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Infection control strategies for patients and accompanying persons during the COVID-19 pandemic in German hospitals: a cross-sectional study in March–April 2021

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SUMMARY

Background: Patients are at risk of nosocomial COVID-19 infection. The role of accompanying persons/visitors as potential infection donors is not yet well researched, but the risk will be influenced by prevention measures recommended by infection control practitioners.
Aim: To collect information about COVID-19 infection control strategies for patients and accompanying persons from infection control practitioners in German hospitals.
Methods: A cross-sectional questionnaire was developed, ethically approved, pre-tested and formatted as an online tool. Infection control practitioners in 987 randomly selected German hospitals were invited to participate in March and April 2021. For statistical analysis, the hospitals were categorized as small (0–499 beds) or large (≥500 beds).
Findings: One hundred surveys were completed (response rate: 10%). A higher proportion of large (71%) than small (49%) hospitals let patients decide freely whether to wear medical or FFP2 masks. Most hospitals reported spatial separation for COVID-19 patients and non-COVID-19 cases (38%) or additionally for suspected COVID-19 cases (53%). A

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separation of healthcare teams for these areas existed in 54% of the hospitals. Accompaniment bans were more prevalent in large (52%) than in small hospitals (29%), but large hospitals granted more exemptions.

Conclusion: The decision as to whether to separate areas and teams seemed to depend on the hospital's structural conditions, therefore impairing the implementation of recommendations. Accompaniment regulations differ between hospital sizes and may depend on patient numbers, case type/severity and patients' requirements. In the dynamic situation of a pandemic, it can be difficult to stay up to date with findings and recommendations on infection control.

Introduction

On January 27th, 2020, the first known COVID-19 cases occurred in Germany. In March and April 2021, more than one year after the beginning of the pandemic, there was sufficient knowledge available on the transmission routes of COVID-19 and how to minimize transmissions [1—3]. The shortage of personal protective equipment (PPE) at the beginning of the pandemic was overcome [4]. In German hospitals, well-established hygiene regimens for pathogens that transmit analogously were already in place before the pandemic and could be quickly adapted to SARS-CoV-2 [5—8]. Furthermore, the German Public Health Authority Robert-Koch-Institute (RKI) had issued recommendations for handling COVID-19 outbreaks in healthcare facilities and how to prioritize vaccinations in hospitals [9,10].

There is daily fluctuating movement of healthcare workers (HCWs), patients, accompanying persons, and visitors in hospitals. Individuals infected with COVID-19 may not be detected in time because they are asymptomatic or presymptomatic [11—16]. HCWs are at risk of severe disease progression when infected [17]. However, patients are especially vulnerable and one study showed that the mortality rate was higher than in the general population [18]. Not only direct contact with COVID-19 cases, but also simply staying in the same ward was identified as a risk factor for nosocomial infections in patients [19,20]. Furthermore, nosocomial infections can be caused by inadequate isolation of infected patients and improper use of PPE [21].

The current study collected data from infection control practitioners in Germany and aimed to provide an overview concerning the infection control strategies used during the SARS-CoV-2 pandemic in March and April 2021. The focus was on patients and accompanying persons as possible sources of nosocomial COVID-19 infections, reporting especially on hygiene behaviour promotion, PPE, the separation of confirmed, suspected and non-COVID-19 cases as well as HCW teams.

Methods

Sampling process

The participants were the hospital infection control practitioners in German hospitals. A random sample of hospitals was invited, stratified according to hospital size. A detailed description of the sampling process is presented in Supplementary Materials 1.

Questionnaire

The questionnaire was developed in collaboration with the (vice-)speaker of the Scientific Working Group 'Hospital Hygiene: Prevention of Infection and Antibiotic Resistance' and Standing Committee 'General and Hospital Hygiene' of the German Society for Hygiene and Microbiology (Deutsche Gesellschaft für Hygiene und Mikrobiologie, DGHM). The aim of the questionnaire was to collect information about infection control strategies in German hospitals. The questionnaire was pretested by an interdisciplinary team of local researchers, adapted accordingly and retested. The final questionnaire is presented in Supplementary Materials 2.

