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Beliefs and practices among primary care physicians during the first wave of the COVID-19 pandemic in Baden-Wuerttemberg (Germany): an observational study

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Abstract

Background During the first wave of the COVID-19 pandemic various ambulatory health care models (SARS-CoV-2 contact points) were organised in a short period in Baden-Wuerttemberg, a region in Southern Germany. The aim of these SARS-CoV-2 contact points was to ensure medical treatment for patients with (suspected) and without SARS-CoV-2 infection. The present study aimed to assess the beliefs and practices of primary care physicians who either led a SARS-CoV-2 contact point or a primary care practice in Baden-Wuerttemberg during the first wave of the COVID-19 pandemic.

Methods This cross-sectional study was based on a paper-based questionnaire in primary care physicians during the first wave of the pandemic. Participants were identified via the web page of the Association of Statutory Health Insurance Physicians Baden-Wuerttemberg. The questionnaire was distributed between June and July 2020. It measured knowledge, practices, self-efficacy and fears towards SARS-CoV-2, using newly developed questions. Data was descriptively analysed.

Results 155 participants (92 leads of SARS-CoV-2 contact points/ 63 leads of primary care practices) completed the questionnaire. About half participants of both groups did not fear an own infection with the novel virus (between 50.8% and 65.2%), however about 75 % feared financial loss. Knowledge was gained using various sources; main sources were the Association of Statutory Health Insurance Physicians (between 79.3% and 82.5%) and the German Society for Hygiene and Microbiology (RKI) (between 88.9% and 94.6%). SARS-CoV-2 contact points treated on average more patients with (suspected) COVID-19 (mean 431.59) than primary care practices (mean 83.8) ($p<0.001$). Leads of SARS-CoV-2 contact point felt more confident to perform anamnestic/diagnostic procedures ($p<0.001$). The same was found for the confidence level regarding decision-making concerning the further treatment ($p<0.001$). Several prevention measures to contain the spread of SARS-CoV-2 were adopted.

Conclusion Although primary care physicians rose to the challenges of the SARS-CoV-2 pandemic addressing their fears is essential. Next to adequate remuneration for COVID-19 care, support in the clinical and administrative management as well as a robust organisation of care are key issues to prevent exhaustion in the challenge of a prolonged response to the SARS-CoV-2 pandemic.

Trial registration The study has been prospectively registered at the German Clinical Trial Register (DRKS00022224).

Key words COVID-19; SARS-CoV-2, Primary Healthcare, Germany; Pandemic, Beliefs

Background

The novel coronavirus (SARS-CoV-2) which causes the disease COVID-19 was first recognized in the Chinese province of Wuhan, Hubei in December 2019 (1). The virus quickly spread into other provinces of China, to Thailand, Japan, South Korea, the USA, and Europe (2). In Germany, the Bavarian Health and Food Safety Authority confirmed the first patient infected with SARS-CoV-2 infection on 27 January 2020 (3). The effectiveness and resilience of health systems have an impact on the ability of a country to contain a pandemic (4, 5).

In Germany primary care physicians were responsible for a substantial part of the medical treatment of patients with (suspected) SARS-CoV-2 infection, comprising diagnostic testing, identification of those in need of hospital care, doing home visits, and supporting patients who manage the disease at home. At the same time, Germany's primary care sector had to ensure medical treatment for patients without a SARS-CoV-2 infection to prevent undersupply and were responsible to contain the spread of the virus within their practices and other health care facilities (e.g. nursing homes) (6). Although Germany has a reasonably strong primary care sector and a well-organized public health system (7), many challenges need to be addressed for the preventive measures adopted to be effective during the pandemic. A qualitative study conducted in Australia, Israel, and England, for example, showed many issues during the 2009/A/H1N1 pandemic: challenges in patient's consultation e.g. high flow of patients who thought they were infected needed to be treated, overall patient segregation was difficult to maintain, supply of personal protective equipment (PPE) was limited, communication of policies and guidelines, and an increased workload had an impact on ability to contain the pandemic (8). The influenza pandemic plan of Baden-Wuerttemberg (BW) (6), a region with about 11 million inhabitants in South-West Germany, states that patients should be treated within the primary healthcare sector as long as possible. Additionally, patients who need to be hospitalized should be referred to primary care as soon as their state of health allows it (6).

