

RESEARCH

Open Access



# Quality of care in Belgian general practices during the COVID-19 pandemic: results of the cross-sectional PRICOV-19 study

Esther Van Poel<sup>1,2\*</sup>, Pierre Vanden Bussche<sup>1,2</sup>, Benoît Pétré<sup>3</sup>, Cécile Ponsar<sup>4</sup>, Claire Collins<sup>1,5</sup>, Michel De Jonghe<sup>6</sup>, Anne-Françoise Donneau<sup>3</sup>, Nicolas Gillain<sup>3</sup>, Michèle Guillaume<sup>3</sup> and Sara Willems<sup>1,2</sup>

## Abstract

**Background** The COVID-19 pandemic immensely impacted care provision, including quality of care in general practice. This paper aimed: (1) to assess how Belgian general practices acted upon the six dimensions of quality of care during COVID-19; (2) to study differences between the three Belgian regions; and (3) to benchmark the performance of the Belgian practices against the performance in other European countries.

**Methods** The data collected from 479 Belgian practices during 2020–2021 using an online survey as part of the international cross-sectional PRICOV-19 study were analyzed.

Hereby, descriptive statistics, chi-squared tests, and binary logistic regression analyses were performed. Thirty-four survey questions related to the six dimensions of quality of care were selected as outcome variables. The adjusted regression models included four practice characteristics as covariates: practice type, being a teaching practice for GP trainees, multidisciplinary of the team, and payment system.

**Results** Belgian practices made important organizational changes to deliver high-quality care during COVID-19. Most practices ( $n=259$ ; 56.1%) actively reached out to vulnerable patients. Limitations to the practice building or infrastructure threatened high-quality care in 266 practices (55.5%). Infection prevention measures could not always be implemented during COVID-19, such as using a cleaning protocol ( $n=265$ ; 57.2%) and providing a separate doctor bag for infection-related home visits ( $n=130$ ; 27.9%). Three hundred and sixty practices (82.0%) reported at least one safety incident related to a delayed care process in patients with an urgent condition. The adjusted regression analysis showed limited significant differences between the Belgian regions regarding the quality of care delivered. Belgian practices demonstrated varied performance compared to other European countries. For example, they excelled in always checking the feasibility of isolation at home but reported more patient safety incidents related to timely care than at least three-quarters of the other European countries.

**Conclusions** Future studies using different design methods are crucial to investigate which country and practice characteristics are associated with delivering high-quality care.

**Keywords** Primary health care, General practice, Quality of care, Equity, Patient safety, Timeliness, Person-centeredness, Efficiency, Effectiveness, COVID-19, PRICOV-19

\*Correspondence:

Esther Van Poel

Esther.VanPoel@UGent.be

Full list of author information is available at the end of the article



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

## Background

The COVID-19 pandemic profoundly impacted healthcare services globally, including primary care (PC) [1]. General practitioners (GPs), who serve as the first point of contact for potentially infected patients and provide both short- and long-term follow-up care for most patients [2, 3], were faced with unprecedented structural and organizational challenges to deliver high-quality care [4]. These included amended tasks like performing teleconsultations, increased collaboration with secondary care services and neighboring general practices (GP practices), and limited resources [5–8]. In the initial months of the pandemic, the lack of established protocols for COVID-19 and the continued management of non-COVID patients in an exceptional context was particularly challenging [9]. Later, healthcare providers were overwhelmed with guidelines which quickly changed [10]. In Belgium, guidelines for safe care during COVID-19 were developed by several organizations. For example, the professional organization Domus Medica provided guidelines for safe practice in Flanders [11], while its counterpart SSMG (la Société Scientifique de Médecine Générale) was responsible for drawing guidelines in Wallonia [12]. At the national level, guidelines were also established through the health institute Sciensano in collaboration with policymakers, scientists, and healthcare professionals [13]. Previous Belgian research demonstrated that GPs felt burdened and strained by the need to stay constantly informed [14].

Additionally, Belgian GPs were worried about unmet healthcare needs among patients: there was a temporary ban on all planned non-urgent care in PC and secondary care, including chronic and preventive care, while also patients postponed care because of fearing infection or assuming that GPs were overwhelmed [15]. Furthermore, the pandemic led to an increased number of patients with greater vulnerability [16, 17], including chronic patients for whom COVID-19 posed a potentially life-threatening risk and those who were indirectly susceptible to health problems due to public health and social measures, such as patients with a limited social network or already precarious mental health [18, 19]. GPs were crucial in identifying these vulnerable patients and limiting collateral damage [5, 15, 20].

Given that GP practices were urged to reorganize their way of working and revise care processes in unprecedented circumstances [21], delivering high-quality care became an important challenge during COVID-19 [22, 23]. This paper has three aims: (i) to describe the organization of care in Belgian GP practices from the perspective of the six dimensions of quality of care: equity, patient-centeredness, safety, effectiveness, timeliness, and efficiency; (ii) to investigate the differences in terms

of quality of care during COVID-19 between the three Belgian regions (i.e., the Flemish Region (FR), Brussels-Capital Region (BCR), and Walloon Region (WR)); and finally, (iii) to benchmark the Belgian performance on the six dimensions of quality of care against the performance in 36 other European countries. The findings could serve as an initial step towards formulating policies for potential future outbreaks where there is an increased number of patients with symptoms of infections within GP practices.

## Methods

### Study design and setting

During the summer of 2020, an international consortium comprising over 45 European research institutes was established under the coordination of Ghent University (Belgium) to launch the PRICOV-19 study [24]. This multi-country cross-sectional study aimed to investigate various aspects related to the organization of GP practices during the COVID-19 pandemic, including the provision of high-quality care, changes in task roles, the impact on the well-being of healthcare providers, and potential differences among various types of practices and healthcare systems. Data were collected in 37 European countries and Israel. For Belgium, data collection took place in all three regions. The FR is located in northern Belgium and predominantly Dutch-speaking, while the WR in the south is primarily French-speaking. The BCR, the capital of Belgium, operates as a separate bilingual region, officially recognizing Dutch and French as its languages.

### Measurement

Data were collected using an online survey among GP practices. The survey was developed at Ghent University in multiple phases, including a pilot study among 159 practices in Flanders (Belgium). Details on the study protocol and the survey's development are published elsewhere [24]. The final survey included 53 items divided into six sections: patient flow; infection prevention; information processing; communication; collaboration and wellbeing; and practice and participant characteristics. This version was translated into Dutch and French using the forward-backwards method. The REDCap platform was used to host the survey [25].

### Sampling and recruitment

In each country, GP practices were selected following a pre-defined recruitment procedure, preferably random. Only one survey was completed per practice, usually by a GP. Data were collected between November 2020 and December 2021. Belgian practices were recruited between December 2020 and August 2021. A random

selection of 1,477 Belgian practices was made from an updated listing on the web application of the National Institute for Health and Disability Insurance (INAMI/RIZIV), which specifically included GPs active as of November 1, 2020 [26]. Being qualified as a GP before 1980 was considered an exclusion criterion to exclude retired GPs or GPs seeing only a limited number of patients. The practices of all selected GPs were invited to participate in the study using a standardized procedure, including several attempts of contact via telephone and email. This resulted in the participation of 370 practices (response rate of 25.1%). An additional convenience sample of 134 GP practices was drawn through the professional and personal networks of the research teams involved. A total of 109 GP practices participated in the study (response rate of 81.3%).

