




BMJ Open Healthcare use during COVID-19 and the effect on psychological distress in patients with chronic cardiopulmonary disorders in the Netherlands: a cross-sectional study

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ABSTRACT

Objectives The COVID-19 pandemic caused a massive shift in the focus of healthcare. Such changes could have affected health status and mental health in vulnerable patient groups. We aimed to investigate whether patients with chronic pulmonary and cardiac diseases had experienced high levels of psychological distress during the COVID-19 pandemic in the Netherlands.

Design A cross-sectional study.

Setting COVID-19 pandemic-related changes in healthcare use, health status and psychological distress were investigated among patients with chronic obstructive pulmonary disease (COPD), pulmonary fibrosis (PF) and congestive heart failure (CHF), using an online nationwide survey.

Participants 680 patients completed the survey. COPD was the most often reported diagnosis 334 (49%), followed by congestive heart failure 219 (32%) and PF 44 (7%). There were 79 (12%) patients with primary diagnosis 'other' than chronic cardiopulmonary disease, who also completed this survey.

Interventions Psychological distress was assessed via the DASS-21 score (Depression Anxiety Stress Scale). Moreover, specific worries and anxieties regarding COVID-19 were explored.

Results The frequency of contact with healthcare professionals changed in 52%. Changes in treatment were reported in 52%. Deterioration in health status was self-reported in 39%. Moderate to extremely severe levels of depression, anxiety and stress was observed in 25.8%, 28.5% and 14%, respectively. Over 70% reported specific worries and anxieties, such as about their own health and fear of being alone. Both the deterioration in health status and increased levels of anxiety were significantly ($p < 0.001$, $p < 0.006$) associated with changes in treatment. Exploratory analyses indicated that lack of social support may further increase anxiety.

Conclusion Healthcare use changed during the COVID-19 pandemic in the Netherlands. It was associated with a decrease in health status, and increased psychological stress among patients with chronic cardiopulmonary disorders. Provision of healthcare should be more sensitive

Strengths and limitations of this study

- This is one out of few studies investigating the nationwide change in healthcare use due to COVID-19 and its psychological impact, among patients with chronic cardiopulmonary disorders.
- This study highlights the need for both a permanent access to healthcare and attention to mental health needs of patients with chronic cardiopulmonary disorders during COVID-19 outbreaks or other future pandemics.
- We did not obtain any information on the severity of the underlying cardiopulmonary diseases in our survey. This might impact the generalisability of our results.
- We have no data on health status and healthcare use prior to COVID-19. In our survey, patients had to recall if their health status had worsened. This might have introduced a responder bias.
- This is a cross-sectional study, therefore, statements regarding causality cannot be made.

to the mental health needs of these patients during subsequent COVID-19 waves.

INTRODUCTION

Patients with chronic cardiopulmonary diseases such as chronic obstructive pulmonary disease (COPD), pulmonary fibrosis (PF) and congestive heart failure (CHF), are at an increased risk for developing COVID-19 related morbidity and mortality.^{1 2} The COVID-19 pandemic led to a massive shift in the provision of healthcare: stringent public health measures were implemented to curtail the spread of COVID-19. Primary healthcare services were restricted and hospital services were suspended due to increased numbers of patients needing hospitalisation.³ Fear that



the hospital could be a place where one might contract COVID-19, and fear of bothering busy doctors and nurses have additionally resulted in drastic reductions of hospital visits.^{4 5} Such healthcare changes may be particularly stressful for vulnerable patients, such as those suffering from chronic cardiopulmonary diseases. The goal of this study was to investigate whether the COVID-19 pandemic altered healthcare use (HCU) and increased psychological distress in patients with chronic cardiopulmonary diseases.

METHODS

Study design

This study was set up as a cross-sectional study. The aim was to study the effect of the changes in HCU during the COVID-19 pandemic on psychological distress and self-reported health status in patients with COPD, PF and CHF. We choose these patients groups because they are known to have worse outcomes after COVID-19.^{6 7}

The Dutch national group of clinical and scientific experts in palliative care (PalZon) conducted an open online anonymous survey from 21 May 2020 to 15 July 2020. A 13-question survey was disseminated through social media (eg, Facebook, LinkedIn) and various patient—and national organisations in the Netherlands. All respondents provided informed consent. The survey consisted of four parts. In the first part, information was obtained on demographic data, underlying chronic diseases and details concerning possible SARS-CoV-2 infections. In the second part, information about utilisation and delivery of healthcare during the outbreak of the COVID-19 pandemic in the Netherlands was obtained. The third part concerned questions about the current health status, quality of life (QoL) and specific fears and worries related to COVID-19. Lastly, psychological distress of patients was assessed using the DASS-21 score.