In BW a variety of ambulatory health care models (SARS-CoV-2 contact points), besides the regular primary care practices, were established in a short period as part of a crisis

management: 204 Subspecialised (primary care) Practices, 51 Fever Clinics, and 16 Testing sites (Status: June 2020) by primary care physicians in cooperation with the public health sector and the Association of Statutory Health Insurance Physicians (German: Kassenaerztliche Vereinigung Baden-Wuerttemberg (KVBW)). The newly implemented SARS-CoV-2 contact points are claimed to have an important role in the relatively moderate spread of the disease and the relatively low mortality by COVID-19 in Germany so far (9). Little research has been done on the organisation of the newly implemented ambulatory healthcare models and the challenges primary care physicians had to face in the first months after the arrival of the virus in Germany.

The physicians' involvement in active participation in contact points was on a voluntary base, however incentivised by supply PPE in a time of extreme shortage in this regard. Therefore, the implementation of these ambulatory healthcare models was not systematically planned and the contact points were not equally spread over the country. The knowledge and beliefs of primary care physicians may influence the effective organisation of the different ambulatory health care models. To get insights for further pandemic management, the present study aimed to assess the self-efficacy, practices, knowledge and fear among primary care physicians who engaged themselves additionally in a SARS-CoV-2 contact point in comparison to primary care physicians who continued "usual" primary care.

Methods

This cross-sectional study was based on a paper-based survey in primary care physicians who worked in SARS-CoV-2 contact points of BW, Germany as well as primary care practices during the first wave of the pandemic. The study was registered at the German Clinical Trial Register prior to the start of the study, registration number: DRKS00022224. The ethical committee of the medical faculty of the Heidelberg University approved the study (S-418/2020). Informed consent to participate was assumed when participants posted the completed questionnaire to the research team. The research conducted in this study was performed in accordance with the Declaration of Helsinki.

Recruitment and study sample

All 271 SARS-CoV-2 contact points in BW were identified via the web page of the Association of Statutory Health Insurance Physicians Baden-Wuerttemberg (Kassenaerztliche Vereinigung Baden-Wuerttemberg (KVBW)) and invited to participate in this survey in June 2020. Included were all primary care physicians who led one of the SARS-CoV-2 contact points and gave consent to participate in this study by filling in the questionnaire. The aim was a full census sample of primary care physicians leading a SARS-CoV-2 contact point in BW during the first wave of the SARS-CoV-2 pandemic (March-June 2020). Furthermore, a random sample of 400 other primary care practices, also identified via the web page of the KVBW, was invited to participate in the study. Primary physicians of those were excluded from the analysis, if they indicated that they also worked for a SARS-CoV-2 contact point.

SARS-CoV-2 contact points

Primary care practices should be, next to the public health sector, the first contact point for patients if they are worried they may be infected with SARS-CoV-2 and show symptoms of the COVID-19 disease. In BW, three types SARS-CoV-2 contact points were established by to support primary care physicians:

- Subspecialised Primary Care Practices, are primary care practices or specialist practice who offer appointments for patients with potential SARS-CoV-2 infection or other infectious diseases.
- Fever Clinics, are usually located centrally or decentralised in local buildings (e.g. schools, sport halls) and are organised by primary care physicians and the KVBW.
- Special Points for Testing, are available in some regions and are organised by the primary health care sector in collaboration with health authorities.

The idea of these SARS-CoV-2 contact points was that primary care physicians were able to refer patients with (suspects) SARS-CoV-2 infection.

