



SARS-CoV-2 attack rate in reception and accommodation centres for asylum seekers during the first wave: Systematic review of outbreak media reports in Germany



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ABSTRACT

Objectives: Despite concerns about the impact of the severe acute respiratory syndrome corona virus (SARS-CoV-2) in refugee camps, data on attack rates and effectiveness of containment measures are lacking. We aimed to (1) quantify the attack rate of SARS-CoV-2 during outbreaks in reception and accommodation centres in Germany during the first pandemic wave, (2) assess differences in the attack rate based on containment measures, and (3) provide an overview of testing strategies, communication, conflicts, and protection measures for refugees with special needs.

Methods: Systematic web-based review of outbreak media reports (until June 2020) on confirmed SARS-CoV-2 cases in reception centres for asylum seekers in Germany using the google search engine. Reports were screened for pre-defined inclusion criteria and complemented by snowball searches. Data on facility name, location, confirmed cases, containment measures, communication, protection strategies, and conflicts was extracted for each outbreak and reporting date. Evidence synthesis: meta-analysis and negative binomial regression.

Findings: We identified 337 media reports on 101 SARS-CoV-2 outbreaks in 99 reception and accommodation centres in Germany. The pooled SARS-CoV-2 attack rate was 13.1% (95% confidence interval, CI: 9.8–16.7). Outbreak sites implementing mass quarantine ($n = 76$) showed higher rates (15.7; 95% CI: 11.6–20.2) compared to sites using conventional strategies (6.6; 95% CI: 3.1–11.2), yielding a rate ratio of 0.44 (95% CI: 0.27–0.72) adjusted for testing strategies, type and size of accommodation. Conflicts occurred in at least 11.8% of all outbreaks. Few sites reported specific measures to protect refugees with special needs.

Conclusion: Mass quarantine is associated with higher attack rates, and appears to be a counter-productive containment measure in overcrowded camps, but further research with individual-level data is required to rule out residual confounding. Despite available vaccines, reception centres and refugee camps should follow the available guidelines on COVID-19 response and refrain from mass quarantine if physical distancing cannot be guaranteed.

Introduction

Experts and international organisations from across the fields of migration, health, and human rights have highlighted the potential devastating impact of the severe acute respiratory syndrome corona virus (SARS-CoV-2) on refugee camps and expressed concern that overcrowded living conditions, limited access to health services and poor sanitation would provide fertile ground for disease transmission (Kluge et al., 2020, Interagency Standing Committee, 2020, UNHCR 2020, OHCHR, IOM, UNHCR and WHO, 2020, Kuehne and Gilsdorf, 2016, Truelove et al., 2020, Desai et al., 2020). During the “first wave” of the COVID-19 pandemic, confirmed cases were reported

in refugee camps in Bangladesh, Jordan, Lebanon, Syria, Greece and Palestine, and immigrant detention centres in the US (Godin, 2020, BBC News, 2020, BBC News, 2020, Medecins sans Frontieres, 2020, UNHCR, 2020). In Germany, this wave lasted from March 3rd to June 17th, 2020 (Schilling et al., 2021). The first SARS-CoV-2 cases in reception centres for refugees and asylum seekers in the country were reported in March 2020, followed by major outbreaks with several hundred cases (European Centre for Disease Prevention and Control, 2020). Asylum seekers in Germany are obliged to live in reception centres for up to 18 months with shared rooms, sanitary and kitchen facilities. As a part of the response to SARS-CoV-2 outbreaks, reception centres have repeatedly been placed under mass quarantine (Bozorgmehr, 2020).