SS-NET software was used to administer the on-line obtained questionnaires. Patients that were not able to complete the online version were allowed to fill in a paper version. Their answers were entered in the database by the study staff afterwards.

Study parameters

Information was collected on age, sex, region of habitat, and living conditions. In addition, self-reported details on primary diagnosis (COPD, PF, CHF and other), comorbidities and self-reported infections with SARS-CoV-2, were obtained. Because regional differences in the prevalence of COVID-19 could influence our results, we categorised the twelve provinces of the Netherlands into different regions: high prevalence (>10%), moderate (2%–10%) or relatively low (<2%) prevalence of COVID-19. Data on COVID-19 prevalence were obtained from the National Institute for Public Health and the Environment.⁸

To measure change in HCU, participants were asked to report the contact they had with healthcare professionals during COVID-19, that is, in the 3 months prior to the

study. Changes in HCU were categorised as (1) changes in contact frequency compared with pre-COVID-19 (decreased, similar or increased), (2) changes in mode of contact (telephone, visit to the hospital/general practitioner or digital) and (3) changes in treatment (postponed/cancelled/changed). Participants' experience of support by caregivers was assessed by the following items: I received sufficient support by general practitioner/specialist, with household, with personal care, with nursing care, I received sufficient personalised attention, and sufficient emotional support (scale: I don't know, not applicable, (totally) disagree, not agree/not disagree, (totally) agree).

To measure the effect of the change in HCU, participants were asked to score their current health status during in comparison to prior the pandemic (better, worse, the same). Overall QoL was rated on a 10-point scale, and categorised in (very) poor (score 0–4), moderate (score 5–6), (very) good (score 7–10).

To explore how changes in healthcare could have an impact on patients, we asked them about specific worries and anxiety related to the COVID-19 pandemic. These questions were taken from the international study 'Experience of end-of-life care during the COVID-19 crisis' of the joined centres of expertise palliative care and concern the following topics.⁹ Topics that were evaluated were worries (scale: yes/no) about the own health, the health of partner, children, family or friends, about the financial situation, or home situation, and worries regarding relationships. Fear (scale: yes, no, a little) was assessed with respect to getting infected themselves, fear of Intensive Care Unit (ICU) admission, or of dying, and fear of loneliness if ill. Social support was assessed using the following questions (scale: never, seldom, sometimes, often): I missed company, I felt connected with people, there were people I could call on, and I had the feeling that people really understood me. For (post hoc) analyses a social support total score was calculated based on the four items. The internal consistency was adequate, Cronbach's alpha in the current study was 0.69.

The DASS-21 is a self-report questionnaire consisting of three subscales of seven items each that measure depression, anxiety and stress.¹⁰ Participants responded by rating the degree to which the statement applied to them during the past 2 weeks, using a 4-point Likert-type scale (ranging from 'did not apply to me at all'=0 to 'applied to me very much or most of the time'=3). Higher scores denoted a greater severity of depression, anxiety and stress symptoms. Scores were determined by summing the individual items for each scale.

The DASS-21 has shown good convergent, discriminant and predictive validity across clinical and non-clinical samples.^{10 11} Moreover, internal consistency was shown to be very good to excellent for all three subscales. Cronbach's alpha in the current study were respectively 0.90 for the depression subscale, 0,81 for the anxiety subscale and 0,91 for the stress subscale.

For the analyses, the depression subscale score was divided into normal (0–4), mild depression (5–6), moderate depression (7–10), severe depression (11–13) and extremely severe (≥ 14). The anxiety subscale score was divided into normal (0–3), mild anxiety (4–5), moderate anxiety (6–7), severe anxiety (8–9) and extremely severe anxiety (≥ 10). The stress subscale score was divided into normal (0–7), mild stress (8–9), moderate stress (10–12), severe stress (13–16) and extremely severe stress (≥ 17).¹²

Patient and public involvement statement

Patients were not involved in the design of this part of the study. Several national patient advocacy organisations (see the acknowledgements section) were actively involved in promoting and spreading the questionnaires. A patient representative of ‘Longfonds’ is actively involved in the design of the follow-up of this study.