Questionnaire

The questionnaire (*Additional file 1, German*) was developed at the Department of General Practice and Health Services Research at the University Hospital Heidelberg and based on eight telephone interviews with primary care physicians to identify relevant topics. In total six relevant topics were identified. The first part of the questionnaire focused on demographic and practice characteristics such as age, gender, professional qualification, type of SARS-CoV-2 contact point, inhabitants, catchment area, location, and month of implementation (*in categories*). The second part of the questionnaire covered the structure and organisation of the SARS-Cov-2 contact points/ primary care practices including questions such number of staff (*in total numbers*), opening hours, changes to opening hours, remuneration, spatial conditions, diagnostic possibilities, treatment offers, the financing of the SARS-CoV-2 contact, and type of support which enable the implementation (*in categories*). The third part comprised patients contacts and treatment capacities (*in total numbers*). Part four covered questions regarding the nature of the medical documentation and medical history used, the main content of medical documentation used, and the satisfaction with these documents (*answering options yes, partly, no, I don't know*). This part also included questions concerning collaboration/cooperation with other healthcare facilities (*in categories*) and satisfaction with it (*answering options yes, partly, no, I don't know*).

The main part of the questionnaire, which is reported in this paper, covered questions regarding fear for an infection, self-efficacy and practice, sources (*in categories*) and level of knowledge (*answering options yes, partly, no, I don't know*). The last part focused on PEE and disinfection methods (*in categories*), other prevention measures, the utilisation of their SARS-CoV-2 contact point/ primary care practices and how healthcare during the second wave of the SARS-CoV-2 pandemic should be managed (*answering options yes, partly, no, I don't know*) in BW, Germany. The last question was an open-end question which gave the participants the opportunity to share their personal thoughts regarding the pandemic.

Data Collection

Each primary care physician leading a SARS-CoV-2 contact point as well as a random sample of other primary care physicians were invited to participate in the paper-based survey. They received an information leaflet, the paper-based questionnaire, a reply envelope, and a letter from the KVBW with the request to participate. Data collection was conducted between 15 June and 20 July 2020. A reminder was sent to all potential participants two weeks after the initial invitation to the survey.

Data analysis

Data was analysed using the statistic software IBM SPSS Version 25.0. Mean and standard deviations for continuous variables and frequencies and percentages for categorical variables were calculated. Chi-Square tests were used to examine if differences in SARS-CoV-2 contact points and primary care practices were significant. For continuous variables a student's t-test was conducted. $P < 0.05$ was considered significant in all analysis.

Results

Out of 271 SARS-CoV-2 contact points 92 participated (16 Fever Clinics, 74 Corona-Subspecialised Primary Care Practices, and 2 Special Places for Corona-Testing) (response rate 33.9%). Of the 400 invited primary care practices 79 participated (response rate 19.7%), 16 of those were excluded from the analysis since they indicated that they also worked for a SARS-CoV-2 contact point. Table 1 shows that leads of SARS-CoV-2 contact points were predominantly male and between 51 and 60 years old, with a qualification of primary care medicine compared to other medical specialists. Almost 50 % of the primary care physicians, were female and also predominantly between 51 and 60 years old. Most of the leads of SARS-CoV-2 contact points worked in a Corona-Subspecialised Primary Care Practice located in places with a number of inhabitants between 5000 and 20000, covering a catchment area between 15 and 30 kilometres. Primary care practices were mainly located in city centres with

inhabitants between 5000 and 200000. Most SARS-CoV-2 contact points were opened in March 2020, the first month of the pandemic in Germany (Table 1).