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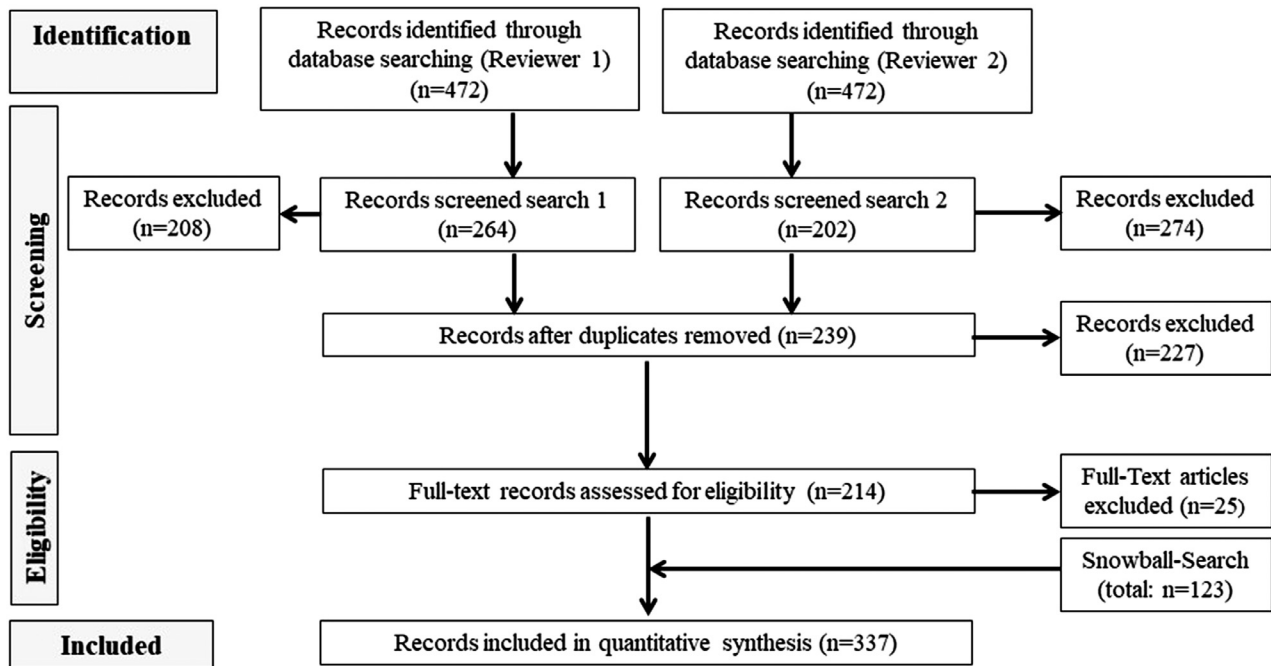


Fig. 1. PRISMA flow chart.

Despite global concerns about the transmission of SARS-CoV-2 in refugee camps and reception centres, pre-existing weaknesses in health information systems (Bozorgmehr et al., 2019) led to a lack of reliable data on attack rates as well as effectiveness and consequences of containment measures during the first wave. In the absence of reliable and timely data sources to study SARS-CoV-2 outbreaks in reception centres, the extensive media coverage of such outbreaks in Germany, a country with a strong and independent press, may provide useful insights. We use a systematic web-based review strategy to (1) quantify the attack rate of SARS-CoV-2 during outbreaks among refugees living in reception and accommodation centres in Germany, (2) assess differences in the attack rate based on containment measures, and (3) provide an overview of reported testing strategies, communication, conflicts in the facilities, and protection measures for refugees with special needs.

Methods

We conducted a web-based systematic search of media reports of SARS-CoV-2 outbreaks in reception and accommodation centres in Germany, published between January 27th, 2020, (date of first confirmed SARS-CoV-2 case in Germany) and June 24th, 2020 using the Google Search Engine (see Appendix A for search queries). All retrieved hits were de-duplicated and titles and full-texts were screened for pre-defined inclusion criteria: formal media source (i.e. no social media); mention SARS-CoV-2 among refugees in Germany in title; reporting number of confirmed cases in full-text. Both search and screening were conducted in duplicate (RJ, MH) and disagreements resolved by consensus.