Data analysis

Descriptive statistics were performed using mean (SD) or median and 25th–75th percentile (IQR). For categorical data number and proportion (%) was used. Normality was assessed visually and using the Shapiro-Wilk test. To assess differences between subgroups, the χ^2 test was used.

To determine the association between DASS-21 scores (recoded in five categories), change of health status, and QoL as dependent variables, and the frequency of contact (the same, less or more often) with healthcare professionals and changes in treatment (appointments postponed/cancelled/changed), as independent variables, χ^2 tests were used. Additionally, for the DASS-21 stratified analyses were applied for age (<60 vs ≥ 60) and sex. All statistical tests were two tailed, with a significance level set at $p < 0.05$. Statistical analysis was performed using SPSS Statistics V.25 (IBM).

RESULTS

Patients' characteristics

During the study period 736 patients completed the online questionnaire and 28 patients a paper version. Data were incomplete in 84 (11%) patients and these were excluded. The final study population consisted of 680 subjects. Patient characteristics are presented in table 1.

The majority of respondents were female (58%) and most participants were ≥ 60 years old. COPD was the most often reported diagnosis 334 (49%), followed by CHF 219 (32%) and PF 44 (7%). There were 79 (12%) patients with primary diagnosis ‘other’ than chronic cardiopulmonary disease, who also completed this survey. More than half of the patients reported any comorbidity. Seventy respondents (10%) reported to have diabetes mellitus. Cancer was rarely reported as comorbidity (24 patients, 4%). The majority of patients lived in a region with a ‘moderate prevalence’ and almost one third of patients lived in a ‘high prevalence’ region. Most patients reported that they hadn’t suffered from COVID-19. Only

Table 1 Patient characteristics

Patients characteristics	Baseline sample (N=680)
Age	63 (54–71)
<60	244 (38%)
≥ 60	401 (62%)
Missing data	35
Gender	
Female	388 (58%)
Male	282 (42%)
Missing data	10
Diagnosis	
COPD	334 (49%)
Congestive heart failure	219 (32%)
Lung fibrosis	44 (7%)
Other	79 (12%)
Missing data	4
Comorbidity	
Cardiovascular disease	123 (18%)
Chronic lung disease	121 (18%)
Diabetes mellitus	70 (10%)
Other	200 (29%)
Region in the Netherlands*	
Low prevalence	86 (13%)
Moderate prevalence	390 (58%)
High prevalence	197 (29%)
Missing data	7
SARS-CoV-2 infection†	
Yes	9 (2%)
Probably	39 (6%)
No, probably not	222 (33%)
No, definitely not	316 (47%)
I do not know	78 (12%)
Missing data	16
QoL‡	6.32 (2.09)
Social support	
I missed company	
Never/seldom	181 (32%)
Sometimes/often	393 (68%)
Missing data	106
I felt connected with people	
Never/seldom	101 (18%)
Sometimes/often	456 (82%)
Missing data	123
There were people I could call on	
Never/seldom	84 (15%)
Sometimes/often	483 (85%)
Missing data	113

Continued

Table 1 Continued

Patients characteristics	Baseline sample (N=680)
I had the feeling that people really understood me	
Never/seldom	102 (18%)
Sometimes/often	455 (82%)
Missing data	123
DASS-21 score§	
Depression	3.0 (1.0–7.0) (147)
Anxiety	3.0 (1.0–6.0) (141)
Stress	3.5 (1.0–7.0) (146)

Data are represented as: mean (SD) median (25th–75th percentile), or number (%), (missing data).

*Definition low/moderate/high risk: the 12 provinces of the Netherlands were categorised in different regions: regions with a high prevalence (>10%), moderate (2%–10%) or relatively low (<2%) prevalence of COVID-19-infected patients obtained from the National Institute for Public Health and the Environment database. Reference date 20 May 2020.

†SARS-CoV-2 infection as assumed by responders.

‡The overall QoL was rated 0 (as poor as it can be) to 10 (as good as it can be), expressed as mean (SD).

