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Follow-up of a national web-based survey on the SARS-CoV-2 infectious state of otorhino-laryngologists in Germany

Supplementary Information

The online version of this paper (https://doi.org/10.1007/s00106-021-01075-4) contains the German version of the COVID-19 questionnaire. The article and supplementary material are available at www.springermedizin.de. Please enter the title of the article in the search field. The additional material can be found at the article under "Ergänzende Inhalte".

Background

More than 1 year after the appearance of COVID-19, the pandemic is still in full force. Healthcare workers (HCW) appear to be at higher risk of contracting SARS-CoV-2 [7]. Among these HCW, due to the very nature of the specialty, otorhinolaryngologists (ORLs) have a high probability of exposure to patient aerosols [2, 6, 8, 12, 13, 17, 24, 25]. Numerous recommendations for ORLs regarding the treatment of COVID-19 patients [1, 9–11, 19, 21, 22, 28] and protection against SARS-CoV-2 infection were published [4, 5, 14, 18, 20, 27, 31, 32]. However, only a few studies are available reporting the number of infections or estimating the risk of infection for ORLs [15, 23, 29, 30]. Recently, we reported that German ORLs had almost a 3.7-fold risk of contracting SARS-CoV-2 in the first wave of the pandemic compared with the population baseline level [15].

The aim of this study was to provide follow-up data on German ORLs from a continuous survey since the beginning of the pandemic with SARS-CoV-2 in Germany in January 2020 to March 2021 in order to evaluate whether the relative risk for our specialty has changed over the course of the pandemic.

Methods

The study was designed as a follow-up of a previously conducted web-based survey of German ORLs, the methods of which were previously described in detail [15]. Briefly, the web-based survey was supported by the German Society of Oto-Rhino-Laryngology, Head and Neck Surgery (DGHNOKHC) and the German ENT Association (HNOBV). The members of the societies were addressed via e-mail (DGHNOKHC $n = 3518$; HNOBV $n = 4179$; in total $N = 7697$) and via the e-newsletters of the societies to participate. Reminders were launched bi-monthly on the Corona-News-Ticker of the societies (www.hno.org/de/corona) and individual reminders were also circulated among ORLs. The initial survey was active from April 17, 2020 to May 31, 2020 for all ORLs in Germany, regardless of SARS-CoV-2 status. It was intended to cover the beginning of the pandemic in Germany in January 2020 up to the decrease in the initial number of COVID-19 cases. The follow-up survey (June 1, 2020 to February 28, 2021 and still ongoing) aimed to register ORLs with a PCR-confirmed SARS-CoV-2 infection in the course of the pandemic. The questionnaire consisted of the same questions as the initial one. The survey was performed using SurveyMonkey (San Mateo, CA, USA).

Calculations and data interpretation were performed from the data used for the initial publication [15] as well as the follow-up survey. Some ORLs are members of both associations, which might result in an overestimation. Therefore, the total