Table 1: Description of the study population

Characteristics	SARS-CoV-2 contact points (n=92)	Primary care practices (n=63)
Age group, n (%)		
under 30 years	1 (1.1)	0
between 30 and 40 years	13 (14.1)	7 (11.1)
between 41 and 50	27 (29.3)	16 (25.4)
between 51 and 60	39 (42.4)	26 (41.3)
above 60 years	11 (12.0)	14 (22.2)
no answers	1 (1.1)	0
Gender, n (%)		
Male	61 (66.3)	31 (49.1)
Professional Qualification, n (%) ^a		
Primary Care Physicians	76 (82.6)	60 (95.24)
Other Medical Specialists	13 (14.1)	11 (14.5)
Nurses or practices' assistants	3 (3.3)	0
No answer	0	3 (4.8)
SARS-CoV-2 contact points, n (%)		
Fever Clinics (German: Zentrale Fieberambulanz)	16 (17.4)	n/a
Corona-Subspecialised Primary Care Practices (German: Corona-Schwerpunktpraxis)	74 (80.4)	
Special Places for Corona-Testing/ Testing sites (German: Abstrichstellen)	2 (2.2)	
Number of inhabitants, n (%)		
less than 5.000 inhabitants	11 (12.0)	3 (4.8)
between 5.000 and 20.000 inhabitants	39 (42.4)	24 (38.1)
between 20.000 and 100.000 inhabitants	24 (26.1)	23 (36.5)
over 100.000 inhabitants	18 (19.6)	13 (20.6)
Catchment area, n (%)		
less than 15 km	13 (14.1)	n/a
between 15 and 30 km	65 (70.7)	
between 30 and 50 km	12 (13.0)	
more than 50 km	2 (2.2)	
Location, n (%)		
City centre	44 (47.8)	36 (57.1)
Urbanized (20 km)	31 (33.7)	17 (27.0)
Rural area (City > 20 km)	17 (18.5)	8 (12.7)
No answer	0	2 (3.2)
Implementation of the SARS-CoV-2		
February 2020	5 (5.4)	n/a
March 2020	42 (45.7)	
April 2020	34 (37.0)	
May 2020	5 (5.4)	
June 2020	1 (1.1)	
no answer	5 (5.4)	

a Multiple answer were possible

Fears related to SARS-CoV-2

The fear of a SARS-CoV-2 infection varied slightly within the groups but also between the groups. Nevertheless, primary care physicians who worked in primary care practices only seemed to feel slightly more anxious towards an own infection (25.4% compared to 13.0%). Primary care physicians, stated to be worried for various reason like transmitting the virus to the private environment (42.9%) or the professional environment (46.0%). In comparison, primary care physicians who led a SARS-CoV-2 contact point tended to feel less anxious to fall sick themselves (65.2%) or to spread the virus within their private environment (43.5%) or their professional environment (48.9%). The vast majority of participants of the regular primary care practices and the contact points (about 75 %) feared financial loss during the pandemic because of a possible closure of practices. However, none of the differences between the two groups were significant (Table 2).

Table 2: Fear for a potential infection with SARS-CoV-2 or financial loss due to practice closure

	SARS-CoV-2 contact points n=92	Primary care practices n=63	p-Value
I fear for an infection with SARS-CoV-2 because I may develop COVID-19 myself			
Yes	12 (13.0)	16 (25.4)	0.115
Partly	20 (21.8)	14 (22.2)	
No	60 (65.2)	32 (50.8)	
I don't know/ no answer	0	1 (1.6)	
I fear for an infection with SARS-CoV-2 because I may spread the virus within my private environment			
Yes	23 (25.0)	27 (42.9)	0.089
Partly	28 (30.4)	12 (19.0)	
No	40 (43.5)	24 (38.1)	
I don't know/ no answer	1 (1.1)	0	
I fear for an infection with SARS-CoV-2 because I may spread the virus within my professional environment			
Yes	25 (27.2)	29 (46.0)	0.070
Partly	21 (22.8)	13 (20.6)	
No	45 (48.9)	21 (33.3)	
I don't know/ no answer	1 (1.1)	0	
I fear for a financial loss due a temporary practice closure due to an infection with SARS-CoV-2			
Yes	69 (75.0)	48 (76.2)	0.958
No	22 (23.9)	15 (23.8)	
I don't know/ no answer	1 (1.1)	0	

Source and level of knowledge

Participants were also asked about their sources and their level of knowledge during the first wave of SARS-CoV-2 pandemic (Table 3). At the time of the survey the majority of participants (between 88.9 and 90.2 %) indicated that their level of knowledge was up to date. At the beginning of pandemic for almost 74 % of leads of SARS-CoV-2 contact points and 65 % of the primary care physicians stated that meeting their needs for knowledge regarding SARS-CoV-2 was difficult. This changed during the ongoing pandemic. Information was used from various sources; main sources were the Association of Statutory Health Insurance Physicians, the German Society for Hygiene and Microbiology (RKI), the German federal government agency, and research institute responsible for disease control and prevention. The novel source of knowledge “podcasts” was used from about 40 % of all participants. None of the differences between the groups were significant (Table 3).