§DASS-subscores (range 0–21). The total depression subscale score was categorised into normal (0–4), mild (5–6, moderate (7–10), severe (11–13) and extremely severe depression (14+). The total anxiety subscale was divided into normal (0–3), mild (4–5), moderate (6–7), severe (8–9) and extremely severe anxiety (10). The total stress subscale score was divided into normal (0–7), mild (8–9), moderate (10–12), severe (13–16) and extremely severe stress (17+).

COPD, chronic obstructive pulmonary disease; QOL, quality of life.

9 (2%) patients reported they had been infected with SARS-CoV-2. Patients reported their current QoL as (very) poor in 19% of cases, moderate in 24% score and (very) good in 57% of cases. Respondents' depression, anxiety and stress levels, measured using the DASS-21-item scale, revealed a median score of 3.0 (IQR 1–7) for depression, 3.0 (1–6) for anxiety and 3.5 (1–7) for stress.

Changes in healthcare use HCU as a consequence of COVID-19

Most patients (83%) had had contact with a healthcare professional during the COVID-19 period, that is, in the

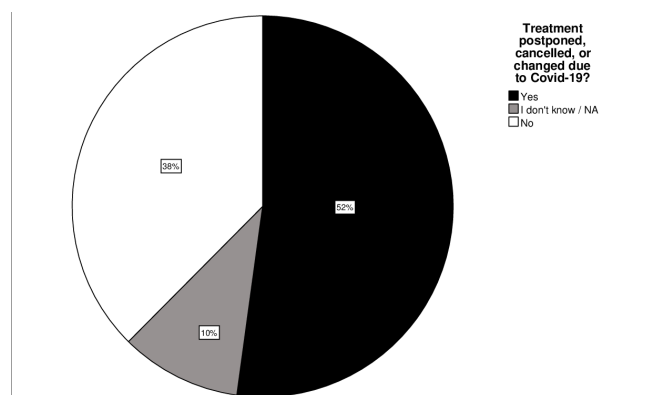


Figure 1 Change in treatment (postponed, cancelled or changed) due to COVID-19. NA, not available.

Table 2 Change in contact frequency between responders and healthcare professionals during the COVID-19 pandemic

Healthcare professional	Change in contact frequency		
	Decreased	Similar	Increased
General practitioner	87 (25)	167 (48)	96 (27)
Medical specialist	93 (28)	157 (47)	87 (25)
Practice nurse	25 (31)	44 (55)	11 (14)
Pulmonary nurse	24 (20)	57 (48)	37 (32)
Cardiovascular nurse	9 (12)	48 (61)	21 (27)
Physiotherapist	120 (60)	49 (25)	31 (15)

Number (%), only of the patients who did contact a healthcare professional.

Change in contact frequency with healthcare professionals during COVID-19, that is, in the 3 months prior to the study.

3 months prior to the study. Practice nurses were most frequently contacted (70%), followed by general practitioners and consultant physicians (both 53%). Contact with professionals was mainly by telephone (66%), a visit to the hospital/general practitioner (34%) or via video calls (Skype, Zoom, FaceTime; 9%).

HCU changed as a consequence of the COVID-19 pandemic. For most of the healthcare professionals, contact frequency on average did not change (47%); the number of patients reporting a decline almost equalled those reporting an increase. However, contact frequency with a physiotherapist sharply declined (table 2).

Second, more than half of patients reported that their treatment was either postponed, cancelled, or changed (figure 1). Moreover, 12% of patients reported that they did not visit the emergency department (ED) despite having symptoms. This was because of fear that they might contract COVID-19 in the hospital. Changes in HCU were similar in regions with high and with low prevalence of SARS-CoV-2 infections.

Changes in health status during COVID-19 pandemic

Almost 40% of patients reported a deterioration in their health status (figure 2). The deterioration in health status was not associated with a change in contact frequency with healthcare professionals (data not shown). In contrast, this deterioration was significantly associated with changes in treatment (table 3): almost half of patients (47%) who reported a change in treatment also self-reported a deterioration in their health status ($p < 0.001$).

Worries and anxiety in relation to COVID-19

Almost 80% of participants reported specific worries and anxiety about their health and treatment during the COVID-19 pandemic (figures 3 and 4). Of these patients, more than half worried about their own health status and condition, and approximately one-third worried about their loved ones (partner, children, family or friends).

