

## **SARS-CoV-2 infection in 86 healthcare workers in two Dutch hospitals in March 2020: a cross-sectional study with short-term follow-up**

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### **Abstract**

COVID-19 is spreading rapidly over the world. On February 27, 2020, the first patient with COVID-19 was reported in the Netherlands, linked to a trip to Northern Italy. In the following weeks, we identified nine Health Care Workers (HCW) of whom eight had no epidemiological link to countries with a high incidence of COVID-19 at that time. This suggested local spread of SARS-CoV-2 in the community and prompted a low-threshold screening in HCWs.

Screening was performed in two large teaching hospitals in the southern part of the Netherlands.

HCWs who suffered from fever or mild respiratory symptoms were tested for SARS-CoV-2 by RT-PCR on oropharyngeal samples. Structured interviews were conducted to document symptoms.

Eighty-six (6.4%) out of 1,353 HCWs were infected with SARS-Cov-2. The median age was 49 years and 15 (17.4%) were male. Most suffered from relatively mild disease. Only 46 (53.5%) HCWs had fever during the course of illness. Seventy-nine (91.9%) HCWs met a case definition of fever and/or coughing and/or shortness of breath. The majority (n=54, 62.8%) reported to have worked while being symptomatic.

Within one week after the first case was reported, a substantial proportion of HCWs with fever or respiratory symptoms were proven to be infected with SARS-Cov-2. This observation suggests that there is a relatively high prevalence of mild clinical presentations that may go undetected. The spectrum of symptoms present in HCWs with COVID-19, frequently not including fever, asks for less stringent use of the currently recommended case-definition for suspected COVID-19.

## Introduction

Since December 2019, the world has been in the grip of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease it causes, coronavirus disease 2019 (COVID-19) ([WHO A](#)). On February 27, 2020, the first patient with COVID-19 was reported in the Netherlands, linked to a trip to Northern Italy between February 18, 2020 and February 21, 2020 ([Alderweireld](#)). During the following weeks, more cases of COVID-19 were identified in the Netherlands, including nine healthcare workers (HCWs) of two Dutch teaching hospitals in the southern part of the Netherlands who were diagnosed between March 2, 2020 and March 6, 2020. Eight of these nine healthcare workers (HCWs) had no history of travel to China or Northern-Italy, raising the question of whether undetected community circulation was occurring. As these findings coincided with the seasonal influenza peak ([NIC](#)), and SARS-CoV-2 infection in HCWs could lead both to sick leave and introduction of the virus into the hospitals, this finding prompted a demand for testing HCWs. Following initial observations of SARS-CoV-2 detection in persons with mild symptoms not meeting the definition for case finding ([WHO B](#)), a low-threshold screening regime was implemented to determine the prevalence and the clinical presentation of COVID-19 among HCWs in these two hospitals.

## Methods

A cross-sectional study with short-term follow-up was conducted in the 700-bed Amphia Hospital (Breda, the Netherlands) and the 800-bed Elisabeth-TweeSteden Hospital (Tilburg, the Netherlands), employing 9,705 HCWs, 17.7% of whom are male. Between March 7, 2020 and March 12, 2020, HCWs in both teaching hospitals who suffered from fever or mild respiratory symptoms in the last 10 days were voluntary tested for SARS-CoV-2 infection, in accordance with the local infection control policy during outbreaks. A semi-quantitative real-time reverse-transcriptase PCR (RT-PCR, 45 cycles) targeting the E-gene was performed on oropharyngeal samples as described previously ([Corman](#)). Structured interviews were conducted to document symptoms for all HCWs with confirmed SARS-CoV-2 infection, including those diagnosed before March 7, 2020.

Recovery was defined as being without symptoms for more than 24 h. No analysis for statistical significance was performed given the descriptive nature of the report. Ethical approval was obtained from the Ethics Committee Brabant, with a waiver of written informed consent (METC Brabant/20.134). Verbal informed consent was obtained from all HCWs for SARS-CoV-2 testing and data collection. Data were de-identified and analysed using SPSS version 25.0 (IBM, Armonk, NY, USA).