Table 3: Knowledge and sources of knowledge related to the SARS-CoV-2 pandemic

	SARS-CoV-2 contact points n=92	Primary care practices n=63	p-value
My level of knowledge regarding SARS-CoV-2 is up to date ^b	83 (90.2)	56 (88.9)	0.947
To address my lack of knowledge regarding SARS-CoV-2 was difficult <u>at the beginning</u> of the first wave of the pandemic ^b	68 (73.9)	41 (65.1)	0.421
To address my lack of knowledge regarding SARS-CoV-2 <u>during</u> the first wave of the pandemic was difficult ^b	36 (39.1)	22 (34.9)	0.799
Sources of knowledge are ^a			
Association of Statutory Health Insurance Physicians	73 (79.3)	52 (82.5)	n/a
Robert Koch Institute (German Society for Hygiene and Microbiology)	87 (94.6)	56 (88.9)	
Health Authorities	40 (43.5)	25 (39.7)	
DEGAM	44 (47.8)	29 (46.0)	
Hausärzte Verband	30 (32.6)	28 (44.4)	
Colleagues	43 (46.7)	26 (41.3)	
Medical Chamber	16 (17.4)	14 (22.2)	
Deutsches Ärzteblatt (German magazine for doctors)	42 (45.6)	40 (63.5)	
Deximed (German Medical Encyclopaedia)	8 (8.7)	6 (9.5)	
Podcast well-known virologist	39 (42.4)	23 (36.5)	
Podcast virologist	14 (15.2)	5 (7.9)	
Podcast chair of DEGAM	7 (7.6)	5 (7.9)	
Other Podcast	n/a	6 (9.5)	
Journals	52 (56.5)	38 (60.3)	
Other	21 (22.8)	11 (17.5)	

a Multiple answer were possible; b Answering options were yes, partly, no, I don't know/ no answer; for better readability only 'yes' is reported.

Self-efficacy regarding anamnestic and diagnostic procedures related to SARS-CoV-2

Another part of the survey was the self-efficacy and practice of participants regarding anamnestic and diagnostic procedures related to SARS-CoV-2 and the decision-making process regarding the further procedure. The results show that in both settings the confidence to treat patients with (suspected) SARS-CoV-2 infection increased over time. There was a difference in the confidence level between the two groups in performing anamnestic and diagnostic procedures for patients with COVID-19 at the beginning of the pandemic ($\chi^2=24.462$, $p<0.001$), after four weeks ($\chi^2=31.818$, $p<0.001$), and present ($\chi^2=14.696$, $p=0.005$).

This result suggests that primary care physicians who led at SARS-CoV-2 contact points felt significantly more confident. The same is true for the confidence level regarding the decision-making process regarding further procedure. At the beginning of the pandemic and after four weeks there was a difference between the both groups ($\chi^2=18.589$, $p=0.001$, $\chi^2=24.295$, $p<0.001$, respectively). There was no significant difference regarding deciding how the further procedure of patients with COVID-19 should look like when the participants completed the questionnaire (June/July 2020) (Table 4).

Table 4: Self-efficacy regarding anamnestic and diagnostic procedures related to SARS-CoV-2