### Data analysis

Data cleaning and statistical analysis were performed at Ghent University using SPSS Statistics for Windows, version 28.0 (IBM Corp., Armonk, N.Y., USA). Data cleaning involved invalidating answer options of 'I do not know,' 'not applicable,' and 'no answer.' Additionally, potential outliers in the dataset were checked with the respective country coordinators. In total, 34 quality of care-related items were selected as the outcome variables based on the definitions of the Institute of Medicine regarding the six dimensions [27]: person-centeredness and equity (#15), safety and effectiveness (#13), timeliness (#4), and efficiency (#2). Their respective survey items, original and recoded answer options, and number of missing values are included in Additional File (1) Based on a literature review [28, 29], four practice characteristics were used as covariates: practice type (solo, duo, or group practice based on the number of GPs in practice); being a teaching practice for GP trainees (yes or no); payment system (fee-for-service or capitation); and multidisciplinary of the team (having at least one other paramedical discipline working in practice apart from a GP or not having such). Frequencies and valid percentages were used to describe the outcome variables and four practice characteristics. Given the lack of publicly available data on the distribution of GP practice among the Belgian regions, an assessment of its representativeness is made based on the number of GPs in Belgium. Differences in practice characteristics between the regions were analyzed using Pearson's chi-squared tests. Unadjusted and adjusted binary logistic regression models were used to examine the differences between the regions on the outcome variables. A comparison between both models is included in Additional File (2) Odds ratios and 95% confidence interval were reported. The criterion of statistical significance (two-fold,  $p$ ) was determined at 0.05.

Furthermore, countries were first ranged using the valid percentages to benchmark the Belgian performance on each outcome variable against the performance in the other 36 participating European countries. Next, quartiles were calculated (Q1-Q4), where Q1 included the eight countries that performed best on a given outcome variable, and Q4 referred to the eight countries with the lowest performance.

## Results

### Description of the participating Belgian GP practices

The characteristics of the 479 Belgian practices included in the cleaned dataset are shown in Table 1. Two hundred and eighty practices were located in the FR (58.5%), 152 (31.7%) in the WR, and 47 (9.8%) in the BCR. Based on the available data on the number of GPs, a representative sample regarding its distribution between the Belgian regions participated in this study. In the FR, the practices were significantly more often duo or group practices compared to the WR and BCR ( $p < 0.001$ ). Also, multidisciplinary practices were significantly more frequent in the FR than in the WR or BCR ( $p < 0.05$ ). No significant differences between the regions were found regarding being a teaching practice for GP trainees or the practice's payment system.

### Performance of the Belgian GP practices

#### *Person-centered and equitable care*

Table 2 shows the efforts of the practices in delivering person-centered and equitable care during COVID-19. These include extracting a list of patients with a chronic condition at least once from the electronic medical record ( $n = 87$ ; 19.6%) or performing proactive telephone calls to patients with a chronic condition ( $n = 228$ ; 50.2%), a psychological vulnerability ( $n = 161$ ; 35.6%), or known domestic violence problems or issues related to raising or parenting a child ( $n = 63$ ; 14.9%). Practices from the BCR significantly more often reached out to the latter than practices in the WR ( $p < 0.05$ ). In 221 practices (50.2%), GPs and/or GP trainees were more involved during COVID-19 in reaching out to patients who might have postponed health care, and in 102 practices (42.3%), this was the case for non-GP staff members. The involvement of non-GPs in outreach occurred more frequently in the FR than in the WR ( $p < 0.05$ ). In 64.6% of the practices ( $n = 153$ ), non-GP staff members were more involved in providing additional information or explanation to vulnerable patients such as those with low health literacy compared to before COVID-19.

Multilingual communication was available in 9.5% ( $n = 42$ ) of the Belgian practices on their answering machine, 13.5% ( $n = 47$ ) for the practice website, 13.1% ( $n = 36$ ) for the practice leaflet, and 25.1% ( $n = 57$ ) for a

**Table 1** Practice characteristics of the participating Belgian GP practices and a comparison between the Belgian regions: descriptive statistics and chi-square tests

		Belgium (total) <sup>b</sup>	Brussels-Capital Region	Walloon Region	Flemish Region	<i>p</i> value
GPs <sup>a</sup>	Total population	11,767 (100)	1178 (10.0)	3784 (32.2)	6805 (57.8)	
GP practices	Study sample	479 (100)	47 (9.8)	152 (31.7)	280 (58.5)	
Practice type	Solo	178 (37.3)	24 (52.2%)	88 (58.7)	65 (23.2)	< 0.001
	Duo	93 (19.5)	6 (13.0%)	28 (18.7)	59 (21.1)	
	Group	206 (43.2)	16 (34.8%)	34 (22.7)	156 (55.7)	
Multidisciplinarity of the team	Yes	145 (31.2)	14 (29.8%)	32 (22.2)	98 (35.9)	0.016
	No	320 (68.8)	33 (70.2%)	112 (77.8)	175 (64.1)	
GP trainee teaching practice	Yes	201 (42.3)	17 (37.0%)	63 (42.3)	121 (43.4)	0.717
	No	274 (57.7)	29 (63.0%)	86 (57.7)	158 (56.6)	
Payment system	Fee-for-service	435 (91.0)	39 (83.0)	142 (94.0)	253 (90.7)	0.066
	Capitation	43 (9.0)	8 (17.0)	9 (6.0)	26 (9.3)	

Data are given as n (valid percentage)

GPs general practitioners

<sup>a</sup> Information regarding the number of GPs in 2020 is obtained from the IMA Atlas via the following link: <http://www.ima-aim.be>

<sup>b</sup> One GP practice could not be classified into one of the regions as the zip code was missing

COVID-19 leaflet. As expected due to the official bilingualism in the BCR, multilingual communication was more prevalent in BCR practices compared to the WR ( $p < 0.001$ ). The BCR and FR also differed significantly, including a greater focus on multilingualism in the BCR. However, these differences were less pronounced for the answering machine ( $p < 0.01$ ) or the COVID-related leaflet ( $p < 0.01$ ). Finally, a multilingual COVID-related leaflet was more often available in the FR than in the WR ( $p < 0.01$ ).

Practices were asked to which extent they actively checked the patients' social context. When quarantine or isolation was indicated, one hundred fifty Belgian practices (32.1%) always checked whether this was feasible at home for the patient. In case of a referral to another facility (e.g., getting a COVID-test), 43.4% of practices ( $n = 200$ ) checked whether the transport to the other facility was feasible for the patient. This was significantly less often checked in the FR than in the WR ( $p < 0.05$ ). Compared to before COVID-19, 40.9% of the practices ( $n = 186$ ) checked more or much more frequently whether patients experienced financial problems. The latter was occurred significantly more often in practices in the WR than in the FR ( $p < 0.05$ ). Also, 17.1% of the practices ( $n = 78$ ) checked more or much more frequently whether the patient had experienced domestic violence during COVID-19.