Media reports were clustered for each outbreak and complemented by outbreak-specific snowball searches. For each outbreak, data was extracted on: reporting date, facility name and location, incident and cumulative cases of SARS-CoV-2 infections among refugees or staff, testing strategies, quarantine measures, measures to isolate infected individuals, conflicts within the facility as well as communication strategies. Outbreaks were excluded if the total number of inhabitants of the centre (at-risk population) was not reported.

The attack rate was calculated as the cumulative number of confirmed cases per outbreak divided by the at-risk population. In case of

disagreement between reported numbers of inhabitants of a centre, the mean was used as denominator. Attack rates were pooled (i) across all outbreak sites, (ii) by strictest form of management strategy applied over the course of the outbreak (mass-quarantine vs. no mass-quarantine) and (iii) by accommodation type (reception centres (RC); district accommodation centres (AC)) using random effects models with the Freeman and Tukey double arcsine transformation. Meta-analysis was performed using the 'metaprop' command in StataSE 15 (Nyaga et al., 2014). Funnelplots were used as graphical test of bias (using Stata's 'metafunnel' command) (Sterne, 2003). We performed two sensitivity analyses to account for: 1) potential superspreading events by excluding outbreak-sites with more than 50% of inhabitants infected, and 2) potential effects of testing strategies on attack rates by stratified analyses (mass testing vs. targeted testing of contact persons or symptomatic individuals). We further analysed the relationship between outbreak management strategies and SARS-CoV-2 attack rate by multiple regression in a negative binomial model ('nbgreg' command), controlling for possible confounders at level of facilities (testing strategy, and size and type of accommodation centres).

Results

The search strategy yielded a total of 337 reports which were included for analysis (see Figure 1 for PRISMA flow chart). Of these, 196 (58.16%) were published by local newspapers, 45 (13.35%) by regional and national newspaper outlets, and 44 (13.06%) were press releases by local governments or city administrations. Other sources included web reports from radio ($n = 30$; 8.90%) and TV stations ($n = 7$; 2.08%), and political outlets ($n = 9$; 2.67%). The median number of reports per outbreak was 3.71 (min:1; max:15) and for 91 outbreaks (90.10%), at least two reports were available.

Descriptive analysis of review results

We identified 101 COVID-19 outbreaks in 99 reception and accommodation centres across 14 of the 16 German federal states. 2,646 confirmed SARS-CoV-2 infections were reported among a total of 18,454

Table 1
PCR-confirmed SARS-CoV-2 cases per outbreak and population size per centre, overall and by centre type, $N = 101$ outbreaks in 14 federal states, Germany.

	Reception Centre (RC)		Accommodation Centre (AC)		Overall	
	Cases (n)	Inhabitants (N)	Cases (n)	Inhabitants (N)	Cases (n)	Inhabitants (N)
Mean	55.77	360.27	15.95	121.16	26.2	182.71
SD	86.35	215.47	19.72	125.17	49.58	185.04
Md	20.5	309.5	7	88	8	118
Min	1	39	1	11	1	11
Max	400	792	86	850	400	850

Legend: n= PCR-confirmed SARS-CoV-2 cases, N= Total number of inhabitants (at-risk population) SD= standard deviation; Md= Median; Min=Minimum; Max=Maximum

residents, as well as 81 confirmed cases among staff. 26 of these outbreaks occurred in RC and 75 in AC (see Table 1).

Mass quarantine, i.e. indiscriminate movement restriction of all inhabitants and restriction of in-and-out movements, was implemented during 76 outbreaks (75% of all outbreaks), affecting a total of 12,692 refugees. The average duration of mass quarantine was 19 days, with a high variation (SD: 8.62 min. 2; max. 43). Of all sites implementing mass quarantine ($N = 76$), 84.2% ($n = 64$) implemented this measure within two days after the first confirmed SARS-CoV-2 case. In 23.8% ($n = 24$) of all outbreaks ($N = 101$), conventional management strategies were applied, i.e. isolation of confirmed cases with or without contact tracing and quarantine of close contact persons.