	SARS-CoV-2 contact points n=92	Primary care practices n=63	p-value
<u>At the beginning</u> of my work at the SARS-CoV-2 contact point/ of the pandemic (Primary care practices) I felt confident in performing <u>anamnestic and diagnostic procedures</u> for patients with COVID-19 ^b	54 (58.7)	24 (38.1)	<0.001
<u>After 4 weeks</u> of working at the SARS-CoV-2 contact point/ in the Easter period (Primary care Practices) I felt confident in performing <u>anamnestic and diagnostic procedures</u> for patients with COVID-19 ^b	80 (87.0)	35 (55.6)	<0.001
<u>At present</u> I feel confident in performing anamnestic and diagnostic procedures for patients with COVID-19 ^{b, c}	83 (90.2)	48 (76.2)	0.005
<u>At the beginning</u> of my work at the SARS-CoV-2 contact point/ of the pandemic (Primary care practice) I feel confident to decide how the <u>further procedure</u> for patients with COVID-19 should look like ^b	51 (55.4)	26 (41.3)	0.001
<u>After 4 weeks</u> of working at the SARS-CoV-2 contact point/ in the Easter period (Primary care practice) I feel confident to decide how the <u>further procedure</u> for patients with COVID-19 should look like ^b	81 (88.0)	40 (63.5)	<0.001
<u>At present</u> I feel confident to decide how the <u>further procedure</u> for patients with COVID-19 should look like ^{b, c}	83 (90.2)	56 (88.9)	0.412

b Answering options were yes, partly, no, I don't know/ no answer; for better readability only 'yes' is reported.

c Data was collected between 15 June and 20 July 2020.

Adoption of prevention measures and hygiene regulations

Different prevention measures to contain the spread of SARS-CoV-2 were adopted in both settings. The majority of leads of contact points and almost all primary care physicians reported that the implementation of hygiene regulations (masks, social distancing, disinfection) was possible (95.7 and 87.3 %, respectively). The results suggest that the implementation of prevention measure was easier implemented by SARS-CoV-2 contact points ($\chi^2= 6.413$, $p=0.040$). The vast of majority of all participants stated that physical and temporal separation of patients' groups was done. However, there was a significant difference regarding physical separation, suggesting that leads of SARS-Cov-2 contact points tended to feel like introducing physical separation was done easier ($\chi^2= 8.411$, $p=0.038$). Physical separation was ensured by using different waiting or treatment rooms, waiting times in cars or in front of the facility. Temporal separation was ensured by appointment allocation (Table 5).

Table 5: Prevention measures to contain the spread of SARS-CoV-2

	SARS-CoV-2 contact points n=92	Primary care practices n=63	p-value
The implementation of <u>hygiene regulations</u> regarding the contact with patients with potential SARS-CoV-2 infection in our facility was possible ^b	88 (95.7)	55 (87.3)	0.040
Medical face masks were available sufficient number ^b	90 (97.8)	56 (88.9)	0.074
The physical separation of patients with potential SARS-CoV-2 infection was possible ^b	79 (85.9)	46 (73.0)	0.038
The temporal separation of patients with potential SARS-CoV-2 infection was possible ^b	74 (80.4)	47 (74.6)	0.942
Physical separation was ensured by ^a			
Different waiting rooms	23 (9.3)	19 (30.6)	n/a
Waiting time in the car in front of the facility	48 (19.4)	22 (35.5)	
Waiting time in front of the facility	63 (25.4)	39 (62.9)	
Different treatment rooms	63 (25.4)	19 (79.0)	
Waymarks	23 (9.3)	6 (9.7)	
Other	28 (11.3)	44 (71.0)	
No answer	3 (3.3)	1 (1.6)	
Temporal separation ensured by ^a			
Appointment allocation	80 (83.3)	n/a	n/a
Overall less patients	n/a	26 (46.4)	
Special days for patients with SARS-CoV-2 infection	n/a	1 (1.8)	
Scheduled time for consultations for patients with SARS-CoV-2 infection	n/a	46 (82.1)	
Other	16 (16.7)	12 (21.4)	
No answer	8 (8.7)	7 (11.1)	

a Multiple answer were possible; b Answering options were yes, partly, no, I don't know/ no answer; for better readability only 'yes' is reported.

Treatment capacity and patient contacts

SARS-CoV-2 contact points treated on average 3 more patients with (suspected) COVID-19 (mean 8.46 (0-120)) than primary care practices (mean 5.7 (0-120)). However, the difference was not significant. In total SARS-CoV-2 contact points treated on average 431.95 (0-7100) patients since they opened, whereas on average 83.8 patients were treated by primary care practices ($F(251.654 - 901.165) = 20.705$, $p < 0.001$). The maximum treatment capacity of SARS-CoV-2 contact points can be increase immediately on average by 31.78 patients, if personal resources are increased by 34.44 patients, or if other actions are adapted by 48.67 patients (Table 6).