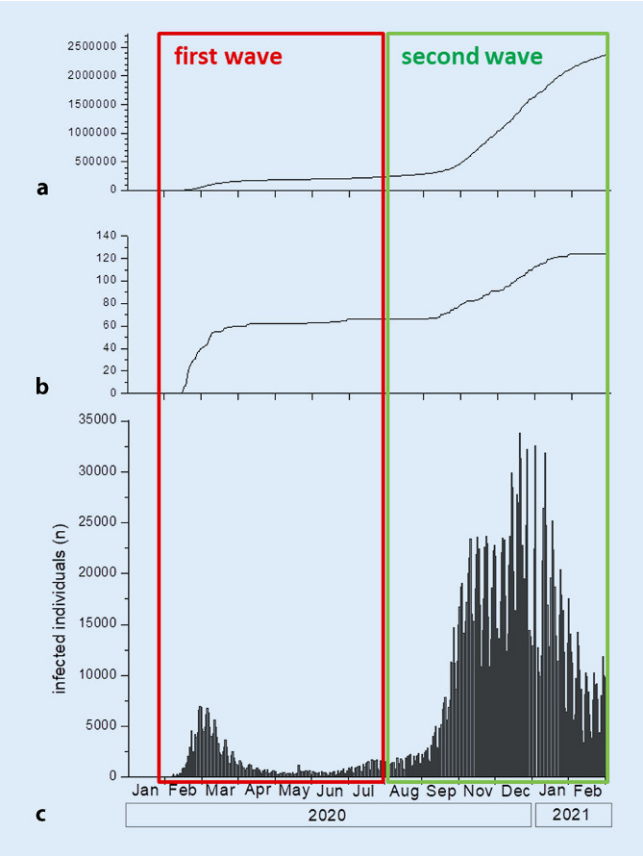

Fig. 1 ▲ Course of SARS-CoV-2 infection in Germany. **a** Cumulative number of individuals with SARS-CoV-2 infection in Germany. **b** Cumulative number of ORLs with SARS-CoV-2 infection in Germany. **c** Daily number of individuals with SARS-CoV-2 infection in Germany. Data for Germany were derived from the Robert Koch Institute. Based on these data, a first (January 28, 2020 to July 31, 2020) and a second wave (August 1, 2020 to February 28, 2021) were defined

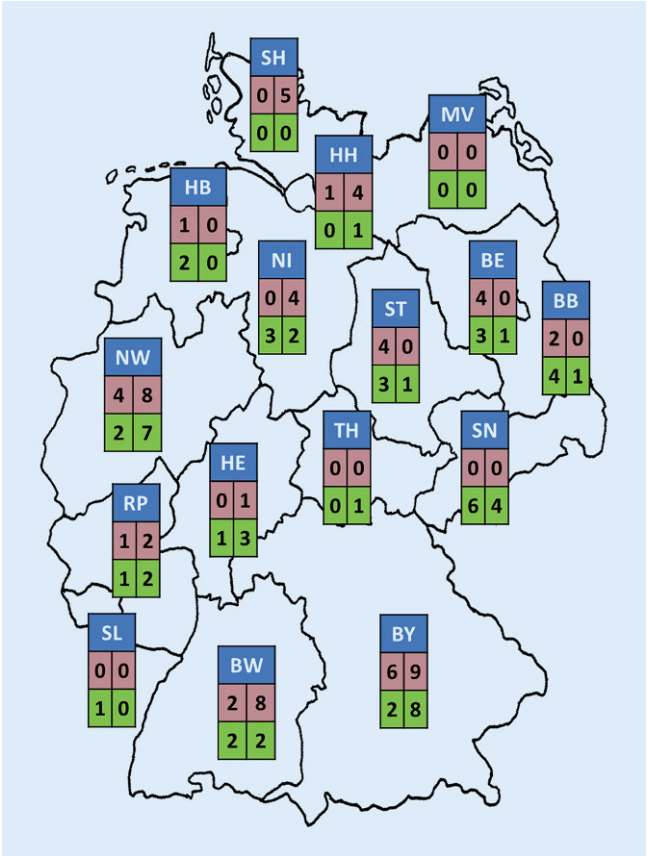

Fig. 2 ▲ Geographical distribution of ORLs with SARS-CoV-2 infection. Infected ORLs are given in the table of each federal state of Germany. The *red row* represents the first wave, the *green row* the second wave. In each row the hospital ORLs are listed on the *left side*, the ORLs in private practice on the *right side*. During the first wave, ORLs were predominately affected in the west and south of Germany (NW, BW, BY). The second wave was more distinct in the eastern and southern part of Germany (SN, BB, BY). Abbreviation of federal states: *BW* Baden-Württemberg, *BY* Bavaria, *BB* Brandenburg, *BE* Berlin, *HB* Bremen, *HH* Hamburg, *HE* Hessen, *MV* Mecklenburg-West Pomerania, *NI* Lower Saxony, *NW* North Rhine-Westphalia, *RP* Rhineland-Palatinate, *SL* Saarland, *SN* Saxony, *ST* Saxony-Anhalt, *SH* Schleswig-Holstein, *TH* Thuringia