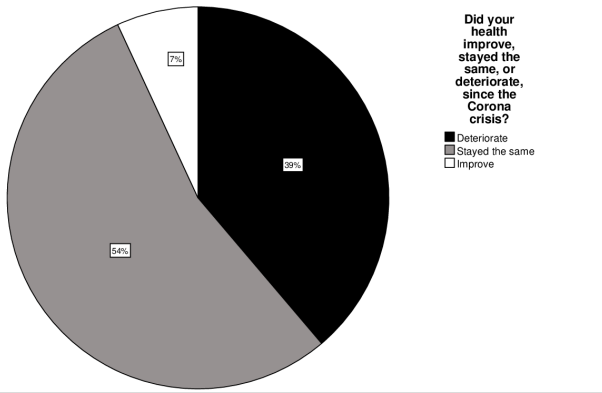


Figure 2 Change in self-rated health status due to the COVID-19 pandemic.

The majority of patients were afraid of getting infected with SARS-CoV-2 because they belonged to a vulnerable group. Fear of admission to an ICU, and fear of being alone were also frequently mentioned in 75% and 66%, respectively. Importantly, more than half of patients reported fear of dying as a consequence of an SARS-CoV-2 infection.

Mental health during COVID-19 assessed by the DASS-21 score

Psychological distress during COVID-19 pandemic was assessed by the DASS-21 questionnaire. The majority of patients had a normal DASS-21 score. Nevertheless, moderate to extremely severe depression, anxiety and stress were still reported in a substantial proportion of participants (25.8%, 28.5% and 14%, respectively (table 4)).

We further investigated if changes in treatment affected psychological distress. Changes in treatment (postponed/cancelled/changed) were not associated with depression and stress (data not shown). In contrast, changes in treatment were associated with changes in anxiety scores, (p=0.006, table 5).

Post hoc analyses revealed that a change in treatment resulted in significantly more people indicating mild, or

Change in treatment	Health status		
	Deterioration	No change	Improvement
Yes	145 (47)	152 (48)	15 (5)
No	64 (30)	133 (60)	24 (10)
I do not know/NA	21 (36)	35 (60)	2 (4)

Number (%).
 Health status: respondents were asked to rate their current health status in relation to prior COVID-19.
 Change in treatment: treatment postponed, cancelled, or changed due to COVID-19.
 NA, not applicable.

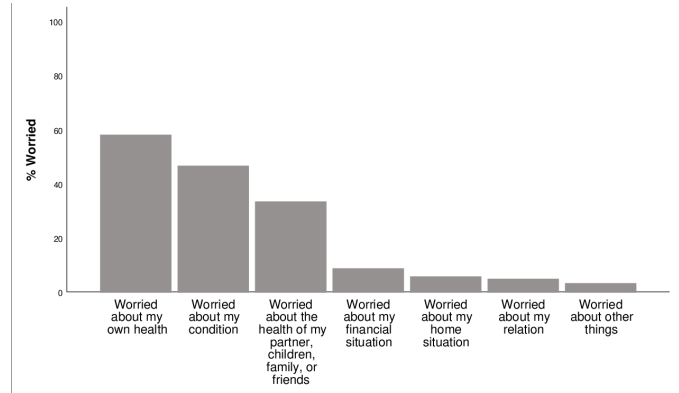


Figure 3 Specific worries about health consequences of COVID-19.

extremely severe anxiety, versus normal anxiety, (p=0.01). After stratification for age and sex respectively, change in treatment remained significantly associated with increased anxiety scores, (p=0.006). Subsequently, we explored which factors might have contributed to or protected against extreme anxiety in case treatment changed. Multivariate binary regression with extreme anxiety yes/no) as outcome and age (<60 versus ≥60), sex, living conditions (alone vs not alone), attention and emotional support by caregivers, and social support were performed for participants for whom treatment had changed. Results showed that higher levels of experienced social support protected against extremely severe anxiety, in patients for whom treatment was changed (p=0.015, OR 0.82, 95% CI 0.69 to 0.96).