Efforts to isolate confirmed cases from the remaining inhabitants were reported in 64 (84.21%) of the 76 outbreak sites which were placed under mass quarantine. Among sites applying conventional management strategies ($N = 24$) or where this information was missing ($n = 1$), the isolation of infected individuals was reported for 23 outbreaks (92%). Specific measures to protect individuals with special needs, commonly comprising unaccompanied minors, elderly individuals, or pregnant women, were reported for 27 (26.7%) outbreaks. Of these, 17 (63%) sites evacuated or transferred refugees with special needs to separate areas within the centre or to designated protective shelters.

Across the 101 identified outbreaks, mass testing of all inhabitants of the centre was implemented in 75.3% ($n = 61$), with some centres repeating the mass testing every few days. Among the centres implementing mass quarantine ($N = 76$), 65.8% ($n = 50$) implemented mass testing at least once. In 11.9% ($n = 12$) of all outbreaks ($N = 101$), tests were conducted for contact persons of confirmed cases, and 7.9% ($n = 8$) of outbreak sites followed other strategies, such as testing individuals with clinical symptoms only. Information on testing strategies was not reported for 19.8% ($n = 20$) of outbreaks.

Specific measures to inform the centres' inhabitants about the COVID-19 pandemic or specific containment measures were reported in 25.7% ($n = 26$) of outbreaks, 9.0% ($n = 9$) reported that no specific measures were taken, the remainder lacked data on these aspects. In 11.8% ($n = 12$) of all outbreaks, conflicts were reported within the facilities. These occurred mostly in connection with mass quarantine measures and often necessitated police response. In 10.8% ($n = 11$) it was explicitly stated there had been no conflicts, while reports on the remaining outbreaks lacked information on conflicts.

Pooled SARS-CoV-2 attack rate

The pooled SARS-CoV-2 attack rate for the 101 outbreaks in accommodation centres for asylum seekers was 13.08% (95% CI: 9.84–16.69), and no differences were observed between different accommodation types (RC: 12.93% (95% CI: 6.39–21.28), AC: 13.11% (95% CI: 9.88–16.70)). Attack rates were higher among outbreak sites under mass quarantine (15.65% (95% CI: 11.58–20.18)) compared to outbreaks in which conventional management strategies were applied (6.60% (95% CI: 3.09–11.17)) (see Fig. 2).

Table 2
Absolute and relative frequency of outbreaks by quarantine measure and testing strategy.

Quarantine measure	Mass testing n (%)	Targeted testing or test-information N/A* n (%)	TotalN (%)
Mass quarantine	50 (65.79%)	26 (34.21%)	76 (100%)
No mass quarantine +	11 (44.00%)	14 (56.00%)	25 (100%)
Total	61 (60.40%)	40 (39.60%)	101 (100%)

Pearson chi2(1) = 3.7340 p = 0.053

Legend: Pearson chi2: chi-square test statistic. p: p-value. *Information on testing strategy not available (not reported). +Includes n=1 centre for which information on quarantine measures was missing/not reported. n: absolute frequency. %: percentage. N= totals.

The funnel plot showed an asymmetric distribution, and grouping by quintiles of inhabitants shows a tendency towards lower attack rates in larger camps, likely due to a higher number of non-contact persons considered as "at-risk population". Stratified analysis by accommodation size showed no difference in attack rates (Appendix B). The Egger's test rejects the H0-hypothesis of no small-study effect ($p = 0.000$), indicating that a small-study effect may be a possible explanation for asymmetric distribution (Appendix C).