number of ORLs in Germany ($n = 6501$) was given by the German Medical Association (www.bundesaerztekammer.de) as of December 31, 2019. Among these ORLs, 1509 were classified as working in hospitals, 4541 in private practices, with the remainder in nonclinical positions. The total population of Germany was given as 83,122,889 (Federal Statistical Office, June 30, 2020; www.destatis.de). The inhabitants of the federal states and the total were taken from the Federal Statistical Office, December 31, 2019 (www.destatis.de). The daily infection data on SARS-CoV-2 were derived from the Robert Koch Institute (www.rki.de). The cumulative number of infected individuals in Germany on July 31, 2020 was 208,698, and on February 28, 2021 it was 2,233,638.

Results

Course of infection and definition of two infection waves

On the basis of the daily number of infected persons, two infection waves can be identified. The cumulative number of infected individuals in Germany is given in **Fig. 1a**. In parallel, the cumulative increase in infected ORLs reveals two waves, as shown in **Fig. 1b**, and the course of COVID-19 in Germany is given in **Fig. 1c**. The first wave starts with the first registered SARS-CoV-2 infection on January 28, 2020. A peak was observed in March 2020 and the infection rate decreased to a baseline low level in May 2020. From August 1, 2020 an increase is detectable again, representing the beginning of the second wave. The peak occurred in December 2020 and the decrease plateaued at a new baseline in February 2021. February 28, 2021 was set as the end of the second wave when an increase was detectable again.

Demographic data

Overall, 129 ORLs (83 male, 46 female) reported a SARS-CoV-2 infection during the study period. During the first wave and second wave, 66 individuals (41 male, 25 female) and 63 ORLs (42 male, 21 fe-

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Follow-up of a national web-based survey on the SARS-CoV-2 infectious state of otorhinolaryngologists in Germany

Abstract

Purpose. The SARS-CoV-2 pandemic has affected the health and practice of otorhinolaryngologists (ORLs) for over 1 year. Follow-up data of a national survey with German ORLs were evaluated regarding differences between the two waves of the pandemic.
Methods. As in the initial survey, German ORLs were addressed via e-mail through the German Society of ORL, Head and Neck Surgery and the German ENT Association. All ORLs afflicted with SARS-CoV-2 were invited to participate in a web-based survey. General data on infections and concomitant parameters were evaluated.
Results. Since the start of the pandemic, 129 ORLs reported testing positive for SARS-CoV-2 in Germany. The ORLs infected during the first wave had a relative risk (RR) of 4.07 (95% CI: 3.20; 5.19) of contracting SARS-CoV-2. During the second wave, the RR decreased to 0.35 (95% CI: 0.28; 0.45). The availability of personal protective equipment (PPE) increased from the first to the second wave along with an increased perception of protection in the professional environment. The source of infection shifted from infections via medical staff during the first wave to patients and household exposure during the second wave. Regular medical practice was resumed by clinicians and general practitioners in the second wave. Nevertheless, a proportionally lower infection rate was observed compared with the German population as a whole.
Conclusion. The data reflect a unique long-term survey of ORLs during the pandemic. Differences in the source of infection were seen between the first and second wave, confirming the need for appropriate PPE for medical professionals working in high-risk environments. Further strategies to reduce the risk of infection include consistent testing for SARS-CoV-2 in healthcare professionals, patients, and the general public as well as vaccination of high-risk medical groups.