## Results

A total of 1,353 HCWs were screened, 86 (6.4%) of whom were infected with SARS-CoV-2. HCWs with COVID-19 were employed in 52 different hospital departments, including 36 medical wards, had a median age of 49 years (range 22-66 years) and 15 (17.4%) were male ([Table 1](#)). Most HCWs with COVID-19 suffered from relatively mild disease. Forty-six (53.5%) HCWs had fever during the course of illness, another 10 (11.6%) reported a feverish feeling without having measured their temperature. Seventy-nine (91.9%) HCWs met a case definition of fever and/or coughing and/or shortness of

breath. Extending this case definition with severe myalgia and/or general malaise would capture all 86 (100%) HCWs with COVID19 in this evaluation. Other frequent symptoms were headache, a runny nose, a sore throat, chest pain, diarrhoea and loss of appetite. Seven (8.1%) indicated that they were already symptomatic before February 27, 2020, the day the first Dutch patient with COVID-19 was diagnosed (Figure 1). Five (5.8%) HCWs had recovered on the day of screening, 20 (23.3%) on the day of the interview, with a median duration of illness of 8 days (range 1-20 days) (Table 1). Two (3.7%) HCWs were admitted to the hospital and did not develop critical disease up to the moment of reporting. Coughing, a sore throat, shortness of breath, myalgia and loss of appetite were more frequent in HCWs who were interviewed during the second week of illness. Three (3.5%) HCWs reported to have been exposed to an inpatient known with COVID-19 prior to the onset of symptoms, and 54 (62.8%) mentioned to have worked while being symptomatic.

The median RT-PCR Ct value was 27.0 (range 14.5-38.5). Within the limited resolution in time since the onset of symptoms, Ct values tended to be higher in HCWs who were tested later in the course of disease (Figure 2). Ct values were similar for HCWs with and without fever (median 25.1 and 27.6, respectively), and for HCWs with and without any symptoms on the day of screening (median 26.9 and 27.7, respectively).

## Discussion

Two weeks after the first Dutch patient with COVID-19 was reported, the prevalence of COVID-19 in HCWs with fever or respiratory symptoms in two Dutch hospitals in the southern part of the Netherlands was 6.4%. This unexpected high prevalence supported the hypothesis of hidden community spread of SARS-CoV-2 and is considered a minimal estimate of the prevalence in all HCWs at the time of screening. Only HCWs with (recent) symptoms were screened, and oropharyngeal swabs were used for testing, which may have a slightly lower sensitivity than a nasopharyngeal swab (Wang). Another possible explanation for the unexpectedly high prevalence would be hospital-acquisition. However, all patients with fever or respiratory symptoms in both hospitals were routinely tested for SARS-CoV-2. At that time, a limited number of infected patients was nursed under strict isolation precautions, and only three SARS-CoV-2-infected HCWs mentioned exposure to an inpatient known with COVID19. There was no clustering of infected HCWs in specific departments. The low percentage of males among HCWs with COVID19 (17.4%) reflects that of the source population of HCWs in the two participating hospitals (17.7%).

Most HCWs suffered from mild disease as compared to the clinical presentation and outcomes reported for hospitalised patients so far (Arentz, Wu). Notably, fever or a feverish feeling was frequently not reported. A question is what is a sensitive case definition for early detection of SARS-CoV-2 infected individuals. At the time of the study, the internationally recommended case definition included a history of travel to China or Northern-Italy, which did not apply for any of the infected HCWs identified through our screening (WHO B). When using the definition without travel history to capture community transmission, about 40% of HCWs with COVID-19 in our hospitals still would not have been detected. Sensitive detection of COVID-19 cases in HCWs is crucial for hospital infection prevention policy, particularly for those who work with vulnerable patients. We therefore suggest

adjusting the currently used case-definition for suspected COVID-19 in HCWs by taking fever as one of the possible symptoms and not as a required symptom (WHO B). Further improvement of the sensitivity of COVID-19 detection in HCWs can be achieved by adding severe myalgia and general malaise to the case-definition.

To the best of our knowledge, this report is the first to describe the clinical presentation and early outcomes of COVID-19 in HCWs, which may be helpful for others seeking to identify HCWs suspected for COVID-19. A limitation of our evaluation is that screening of HCWs was based on the presence of fever or mild respiratory symptoms in the last ten days, and that no data were collected in HCWs without these symptoms. The sensitivity and specificity of the reported symptoms could therefore not be estimated.

In conclusion, during the containment phase and within one week after the first case was confirmed, a substantial proportion of HCWs with fever or respiratory symptoms were infected with SARS-CoV-2, probably caused by acquisition of the virus in the community during the early phase of local spread. This observation confirms the insidious nature of SARS-CoV-2 spread, given the high prevalence of mild clinical presentations that may go undetected (Munster). The spectrum of relatively mild symptoms present in HCWs with COVID-19, frequently not including fever, asks for less stringent use of the currently recommended case-definition for suspected COVID-19.

### **Conflicts of interest**

All authors declare no conflict of interest.