The LimeSurvey platform (https://www.limesurvey.org/) was used to supply the questionnaire. The anonymous online survey was conducted in March and April 2021. Infection control practitioners from 987 hospitals across Germany received an invitation email to participate in the survey. This project received positive ethical consent by the local committee under the file no. 5/2/21 An.

Data analysis

All the data obtained from completed questionnaires were analysed with SPSS 26 (IBM Deutschland GmbH, Ehningen, Germany). The hospital categories were combined into small hospitals with 0—499 beds and large hospitals with a capacity of >499 beds. Fisher's exact test was used to determine statistical significance of differences between small and large hospitals. For multiple choice questions, the test was performed per item. For single choice questions, the test was performed for the entire question. If the result was significant, Fisher's exact tests were used for post-hoc analysis. Statistical significance was defined as $P<0.05$.

Results

Respondent characteristics

One hundred out of 987 questionnaires delivered were completed by infection control practitioners across Germany (response rate: 10%). As seen in Table I, about two-thirds of the participants were either director or deputy of a department responsible for infection control. Ninety-three percent of the participants were qualified in hospital hygiene and infection control. There is a reasonable distribution of responding hospitals across the regions, which also reflects the distribution of the population, resulting in an even

Table I
Respondents' characteristics

Respondents' characteristics	Total ($N = 100$)
Infection control practitioners' position	
Director of hospital hygiene or infection control institute	61
Deputy of hospital hygiene or infection control institute	5
Not in the leader position	34
Infection control practitioners' competence area (multiple answers possible)	
Hospital hygiene	93
Microbiology	17
Virology	6
Public health	8
Region	
North (Bremen, Hamburg, Lower Saxony, Mecklenburg-Western Pomeranian, Schleswig-Holstein)	21
East (Brandenburg, Berlin, Saxony, Saxony-Anhalt, Thuringia)	17
South (Bavaria, Baden-Wurttemberg)	26
West (North Rhine-Westphalia, Hesse, Rhineland-Palatinate, Saarland)	36
Hospital size	
Small hospitals	49
Large hospitals	51

All values are percentages.

response rate of 4–5% per region. The distribution between small and large hospitals was almost equal.

Communication of desired hygiene behaviour of patients

Before the start of the pandemic most hospitals already provided hand sanitizer dispensers in the entrance (88%) and waiting areas (84%). Nearly two-thirds of the hospitals displayed hygiene promotion posters before the pandemic, and after the pandemic started almost all of the hospitals used this intervention.

Information for patients about desired hygiene behaviour distributed by oral briefing prior to admission was the most prevalent form in the hospitals (62%), followed by written information (42%) and distribution of brochures (29%) and posters (28%) in patients' rooms. This applies to all hospitals regardless of size (Supplementary Materials 3).

Personal protective equipment recommendation for patients

As shown in Table II, 60% of hospitals allowed their patients to decide on whether to wear a medical or FFP2 mask (small: 49%; large: 71%; P=0.082).

In the presence of medical staff, patients were recommended to wear a mask in 73% of the hospitals. Patients were also recommended to wear masks in rooms when visitors were present in 65% of the hospitals. This was more prevalent in large (77%) than in small hospitals (53%; P=0.021).

Separation strategies for confirmed and suspected COVID-19 cases

Thirty-eight percent of the hospitals reported spatial separation for COVID-19 and non-COVID-19 patients (Table III). A separation for these groups and additionally for suspected COVID-19 cases was reported by 53% of the hospitals. In the area for suspected COVID-19 cases, single rooms were available in 43% of the hospitals.

Separation mostly occurred in the form of separate wards (66%). However, there were also separations that occurred within the same ward (22%). Separation strategies were applied mostly in normal wards (78%). In intensive care units, separation was more prevalent in large (59%) than small (39%) hospitals (P=0.049). One-fourth of the hospitals had completely separated areas in the emergency room. Separate HCW teams for COVID-19 and non-COVID-19 areas were prevalent in 54% of the hospitals. Fifteen percent separated the teams only if a nosocomial infection was suspected or confirmed.