Keywords

ENT · ORL · Personal protective equipment · Risk · COVID-19

Ergebnisse der Web-basierten Nachfolgebefragung zum Infektionsstatus deutscher HNO-Ärzt*innen mit SARS-CoV-2

Zusammenfassung

Ziel. Die Pandemie mit SARS-CoV-2 bedroht seit nunmehr über einem Jahr die eigene Gesundheit und beeinflusst das alltägliche Arbeiten von HNO-Ärzt*innen in Deutschland. Die Nachfolgedaten einer initialen Web-basierten Befragung werden im Hinblick auf Unterschiede zwischen der ersten und zweiten Infektionswelle mit SARS-CoV-2 vorgestellt.
Methoden. Im Unterschied zur ersten Befragung (April bis Mai 2020), bei der alle HNO-Ärzt*innen – unabhängig vom Infektionsstatus – aufgerufen waren teilzunehmen, waren in der Nachfolgeerhebung (Juni 2020 bis Februar 2021) nur infizierte Kolleg*innen aufgerufen, daran teilzunehmen. Persönliche Daten zu Krankheitsverlauf, Symptomen, Arbeitsort, aber auch Informationen zu Infektionsursache, Verfügbarkeit von Schutzmaterialien und empfundener Sicherheit wurden via E-Mail von der Deutschen Gesellschaft für Hals-Nasen-Ohren-Heilkunde, Kopf- und Hals-Chirurgie (DGHNO KHC) und dem Deutschen Berufsverband der Hals-Nasen-Ohrenärzte e.V. (BVHNO) erfragt.
Ergebnisse. Seit Beginn der Pandemie infizierten sich 129 HNO-Ärzt*innen mit SARS-CoV-2. Das relative Risiko für HNO-Ärzt*innen lag während der ersten Welle bei 4,07 (95%-Konfidenzintervall, 95%-KI: 3,20; 5,19) und sank während der zweiten Welle auf 0,35 (95%-KI: 0,28; 0,45). Persönliche Schutzmaterialien waren während der zweiten Welle in ausreichendem Maß verfügbar, wohingegen viele Teilnehmer einen Mangel daran während der ersten Welle empfanden. Die gesicherten Infektionsketten zwischen erster und zweiter Welle wiesen Unterschiede auf. Während der ersten Welle spielte die Übertragung durch infiziertes Personal eine große Rolle. In der zweiten Welle lag der Schwerpunkt der Infektionsübertragung bei dem Kontakt zu COVID-19-Patient*innen und infizierten Familienmitgliedern. Die reguläre medizinische Tätigkeit wurde von Klinikärzt*innen und niedergelassenen Ärzt*innen in der zweiten Welle wieder aufgenommen. Dennoch zeigte sich eine anteilig geringere Infektion mit SARS-CoV-2 im Vergleich zur deutschen Gesamtbevölkerung.
Schlussfolgerungen. Die vorliegenden Daten der einzigen Langzeiterhebung unter HNO-Ärzt*innen während der Pandemie sprechen dafür, dass eine Rückkehr zu einer regulären HNO-ärztlichen Tätigkeit unter konsequenter Beachtung persönlicher Schutzmaßnahmen möglich ist. Zu den weiteren Strategien, um das Infektionsrisiko zu senken, gehören auch konsequentes Testen auf SARS-CoV-2 bei im Gesundheitswesen Tätigen, Patient*innen und der allgemeinen Bevölkerung sowie die frühzeitige Impfung für medizinische Hochrisikogruppen.

Schlüsselwörter

Hals-Nasen-Ohren-Heilkunde · Otorhinolaryngologie · Persönliche Schutzausrüstung · Risiko · COVID-19

male) were infected. The age distribution and practice location (hospital vs. private practice) are displayed in **Table 1**. Most of the infected ORLs working in hospital were between 30 and 40 years of age, whereas ORLs in private practice ranged between 50 and 60 years, with no difference between the two waves. During the first wave, the majority of infections in the general population of Germany occurred in the federal states of North Rhine-Westphalia, Baden-Württemberg, and Bavaria (**Fig. 2**). If the infected ORLs during the first and second wave as well as the total number are correlated with the total inhabitants of a specific federal state, the federal states of Bremen, Hamburg, Saxony-Anhalt, Saxony, and

Table 1 Age distribution of ORLs with SARS-CoV-2 infection

Age (years)	First wave		Second wave	
	Hospital ($n = 25$)	Private ($n = 41$)	Hospital ($n = 30$)	Private ($n = 33$)
< 30	1	0	4	0
30–35	12	1	14	2
36–40	7	2	3	1
41–45	1	4	0	2
46–50	1	7	8	4
51–55	2	9	1	6
56–60	1	10	0	12
61–65	0	4	0	1
66–70	0	4	0	3
> 70	0	0	0	2

