


## ORIGINAL RESEARCH

# Integrating healthcare for follow-up of adult COVID-19 patients in an outpatient clinic: A matter of cooperation

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## Abstract

**Rationale, aims, and objectives:** A large number of patients infected with SARS-CoV-2 (COVID-19) need outpatient follow-up after hospitalization. As these patients may experience a broad range of symptoms, as do patients infected with the related SARS-CoV-1 virus, we set up a multidisciplinary outpatient clinic involving pulmonologists, internists, and geriatricians. Patients were allocated to a specialist based on symptoms reported on a self-developed questionnaire of expected symptoms of COVID-19. This study aimed to evaluate the effectiveness of this outpatient clinic.

**Methods:** In this retrospective study, the medical records of patients who presented to the outpatient clinic for follow-up after hospitalization for COVID-19 up to 31 August 2020, were reviewed.

**Results:** In total, 266 patients were seen at the outpatient clinic at least once. Overall, 100 patients were seen by a pulmonologist, 97 by an internist, and 65 by a geriatrician. A referral between these 3 medical specialists was needed for only 14 patients (5.3%). Fifty patients were seen by a psychologist, mostly those with a HADS score >10. Only 5 (2.2%) of the 221 patients who were not directly referred to a psychologist based on triage needed psychological support. Forty-eight patients (18%) were also seen by a physiatrist.

**Conclusion:** Identifying which medical specialist (pulmonologist, internist, and/or geriatrician) should see patients attending a post-COVID outpatient clinic based on patient-reported symptoms proved an effective approach to managing the flow of post-COVID patients.

## KEYWORDS

cooperation, Covid-19, organization, outpatient

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## 1 | INTRODUCTION

In the Spring of 2020, the SARS-CoV-2 (COVID-19) pandemic started. Patient numbers increased rapidly, with the most affected region in the Netherlands being North Brabant.<sup>1</sup> Soon it became clear that hospitals in this region would be confronted with a second challenge: how to design an outpatient clinic to cope with the large number of patients needing post-hospitalization follow-up.

There were two major problems. First, the large number of patients who needed to be followed up in a period in which the healthcare system was already overloaded and in which deferred regular outpatient care had to be resumed. Second, because COVID-19 was a new virus at the time, little was known about the follow-up of patients who had been infected with COVID-19.

In the Jeroen Bosch Hospital in 's-Hertogenbosch, North Brabant, the Netherlands, a system was developed based on the expected long-term effects of COVID-19, which were in turn based on what was known about SARS-CoV-1, the SARS virus circulating in 2003. Known long-term effects of an infection with SARS-CoV-1 include pulmonary fibrosis, persistent pulmonary symptoms, psychological symptoms, chronic fatigue, and impaired physical and cognitive functioning, leading to reduced quality of life.<sup>2-8</sup> The recent literature confirms that the sequelae of COVID extend beyond the pulmonary system, with cardiovascular and mental problems also being seen.<sup>9</sup> As COVID-19 is closely related to SARS-CoV-1, we hypothesized that COVID-19 would lead to a similar, diverse spectrum of long-term effects. Therefore, we designed a model for the follow-up care of COVID-19 patients that involved a team of healthcare professionals from different medical specialties. The main aim of this study was to investigate the effectiveness of this approach.

## 2 | METHODS

### 2.1 | Study design

This study was a cross-sectional retrospective study of a new design for a COVID follow-up outpatient clinic.

### 2.2 | Patients

All patients who had been hospitalized in the Jeroen Bosch Hospital for a confirmed COVID-19 infection received an invitation for follow-up at the outpatient clinic. Patients who had been hospitalized between 1 March and 30 June 2020 were included in this study, so that a recovery time of at least 2 months could be analyzed. Patients initially hospitalized in the Jeroen Bosch Hospital who had been transferred to another hospital later on were also included. Patients who had been transferred to the Jeroen Bosch Hospital from a hospital elsewhere were excluded because follow-up could best take place in the patients' residential region. Children (younger than 18 years) were not included in our patient population.