As shown in Table 2, the performance of the Belgian practices to deliver person-centered and equitable care compared to 36 other European countries differed according to the outcome variable. For example, Belgium

was in the first quartile for increased screening of domestic or financial issues in patients during COVID-19, while it ranked in the lowest quartile (Q4) for greater involvement of non-GP staff in outreach work, compared to before COVID-19.

#### Safe and effective care

Two hundred sixty-six practices (55.5%) indicated that they experienced limitations to the practice building or infrastructure to deliver high-quality care (Table 2), which was more common in the FR than in the WR ( $p < 0.01$ ). More than one in three ( $n = 176$ ; 37.1%) practices considered making future adjustments to the practice or infrastructure.

In 81.5% of the practices ( $n = 224$ ), patients wishing to make an appointment were informed about symptoms that might prevent them from entering the practice. This happened more frequently in the FR than in the WR ( $p < 0.001$ ) or BCR ( $p < 0.05$ ). Also, in most practices, patients needed to give a reason for the encounter when making the appointment by phone ( $n = 387$ ; 85.4%), in contrast to 68.2% ( $n = 191$ ) when making an online appointment. In 68.7% of the practices ( $n = 314$ ), a protocol was available for answering calls from potential COVID-patients. However, only 26.3% of these practices ( $n = 81$ ) always used such a protocol. Overall, 28.0% of the practices ( $n = 119$ ) always called patients with an online appointment to check their infection risk if this was unclear. In 79.8% of the practices ( $n = 225$ ), a GP was always available as a backup in case of questions when a non-GP answered telephone calls from patients. This

**Table 2** Comparison of Belgium to 36 other European countries and between the Belgian regions: descriptive statistics and adjusted binary logistic regression models for the six dimensions of quality of care

	Valid percentage				Odds Ratio (95% Confidence Interval)		
	Belgium (total) Quartile	Brussels-Capital Region (BCR)	Walloon Region (WR)	Flemish Region (FR)	BCR vs. WR Reference cat: WR	FR vs. WR Reference cat: WR	BCR vs. FR Reference cat: FR
<i>Person-centered and equitable care</i>							
The practice extracted a list of at least one group of patients with a chronic disorder from the electronic medical record system. (yes)	19.6% Q3	28.6%	17.1%	19.5%	1.62 (0.65–4.04)	1.05 (0.56–1.98)	1.54 (0.65–3.66)
The practice actively reached out to ...							
patients with a chronic condition who needed follow-up care (yes)	50.2% Q3	55.8%	43.7%	52.6%	1.53 (0.72–3.25)	1.03 (0.64–1.67)	1.48 (0.72–3.05)
psychologically vulnerable patients (yes)	35.6% Q2	37.8%	31.9%	37%	1.02 (0.46–2.24)	0.81 (0.48–1.48)	1.26 (0.60–2.66)
patients with known problems of domestic violence or families with a known problematic parenting situation (yes)	14.9% Q2	27.5%	10.2%	15.5%	2.78* (1.04–7.41)	1.15 (0.55–2.40)	2.42 (0.99–5.90)
Change of roles compared to before COVID-19, including a greater involvement of ...							
GP or GP trainees: actively reaching out to patients that might postpone healthcare (yes)	50.2% Q2	53.3%	56.8%	45.6%	0.84 (0.42–1.69)	0.65 (0.41–1.04)	1.29 (0.66–2.53)
Staff members <sup>a</sup> : actively reaching out to patients that might postpone healthcare (yes)	42.3% Q4	52.9%	55.0%	36.8%	0.59 (0.19–1.89)	2.47* (1.22–7.94)	1.46 (0.49–4.33)
Staff members <sup>a</sup> : giving information or explanation about what the caregiver said to illiterate patients, patients with low health literacy, or migrants (yes)	64.6% Q2	70.6%	67.2%	62.7%	0.88 (0.26–3.00)	1.74 (0.83–3.64)	1.53 (0.48–4.85)
The availability of multilingual communication in the practice regarding ...							
the practice answering machine (yes)	9.5% Q2	30.8%	3.5%	9.6%	11.81*** (3.65–38.23)	2.86 (1.00–8.17)	4.12** (1.70–10.06)
the practice leaflet (yes)	13.1% Q2	50.0%	4.6%	12.2%	34.83*** (5.70–212.9)	3.91 (0.82–18.66)	8.91*** (2.63–30.22)
the leaflet with information on COVID-19 (yes)	25.1% Q3	75.0%	8.0%	29.2%	26.14*** (6.59–103.7)	3.82** (1.44–10.16)	6.84** (1.89–24.73)

**Table 2** (continued)

	Valid percentage				Odds Ratio (95% Confidence Interval)		
	Belgium (total) Quartile	Brussels-Capital Region (BCR)	Walloon Region (WR)	Flemish Region (FR)	BCR vs. WR Reference cat: WR	FR vs. WR Reference cat: WR	BCR vs. FR Reference cat: FR
the practice website (yes)	13.5% Q3	53.8%	8.5%	10.9%	11.44*** (3.61–36.27)	1.24 (0.48–3.16)	9.24*** (3.53–24.20)
The GP or GP trainee checked ...							
the feasibility of isolation at home when indicated. (always)	32.1% Q1	26.1%	25.2%	36.6%	0.95 (0.43–2.09)	1.53 (0.93–2.52)	0.62 (0.29–1.30)
the feasibility of transport to another facility in case of a referral. (always)	43.4% Q2	39.5%	49.3%	41.0%	0.61 (0.30–1.25)	0.61* (0.39–0.97)	0.99 (0.50–1.98)
The GP or GP trainee screened whether a patient experienced ...							
Domestic violence (more or much more than before COVID-19)	17.1% Q1	22.7%	17.4%	16.0%	1.22 (0.53–2.84)	0.74 (0.41–1.35)	1.65 (0.73–3.70)
financial problems (more or much more than before COVID-19)	40.9% Q1	50.0%	46.4%	36.2%	1.11 (0.55–2.24)	0.54* (0.34–0.87)	2.04 (1.03–4.02)
<i>Safe and effective care</i>							
Building/infrastructure of the practice							
Experiences of limitations to be able to provide high-quality care <sup>b</sup> . (to a large or limited extent)	55.5% Q2	53.2%	39.1%	64.6%	1.65 (0.80–3.41)	1.94** (1.21–3.10)	0.85 (0.43–1.70)
Considering making adjustments in future <sup>b</sup> . (to a large or limited extent)	37.1% Q1	39.1%	32.0%	39.8%	1.20 (0.57–2.51)	1.03 (0.64–1.68)	1.16 (0.58–2.32)
Appointment system							
Online appointment: informative message about symptoms patients may not enter the practice (yes)	81.5% Q1	66.7%	56.0%	89.2%	1.21 (0.38–3.81)	4.27*** (1.85–9.83)	0.28* (0.10–0.82)
Online appointment: patients needed to give a reason for encounter (yes)	68.2% Q2	59.1%	60.0%	71.2%	0.74 (0.25–2.15)	1.31 (0.62–2.79)	0.56 (0.22–1.44)
Appointment by phone: patients needed to give a reason for encounter (yes)	85.4% Q3	81.8%	84.4%	86.5%	0.81 (0.31–1.80)	1.07 (0.57–2.03)	0.75 (0.31–1.80)
Protocol for answering phone calls from potential COVID-19 patients							
Availability of a protocol (yes)	68.7% Q4	69.8%	61.8%	72.1%	1.26 (0.57–2.76)	1.11 (0.68–1.82)	1.13 (0.52–2.44)