Hospital ORLs working in a hospital environment, *Private* ORLs working in a private practice

Table 2 Geographical distribution and demographic correlation

		First wave		Second wave		Total	
Federal state	Inhabitants	Infected ORLs (*n*)	% 10–4	Infected ORLs (*n*)	% 10–4	Infected ORLs (*n*)	% 10–4
BW	11,100,394	10	0.9	4	0.36	14	1.26
BY	13,124,737	15	1.14	10	0.76	25	1.9
BB	2,521,893	2	0.79	5	1.98	7	2.78
BE	3,669,491	4	1.09	4	1.09	8	2.18
HB	681,202	1	1.47	2	2.94	3	4.4
HH	1,847,253	5	2.71	1	0.54	6	3.25
HE	6,288,080	1	0.16	4	0.64	5	0.8
MV	1,608,138	0	0	0	0	0	0
NI	7,993,608	4	0.5	5	0.63	9	1.13
NW	17,947,221	12	0.67	9	0.5	21	1.17
RP	4,093,903	3	0.73	3	0.73	6	1.47
SL	986,887	0	0	1	1.01	1	1.01
SN	4,071,971	0	0	10	2.46	10	2.46
ST	2,194,782	4	1.82	4	1.82	8	3.65
SH	2,903,773	5	1.72	0	0	5	1.72
TH	2,133,378	0	0	1	0.47	1	0.47
Germany	83,166,711	66	0.79	63	0.76	129	1.55

The abbreviations of the federal states are given in the legend of **Fig. 2**

Brandenburg are among the five most affected regions (**Table 2**).

Clinical data

The clinical symptoms of COVID-19 did not vary between the first and second wave (**Table 3**) and the duration of the disease and therapy required was also similar. In both waves, more than 90% of the infected ORLs were treated by domestic quarantine. Two ORLs needed to be admitted to an intensive care unit during the second wave. No fatalities were reported.

Medical activities

During the first wave, ORLs in hospital as well as private practice reduced their medical activities to a low level (**Table 4**). Clinical examinations were conducted by only approximately one quarter of the ORLs in hospital and private practice. Almost no surgeries—except a few tracheostomies—were conducted. An increase in clinical activity including endoscopy and surgeries was reported for the second wave both in hospitals and in private practice. The number of tracheostomies increased during the second wave.

Personal protective equipment and perceived protection

The availability of personal protective equipment (PPE) and perceived protection differed between hospital and private practice in the first wave but not in the second wave (**Table 5**). Private ORLs reported a low availability of PPE (and, as expected, a low perception of protection) during the first wave. Availability of PPE was higher in a hospital-based setting during the first wave than in private practice in both the first and second wave.

Source of infection

In comparison with those in private practice, during the first wave, ORLs in hospitals had more contact with infected medical staff, family, and the neighborhood and less contact with infected patients. Those in private practice had a higher percentage of unidentified contacts (**Table 6**). The ORLs in hospital assumed that their exposure was not related to their professional setting (patients + medical staff) whereas 52% of the confirmed sources of infection were within their professional environment from infected medical staff. No infection was traced back to infected patients in the first wave. During the second wave, contact with patients known to be positive increased for both hospital and private ORLs. The percentage of infected medical staff remained high in the hospital group (23%). Contact with a higher percentage of infected persons outside the hospital was reported. Perceived exposures were estimated in a more realistic manner compared with the first wave. Interestingly, private ORLs reported a higher percentage of confirmed infections by contact with infected medical staff during the second wave, whereas this percentage decreased for the hospital ORLs.