Excluding seven outbreak sites that could represent super-spreading events (attack rates > 50%) (sensitivity analysis 1) reduced the overall pooled attack rate to 10.05% (95% CI: 8.05; 13.21), but did not affect the finding that attack rates in facilities under mass quarantine were higher (12.59%; 95% CI: 9.63–15.87) compared to sites applying conventional management strategies (5.38%; 95% CI: 2.39–9.34) (for details see Appendix D). Sensitivity analysis 2 revealed higher SARS-CoV-2 attack rates in outbreaks implementing mass testing (16.05%; 95% CI: 11.38–21.32) compared to sites implementing targeted testing of close contacts or only symptomatic inhabitants (9.07%; 95% CI: 4.12–15.57) (for details see Appendix D). Testing strategies differed by quarantine measures to marginally significant ($p = 0.053$) extent (Table 2).

The attack rate among outbreaks implementing conventional containment strategies was 0.44 times the rate under mass quarantine, adjusted for testing strategy, as well as size and type of accommodation (Table 3).

Discussion

Using a web-based systematic review approach, we found a SARS-CoV-2 attack rate of 13% in reception and accommodation centres for asylum seekers in Germany during the first wave. Outbreak management strategies included mass quarantine of entire centres among 75% of the 101 identified outbreaks. In these settings, the SARS-CoV-2 attack rate was significantly higher compared to conventional management strategies. The difference in SARS-CoV-2 attack rates between sites implementing mass quarantine and those using conventional strategies remained stable when excluding outbreaks with potential