**Table 2** (continued)

	Valid percentage				Odds Ratio (95% Confidence Interval)		
	Belgium (total) Quartile	Brussels-Capital Region (BCR)	Walloon Region (WR)	Flemish Region (FR)	BCR vs. WR Reference cat: WR	FR vs. WR Reference cat: WR	BCR vs. FR Reference cat: FR
<b>Triage</b>							
Using a protocol for answering calls if this was available. (always)	26.3% Q4	20.0%	29.1%	26.0%	0.56 (0.20–1.56)	0.69 (0.36–1.31)	0.81 (0.30–2.16)
Calling patients who made an online appointment to check infection risk. (always)	28.0% Q3	26.5%	21.8%	31.1%	0.94 (0.36–2.40)	1.44 (0.83–2.50)	0.65 (0.27–1.58)
Availability of a GP as a backup when a non-GP does the telephonic triage. (always)	79.8% Q2	55.0%	70.9%	86.3%	0.31* (0.10–0.94)	1.80 (0.85–3.80)	0.17** (0.06–0.51)
Availability of the most recent information on how to refer a patient to a triage station in each GP consultation room. (yes)	75.2% Q3	72.5%	75.4%	76.4%	0.88 (0.38–2.02)	1.09 (0.63–1.91)	0.81 (0.37–1.75)
<b>Cleaning the practice</b>							
Using a detailed cleaning protocol by cleaning employees during COVID-19. (always)	57.2% Q4	46.7%	58.3%	58.6%	0.50 (0.24–1.05)	0.98 (0.61–1.57)	0.52 (0.26–1.04)
Sufficient time between consultations for the disinfection. (always)	38.5% Q2	46.7%	41.4%	35.4%	1.18 (0.59–2.39)	0.83 (0.52–1.32)	1.43 (0.73–2.80)
<b>Home visits</b>							
Availability of a separate medical bag for (possible) infection-related consultations. (yes)	27.9% Q4	22.7%	36.3%	24.0%	0.47 (0.20–1.07)	0.66 (0.41–1.09)	0.70 (0.31–1.59)
<b>Timely care</b>							
Occurrence of a safety incident in which a patient with an urgent condition was seen late because							
the patient did not come to the practice sooner <sup>b</sup> . (yes)	70.9% Q4	61.9%	62.7%	76.5%	0.93 (0.44–1.99)	1.47 (0.88–2.46)	0.63 (0.30–1.33)
the patient did not know how to reach a GP <sup>b</sup> . (yes)	39.3% Q4	48.6%	22.8%	46.9%	2.58* (1.14–5.82)	2.63*** (1.53–4.53)	0.98 (0.46–2.09)
the situation was assessed as non-urgent during the telephonic triage <sup>b</sup> . (yes)	26.0% Q4	18.4%	26.0%	26.9%	0.74 (0.29–1.90)	1.13 (0.65–1.98)	0.66 (0.27–1.62)



**Table 2** (continued)

	Valid percentage				Odds Ratio (95% Confidence Interval)		
	Belgium (total) Quartile	Brussels-Capital Region (BCR)	Walloon Region (WR)	Flemish Region (FR)	BCR vs. WR Reference cat: WR	FR vs. WR Reference cat: WR	BCR vs. FR Reference cat: FR
Occurrence of safety incident because a patient with a fever caused by a non-COVID infection was seen late due to the COVID-19 protocol <sup>b</sup> . (yes)	47.9% Q4	46.3%	48.5%	48.0%	0.67 (0.32–1.42)	0.68 (0.42–1.11)	0.98 (0.48–2.01)
<i>Efficient care</i>							
Change of roles compared to before COVID-19 including a greater involvement of							
Staff members <sup>a</sup> : triaging of patients (yes)	91.1% Q1	88.9%	80.3%	95.2%	1.46 (0.27–7.98)	0.34 (0.11–1.02)	0.49 (0.08–2.90)
Staff members <sup>a</sup> : giving information and recommendations to patients contacting the practice by phone (yes)	85.4% Q3	88.9%	75.8%	88.5%	1.94 (0.35–10.65)	0.85 (0.34–2.11)	1.65 (0.29–9.21)

odds ratios (ORs) are used to represent the likelihood of outcomes. An OR > 1 indicates an increased likelihood of the outcome as the predictor variable increases, while an OR < 1 suggests a decreased likelihood. For ORs < 1, interpretations can be inverted for clarity. This inversion aids in easier comprehension while maintaining statistical accuracy

Adjusted models included the following covariates: practice type (solo, duo, or group); being a teaching practice for GP trainees (yes or no); multidisciplinary of the practice (yes or no); and payment system of the practice (fee-for-service or capitation)

\**p*<0.05

\*\**p*<0.01

\*\*\**p*<0.001

<sup>a</sup> only GP practices with more than one paid staff member were included in the analyses

<sup>b</sup> these outcome variables were inverse scored to calculate the quartiles; Q1 included the eight countries that performed best on high-quality care for the respective outcome variable, and Q4 represented the eight countries that obtained the worse scored regarding high-quality care

was significantly more likely the case in the FR than in the BCR (*p* < 0.01). In 75.2% of the practices (*n* = 319), the most recent information on referring patients to a triage station was within immediate reach in every GP consultation room.

During COVID-19, cleaning employees in more than half of the practices (*n* = 265; 57.2%) always used a detailed protocol for cleaning the practice. In addition, in only 38.5% of the practices (*n* = 178), there was always sufficient time between every consultation to disinfect the consultation room. A total of 27.9% of the practices (*n* = 130) had a separate doctor bag available for infection-related home visits as an infection prevention measure. Belgium’s performance on a European level showed considerable variation, generally ranking in the top half (Q1-Q2) for aspects such as experienced limitations related to the building/infrastructure and showing informative messages in the online appointment system, but positioned lower (Q3-Q4) in areas such as the

availability of a telephone protocol and consistently calling online-booked patients to verify the infection risk.

**Timely care**

Regarding the timeliness of care, 310 practices (70.9%) reported a safety incident in which a patient with an urgent condition was seen late because the patient did not come to the practice sooner (Table 2). Almost two-fifths (*n* = 151; 39.3%) of practices encountered similar patient safety incidents because a patient did not know how to reach the GP sooner, which was significantly more common in the BCR (*p* < 0.05) and the FR (*p* < 0.001) than in the WR. About one-fourth (*n* = 105; 26.0%) of the practices experienced at least one safety incident in which a patient with an urgent condition was seen late due to misjudgment as non-urgent during the telephone triage. Almost half of the practices (*n* = 203; 47.9%) experienced a safety incident in which a patient with a fever due to a non-COVID-infection was seen late due to the COVID-19 protocol. All these situations were more often



reported in Belgium than in at least three-quarters of the other European countries (Q4).