### **Author contributions**

SP, JV and MKo were involved in laboratory testing of HCWs. MKI, AB, RB, WB, AO, MR and JK were involved in data collection. MK analysed the data and drafted the manuscript. All authors revised and approved of the final version of the manuscript.

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**Table 1.** Demographic characteristics, symptoms during the course of illness and outcomes of 86 healthcare workers with confirmed coronavirus disease 2019.

	Overall (n=86)		Interview within 7 days of the onset of symptoms (n=32)		Interview after 7 days of onset the of symptoms (n=54)	
	No. (%) of patients <sup>a</sup>		No. (%) of patients <sup>a</sup>		No. (%) of patients <sup>a</sup>	
Demographic characteristics						
Male	15	(17.4)	6	(18.8)	9	(16.7)
Age, years, median (range)	49	(22-66)	47	(27-66)	49	(22-65)
Symptoms						
Fever <sup>b</sup>	46	(53.5)	20	(62.5)	26	(48.1)
Feeling feverish, temperature not measured	10	(11.6)	1	(3.1)	9	(16.7)
Coughing	65	(75.6)	21	(65.6)	44	(81.5)
Shortness of breath	33	(38.4)	6	(18.8)	23	(42.6)
Sore throat	34	(39.5)	11	(34.4)	27	(50.0)
Runny nose	47	(54.7)	18	(56.3)	29	(53.7)
General malaise	65	(75.6)	22	(68.8)	33	(61.1)
Severe myalgia	55	(64.0)	21	(65.6)	44	(81.5)
Headache	49	(57.0)	18	(56.3)	31	(57.4)
Chest pain	25	(29.1)	9	(28.1)	16	(29.6)

Abdominal pain	5	(5.8)	1	(3.1)	4	(7.4)
Diarrhoea or loose stools	16	(18.6)	5	(15.6)	11	(20.4)
Loss of appetite or nausea	15	(17.4)	1	(3.1)	14	(25.9)
Other	20	(23.3)	3 <sup>c</sup>	(9.4)	17 <sup>d</sup>	(31.5)
Outcomes at day of interview						
Recovered	20	(23.3)	9	(28.1)	11	(20.4)
Days until recovery for those recovered, median (range)	8	(1-20)	5	(1-7)	9	(8-20)
Days until interview for those not recovered, median (range)						
Since the onset of symptoms	9	(4-25)	6	(4-7)	12	(8-25)
Since the SARS-CoV-2-positive test	6	(2-11)	4	(2-6)	6	(2-11)
Hospital admission	2	(2.3)	0	(0.0)	2	(3.7)

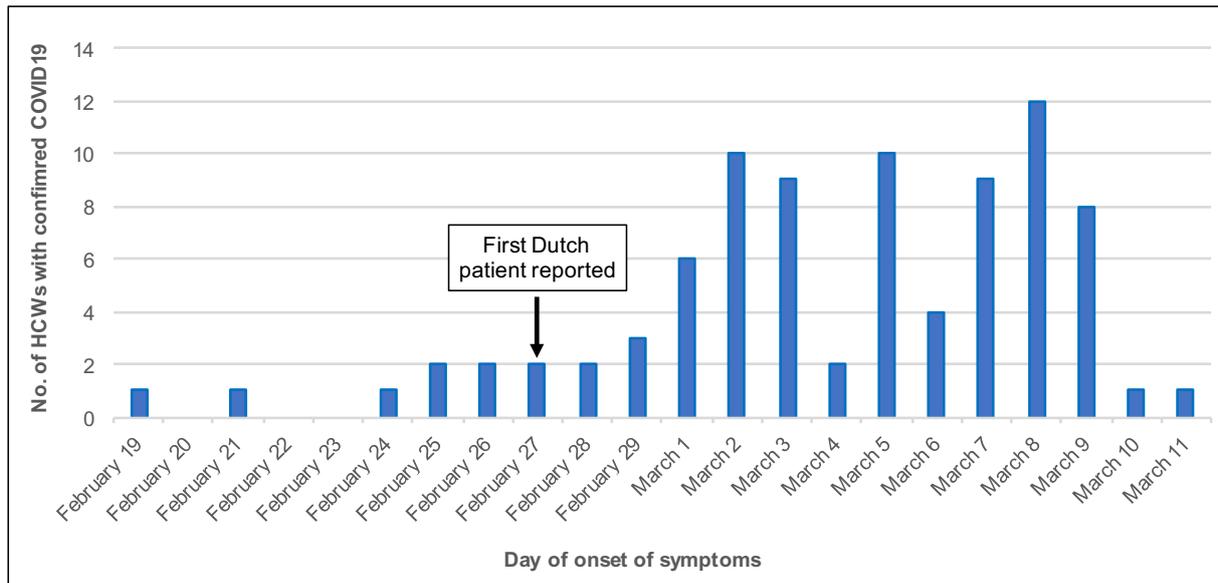
a. Unless indicated otherwise.

b. Defined as temperature of 38.0°C or higher.