Table 6: Treatment capacity per SARS-CoV-2 contact point and primary care practices during the first wave of the SARS-CoV-2 pandemic in Baden-Wuerttemberg, Germany

	SARS-CoV-2 contact points n=92	Primary care practices n=63	p-value
Treatment of patients with or with potential SARS-CoV-2 infection			
Average per day	8.46 (0-120)	5.7 (0-120)	0.258
Total since opening	431.95 (0-7100)	83.8 (2-500)	<0.001
Maximum treatment capacity for patients with or with potential SARS-CoV-2 infection per day			
Immediately	31.78 (0-200)	n/a	n/a
If personal resources are increased	34.44 (0-400)	n/a	
If other actions are adapted	48.67 (0-600)	n/a	

Reported are mean, minimum, and maximum. Responds option average per day estimated or calculated, as well as overall since opening were summarized using either the calculated values of the practice software (if reported) or the estimated values

Discussion

The main goal of this study was to describe knowledge, practice, self-efficacy and fears among primary care physicians leading a SARS-CoV-2 contact point compared to primary care physicians with “continued usual practice” during the first wave of COVID-19 pandemic in Germany. A quarter of all participating primary care physicians did not fear an infection with SARS-CoV-2 but were afraid of transmitting it to members of their families or colleagues. The majority of all participants was afraid of financial loss due to lost revenues. Acquiring knowledge about the new coronavirus disease was challenging but this changed during the pandemic and extending knowledge became easier. Sources of knowledge varied but the Association of Statutory Health Insurance Physicians, the German Society for Hygiene and Microbiology and medical journals represented the most important sources of information. The majority of primary care physicians of both groups felt confident in anamnestic and diagnostic procedures at the beginning, the level of confidence increased over time. Primary care physicians who led SARS-CoV-2 contact point were more confident compared to their peers. Hygiene regulations were implemented in all healthcare facilities, but easier by SARS-CoV-2 contact points. Physical separation was ensured mainly by different treatment rooms and waiting in front of the facility by both groups but the results of this study showed that leads of SARS-CoV-2 contact points tended to introduce physical separation easier. Temporal

separation was ensured via appointment allocation, overall fewer patients in primary care practices or special consultation hours for patients with suspected infection. SARS-CoV-2 contact point treated on average significant more patients with (suspected) COVID-19 compared to primary care practices.

The results of this study showed that most participants did not fear an infection with the novel virus but expressed concerns regarding the possibility to spread it within their professional and private environment. Additionally, the majority of both groups feared financial lose. These results agree with those by Huston et al. (5). In Australia and New Zealand for example where remuneration is mainly based on fee-for-service a rapid decrease in patient visits has led to severe financial losses (5). The specific concerns of primary care physicians should be taken into consideration since primary healthcare systems and public health systems rely on the mental and physical health of primary care physicians and their economic efficiency (10).

The majority used the Association of Statutory Health Insurance Physicians and the German Society for Hygiene and Microbiology as source of knowledge which provide an easy and accessible way of getting valid and processed information regarding a growing and changing knowledge base. Interestingly, almost half of the participants (between 36% and 42%) stated to listen to a podcast even though the majority of participants were in the age groups between 41 and 60 years. Podcasts or broadcasts are primarily used by the younger generation (between 14 and 29 years) (11). Another reason might be the trust in a well-known virologist subspecialised in Coronaviruses who chose to record an own podcast to inform the broader community about SARS-CoV-2. Primary care physicians in this study used various sources of information which may made it difficult to be always up-to-date. Interesting is that only half used information provided by professional societies.

Self-efficacy regarding anamnestic and diagnostic procedures related to SARS-CoV-2 of primary care physicians increased over time during the first wave of the pandemic. This can be explained by the experience they gained during the first month of the pandemic. Physicians had to acquire knowledge on the novel virus first under the pressure of the dynamic situation

of the pandemic. For a second wave of SARS-CoV-2 pandemic primary care physicians may be better prepared since scientific as well practical knowledge improved during the first months of the pandemic.