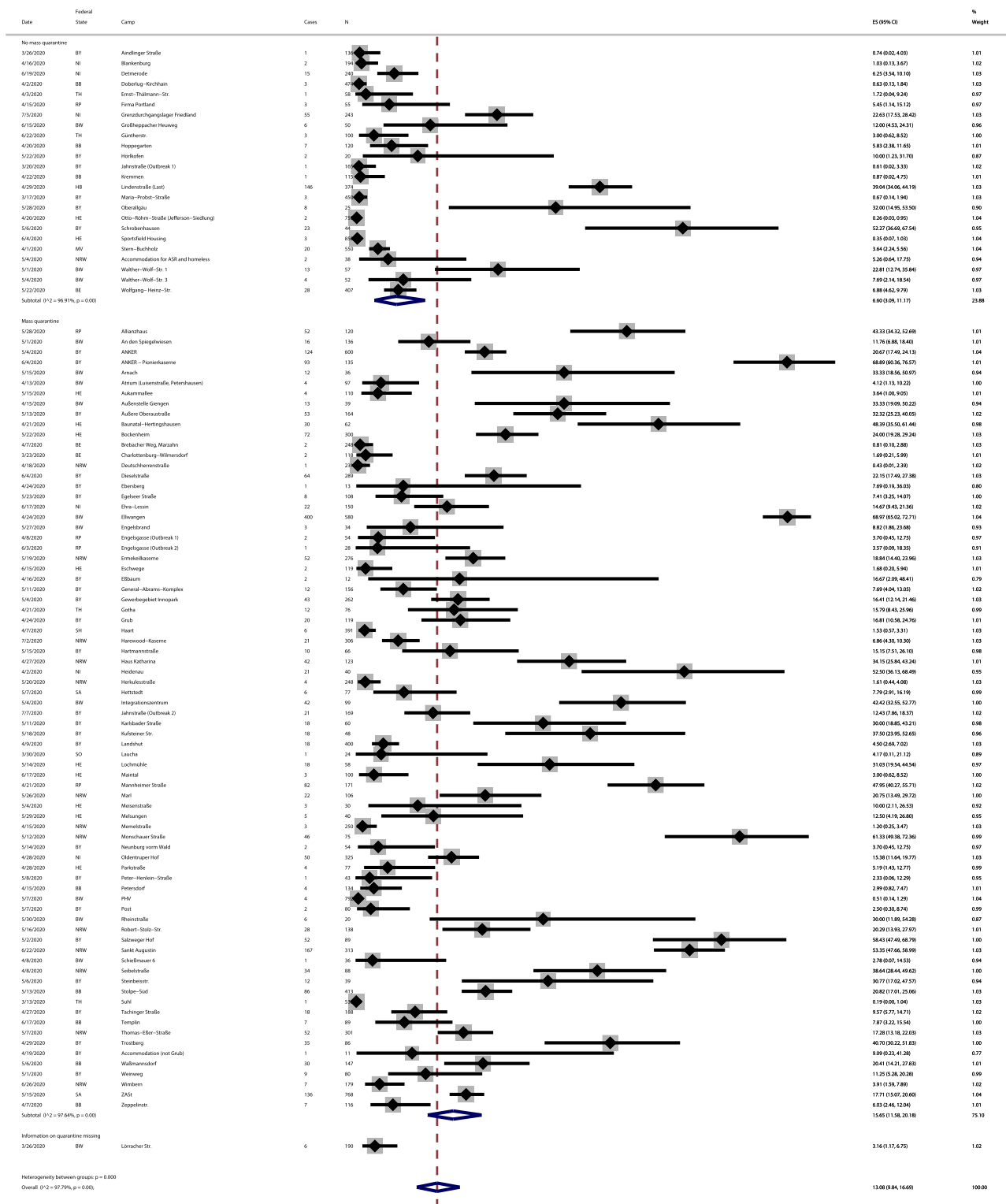


Fig. 2. Forest plot of attack rates for each facility and pooled estimates, by type of quarantine, N = 101 outbreaks in 14 federal states, Germany
 Legend: ES: estimate of attack rates. I²: I-squared measure of heterogeneity. Information on quarantine measures was not reported for one outbreak (missing = 1). Y-axis: attack rate in percentages. Federal states: BB: Brandenburg; BE: Berlin; BW: Baden-Württemberg; BY: Bavaria; HB: Bremen; HE: Hesse; MV: Mecklenburg Western Pomerania; NI: Lower Saxony; NRW: Northrhine-Westphalia; RP: Rhineland Palatinate; SN: Saxony; ST: Saxony-Anhalt; SH: Schleswig Holstein; TH: Thuringia.

Table 3

Rate ratios of SARS-CoV-2 attack rates (per 100.000) obtained by multiple negative binomial regression model, N=100 outbreaks in 14 federal states, Germany.

	Variable (vs. reference)	RR [95% CI]	p-value
Quarantine measure	No mass quarantine+ (vs. mass quarantine)	0.44 [0.27-0.72]	0.001
Testing strategy	Targeted testing or test-information N/A (vs. mass testing)	0.63 [0.41-0.97]	0.034
Accommodation size	Q2	0.96 [0.50-1.84]	0.904
	Q3	0.56 [0.29-1.09]	0.089
	Q4	0.49 [0.26-0.96]	0.038
	Q5 (vs. Q1)	0.56 [0.26-1.18]	0.128
Accommodation type	Reception centre (vs. district accommodation centre)	1.38 [0.76-2.50]	0.284

Legend: RR: rate ratio. N/A: no information available. vs: versus. Q1-5: quintiles. +Includes n=1 centre for which information on quarantine measures was missing/not reported.

super-spreading events (sensitivity analysis 1), and when controlling in multiple regression models for testing strategies as well as accommodation type and size. Information on conflicts was rare, but they occurred in at least about 12% of all outbreaks. Few sites reported specific measures for the protection of refugees with special needs.