Table 3 Symptoms, duration of infection, and therapy required for ORLs with COVID-19

	First wave		Second wave	
	n	**%**	***n***	**%**
Symptoms				
No symptoms	6	9.1	5	7.6
Fever	34	51.5	27	40.9
Cough	26	39.4	23	34.8
Coryza	13	19.7	23	34.8
Sore throat	15	22.7	14	21.2
Musculoskeletal pain	29	43.9	34	51.5
Fatigue	44	66.7	41	62.1
Dyspnea	4	6.1	12	18.2
Hyposmia	26	39.4	21	31.8
Duration of disease (days)				
< 12	32	48.5	34	54.0
12–15	12	18.2	16	25.4
16–20	9	13.6	6	9.5
21–25	5	7.6	4	6.3
26–30	3	4.5	2	3.2
> 30	5	7.6	1	1.6
Therapy				
Domestic quarantine	64	97.0	58	92.1
Hospital regular care	2	3.0	3	4.8
Hospital intensive care unit	0	0	2	3.2

Hospital ORLs working in a hospital environment, ***Private*** ORLs working in a private practice

Risk of infection for ORLs

The relative risk (RR; 95% confidence interval [95% CI]) of contagion during the first wave was 4.07 (95% CI: 3.20; 5.19) for all ORLs compared with the total population of Germany, with hospital-based ORLs having an RR of 6.32 (95% CI: 4.26; 9.38) and private ORLs an RR of 3.62 (95% CI: 2.66; 4.92). Contrary to the first wave, the RR for all ORLs decreased to 0.35 (95% CI: 0.28; 0.45) during the second wave, with an RR of 0.69 (95% CI: 0.48; 1.00) and 0.27 (95% CI: 0.19; 0.37) for hospital and private ORLs, respectively.

Table 4 Medical procedures performed by ORLs during the first and second wave

Medical procedures	First wave		Second wave	
	Hospital (*n* = 25)	**Private (*n* = 41)**	**Hospital (*n* = 30)**	**Private (*n* = 33)**
Examination	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Nose	6 (24.0)	10 (24.4)	20 (66.6)	23 (69.7)
Oral cavity	7 (28.0)	10 (24.4)	22 (73.3)	19 (57.6)
Pharynx/larynx	7 (28.0)	10 (24.4)	21 (70.0)	19 (57.6)
Ears	6 (24.0)	10 (24.4)	17 (56.7)	17 (51.5)
Endoscopy	4 (16.0)	10 (24.4)	19 (63.3)	16 (48.5)
Sonography	0 (0)	8 (19.5)	8 (26.7)	11 (33.3)
Surgery				
Nose and sinus surgery	0 (0)	2 (4.9)	2 (6.7)	5 (15.2)
Tonsillectomy	0 (0)	0 (0)	2 (6.7)	2 (6.1)
Tumor surgery	1 (4.0)	0 (0)	1 (3.3)	0 (0)
Ear surgery	0 (0)	0 (0)	1 (3.3)	0 (0)
Tracheostomy	2 (8.0)	0 (0)	9 (30.0)	0 (0)

Medical procedures Procedures which were performed by the participants, ***Hospital*** ORLs working in a hospital environment, ***Private*** ORLs working in a private practice

Table 5 Availability of personal protective equipment and perceived protection of hospital ORLs versus those in private practice[a]

	First wave				Second wave			
	Hospital (*n* = 25)		**Private (*n* = 41)**		**Hospital (*n* = 30)**		**Private (*n* = 33)**	
	n	**%**	***n***	**%**	***n***	**%**	***n***	**%**
Personal protective equipment								
Surgical mask	25	100	37	90	30	100	32	97
FFP2	18	72	18	44	29	97	28	85
FFP3	8	32	5	12	7	23	5	15
Protective glasses	16	64	15	37	22	73	24	73
Helmet/shield	5	20	3	7	4	13	3	9
PAPR	1	4	0	0	0	0	0	0
Gloves	25	100	38	93	27	90	30	91
Protective coat	22	88	13	32	25	83	23	70
Perceived protection								
Mean	2.52		3.49		2.17		2.61	
SD	1.17		1.25		0.78		1.15	
95% CI	2.06; 2.98		3.10; 3.87		1.89; 2.45		2.21; 3.00	