The results of our study showed that key challenges which were difficult to tackle during the 2009/A/H1N1 pandemic in Australia, Israel, and England such as segregation of patients with (suspected) infection (8) were easier implemented during this pandemic in Germany, BW. A study conducted in Germany during the influenza pandemic 2009/10 (10), for example, showed that changing their practice management in order to separate patients physically and in time was implemented by 74% and 38% of the participants, respectively. However, participants in this study (10) were part of the surveillance network of the German Society for Hygiene and Microbiology which may implied a selection bias. Nevertheless, segregation of patients was easier for primary care physicians who led a SARS-CoV-2 contact points. Further research is needed to evaluated why this was the case.

First evaluations on accounting data have shown that seven out of eight COVID-19 patients (about 85 %) were treated in an ambulatory setting (12, 13). Although the results of our study cannot be generalized, they give a first impression on the workload primary care physicians had to manage in BW. As requested and expected more patients with (suspected) COVID-19 were treated in SARS-CoV-2 contact points than in primary care practices. The SARS-CoV-2 contact points as well as the prevention measures in both settings may have contained the spread of the virus.

Primary care physicians had to face several challenges during the ongoing pandemic. That is to ensure care and treatment for (suspected) COVID-19 patients as well as for patients without SARS-CoV-2 infection and were responsible to contain the spread of the virus within their practices through different prevention measures and hygienic regulations. Furthermore, they had to inform themselves as well as their patients about the state of knowledge and the ongoing changes. Future research should focus on measures how primary care physicians could be better prepared for a pandemic and how to address mental and physical challenges. This could be for example the expansion of adequately financially compensated points of care,

support by tools for managing testing of, communication with and care of patients, setting up paths of cooperation between primary care, hospital care, rescue service and health authorities. Expectations in digital tools to are high, but are not being met yet. Furthermore, pandemic plans should be up-to-date and be re-evaluated for the primary care sector.

Limitations

Although this study gives first impressions and important information on challenges primary care physicians had to face during the first wave of the SARS-CoV-2 pandemic, limitations on the study have to be considered. The analysis is based on self-disclosures, so biases cannot be excluded. The response rate is similar to other studies in German physicians, but it may imply selection bias. Furthermore, it is unclear whether the results can be generalized to Germany as the study concerns one region.

Conclusion

The results of this study show that even though primary care physicians rose to the challenges of the SARS-CoV-2 pandemic addressing their fears is essential. Both groups of physicians, those who led SARS-CoV-2 contact points as well as the primary care physician continuing their work in their practices, are crucial for the maintenance of healthcare systems and patient care. Interventions such as adequate payment for COVID-19 care combined with measures that support care management in each practice and may ease communication between practices and sectors should be implemented to support the primary health care sector. Primary care physicians will be stressed by the challenges of a prolonged response to the SARS-CoV-2 pandemic. Strengthening primary healthcare, particularly primary care physicians, is therefore of great importance.

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Declaration

Ethics approval and consent to participate

Ethics approval was obtained of the Medical Ethics Committee of the Medical Faculty Heidelberg (S-418/2020) prior to the start of the study. Informed consent to participate was assumed when participants posted the completed questionnaire to the research team. The research conducted in this study was performed in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to European Data Protection Law but are available from the corresponding author on reasonable request.

Conflict of interest

SS organised a fever clinic in BW with expense allowance from the KVBW. The other authors declare no conflicts of interest.

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Authors' contributions

F.PK., J.S., M.W., S.S., and S.WL. conceived the study. A.B., C.R. and S.S. elaborated the study protocol with the input of all other authors. M.W. was principal investigator of the study. A.B., C.R. and S.S. organized data-collection. A.B. and C.R. analysed questionnaire. S.M. supported data-entry and data collection. C.R. and AB wrote the main manuscript text. All authors approved the final version of the manuscript.

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