Our findings conform with other studies in this context. The Robert Koch Institute reported 199 outbreaks in German reception and accommodation centres for asylum seekers recorded by the national notification system by August 2020 (Buda et al., 2020). The outbreaks comprised on average 20.8 confirmed SARS-CoV-2 cases, the highest average outbreak size among all reported outbreak locations in Germany (Buda et al., 2020). However, no attack rates can be calculated based on data of the national notification system as it contains data on cases only and lacks data on denominators (i.e. the number of inhabitants in the centres). A modelling study of SARS-CoV-2 in the Rohingya refugee camp in Cox's Bazar, Bangladesh found that one single case in the camp would likely lead to a large-scale outbreak with more than 1,000 cases, due to large household sizes as well as inadequate access to sanitation and hygiene (Truelove et al., 2020). Other institutionalized settings, such as prisons or nursing homes have been similarly affected by SARS-CoV-2 and overcrowding of the facilities in conjunction with a particularly vulnerable population are considered key factors in the spread of the disease. A modelling study on outbreaks in elderly homes in Ontario, Canada, found that a reduction of individuals per room from four to two could have prevented 19% of all infections, and 18% of all deaths (Brown et al., 2021). Reflecting such findings, European and international guidelines on COVID-19 containment measures in refugee camps and other institutionalized settings recommend the reduction of inhabitants to allow for physical distancing and self-isolation, isolation of confirmed cases and quarantine of contact persons only, and infectious disease surveillance (Interagency Standing Committee, 2020, European Parliament, Council of the European Union, 2013, Centers for Disease Control and Prevention 2020, Robert Koch Institute, 2020).

Our review shows that mass quarantine was used as a rule, rather than an exception in the outbreak management of reception centres for refugees in Germany during the first wave, despite not being recommended by the available COVID-19 guidelines for refugee camps. The finding of higher attack rates in centres under mass quarantine compared to conventional approaches supports concerns raised by academia (Bozorgmehr et al., 2020), the Robert Koch Institute (Robert Koch Institute, 2020), the ECDC (European Centre for Disease Prevention and Control, 2020) and civil society organizations that mass quarantine may increase transmission risk within facilities due to a lack of possibilities to self-isolate and perform social distancing. Nonetheless, mass quarantine remains part of the SARS-CoV-2 containment measures adopted by

reception centres in Germany and has been implemented in different facilities as recently as January 27th, 2022 (Kehler, 2021, Die Senatorin für Soziales, Jugend, Integration und Sport, 2021, Dieckmann, 2022).

Comparisons can be drawn between the situation of reception centres under mass quarantine and outbreaks of COVID-19 in closed setting such as the cruise ship Diamond princess. Here, the cumulative incidence risk was found to be 17%, and it is worth noting that several national governments, including the US and Germany, considered it to be high enough to warrant the evacuation of their citizens from the ship (Der Tagesspiegel, 2020, Mansoor et al., 2020). Modelling studies suggest asymptomatic patients (64%) contributed to the spread of the disease on board, and that measures to separate infected individuals as well as reducing contact between passengers had lowered the basis reproduction rate over the course of the outbreak (Expert Taskforce for the COVID-19 Cruise Ship Outbreak, 2020). However, our results show that even while under mass quarantine, measures to reduce disease transmission within the facilities were not sufficiently adopted. For example, 34.2% of facilities under mass quarantine were reported not to conduct series tests to identify asymptomatic cases, and 15.8% reportedly did not strictly separate infected from non-infected individuals. Mass quarantine of reception centres therefore may not only increase the risk of conflicts, stigma, or mental health disorders (Brooks et al., 2020, BAfF, 2020), but it is also associated with higher risk of transmission in camp contexts and does not offer adequate protection for vulnerable individuals. This finding is consistent with modelling studies suggesting early evacuation is more effective to reduce transmission in confined contexts such as cruise ships (Rocklöv et al., 2020) compared to mass quarantine. While more studies on management strategies are needed, the study findings suggest that mass quarantine should not only be avoided for ethical or psychosocial reasons, but also on epidemiological grounds.