### **Efficient care**

Compared to before COVID-19, non-GP staff members were more involved in triaging patients ( $n=226$ ; 91.1%) and giving information and recommendations to patients contacting the practice by phone ( $n=210$ ; 85.4%) (Table 2). Regarding triaging patients, Belgium was ranked in the top of European countries (Q1), where it was in Q3 for the latter outcome variable.

### **Discussion**

The main aim of this paper was to describe the organization of care in Belgian GP practices during COVID-19 from the perspective of the six dimensions of quality of care: equity, patient-centeredness, safety, effectiveness, timeliness, and efficiency. Moreover, differences between the three Belgian regions were investigated, and Belgium was benchmarked against a pool of 36 other European countries. The results show that Belgian GP practices made important structural and organizational adjustments to guarantee high-quality care in all its dimensions but also encountered challenges in doing so.

Belgian GP practices made important efforts to deliver equitable and person-centered care, such as setting up outreach work. Proactive care for patients with a chronic condition was quite common in Belgium. However, practices did not frequently reach out to psychologically vulnerable patients or patients with known problems of domestic violence or issues related to raising or parenting a child. Based on the findings of another PRICOV-19 paper, the Belgian numbers were lower than the European average, except for proactive care for patients with a psychological vulnerability [30]. Setting up outreach work was one of the new tasks within practices during COVID-19. Half of the Belgian practices indicated that GPs and/or GP trainees were more often involved in actively reaching out to patients who might postpone healthcare, which was less the case for non-GP staff members. The importance of outreach work is highlighted by the high rates of postponement of care observed in recent population-based research during COVID-19, particularly among patients with a certain vulnerability [31]. Another international PRICOV-19 paper demonstrated that many GPs were happy with the overall task changes during COVID-19 but they also felt the need for further training [32]. Thus, training for GPs and non-GPs in particular to organize outreach work may be appropriate. Furthermore, a precondition for setting up proactive care is the identification of patients with a certain vulnerability. However, previous research demonstrated that person-related information is not systematically recorded

or noted in the medical file of patients [33]. This paper also showed that Belgian practices did not have the habit of using the medical records to analyze practice performance or identify patients at risk. These findings stress the importance of integrating the patients' social context in the medical record and using the medical record as a tool to guide practice policy, such as setting up initiatives for patients who seem to postpone healthcare [33].

In line with the international PRICOV-19 findings, the pandemic boosted the shift of tasks and roles from the GP to other staff members [32]. For example, during COVID-19, Belgian non-GPs were more engaged in informing or giving additional explanations about what the caregiver said to vulnerable patients. One vulnerable group was patients with limited knowledge of the official language. Although the survey did not specify whether multilingual communication included other official languages in Belgium (e.g., French in the FR) or minority languages (e.g., Arabic), the availability of multilingual communication varied between the Belgian regions in line with its official languages. Only a minority of the practices in the FR and WR had a leaflet, practice website, or message on their answering machine in multiple languages. Overall, language barriers are considered detrimental to the ability of patients to access care [22]. European countries face an increasing migrant population with diverse languages and cultural backgrounds, which will grow in the upcoming decennia [34, 35]. Therefore, other regions in Belgium and Europe can learn from practices in the BCR how to implement multilingual communication in the future.

Less than half of the practices always checked with patients about the feasibility of transport to another facility when being referred or isolated at home. Compared to before COVID-19, GPs and/or GP trainees screened patients' financial status more often, but screening for domestic violence happened in less than one-fifth of practices. These findings raise concerns as more problems of financial distress and domestic violence have been observed worldwide since COVID-19 [36, 37]. The World Health Organization highlighted the critical role of PC in meeting the needs of vulnerable patients [38], but previous studies also reported that GPs would overestimate patients' socioeconomic status [26]. Therefore, this study recommends preparing students as early as possible during their education in general practice to fulfil this key role as the primary contact point. The main topics could be the awareness of patient vulnerability and training them to discuss sensitive issues regarding the patient's context. Further training is also warranted for GPs during their professional career to refine their skills.

Regarding safe and effective care, infection prevention and control (IPC) in processes and procedures should be prioritized in GP practices to avoid spreading the

SARS-COV-2 virus among patients and staff members. Its importance ties in with the high rates of COVID-19 infections among healthcare professionals due to multiple prolonged exposures [39]. However, many Belgian practices experienced limitations related to the building or the practice's infrastructure to provide safe care. Other studies refer to, for example, the inability to separate patient flows or insufficient air ventilation [40–42]. About one-third of Belgian practices felt that their building and infrastructure needed adjustment in the future, which is lower than the proportion overall found in participating counties in PRICOV-19 (i.e., approximately 54%) [43]. Moreover, Windak et al. indicated that among others, improved IPC equipment is an important factor associated with a reduced perceived need for infrastructural changes [43]. Therefore, IPC should be a point of attention in the conceptualization phase of a practice building. However, literature or recommendations on this topic are scarce. For example, the Dutch College of General Practitioners guidelines include IPC recommendations regarding personal hygiene, protective equipment, cleaning and disinfection of instruments, rooms, furniture, and objects, but not for the organization of the practice building [44]. Moreover, a manual on the (re)construction and design of multidisciplinary healthcare centers in the Netherlands only minimally focuses on how to design the building from an IPC perspective [45]. Also, IPC is barely addressed in the training of architects or designers. Initiatives to fill this knowledge gap are needed.

For most outcome variables on the appointment system and triage, Belgium was benchmarked in the middle against other European countries. However, Belgium ranked in the lowest quartile for always using a telephone protocol for potential COVID-patients, verifying the infection risk in uncertain cases, and providing separate medical bags for home visits involving potential infectious patients. Using protocols can contribute to a better quality of care and reduce patient safety incidents [16]. Therefore, professional organizations are encouraged to put IPC guidelines in the spotlight to reduce the risk of transmission of viruses.

This study found important shortcomings regarding the timeliness of care. Many Belgian practices were faced with patient safety incidents in which patients were seen too late because the patient did not know how to reach a GP, because the patient was wrongly assessed as non-urgent during the telephone triage, or the diagnosis was delayed because of the COVID-19 protocol. With these results, Belgian practices rank remarkably low in the European ranking. Nevertheless, these results are based on the GPs' perceptions of whether these incidents happened. Consequently, the differences between countries could not only be explained by differences in patient

safety but also differences in the patient safety culture between countries. In PC, a positive patient safety culture (PSC) manifests itself, among other things, in open communication and reporting and analysis of incidents in a non-punitive approach [46]. Sharp, Rannus, et al. [47] have already demonstrated that these elements may differ significantly from country to country among nurses in secondary care, implying an important influence of national culture on safety practices. Belgian practices may be associated with a positive PSC leading to a high number of reported incidents during COVID-19. To verify these statements, comparative cross-country research on the existing PSC in GP practices is essential. In any case, the pandemic resulted in the postponement of care and an increased risk of patient safety incidents [48, 49]. An awareness among GPs that this side effect occurs during major epidemics could be a starting point for practice improvement projects preparing the practice for future infectious outbreaks. These can be based on a critical incident analysis, the importance of which has been demonstrated previously [9, 50].