DISCUSSION

The present study shows that non-COVID-19 medical care was less accessible to patients with COPD, PF and CHF during the COVID-19 outbreak in the Netherlands. In 50% of patients, either contact frequency changed or treatment was postponed, cancelled or changed. Moreover, these changes in treatment were associated with a deterioration of patients' health status as well as with higher levels of anxiety. Indeed, psychological distress was high among patients with cardiopulmonary disorders;

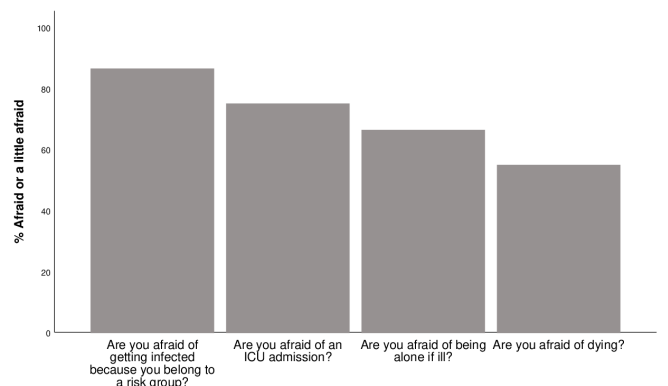


Figure 4 Specific anxiety about health consequences of COVID-19.

Table 4 The mental health status during COVID-19 pandemic assessed by the DASS-21

DASS-21 subscale	Normal	Mild	Moderate	Severe	Extremely severe
Depression (N=533)	336 (63.0)	60 (11.3)	82 (15.4)	28 (5.3)	27 (5.1)
Anxiety (N=539)	302 (56.0)	84 (15.6)	72 (13.4)	30 (5.6)	51 (9.5)
Stress (N=534)	419 (78.5)	35 (6.6)	46 (8.6)	26 (4.9)	8 (1.5)

Number (%).

DASS-21-subcales (range 0–21). The total depression subscale score was categorised into normal (0–4), mild (5–6), moderate (7–10), severe (11–13) and extremely severe depression (14+). The total anxiety subscale was divided into normal (0–3), mild (4–5), moderate (6–7), severe (8–9) and extremely severe anxiety (10+). The total stress subscale score was divided into normal (0–7), mild 8–9, moderate (10–12), severe (13–16) and extremely severe stress (17+).

almost 80% mentioned fears or worries that COVID-19 could affect their health and/or the health of their loved ones.

The reported changes in HCU are in line with recent reports in asthma and cancer patients. A study in patients with asthma reported a disruption of care caused by COVID-19 in 45%.¹³ A second study among patients with cancer showed that 54% of cancer care appointments were cancelled, postponed or rescheduled.¹⁴ In addition to these results of COVID-19 on HCU, we showed that the disruption of HCU was associated with a deterioration in health status in nearly 40% of patients. COVID-19 has impacted the provision of routine care to respiratory patients more than other patient groups. In one global survey among physicians, care to patients with COPD was ranked second as the disorder most impacted by COVID-19.¹⁵ It remains speculative to why this might be the case. It could be due to the strict self-isolation of patients at home and the shifting focus of respiratory physicians to COVID-19 care.

Second, we reported high rates of depression, anxiety and stress in patients with chronic cardiopulmonary disorders, suggesting mental health deteriorated as a consequence of COVID-19. Using a validated screening tool, we showed that signs of depression, anxiety and stress were observed in 37%, 44% and 21% of patients, respectively (table 5). In a large survey among the general population in China similar percentages of depression, anxiety and acute stress were seen during COVID-19.¹⁶ These results may be difficult to compare since prevalence of mental health disorders is generally higher in patients with cardiopulmonary disorders: prevalence of depression in COPD subjects was 27% in a recent systematic review¹⁷ and was 60% in a cross-sectional study on depression in

CHF patients.¹⁸ Because of the cross-sectional nature of our survey, we do not know if COVID-19 truly decreased mental health in our study. However, a recent longitudinal survey from the UK showed that deterioration of mental health during COVID-19 could indeed be attributed to this pandemic.¹⁹ Likewise, in a sample of primary care patients with multimorbidity, levels of anxiety also increased significantly after the onset of COVID-19.²⁰ Therefore, it is likely that the high levels of depression, anxiety and stress as seen in our cohort can, at least partly, be attributed to COVID-19.