### 2.3 | Design of the outpatient clinic

To optimize the limited available time at the outpatient clinic, we developed a strategy to allocate COVID-19 patients to healthcare professionals from different medical specialties. All patients received a questionnaire several weeks after being discharged from the hospital. The questionnaire was custom-made at the Jeroen Bosch Hospital and focused on the persistence of physical and cognitive symptoms, as expected from the known effects of SARS-CoV-1 (Appendix 1). All questionnaires were screened by a physician assistant (PA), who assigned patients for follow-up to an internist/PA of internal medicine, geriatrician, or pulmonologist, based on the most prominent persistent symptoms reported by the patients themselves. Patients who answered question 3 "I still have a cough" positively were allocated to a pulmonologist for follow-up. Patients who did not have a cough were allocated to the internist if they were younger than 75 years or if they answered most questions concerning physical functioning positively (questions 1, 2, 4, 5, 7-11, 17-19). Patients who did not have a cough were allocated to a geriatrician if they were older than 75 years or if they answered most questions concerning cognitive functioning positively (questions 6, 12-16, 20, 21). A known history of a medical condition concerning any of the three specialties could be a reason to deviate from this approach. Patients also completed the Hospital Anxiety and Depression Scale (HADS).<sup>10</sup> Patients with high (>10) scores on the HADS were subsequently offered guidance by a medical psychologist. If a patient reported multiple symptoms in different domains, a multidisciplinary appointment was made—a pulmonologist and geriatrician together or a geriatrician and psychologist together. Assignment of unclear cases was discussed in a multidisciplinary team consisting of the PA, pulmonologist, internist, geriatrician, psychologist, physiatrist, and sports physician. Additional advice and other important information were recorded in the patient's medical record for the healthcare professional at the outpatient clinic.

An exception was made for patients who had been admitted to the intensive care unit (ICU). These patients were expected to have persistent pulmonary problems or symptoms, and therefore they were assigned to a pulmonologist without having to complete the questionnaires. These patients were often seen by the physiatrist and, if necessary, by a psychologist immediately after hospitalization.

Each healthcare professional was provided with a template medical record at the outpatient clinic so that they could focus on the broad spectrum of possible symptoms, especially those not primarily related to their own medical specialty.

### 2.4 | Data collection and statistics

This retrospective study was performed using electronic medical records (HIX, chipsoft) between 1 July and 31 August 2020. The following patient characteristics were retrieved: age, sex, medical history, Body Mass Index (BMI), duration of hospital stay, admission to ICU (yes/no), persistent chest-X-ray abnormalities. Information on the medical specialist allocated for follow-up at the outpatient clinic, the

number of consultations during follow-up, the number of referrals among the three primary medical specialists (internist, geriatrician, and pulmonologist), and the need for referrals to other healthcare professionals were collected. Differences between the primary consultants were studied by chi-square or analysis of variance. Data were processed in SPSS 22 (IBM).