COVID-19 confronted GP practices with limited time availability, infrastructure, protective equipment, and even staff members due to COVID-19 infection or quarantine, which hampered efficient care delivery. Implementing protocols may also benefit the profitable use of resources and offer the possibility of delegating tasks among staff members. Belgian practices were aware of this as many duo and group practices reported that non-GPs took on a larger role in triaging patients and helping patients who contacted the practice. Practices were inundated by calls from patients, which rendered such support indispensable. These findings raised concerns about the situation and well-being of GPs working in solo practices. Analyses of the international dataset on PRICOV-19 confirmed higher distress among GPs in smaller practices [51]. Thus, research on how GPs working in small practices could be supported to deal with a high workload and improve efficiency is essential.

Adjusting for the structural practice characteristics in the regression analysis, limited significant differences were found between the three Belgian regions, indicating that the variations between the regions might stem from practice characteristics rather than cultural differences. This finding is in line with other studies showing the impact of several practice characteristics on quality of care outcomes. A national study in France demonstrated that multi-professional group practices are strongly related to a higher level of reorganization than other practice types during the pandemic [52]. A Dutch cross-sectional study in the pre-COVID era has pointed out that GP practices consisting of more than two GPs may have better safety management than small GP

practices regarding medication, medical record keeping, and hygiene [53]. Literature on the impact of financing (capitation versus fee-for-service) during the pandemic is still inconsistent [15, 28], thus highlighting the need for further investigation.

In addition to practice characteristics, adaptations in PC during COVID-19 also vary among countries, according to previous research [54, 55]. This implies that characteristics of the healthcare system may play a part in coping with the challenges of COVID-19. However, cross-country comparative analyses on the international PRICOV-19 dataset, including the data from more than 5,000 GP practices across Europe, are needed to verify this hypothesis. These may focus on system and practice characteristics contributing to better quality care and the underlying mechanisms leading to this contribution.

### Strengths and limitations

Globally, experts have already stressed the lack of research on the position of PC during the COVID-19 pandemic [2, 9]. This study provided an answer regarding Belgium based on 479 GP practices. According to earlier studies in PC [52, 56], response rates of 25.1% and 81.3% for randomized and convenience sampling methods were reasonable for Belgium. The sample composition among the regions corresponded generally to the actual distribution of GPs in Belgium (IMA-AIM, 2021), implying that a representative sample participated in this study for this criterion. Other characteristics of the GP practices were not compared because of the lack of relevant comparative data. However, a few limitations should also be noted.

Firstly, participation in this study was voluntary, resulting in a risk of self-selection bias and a small sample size. Possibly, mainly GP practices interested in the quality of care and patient safety participated in the study. A few outcome variables had considerable missing data. However, the analysis did not address whether these missing values occurred randomly. Data were collected through an online self-reported survey, so no information on the actual practice organization is known. Furthermore, a few outcome variables focused on differences between the situation before and during COVID-19. Their results should be interpreted carefully as practices that already performed well could not make the same progress as other practices. In addition, only one survey was completed per GP practice as described in the study protocol, thanks to the close collaboration among the research teams involved. It implies that the reliability of the answers also relied on the familiarity of the participating staff member with the practice processes and procedures. However, the function of the participating staff member was not considered in the analyses. In addition, participants were mainly recruited through randomized

sampling, supplemented by a convenient sample. However, to adhere to the General Data Protection Regulation (GDPR), the information concerning the sample allocation of each participant was removed during data processing, rendering it impossible to ascertain whether any significant discrepancies existed in the composition or performance between the two samples.

Data collection was spread between December 2020 and August 2021, owing to the time-consuming recruitment process. Due to the lack of an accurate registry of all GP practices in Belgium, recruitment had to be done at the GP level, which required looking up contact details and ensuring that only one GP was invited per practice. This period encompassed three large waves of the COVID-19 pandemic in Belgium, implying that the timing might have affected the study results. Therefore, the results only demonstrated a snapshot of the practice organization during COVID-19. Consequently, making any statements about possible permanent changes in Belgian practices' practice organization or quality policy is impossible. Monitoring the amended practice organization and their sustainability over time might be useful.

### Conclusion

Overall, Belgian GP practices made important organizational efforts to deliver high-quality care in all six dimensions during COVID-19. Outreach work was organized for vulnerable patients regarding equitable and person-centered care. However, proactive care was more common for patients with a chronic condition than for patients with a psychological vulnerability or known problems of domestic violence or parenting situation. More than half of the practices were confronted with limitations regarding the infrastructure or building to deliver safe and effective care. In addition, safety incidents occurred in practices leading to delayed care among patients with an urgent condition. Many practices used the pandemic as an opportunity to enhance the efficiency of care by redistributing tasks and roles among GPs and non-GPs.

In terms of a leaflet with COVID-information, practice leaflet or website, or answering messages, the availability of multilingual communication varied between the Belgian regions in line with its official languages. Therefore, FR and WR practices may benefit from adopting strategies used in the BCR for effective multilingual communication in the future. Controlling for the structural practice characteristics in the regression analysis, limited significant differences were found between the three Belgian regions. Belgium performed relatively well on the European level, except for the outcome variables on the timeliness of care. Hereby, Belgian practices reported more incidents of delayed care

among non-COVID-patients than in at least 28 other European countries. Future studies using different design methods are crucial to verify and elaborate on the conclusions here, particularly to understand which system and practice characteristics contribute to better quality care.

#### Abbreviations

GP	General practitioner
GP practice	General practice
PC	Primary care
PRICOV-19	Quality and safety in Primary care in times of COVID-19
BCR	Brussels-Capital Region
FR	Flemish Region
WR	Walloon Region
Q	quartile
IPC	Infection prevention and control
PSC	patient safety culture
SSMG	Société Scientifique de Médecine Générale
GDPR	General Data Protection Regulation

#### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12875-024-02305-8>.

**Additional file 1.** Survey questions and their original and recoded answer options that were the basis for the outcome variables, including the number of missing values per variable in the cleaned dataset.

**Additional file 2.** Comparison of Belgium to 36 other European countries and between the Belgian regions: descriptive statistics and unadjusted and adjusted binary logistic regression models for the six dimensions of quality of care.

#### Acknowledgements

The authors wish to express their sincere gratitude to all the participating GP practices in Belgium, which are, among other things, recruited with the valued support of Domus Medica and VWGC (Vereniging van Wijkgezondheidscentra). In addition, the contribution of Dr. Susan Lagaert (UGent) and Dr. Bianca Silva (UGent) in the analyses was appreciated.

#### About this supplement

This article has been published as part of BMC Primary Care Volume 24 Supplement 1, 2023: COVID-19 and beyond – lessons for the future of primary care. The full contents of the supplement are available online at <https://bmcpri.imcare.biomedcentral.com/articles/supplements/volume-24-supplement-1>.

#### Authors' contribution

PVB and SW led the conceptualization and design of the study. EVP and SW developed the funding application. EVP and SW led the coordination of the study in the Dutch-speaking regions of Belgium. BP, CP, MDJ, AD, NG, and MG coordinated the study in the French-speaking regions of Belgium. EVP performed the analyses. EVP and SW wrote the draft. All authors critically reviewed it and provided comments to improve the paper. CC was responsible for the English editing. Finally, all authors read and approved the final manuscript.