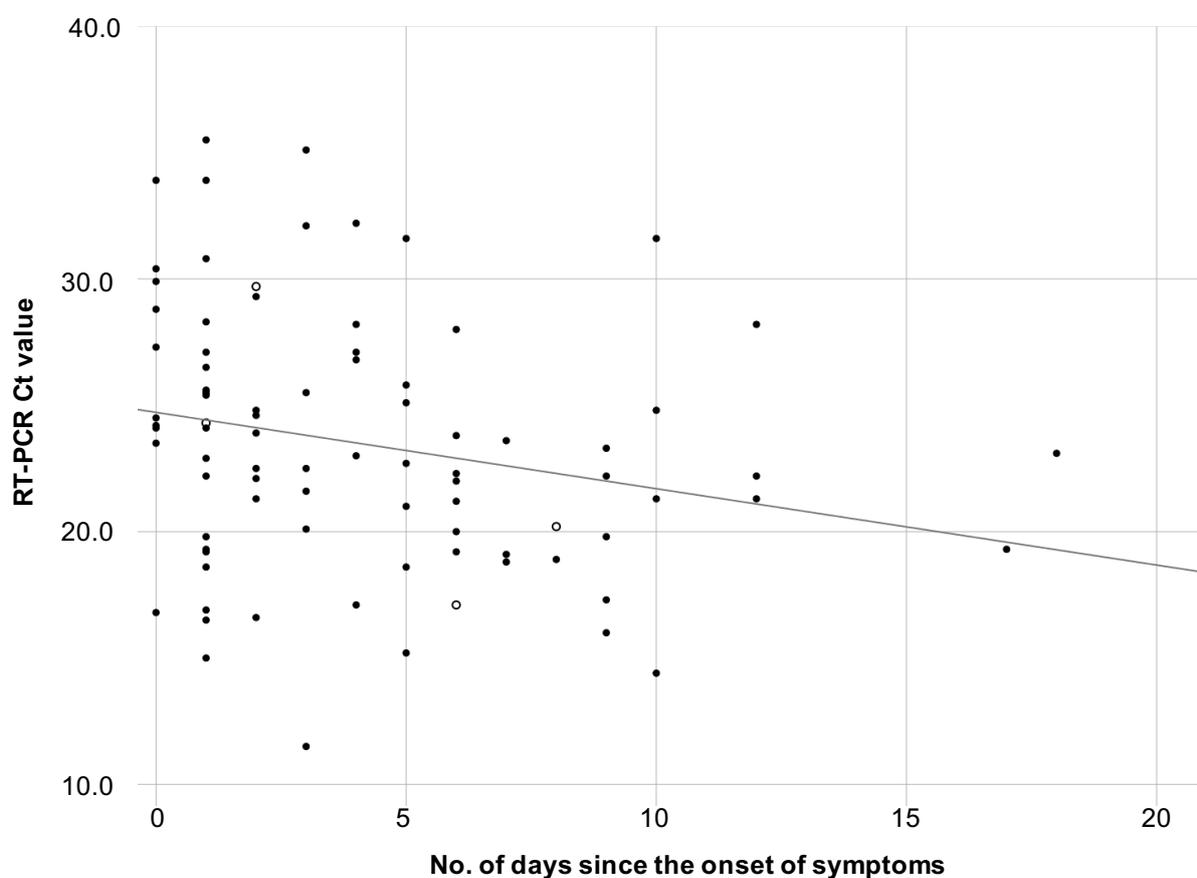
c. Other symptoms include painful or burning eyes and painful joints.

d. Other symptoms include hoarseness, itchy nose, ear pain, painful or burning eyes, syncope, agitation or palpitation, vomiting, hemoptoe, constipation, skin rash, and loss of taste.

**Figure 1.** Day of onset of symptoms for 86 healthcare workers with confirmed coronavirus disease 2019 (COVID-19) in two hospitals in the southern part of the Netherlands.



**Figure 2.** Cycle threshold values for the semi-quantitative reverse-transcriptase PCR targeting the E-gene in relation to the number of days since the onset of symptoms.



Ct=cycle threshold; PCR=polymerase chain reaction; RT=reverse-transcriptase.

Ct values were unavailable for 15 HCWs.

Open circles indicate Ct values for HCWs who had recovered on the day of screening.