### 2.5 | Ethics

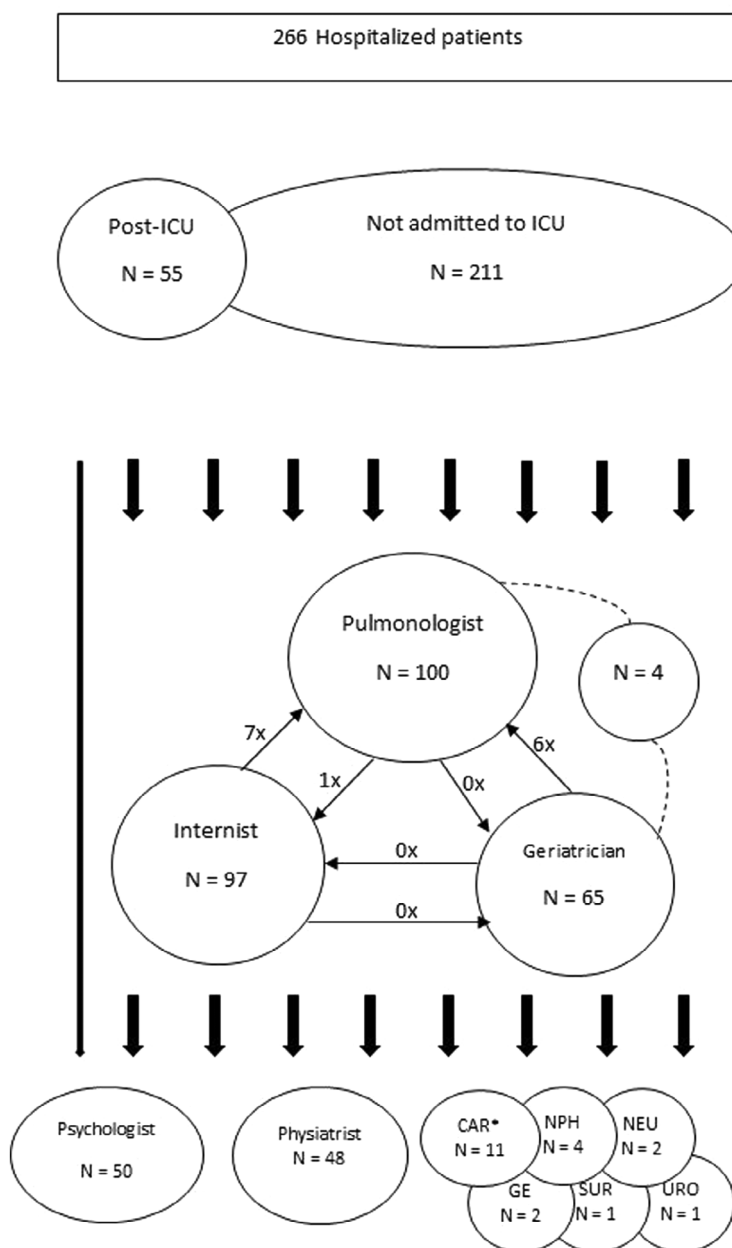
The Medical Ethics Review Board declared that this study fell outside the scope of the Medical Research Involving Human Subjects Act

(WMO). Data from usual care were used. No informed consent was obtained.

## 3 | RESULTS

### 3.1 | Patients

Figure 1 and Table 1 show how patients were routed and their characteristics. In the period between 1 March and 30 June 2020, a total of 431 patients were hospitalized at the Jeroen Bosch Hospital with an infection with SARS-CoV-2. Of these, 101 patients (23%) died



**FIGURE 1** Flow of patients at the outpatient clinic

\*CAR = cardiologist, NPH= nephrologist, NEU = neurologist, GE = Gastroenerologist, SUR = Surgeon, URO = urologist

**TABLE 1** Patient characteristics at the 8-week follow-up after COVID infection

	Total	Internist	Pulmonologist	Geriatrician	Pulmonologist-Geriatrician together
Number of patients	266	97	100	65	4
Age (y)/Mean (range)	64.52 (23-86)	59.16 (23-82)	62.94 (34-86)	74.88 (54-86)	65.75 (49-82)
Male sex	168 (63.2%)	62 (63.9%)	64 (64.0%)	39 (60%)	3 (75%)
BMI (kg/m <sup>2</sup> )/Mean (range)	28.47 (19.24-45.11)	29.20 (19.90-44.79)	27.96 (20.76-43.11)	28.12 (19.24-45.11)	28.14 (22.99-34.72)
Overweight (BMI > 25)	185 (69.5%)	74 (76.3%)	61 (61.0%)	47 (72.3%)	3 (75.0%)
Obesity (BMI > 30)	81 (30.4%)	35 (36.1%)	24 (24.0%)	21 (32.3%)	1 (25.0%)
Hospital stay (d)/Mean (range)	11.9 (1-98)	5.6 (1-22)	21.1 (1-98)	7.3 (1-63)	6.8 (2-9)
Admission to intensive care unit (ICU)	55 (20.7%)	1 (1.0%)	53 (53.0%)	1 (1.5%)	0 (0.0%)
Discharged from further follow-up	185 (69.5%)	81 (83.5%)	47 (47.0%)	56 (86.2%)	1 (25.0%)
Number of consultations until discharge	1.135	1.61	1.26	1.47	1.1
	2.43	2.17	2.17	2.9	
	3.7	3.3	3.4		
Normalization of chest-X-ray findings at first consultation	150 (56.4%)	64 (66.0%)	43 (43.0%)	40 (61.5%)	3 (75.0%)

during or shortly after hospitalization. On 31 August 2020, 266 patients had been seen at the post-COVID outpatient clinic at least once. The characteristics of these patients are shown in Table 1. Not all the patients had visited the outpatient clinic by that time and some patients had come from another region for which they were excluded from this study.