#### Funding

The PRICOV-19 study was set up in close collaboration with the 'European Society of Quality and Safety in Family Practice (EQuiP) and implemented without external funding except for a small grant from the 'European General Practice Research Network' (EGPRN). This publication was funded by a grant of the King Baudouin Foundation (Belgium). The funding bodies had no influence in the design of the study and collection, analysis, and interpretation of data and in writing the manuscript.

#### Availability of data and materials

All data are centrally stored on the server of Ghent University (Belgium). All data was anonymized at Ghent University, and all raw data that could lead to the identification of the participants was permanently removed. Reasonable request is required to access non-identifiable data by users who are external to the PRICOV-19 consortium. Access will be subject to a data transfer agreement and following approval from the principal investigator of the PRICOV-19 study.

#### Declarations

##### Ethics approval and consent to participate

The study was conducted according to the principles of the Declaration of Helsinki. The Research Ethics Committee of Ghent University Hospital approved the protocol of the PRICOV-19 study and Belgian data collection (BC-07617). All participants gave explicit informed consent on the first page of the online survey.

##### Consent for publication

Not applicable.

##### Competing interests

The authors reported no potential conflict of interest.

#### Author details

<sup>1</sup>Department of Public Health and Primary Care, Ghent University, Ghent, Belgium. <sup>2</sup>Quality and Safety Ghent, Department of Public Health and Primary Care, Ghent University, Ghent, Belgium. <sup>3</sup>Department of Public Health, Faculty of Medicine, University of Liège, Liège, Belgium. <sup>4</sup>Institute of Health and Society, University of Louvain, Louvain, Belgium. <sup>5</sup>Research Centre, Irish College of General Practitioners, Dublin D02 XR68, Ireland. <sup>6</sup>Centre Académique de Médecine Générale, Université Catholique de Louvain, Brussels, Belgium.

Received: 7 October 2022 Accepted: 9 February 2024

Published online: 05 March 2024

#### Reference list

1. El Bcheraoui C, Weishaar H, Pozo-Martin F, Hanefeld J. Assessing COVID-19 through the lens of health systems' preparedness: time for a change. *Global Health*. 2020;16(112):1–5.
2. Windak A, Frese T, Hummers E, Klemenc Ketis Z, Tsukagoshi S, Vilaseca J, et al. Academic general practice/family medicine in times of COVID-19—perspective of WONCA Europe. *Eur J Gen Pract*. 2020;26(1):182–8.
3. Park S, Elliott J, Berlin A, Hamer-Hunt J, Haines A. Strengthening the UK primary care response to covid-19. *BMJ*. 2020;370:m3691.
4. Khalil-Khan A, Khan MA. The impact of COVID-19 on primary care: a scoping review. *Cureus*. 2023;15(1):e33241.
5. Kidd M. Australia's primary care COVID-19 response. *Aust J Gen Pract*. 2020;49:1–2.
6. Shbaklo N, Lupia T, De Rosa FG, Corcione S. Infection control in the era of COVID-19: a narrative review. *Antibiotics*. 2021;10(10):1244.
7. de Sutter A, Llor C, Maier M, Mallen C, Tatsioni A, van Weert H, et al. Family medicine in times of 'COVID-19': a generalists' voice. *Eur J Gen Pract*. 2020;26(1):58–60.
8. Matenge S, Sturgiss E, Desborough J, Hall Dykgraaf S, Dut G, Kidd M. Ensuring the continuation of routine primary care during the COVID-19 pandemic: a review of the international literature. *Fam Pract*. 2022;39(4):747–61.
9. Kurotschka PK, Serafini A, Demontis M, Serafini A, Mereu A, Moro MF, et al. General practitioners' experiences during the first phase of the COVID-19 pandemic in Italy: a critical incident technique study. *Front Public Health*. 2021;9:623904.
10. Sahu AK, Nayer J, Aggarwal P. Novel coronavirus: a capsule review for primary care and acute care physicians. *J Family Med Prim Care*. 2020;9(4):1820.
11. Domus Medica. Tien vuistregels voor veilig (blijven) werken: check! 2020. Available from: <https://www.domusmedica.be/actueel/tien-vuistregels-voor-veilig-blijven-werken-check>. Accessed 7 Oct 2022.