Sixty-one percent of the hospitals left incidentally occurring suspected cases in the non-COVID area but in isolation or single rooms until clarification. Most hospitals separated confirmed, suspected and non-COVID-19 cases by scheduling the

Table II
Personal protective equipment recommendations for patients by hospital size

Recommendation	Total ($N = 100$)	Small hospitals ($N = 49$)	Large hospitals ($N = 51$)	P-value
Patient masks recommendation				0.082
Only medical mask (EN 14683)	23.0	28.8	17.6	
Only FFP2 mask (EN 149)	14.0	16.3	11.8	
Possible choice between medical mask or FFP2 mask	60.0	49.0	70.6	
Inpatients wear mask in ward (multiple answers possible)				
In shared room	20.0	26.5	13.7	0.137
When medical staff enters the room	73.0	65.3	80.4	0.116
When visitor enters the room	65.0	53.1[a]	76.5[a]	0.021[a]

All values are percentages. For multiple choice questions, Fisher's exact test was performed per item. For single choice questions, the test was performed for the entire question.
[a] $P<0.05$.

Table III
Separation strategies for confirmed and suspected COVID-19 cases by hospital size

Separation strategies	Total ($N = 100$)	Small hospitals ($N = 49$)	Large hospitals ($N = 51$)	*P*-value
Existence of spatial separation				0.413
Separated area for confirmed patients	38.0	34.7	41.2	
Separated area for suspected patients	53.0	51.0	54.9	
Location of COVID-19 area				0.274
Separate building	2.0	2.0	2.0	
Separate ward	66.0	61.2	70.6	
Separate area within same ward	22.0	20.4	23.5	
Organization of ward for suspected COVID-19 cases (multiple answers possible)				
Shared rooms	10.0	12.2	7.8	0.520
Only single rooms	43.0	38.8	47.1	0.426
Department with completely separated areas for COVID-19 (multiple answers possible)				
Emergency room	25.0	24.5	25.5	1.000
Intensive care unit	49.0	38.8[a]	58.8[a]	0.049[a]
Normal ward	78.0	69.4	86.3	0.054
Separate HCW teams for COVID and non-COVID area				0.101
Only if nosocomial infection is suspected or confirmed	15.0	12.2	17.6	
No	21.0	26.5	15.7	
Yes	54.0	44.9	62.7	
Procedure for incidentally occurring suspected cases in the non-COVID area until clarification is obtained				0.097
Transfer to area for suspected patients	26.0	32.7	19.6	
Remain in area but in isolation/single room	61.0	51.0	70.6	
Organization of performing intervention between confirmed, suspected, and negative COVID-19 cases (multiple answers possible)				
Spatial separation	40.0	38.8	41.2	0.841
Temporal separation	79.0	69.4[a]	88.2[a]	0.027[a]
Patient restriction in the waiting areas	84.0	87.8	80.4	0.661
Distancing in waiting areas (multiple answers possible)				
By one empty chair	24.0	20.4	27.5	0.486
By two empty chairs	27.0	26.5	27.5	1.000
Sitting or standing by ≥1.5 m	77.0	69.4	84.3	0.098

All values are percentages. For multiple choice questions, Fisher's exact test was performed per item. For single choice questions, the test was performed for the entire question.
[a] $P<0.05$.

interventions at different times. Large hospitals (88%) did this more often than small hospitals (69%; $P=0.027$).

Eighty-four percent of hospitals had patient restrictions in the waiting areas and distancing between patients was mostly accomplished by maintaining at least 1.5 m of distance (77%). Some hospitals used one (24%) or two empty chairs (27%) to indicate the required distance.