### 3.2 | Effectiveness of triage using questionnaires

As shown in Figure 1, 100 patients were seen by a pulmonologist, 97 by an internist, and 65 by a geriatrician. Only 14 patients (5.3) needed to be referred by their initial specialist to one of the other two specialists. Thirteen (8%) patients initially seen by an internist or geriatrician were referred to a pulmonologist, and 1 patient initially seen by a pulmonologist was referred to an internist. Reasons for referral are shown in Table 2. A combined consultation by a pulmonologist and geriatrician together was set up for four patients directly, based on their self-reported persistent symptoms. Two patients who had been admitted to the ICU were not seen by a pulmonologist in the first instance: one patient was asked to complete the symptom questionnaire because he had been treated with high-flow oxygen therapy in the ICU and not with mechanical ventilation; the other patient had been sent the questionnaire by mistake.

Twenty-one patients were referred on to another medical specialist. Most referrals were made to a cardiologist ( $n = 11$ ), for persistent chest pain, new-onset atrial fibrillation, a new cardiac murmur, or to exclude the existence of pulmonary hypertension in patients with persistent lung abnormalities and dyspnea. Other referrals were to a nephrologist ( $n = 4$ ), neurologist ( $n = 2$ ), gastroenterologist ( $n = 2$ ), surgeon ( $n = 1$ ), and urologist ( $n = 1$ ). Many of these referrals were made because of symptoms found during follow-up; it was uncertain whether these symptoms were related to the COVID-19 infection. Examples of these symptoms are cluster headache, diarrhea, liver impairment in the presence of gallbladder polyps, aortic aneurysm, and urinary retention.

Fifty patients were seen by a psychologist: 38 patients were sent to a psychologist because of a high ( $>10$ ) HADS score at triage, 7 patients were seen by a psychologist and geriatrician at the first appointment, and 5 patients (2.2%) were referred to a psychologist after their first consultation with one of the three medical specialists. Forty-eight patients (18%) were also seen by a psychiatrist.

Table 2. Reasons for interprofessional referral

### 3.3 | Effectiveness of follow-up at the outpatient clinic

Follow-up was completed by 185 of 266 patients (69.5%). These patients had an average of 1.3 consultations. Pulmonologist significantly performed more consultations (1.5) than geriatricians (1.3) and internists (1.2),  $P = .004$ . Overall, 135 patients (72.9%) had a single