12. la Société Scientifique de Médecine Générale. Actualité COVID-19 2022 [Available from: [https://www.ssmg.be/avada\\_portfolio/actualite-covid-19/](https://www.ssmg.be/avada_portfolio/actualite-covid-19/). Accessed 7 Nov 2023.
13. Sciansano. COVID-19 procedures [Available from: <https://covid-19.sciansano.be/nl/covid-19-procedures>. Accessed 7 Nov 2023.
14. Vaes B, Vos B, Foidart M, De Schreye R, Schrans D, Philips H, et al. Burden of COVID-19 on primary care: a prospective Nationwide Observational Study. *Arch Public Health*. 2021;80(1):250.
15. Danhieux K, Buffel V, Pairen A, Benkheil A, Remmen R, Wouters E, van Olmen J. The impact of COVID-19 on chronic care according to providers: a qualitative study among primary care practices in Belgium. *BMC Fam Pract*. 2020;21(1):255.
16. Khan N, Jones D, Grice A, Alderson S, Bradley S, Carder P, et al. A brave new world: the new normal for general practice after the COVID-19 pandemic. *BJGP Open*. 2020;4(3):bjgpopen20X101103.
17. Rawaf S, Allen LN, Stigler FL, Kringos D, Quezada Yamamoto H, van Weel C, et al. Lessons on the COVID-19 pandemic, for and by primary care professionals worldwide. *Eur J Gen Pract*. 2020;26(1):129–33.
18. Singu S, Acharya A, Challagundla KB, Byrareddy SN. Impact of social determinants of health on the emerging COVID-19 pandemic in the United States. *Front Public Health*. 2020;8:406.
19. McNeely CL, Schintler LA, Stabile B. Social determinants and COVID-19 disparities: Differential pandemic effects and dynamics. *World Med Health Policy*. 2020;12(3):206–17.
20. Jani A. Preparing for COVID-19's aftermath: simple steps to address social determinants of health. *J R Soc Med*. 2020;113(6):205–7.
21. Matenge S, Sturgiss E, Desborough J, Hall SD, Dut G, Kidd M. Ensuring the continuation of routine primary care during the COVID-19 pandemic: a review of the international literature. *Fam Pract*. 2021;39(4):747–61.
22. Golinelli D, Sanmarchi F, Capodici A, Gribaudo G, Altini M, Rosa S, et al. Variations of the quality of care during the COVID-19 pandemic affected the mortality rate of non-COVID-19 patients with hip fracture. *Plos One*. 2022;17(2):e0263944.
23. Labrague LJ, de Los Santos JAA, Fronda DC. Factors associated with missed nursing care and nurse-assessed quality of care during the COVID-19 pandemic. *J Nurs Adm Manag*. 2022;30(1):62–70.
24. Van Poel E, Vanden Bussche P, Klemenc-Ketis Z, Willems S. How did general practices organize care during the COVID-19 pandemic: the protocol of the cross-sectional PRICOV-19 study in 38 countries. *BMC Prim care*. 2022;23(1):1–11.
25. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208.
26. National Institute for Health and Disability Insurance. Een zorgverlener zoeken. Available from: <https://webapps.riziv-inami.fgov.be/silverpages/>. Accessed 1 Nov 2022.
27. Institute of Medicine Committee on Quality of Health Care. Crossing the Quality Chasm: a New Health System for the 21st Century. Washington (DC): National Academies Press (US); 2001.
28. Korneta P, Kludacz-Alessandri M, Walczak R. The impact of COVID-19 on the performance of primary health care service providers in a capitation payment system: a case study from Poland. *Int J Environ Res Public Health*. 2021;18(4):1407.
29. Bouchez T, Gautier S, Le Breton J, Bourgueil Y, Ramond-Roquin A. The challenge for general practitioners to keep in touch with vulnerable patients during the COVID-19 lockdown: an observational study in France. *BMC Prim care*. 2022;23(1):82.
30. Van Poel E, Collins C, Groenewegen P, Spreeuwenberg P, Bojaj G, Gabrani J, et al. The organization of outreach work for vulnerable patients in general practice during COVID-19: results from the cross-sectional PRICOV-19 study in 38 countries. *Int J Environ Res Public Health*. 2023;20(4):3165.
31. Splinter MJ, Velek P, Ikram MK, Kieboom BCT, Peeters RP, Bindels PJE, et al. Prevalence and determinants of healthcare avoidance during the COVID-19 pandemic: a population-based cross-sectional study. *Plos Med*. 2021;18(11):e1003854.
32. Groenewegen P, Van Poel E, Spreeuwenberg P, Batenburg R, Mallen C, Murauskiene L, et al. Has the COVID-19 pandemic led to changes in the tasks of the primary care workforce? An international survey among general practices in 38 countries (PRICOV-19). *Int J Environ Res Public Health*. 2022;19(22):15329.
33. Schrans D, Avonts D, Christiaens T, Willems S, De Smet K, van Boven K, et al. The search for person-related information in general practice: a qualitative study. *Fam Pract*. 2016;33(1):95–9.
34. O'Donnell CA, Burns N, Mair FS, Dowrick C, Clissmann C, van den Muijsenbergh M, et al. Reducing the health care burden for marginalised migrants: the potential role for primary care in Europe. *Health Policy*. 2016;120(5):495–508.
35. International Organization of Migration. World Migration Report 2020. Geneva: International Organization for Migration; 2019.
36. Kourti A, Stavridou A, Panagouli E, Psaltopoulou T, Spiliopoulou C, Tsolia M, et al. Domestic violence during the COVID-19 pandemic: a systematic review. *Trauma, violence, and abuse*. 2021;15248380211038690:719–45.
37. Koch M, Park S. Do government responses impact the relationship between age, gender and psychological distress during the COVID-19 pandemic? A comparison across 27 European countries. *Soc Sci Med*. 2022;292:114583.
38. World Health Organization. A vision for primary health care in the 21st century: towards universal health coverage and the Sustainable Development Goals. Geneva: World Health Organization; 2018.
39. Chou R, Dana T, Buckley DJ, Selph S, Fu R, Totten AM. Epidemiology of and risk factors for coronavirus infection in health care workers: a living rapid review. *Ann Intern Med*. 2020;173(2):120–36.
40. World Health Organization. Infection prevention and control of epidemic and pandemic-prone acute respiratory infections in health care. Geneva: World Health Organization; 2014.
41. Fernemark H, Skagerström J, Seing I, Hårdstedt M, Schildmeijer K, Nilsen P. Working conditions in primary healthcare during the COVID-19 pandemic: an interview study with physicians in Sweden. *BMJ Open*. 2022;12(2):e055035.
42. Turner A, Scott A, Horwood J, Salisbury C, Denholm R, Scott L, et al. Maintaining face-to-face contact during the COVID-19 pandemic: a longitudinal qualitative investigation in UK primary care. *BJGP Open*. 2021;5(5):1–11.
43. Windak A, Nessler K, Van Poel E, Collins C, Wójtowicz E, Murauskiene L, et al. Responding to COVID-19: the suitability of primary care infrastructure in 33 countries. *Int J Environ Res Public Health*. 2022;19(24):17015.
44. Nederlands Huisartsen Genootschap. Richtlijn Infectiepreventie in de huisartsen- en verloskundigenpraktijk 2021 [Available from: <https://www.nhg.org/themas/publicaties/nhg-richtlijn-infectiepreventie>. Accessed 7 Oct 2022.
45. Landelijke Huisartsen Vereniging. Utrecht: Bouw Gezondheidscentra: Graon; 2015.
46. Kirk S, Parker D, Claridge T, Esmail A, Marshall M. Patient safety culture in primary care: developing a theoretical framework for practical use. *Qual Saf Health Care*. 2007;16(4):313–20.
47. Sharp L, Rannus K, Olofsson A, Kelly D, Oldenmenger WH, EONS RECaN group. Patient safety culture among European cancer nurses—An exploratory, cross-sectional survey comparing data from Estonia, Germany, Netherlands, and United Kingdom. *J Adv Nurs*. 2019;75(12):3535–43.
48. Jones D, Neal RD, Duffy SR, Scott SE, Whitaker KL, Brain K. Impact of the COVID-19 pandemic on the symptomatic diagnosis of cancer: the view from primary care. *Lancet Oncol*. 2020;21(6):748–50.
49. Albert SL, Paul MM, Nguyen AM, Shelley DR, Berry CA. A qualitative study of high-performing primary care practices during the COVID-19 pandemic. *BMC Fam Pract*. 2021;22(1):237.
50. Curran C, Lydon S, Kelly ME, Murphy AW, O'Connor P. An analysis of general practitioners' perspectives on patient safety incidents using critical incident technique interviews. *Fam Pract*. 2019;36(6):736–42.
51. Collins C, Clays E, Van Poel E, Cholewa J, Tripkovic K, Nessler K, et al. Distress and wellbeing among general practitioners in 33 countries during COVID-19: results from the cross-sectional PRICOV-19 study to inform health system interventions. *Int J Environ Res Public Health*. 2022;19(9):5675.
52. Saint-Lary O, Gautier S, Le Breton J, Gilbert S, Frappé P, Schuers M, et al. How GPs adapted their practices and organisations at the beginning of COVID-19 outbreak: a French national observational survey. *BMJ Open*. 2020;10(12):e042119.
53. Gaal S, van den Hombergh P, Verstappen W, Wensing M. Patient safety features are more present in larger primary care practices. *Health Policy*. 2010;97(1):87–91.

54. Huston P, Campbell J, Russell G, Goodyear-Smith F, Phillips RL, van Weel C, Hogg W. COVID-19 and primary care in six countries. *BJGP Open*. 2020;4(4):bjgpopen20X101128.
55. van der Velden AW, Bax EA, Bongard E, Aabenhus RM, Anastasaki M, Anthierens S, et al. Primary care for patients with respiratory tract infection before and early on in the COVID-19 pandemic: an observational study in 16 European countries. *BMJ Open*. 2021;11(7):e049257.
56. Ricci-Cabello I, Avery AJ, Reeves D, Kadam UT, Valderas JM. Measuring patient safety in primary care: the development and validation of the patient reported experiences and outcomes of Safety in Primary Care (PREOS-PC). *Ann Fam Med*. 2016;14(3):253–61.

### **Publisher's Note**

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.