Regulations for accompanying persons

Table IV shows that prohibition of accompaniment was more prevalent in large (53%) than in small hospitals (29%; $P=0.016$). Correspondingly, small hospitals (69%) allowed one accompanying person more often than large hospitals (47%; $P=0.027$). Some situations (e.g. childbirth) and characteristics of the patients (e.g. senior) were approved as reasons for exceptions. Large hospitals were granting more exemptions than small hospitals in the following situations: need for translation ($P=0.03$), childbirth ($P<0.001$), as well as senior or underaged patients ($P=0.005$).

All hospitals with a paediatric department allowed accompanying persons for underaged patients. Accompaniment was restricted to only one guardian in 79% of all hospitals. However, large hospitals (55%) allowed alternating between guardians more often than small hospitals (25%; $P=0.002$).

Most hospitals (57%) let the accompanying persons decide whether to wear a medical or FPP2 mask.

Discussion

Hand hygiene is one of the most important measures in infection prevention and control and almost every hospital in our study provided hand sanitizer dispensers in the entrance and waiting areas, even before the pandemic started. However, despite an increase in the beginning of the pandemic,

Table IV
Regulations for accompanying persons by hospital size

Regulations	Total ($N = 100$)	Small hospitals ($N = 49$)	Large hospitals ($N = 51$)	*P*-value
Regulation for accompanying persons				0.019[a]
Accompaniment completely prohibited	41.0	28.6[a]	52.9[a]	0.016[a]
One accompanying person allowed	58.0	69.4[a]	47.1[a]	0.027[a]
Exemptions to regulation for accompanying persons (multiple answers possible)				
Patient with impaired mobility	34.0	26.5	41.2	0.143
Companion for translation	49.0	38.8[a]	58.8[a]	0.030[a]
Senior or underage patient	54.0	38.8[a]	68.6[a]	0.005[a]
Patient with severe disability	41.0	34.7	47.1	0.229
Childbirth	45.0	24.5[a]	62.7[a]	<0.001[a]
Impending death	85.0	77.6	92.2	0.052
Guardian regulation for underage patients				0.002[a]
One guardian	39.0	40.8	37.3	0.838
Alternating between two guardians	40.0	24.5[a]	54.9[a]	0.002[a]
Two guardians	7.0	10.2	3.9	0.264
Mask recommendation for accompanying persons				0.184
Only medical mask (EN 14683)	17.0	18.4	15.7	
Only FFP2 mask (EN 149)	33.0	38.8	27.5	
Possible choice between medical mask or FFP2 mask	48.0	38.8	56.9	

All values are percentages. For multiple choice questions, Fisher's exact test was performed per item. For single choice questions, the test was performed for the entire question. If the result was significant, Fisher's test was used for post-hoc analysis.
[a] $P<0.05$.

previous studies showed that sanitizer dispensers are rarely used [22–27].

After the start of the SARS-CoV-2 pandemic, posters on hygiene behaviour were distributed in nearly every hospital. It is important to note that the effect of information on human behaviour may depend on the way it is communicated [28–30]. All educational material, including posters, especially in the accompanying, widely acknowledged information pandemic, should therefore be soundly designed [31]. Oral briefings might be a good solution, considering that they are more personal and therefore might have a bigger effect.

At the time of the survey, there was no fixed regulation in Germany specifying whether patients had to wear an FFP2 or medical mask [32]. Both mask types significantly reduce the risk of SARS-CoV-2 infection compared to social distancing [33]. This is also reflected in the data since most hospitals left the choice of mask to the patients and accompanying persons. Just a small percentage recommended only FFP2 masks. When worn correctly, FPP2 masks offer more protection against infection, but are also more expensive and restricting than the commonly used medical mask [33]. The latter could also lead to more patients not wearing the FFP2 mask correctly and therefore reducing the protective effect. Especially at times when FFP2 masks are scarce, it makes sense to allocate the limited number of masks only to particularly vulnerable and exposed persons. Additional analysis (Supplementary Materials 4) showed that two-thirds of the hospitals in the south of Germany recommended FFP2 masks for accompanying persons and therefore more frequently than other regions (12–28%; $P\leq0.001$). In contrast to other federal states, Bavaria had already introduced mandatory FFP2 masks in public spaces in January 2021 [34]. This may have fuelled the expectation of FFP2 mask recommendations in Bavarian hospitals and may explain the high recommendation rate in southern Germany.