**TABLE 2** Reasons for interprofessional referral

	Primary allocated specialist	Secondary specialist referred to	Initial triage conform initial plan	Reason for referral	Outcome
Pt 1.	Internal medicine	Pulmonologist	Yes, no coughing	Persistent abnormalities on chest X-ray	Small fibrotic lesion without clinical significance
Pt 2.	Internal medicine	Pulmonologist	Yes, no coughing	Persistent abnormalities on chest X-ray	Normalization during longer follow-up
Pt 3.	Internal medicine	Pulmonologist	Yes, no coughing	Persistent dyspnea	No abnormalities on computed tomography (CT) scan, normal pulmonary function. Concluded as persistent fatigue
Pt 4.	Internal medicine	Pulmonologist	Yes, no coughing	Persistent abnormalities on chest X-ray	Normalization during longer follow-up
Pt 5.	Internal medicine	Pulmonologist,	Yes, no coughing	Persistent abnormalities on chest X-ray	Normalization during longer follow-up
Pt 6.	Internal medicine	Pulmonologist	Yes, no coughing	Persistent abnormalities on chest X-ray and persistent dyspnea	Normalization during longer follow-up and with physical improvements
Pt 7.	Internal medicine	Pulmonologist	Did report not coughing on questionnaire appeared to cough when asked at outpatient clinic	Persistent abnormalities on chest X-ray	Persistent abnormalities with lymphocytosis in broncheoalveolar fluid. Improvements after starting treatment with corticosteroids
Pt 8.	Pulmonologist	Internal Medicine	Yes, post-intensive care unit (ICU) patient	No referral for COVID-related symptoms (Screening for familial thrombosis)	No genetic cause of familial thrombosis was found
Pt 9.	Geriatrician	Pulmonologist	No, did cough. Deviated from triage because of multiple cognitive impairments	Persistent abnormalities on chest X-ray	Normalization of abnormalities during longer follow-up
Pt 10.	Geriatrician	Pulmonologist	Yes, no coughing	Persistent abnormalities on chest X-ray	Normalization during longer follow-up
Pt. 11	Geriatrician	Pulmonologist	Yes, no coughing.	No referral for COVID-related symptoms. Pulmonary node visible after resolving consolidations	Appeared to have lung cancer for which a lobectomy took place
Pt 12.	Geriatrician	Pulmonologist	Yes, no coughing	Persistent abnormalities on chest X-ray.	Interstitial Lung Disease with fibrosis. Pre-existing or COVID-related?
Pt 13.	Geriatrician	Pulmonologist	Yes, no coughing	Persistent dyspnea	Recovery during longer follow-up
Pt 14.	Geriatrician	Pulmonologist	No, post-ICU patient	Persistent abnormalities on chest X-ray	Improved during longer follow-up

consultation, 43 patients a second consultation, and 7 patients a third consultation.

After data collection was stopped, 81 patients were still being followed up. This group consisted of 70 of the most recently discharged patients who were waiting for a second or third follow-up consultation. Only 11 of 266 patients (4.1%) were seen at the outpatient clinic over a longer period of time, of whom 7 patients were seen by a pulmonologist for severe persistent lung abnormalities.

On 1 September 2020, a hospital-wide evaluation showed no important increase in the length of the waiting lists (for COVID-19

and non-COVID-19 care) of the outpatient clinics of the departments of pulmonary disease, internal medicine, and geriatrics.

## 4 | DISCUSSION

This study shows that a collaboration involving healthcare professionals from different medical specialties enables a rather large number of patients to be seen in a post-COVID-19 outpatient clinic, with few referrals to other specialists. Overall, 37.6% of the patients were

seen by a pulmonologist, 36.4% by an internist, and 24.4% by a geriatrician; 1.6% of the patients were offered a combined consultation. More than half of the study population (135 of 266 patients) required only one follow-up consultation.

At the time this outpatient clinic was set up, information on the organization of COVID-19 follow-up was lacking. Based on the literature on SARS-CoV-1, we made assumptions about which doctors would be needed. This approach appears to have been successful because there were few referrals to other specialists and minimal need for multiple follow-up consultations. Our findings support a recent study showing that post-COVID symptoms affect more systems than only the pulmonary system.<sup>9</sup> After the study started, the Federation of Medical Specialists in the Netherlands produced a guideline on outpatient care for COVID-19 patients.<sup>11</sup> According to this guideline, the medical specialist who first treated the patient for the COVID-19 infection should be in charge of subsequent outpatient care. Our experience shows that pulmonologists, internists, and geriatricians are capable of doing this, without the need for many intraprofessional consultations. This supports the hypothesis that the care of COVID-19 patients in outpatient clinics can be shared, which allows a more efficient use of time and resources.

Our strategy, in which the medical specialist in lead of care at the outpatient clinic is selected based on the main persistent symptoms experienced by patients several weeks after discharge, has potential advantages. We found that, depending on their symptoms, COVID-19 patients were evenly distributed over different medical professionals. Further, only a small number of patients were in need of further evaluation by another medical specialist.

