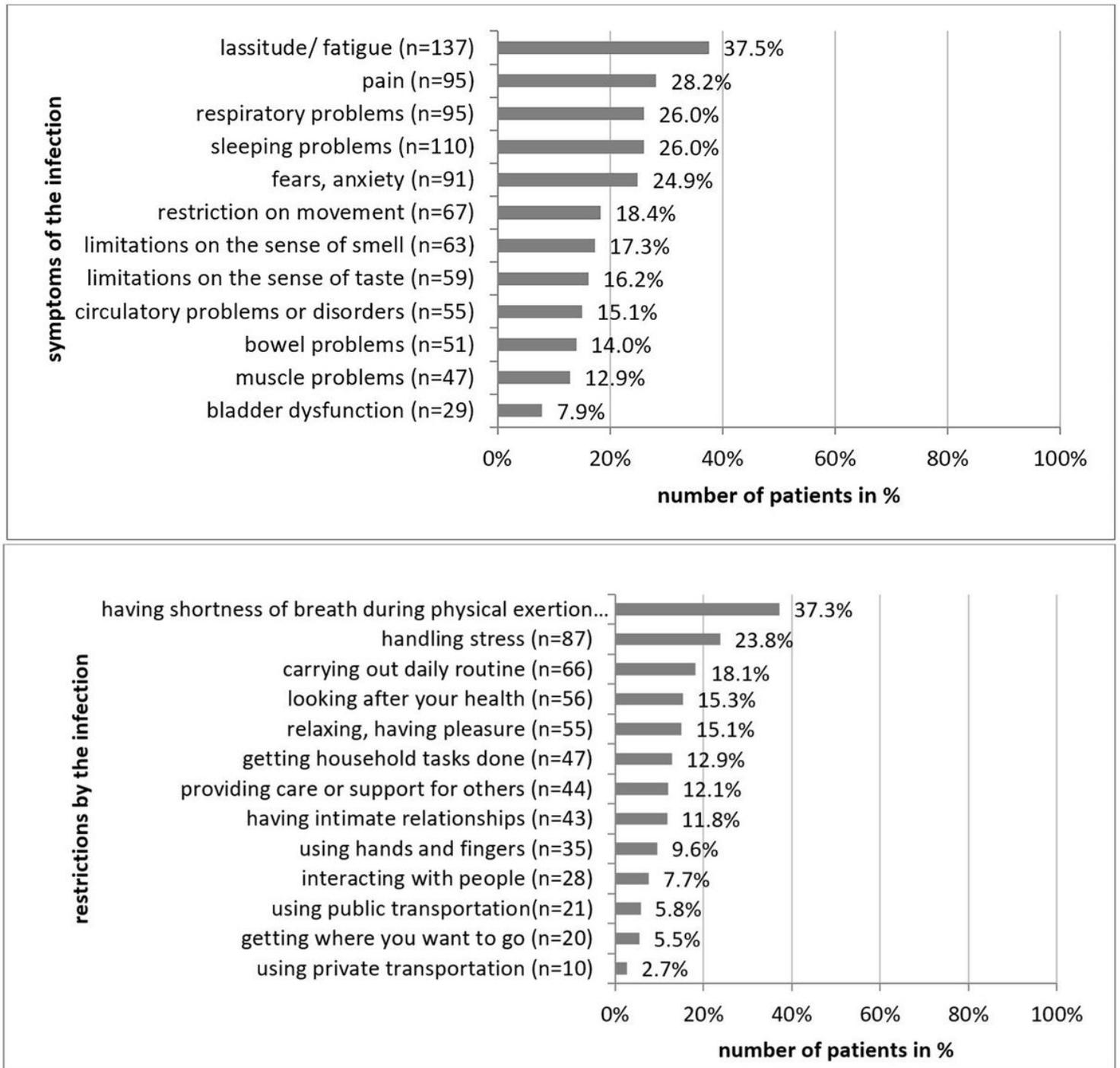


Figure 2

a: Long-term Symptoms 3 months after infection. b: Problems in activity and participation 3 months after infection.