It is known that several factors may influence mental health during COVID-19. For instance, female gender, current or past history of mental disorders, and poor self-rated health are risk factors for depression, anxiety and stress during COVID-19.²¹ Additionally, there are more COVID-19 specific risk factors for a deterioration in mental health. These include restrictions due to lockdown measures, reduction of social contacts and greater perceived changes in life.²² In our study, additional themes arose relating to social and existential factors: one out of three patients worried about family and friends and more than half reported the fear of dying. All in all, almost 80% of patients reported such worries and anxieties. Anxiety, measured using the DASS-21, was higher in patients in whom treatment was postponed, cancelled or changed. In the previously mentioned study among patients with cancer, similar results were seen: 74% reported that delays in treatment had a major impact on their mental and emotional well-being.¹⁴

Such large effects of COVID-19 on the mental health of patients underscore the necessity to adapt routine clinical services for these patient groups during this pandemic. For instance, a large decline

Table 5 Change in treatment due to COVID-19 in relation to the DASS-21, subscale: anxiety

DASS-21 anxiety change in treatment	Normal	Mild	Moderate	Severe	Extremely severe
Yes (N=282)	137 (48.6)	59 (20.9)	38 (13.5)	17 (6.0)	31 (8.7)
No (N=204)	126 (61.8)	22 (10.8)	32 (15.7)	11 (5.4)	13 (6.4)

Number (%).

DASS-21, subscale anxiety: The total anxiety subscale was divided into normal (0–3), mild (4–5), moderate (6–7), severe (8–9) and extremely severe anxiety (10+).

Change in treatment: treatment postponed, cancelled or changed due COVID-19 (p=0.006).

in physiotherapy contacts was seen in our study. Since it is important to maintain physical activity in COPD and heart failure patients,^{23 24} alternative practices should be sought during the COVID-19 pandemic such as telerehabilitation. Also, up-to date and accurate health information (eg, treatment, local outbreak situation) and precautionary measures (eg, hand hygiene, wearing a mask) are important public health instruments to the lower psychological impact of the outbreak and levels of stress, anxiety and depression.²⁵ Such public health measures should thus continuously be offered to general public. Third, lack of social support further added to anxiety in those patients that experienced a change in treatment. This underlines the necessity of deep and meaningful interactions among people during the COVID-19 pandemic. Addressing the needs of patients lacking adequate social support systems could also be a key intervention for clinicians. Though increasing social support of patients is a challenge given the social distancing during COVID-19, online tools are available.²⁶ Advanced care planning (ACP) is a fourth instrument that can be used to mitigate the negative consequences of COVID-19. Previous studies have shown that ACP reduces hospitalisations and healthcare costs and increases the likelihood that care will be delivered in accordance with the patient's wishes during COVID-19.^{27 28} This underlines the necessity to continue regular care for vulnerable patients during COVID-19 outbreaks.

Contrary to our expectations, changes in HCU were similar in regions with high and with low prevalence of SARS-CoV-2 infections. The fear that the hospital can be a place where one might contract COVID-19 has drastically reduced visits to the hospital.^{4 29} As such, we had expected more distinct changes in HCU in regions with high prevalence of COVID-19. One possible explanation might be that healthcare delivery was scaled down in the whole of the Netherlands irrespective of regional prevalence numbers. Another possibility might be that it was the fear of COVID-19 rather than the actual crude prevalence numbers that drove patients to self-isolation and a lower use of healthcare services. Also contrary to our expectations, no association was found between the deterioration in health status and overall QoL. It is known that QoL also includes other domains like level of independence, social relations and environmental items.³⁰ The majority of patients in our study found sufficient mental support in their direct environment, which possibly mitigated the effect the decrease in health status had on QoL.

This study has several limitations. First, we did not obtain any information on the severity of the underlying cardiopulmonary disease in our survey. This might impact the generalisability of our results. Second, no data was available on health status and HCU prior to COVID-19. In our survey, patients had to recall from memory if their health status was worsened. This might have introduced a

responder bias. Third, we used several social media platforms, such as Facebook, to distribute our survey. This might have introduced a selection bias in such a way that patients who might have a poor QOL are more likely to respond to the survey.

In conclusion, we showed that the outbreak of the COVID-19 pandemic had negative consequences for patients with COPD, PF and CHF in the Netherlands. COVID-19-associated changes in treatment were associated with a deteriorated health status and high levels of anxiety. Permanent access to healthcare and attention to mental health needs of patients with chronic cardiopulmonary disorders should be monitored during subsequent COVID-19 outbreaks or other future pandemics.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The Ethics Committee of Maastricht University Medical Centre/ Maastricht University (METC 2020-1338) confirmed that the Medical Research Involving Human Subjects Act (WMO) did not apply for this study. The study was conducted according to the principles of the World Medical Association Declaration of Helsinki.

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