When visitors entered the patient's room, patients were recommended to wear a medical mask more often in large hospitals than in small hospitals. Conversely, it seems that small hospitals more often recommended patients to wear masks in shared rooms. This might explain why further recommendations to wear face masks upon receiving visitors was less frequent in small hospitals.

Especially with a high case number, the RKI recommended avoiding the treatment of COVID-19 cases and other patients in the same building so that patient and staff routes do not overlap. For a smaller number of cases or if this is not possible, a separate ward or ward area should be set up for the care of COVID-19 cases. In the suspected case area, contact between patients must be largely prevented [32]. This was in line with recommendations of the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC) and the European Centre for Disease Prevention and Control (ECDC) [35–37].

COVID-19 areas were often located in a separate ward or a separate unit within the same ward rather than a separate building. Possibilities for spatial separation of COVID-19 cases, suspected COVID-19 cases, and non-COVID-19 cases seem to depend highly on the structural conditions of the hospitals. For example, large hospitals provided normal wards with completely separated areas for COVID-19 cases more frequently, indicating that they had more financial, structural and staffing leeway.

Data from other countries show similar situations. A cross-sectional study involving the heads of 57 emergency departments (EDs) in France (May/June 2020) showed that, while around half of the EDs had a triage area for suspected cases, about 26% of the EDs could not be expanded or moved to another space [38]. In the Netherlands, 89% of the surveyed 66 EDs (80% of total number of ED) had a completely separated

area for COVID-19 cases, which was nevertheless usually located in the original ED unit (July to September 2020) [39]. Around one-third of the heads of 283 Spanish EDs stated in a survey conducted in March/April 2020 that limited space was a challenge, although 80% had areas specifically for patients suspected of having COVID-19 [40].

The data for the intensive care units should be interpreted with caution, since small hospitals mainly provide primary care.

Most of the hospitals in our study left incidentally occurring suspected cases in non-COVID-19 areas in isolation/single rooms until clarification. A proportion of these hospitals did not have an area for suspected cases as seen in the data. If the suspicion is not confirmed, this strategy might be safer and associated with less logistical effort. This especially applies to severely ill or immunocompromised patients, and considering also that not all of the hospitals provided single rooms in the suspected case area. On the other hand, keeping the patient on the same ward as non-infected patients can be more labour-intensive since HCWs have to apply more comprehensive infection control measures. In addition, the risk of infection among HCWs and, consequently, other patients on the ward is always present. One of the great advantages that an area for suspected cases provides is that it reduces the logistical problem of patient location and isolation. This improves the utilization of staff and structural resources by concentrating potential cases at a defined point in the hospital.

The new variant of concern, omicron (B.1.1.529), with high transmissibility and possibly less severe symptoms than previous variants, has led to a high rate of accidental cases [41—43]. Therefore, transferring suspected COVID-19 cases to a separate area, when existing and single rooms are available, seems reasonable and is also in line with RKI recommendations [32].

Another important aspect of our survey was the separation and restructuring of HCW teams for COVID-19 and non-COVID-19 areas. The RKI recommended assigned staff to each of the areas. At least within a shift, HCWs should not change between areas and, if possible, work should always be done in fixed teams [32].

Though interaction between different departments cannot be totally avoided and cross-contamination is therefore possible, segregating teams can be one of the interventions to effectively prevent transmission between personnel in contact with COVID-19 cases, their colleagues, and hence other patients. However, only half of the hospitals in our study had a separate team for suspected and/or confirmed COVID-19 cases. One possible reason for this could be the high staff shortage in nursing, which makes it difficult to set up flexible duty rosters, especially when staff are absent at short notice.