FFP2/3 KN 95 mask or equivalent, ***PAPR*** powered air-purifying respirator, ***SD*** standard deviation, ***95% CI*** 95% confidence interval, ***Hospital*** ORLs working in a hospital environment, ***Private*** ORLs working in a private practice

[a]Perceived protection measured via Likert scale "Did you feel protected against an infection with SARS-CoV-2 during your professional activities?" Options of response: 1 = always; 2 = most of the time; 3 = sometimes; 4 = a little; 5 = never

Discussion

The data presented here represent a unique long-term survey of ORLs in Germany since the beginning of the pandemic with SARS-CoV-2. Two clear waves were identified and the groups of ORLs with SARS-CoV-2 were compared. Differences in the availability of PPE, perceived protection, source of infection, and the relative risk of infection were detectable between the groups.

Several authors have provided registries of ORLs all over the world with respect to SARS-CoV-2 infection or COVID-19. The earliest data were published by Sowerby et al. in spring 2020 providing international data of 361 in-

Table 6 Assumed and confirmed source of SARS-CoV-2 infection for ORLs during first and second wave

	First wave				Second wave			
	Hospital ($n = 25$)		Private ($n = 41$)		Hospital ($n = 30$)		Private ($n = 33$)	
	n	%	*n*	%	*n*	%	*N*	%
Known contact with infected individuals								
Patient	8	32	13	32	20	67	20	61
Staff	11	44	5	12	7	23	2	6
Family	5	20	2	5	4	13	6	18
Neighborhood	4	16	1	2	2	7	1	3
General public	0	0	0	0	1	3	1	3
No contact	4	16	21	51	2	7	11	33
Assumption: "professional environment responsible for infection"								
Yes	1	4	10	24	8	27	10	30
No	11	44	4	10	11	37	7	21
Unknown	13	52	27	66	11	37	16	48
Confirmed course of infection								
Patient	0	0	6	15	9	30	6	18
Staff	13	52	0	0	1	3	5	15
Family	2	8	2	5	5	17	4	12
Neighborhood	1	4	3	7	1	3	1	3
General public	0	0	0	0	3	10	1	3
Unknown	9	36	30	73	11	37	16	48

fected ORLs in 19 countries. Among these ORLs, 19 died from COVID-19 [29]. The weakness of that study lies in the data collection, which was performed by individual inquiry of the participating authors with only a minority of data derived from national surveys. The data presented here stem from a national survey of all contactable ORLs in Germany, with a response rate of 15.2% in the baseline survey [15]. The international registry of Sowerby et al. also included ORLs when clinical symptoms were reported. Data regarding PCR or antibody testing were only available in nine out of 19 countries. In our study, the method of verification of a SARS-CoV-2 infection was based on confirmed PCR testing and ORLs reporting only clinical symptoms or detectable antibodies were not included.

Shortly after the international registry, a UK national registry was published by Stephenson et al. [30]. The authors conducted a web-based survey over a 4-month period supported by the ENT UK society. A total of 73 ORLs reported contracting COVID-19, of whom 35 were confirmed on testing (47.9%). It can be assumed that the total number of ORLs in the UK is much higher than the number of participants, and therefore the data need to be interpreted with caution. Apart from this limitation, the authors provide information about the source of infection. Overall, 44 respondents (60.3%) stated that the likely source of infection was inside the workplace but only four suspected other healthcare workers as the likely source. The authors proposed that the high portion of infections that were traced back to procedures, since PPE was not commonly used in the early stage of the pandemic.

Another study published by Martin-Villares et al. in January 2021 presented a large cohort of Spanish ORLs [23]. Via WhatsApp, the authors were able to contact 975 ORLs all over Spain, which revealed that 157 individuals (16.5%) tested positive for SARS-CoV-2 by PCR. Similar to our data, different rates of infection were present for the first and second wave of the pandemic, with significantly more ORLs infected during the first wave ($n = 136$; 86.6%) than during the second ($n = 21$; 13.3%). The authors do not provide data on the availability of PPE in the group of participants of the survey, but they conclude that the general shortage of PPE during the first wave could be responsible for the higher rate of infections.