We believe results might have been different if the clinical doctor in charge of the patient during his/her hospitalization would have been in charge of that patient during his/her outpatient follow-up. As severe COVID-19 infection leading to hospitalization is mostly related to pulmonary complaints,<sup>12</sup> most patients with a severe COVID-19 infection would most likely be referred to a pulmonologist, which would result in too many COVID-19 patients attending the pulmonary outpatient clinic. Moreover, we would expect more referrals to other outpatient clinics later on, because the long-term effects of a COVID-19 infection affect other organ systems beside the lungs. Not all patients need to be seen by a pulmonologist after an acute COVID-19 infection, as evidenced by the large number of patients seen in our outpatient clinic who did not need to be referred to a pulmonologist. The need for referral to a pulmonologist could be even lower. Most referrals were made because of persistent chest-X-ray abnormalities, which we now know can resolve spontaneously during longer follow-up (see Table 2). Taking this into account, we believe the triage strategy we have shown in this article could result in an even more proportionate shared care, since the follow-up of persistent chest-X-ray abnormalities is the most likely explanation that pulmonologists performed more consultations than internists and geriatricians. Further, a high proportion of patients (56.4%) even showed a normalization of chest-X-ray findings by the time of the first follow-up consultation (see Table 1). This included 21 patients who had been admitted to the ICU. Even more patients were discharged from further follow-up after only a few consultations.

This means that a large number of patients who did have persistent chest-X-ray abnormalities at the first follow-up visit were discharged from follow-up soon thereafter. From this, we can conclude that not all persistent chest-X-ray abnormalities are of significant importance, because patients would not have been discharged with major symptoms. This differs from expectations made in an early phase of the COVID-19 pandemic. This is another argument why COVID-19 care in outpatient clinics does not solely have to rely on pulmonologists and that other medical specialists can share the burden of care, depending on a patient's persisting symptom.

According to our follow-up data, post-COVID-19 patients tend to show a recovery similar to that of patients with non-COVID pneumonia, who often show physical recovery and radiographic resolution within weeks, but sometimes only after months.<sup>13</sup> Still, healthcare providers might benefit from implementing a multidisciplinary post-COVID-19 outpatient clinic to deal with the peak number of patients who present over a short period of time. Also, a relatively large group of 50 patients (18.8%) was referred to a psychologist. The mental health of post-COVID-19 patients seems to require extra attention. In our study, the Hospital Anxiety and Depression Scale was used as a screening tool. Only five patients who were not directly referred to a psychologist based on this triage needed psychological support. Therefore, the HADS seems a useful tool in post-COVID-19 patients. However, recent literature has shown that other, maybe less time-consuming tools can be used as well.<sup>14</sup>

This study is one of the first to describe an effective model of a post-COVID-19 outpatient clinic; however, some limitations should be considered. First, this outpatient clinic approach appeared to be effective for the first wave of patients in 2020, but we do not know whether this will be true for subsequent waves. It might be that COVID-19 influences our health and affects the healthcare system differently in second (and further) waves. Second, this model worked in our healthcare system, in which the physicians also worked together on the COVID ward. It is unclear whether existing collaborations are a prerequisite for the success of the outpatient clinic and whether this model will work in other hospitals. Third, our results are based on local daily practice at an outpatient clinic, which may differ from that of other clinics. On the other hand, COVID-19 is the same disease worldwide, so it is likely that this approach based on patient symptoms is a concept that is generalizable.

## 5 | CONCLUSION

The presence of signs and symptoms after an acute COVID-19 infection is variable and the care of COVID-19 patients at outpatient clinics should be customized to the individual. Identifying patient signs and symptoms after a certain period of recovery, by using of simple questionnaires with self-reported symptoms, seems an appropriate way to assign patients to a specific medical specialist for further consultation and evaluation. Collaboration between medical specialties including psychology is essential for organizing such an outpatient clinic. In this way, health care for large numbers of COVID-19 patients can still

be provided efficiently. Further prospective studies are needed to confirm our findings.

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None.

## CONFLICT OF INTEREST

All authors report no conflict of interest.

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All authors agree with the manuscript in its current form.

The corresponding author confirms to have had full access to all of the data in the study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

## TRANSPARENCY STATEMENT

The corresponding author affirms that the results in this manuscript are an honest and accurate display of the study being reported. No important aspects of the study have been omitted. Any discrepancies from the study as planned have been explained.

## DATA AVAILABILITY STATEMENT

The authors confirm that the data supporting the findings of this study are available within the article. Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so additional data are not available upon request.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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