Interestingly, besides a few case studies no other multicentre study could be found on this topic [44—46]. It would also be interesting to assess, two years into the pandemic, whether the regulations in March/April 2021 were transitional or long-term solutions.

Regarding the regulation of accompanying persons, larger hospitals had a stricter policy in general but at the same time granted more exceptions than smaller hospitals. First, larger hospitals naturally have more patients and therefore more accompanying persons and visitors, presenting a high infection risk and a greater need to be monitored. A general restriction for accompanying persons and visitors could be safer, easier to implement, and less labour-intensive. Second, the higher rate of exceptions could be attributed to more severe cases, where relatives were given the chance to be present. Third, larger hospitals also tend to have more cases with translational needs, etc. Therefore, more tailored rules are necessary.

In addition, small hospitals in Germany are often specialized hospitals which offer care for specific diseases or medical specialization, such as psychiatric, orthopaedic, or paediatric hospitals. In these types of hospital, patients might need more assistance from their relatives, because of their mental health, mobility, or age. Therefore, small hospitals can seem to be more permissive than large hospitals.

Since there have been few studies on the topic of accompanying persons and a thematically very close overlap, we should consider visitor regulations. In North America there has commonly been a general restriction, with exceptions for special circumstances [47—49]. No comparisons were made between hospital sizes in these studies.

While visitor regulation can have a positive effect on the prevention of viral respiratory infections, reviews show that they can also have negative consequences for the mental and physical health of patients, the wellbeing of family members and the workload of care providers [50—53].

Our data indicate that regulations for minor patients were generally less strict, as all hospitals allowed at least one guardian to accompany the child. In the case of alternating guardians, it would be interesting to see in which frequency a switch was allowed and whether this only applied to special departments. A retrospective examination of visitor guidelines in 239 children's hospitals in the USA showed that half of the hospitals restricted the visitation to one guardian, but in other respects there was a wide range of different regulations [54].

There is a lack of primary research regarding the impact of visitor restrictions on children during the pandemic, but one can assume that it causes similar or worse consequences compared to adults [55]. Therefore, restrictions for accompanying persons and visitors should only be implemented when necessary and effective. Healthcare providers should prepare for a higher demand for coping and communication with as well as support of patients, especially underaged patients and family members, when introducing such restrictions.

The questionnaire was developed in collaboration with an interdisciplinary expert group and distributed across a randomized sample of all German hospitals. The comparably low response could be explained by the following considerations. First, the questionnaire was relatively long with a minimum completion time of 15 min. Second, the second wave of the pandemic peaked during the survey period, which unsurprisingly meant that the target group were confronted by many pandemic-related commitments.

A cross-sectional study performed at a single time-point cannot map the dynamic development of the pandemic. It does, however, give an overview of the infection control strategies for patients and accompanying persons during the COVID-19 pandemic in a varied sample of German hospitals.

Conclusion

Possibilities for separation of COVID-19, suspected COVID-19, and non-COVID-19 cases as well as segregation of HCW teams seem to depend on the structural conditions of the hospitals, and separation recommendations were not always implemented.

Regulations for accompanying persons differed between small and large hospitals and therefore possibly depend on overall patient numbers, case type and severity, as well as patients' requirements. The age of the patient might have an impact since regulations for underage patients were generally less strict. When implementing visitor regulations, possible consequences for the wellbeing of patients and family members as well as the workload of care providers should be considered.

Wearing masks was recommended for patients and accompanying persons, but recommendations differed between medical and FFP2 masks. This could depend on regional regulations as well as different assessments of necessity and safety. Due to the dynamic pandemic development, knowledge and recommendations on infection control measures might quickly change. Keeping up to date and filtering out the important and correct information can be difficult, especially for hospitals with few highly skilled infection control staff. Information and counselling services can be useful here.

Further studies are necessary to evaluate the impact of infection control and prevention strategies of the hospitals and their repercussions not only at the organizational level but also on the compliance to the given recommendations.

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Appendix A. Supplementary data

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