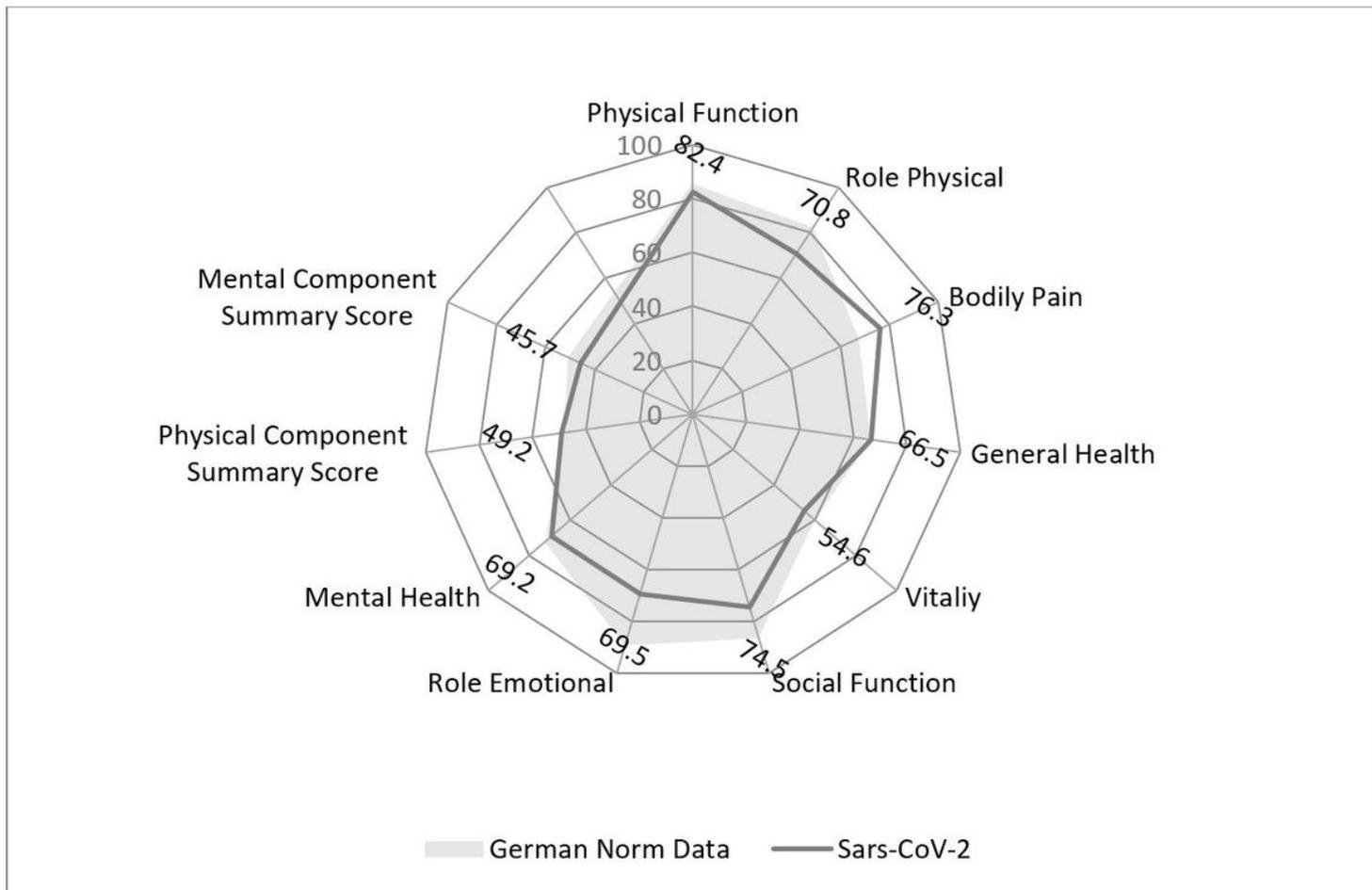


Figure 3

Results of SF-36, entire group (n=365)