As noted by the aforementioned studies, a shortage of PPE in the beginning of the pandemic could be the main reason for high infection rates among ORLs in many countries. The data of this survey provide similar evidence, with ORLs in private practice reporting a low availability of PPE in comparison with those who were hospital-based. A worldwide survey about the adherence to PPE guidelines revealed a relatively low value for Germany during the first wave compared with other nations [26]. The authors describe the shortage of PPE as one of the reasons for the low adherence to PPE and our data confirm this speculation. The correlation between sufficient availability of PPE and high perceived level of safety is also reported for American ORLs [3, 32] and was confirmed in this survey again.

Due to the risk of infection, many ORLs reduced their regular surgical and ambulatory procedures [16]. Only one quarter of the participants in Germany continued performing regular examinations of the upper airways in hospital and private practice during the first wave. During the second wave, approximately two thirds of the ORLs in hospital and private practice performed regular examinations and surgeries. Adherence to PPE usage likely contributed to a reduction of infection in spite of increased potential exposure, as was recently demonstrated for pediatric ORLs [18].

No data are available about the risk of spread by healthcare professionals. During the first wave, many hospital ORLs had contact with COVID-19-positive medical staff. Once an infection was confirmed, healthcare professionals were sent into domestic quarantine but the low availability of PCR testing often led to a delay in confirmation. Moreover, rapid antigen testing was not commonly available during the first wave. Interestingly, the ORLs with COVID-19 did not consider medical staff factor to be a risk for their own infections in spite of coworkers being the source of more infections than COVID-19 patients in the first wave.

The relative risk (RR) for all ORLs during the first wave was 4.07. Our initial survey reported an RR of 3.67 [15]. The increase can be explained by additional ORLs who participated in the follow-up survey after termination of the initial survey. The reported RR is a minimum, as more participants in the survey would lead to an increase in the calculated RR. Other factors need to be considered that might have shifted the second wave RR toward the much lower value of 0.35. Reduced participation during the second wave is possible, but in order to reach a similar RR as the first wave, 657 ORLs would have been infected (10% of all ORLs in Germany).

Limitations

One limitation of this study is that data reflect only ORLs who were confirmed to be positive for SARS-CoV-2. Contrary to the initial survey in which 970 ORLs participated (15.2% of all ORLs in Germany), the follow-up survey collected information from infected individuals after termination of the first survey on May 31, 2020. When interpreting the given responses, it is important to keep in mind that the data are only derived from ORLs who tested positive for SARS-CoV-2 and might have a different opinion on concomitant parameters of the pandemic. On the other hand, the infected ORLs are part of a medical environment in hospitals and private practices. They work under the same conditions as non-infected colleagues and one can assume that most healthcare professionals have a similar perception of the medical environment they are working in.

Practical conclusion

- **The survey provides data from the beginning of the SARS-CoV-2 pandemic to the present, which is unique for German otorhinolaryngologists (ORLs) and not available for other medical specializations or countries.**
- **Despite an increase of individuals infected with SARS-CoV-2 in Germany during the second wave, ORLs were proportionally less affected than during the first wave. The source of infection shifted toward the private environment during the second wave.**
- **The consistent use of personal protective equipment (PPE) and more frequent testing appears to have lowered the risk of infection and enabled partial resumption of regular medical procedures despite an increase of infections in the total population.**
- **The strategy of consistent use of PPE in combination with testing and vaccination could support a return to regular medical practice for ORLs.**

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Declarations

Conflict of interest. M. Herzog, A.G. Beule, J.-C. Lüers, O. Guntinas-Lichius, L.J. Sowerby, V. Bogdanov and D. Grafmans declare that they have no competing interests.

For this article no studies with human participants or animals were performed by any of the authors. All studies mentioned were in accordance with the ethical standards indicated in each case. All survey participants provided written informed consent. The approval of an ethics committee was not necessary.

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