Since the first wave, important scientific advances have increased the options available for managing the COVID-19 pandemic. Crucially, several vaccines have been developed, approved and made available in large parts of the world. In August 2021, the World Health Organization (WHO) issued an interim guidance calling for the inclusion of asylum seekers and refugees in national vaccination programmes (WHO, 2021). Evidence suggests that vaccine uptake may be challenging due to access barriers such as accessibility, appropriateness of information, language barriers, and vaccine hesitancy (Crawshaw et al., 2021, Deal et al., 2021, Salibi et al., 2021). The WHO guidance therefore recommends developing specific, targeted interventions and outreach programs to reduce access barriers and increase uptake (WHO, 2021). In Germany, there have been campaigns to administer vaccinations in reception centres on site, but there has been no official information about the extent and uptake of these efforts (Spiegel, 2022, Strerath, 2021). Media reports suggest that vaccination efforts have achieved high vaccination rates in some facilities, but overall uptake appears to be low (Spiegel, 2022, Lang et al., 2021, Memarnia, 2021, Norddeutscher Rundfunk, 2021, BR24 Redaktion, 2021). Vaccination campaigns for asylum seekers in reception centres urgently need to be scaled up and their appropriateness as well as translation services ensured. But while uptake remains low, and new SARS-CoV-2 variants are permanently expected to emerge, it is paramount that infection control measures within the facilities conform with existing guidelines and, in particular, that mass quarantine measures are avoided.

Strengths and limitations

Published online as a preprint on March 21st 2021, the results of this study were the first estimate of the attack rate of SARS-CoV-2 infection in refugee reception centres that we were aware of, especially as no such studies were found in available systematic reviews on COVID-19 in migrants (Hintermeier et al., 2021, Hayward et al., 2021). The reason for a lack of studies lies in weak health information systems that do not have the capacity to generate timely and reliable health data in reception centres and refugee camps (Bozorgmehr et al., 2019).

Given the lack of timely and reliable data, the web-based systematic review approach has proven to be a useful tool to generate early estimates while retaining an acceptable degree of robustness. A similar approach has been applied by Dawood et al. (2020), using daily web-based surveillance to identify global patterns of SARS-CoV-2 infections (Dawood et al., 2020). The sources they included focused on official government or ministry websites. While we searched for official press releases for the identified outbreaks of COVID-19 in reception centres, these constituted 13% of the included reports. We did, however, cross-match information from available reports on each of the 91 (90.1%) outbreaks for which more than one report was available to verify the reported data. Our study highlights the importance of media sources and a free press to obtain health-related information in public health emergencies. Limitations associated with the data sources and the web-based systematic review approach include incompleteness of some of the contextual data regarding testing strategies, information of inhabitants, conflicts, and protection measures for at-risk individuals. Information on quarantine measures and dates on which measures have been implemented, however, was available for all but one of the outbreaks. There may be an over reporting of more severe outbreaks, possibly because mass quarantine measures or police presence in the camps may attract attention from the host community as well as the media, leading to ascertainment bias. Moreover, differing testing strategies and time lags in the testing of inhabitants may have resulted in a delayed diagnosis and the infections may have occurred before the quarantine measures took effect. However, as most facilities implemented mass quarantine within two days after the first SARS-CoV-2 case was confirmed, the measure was likely to precede diagnosis of further cases, so that reverse causation (i.e., higher incidence leading to more strict containment strategies such as mass quarantine) can be considered unlikely. To better understand the dynamic of these local outbreaks and to rule out residual confounding, further research using individual-level data in respective outbreak sites is urgently needed. Moreover, the significant heterogeneity between centres suggest relevant contextual factors in disease transmission which warrant more detailed study.

Conclusion

The estimates from this web-based systematic review show SARS-CoV-2 attack rates of 13% in German reception centres during the first wave. Attack rates were higher under mass quarantine compared to conventional strategies, even after controlling for differences in testing strategies and other facility-level variables. This suggests that mass quarantine does not benefit overall virus containment in camps which do not allow for self-isolation and physical distancing, and may hence be counter-productive. Although further research with individual-level data is required to rule out residual confounding, authorities should refrain from implementing mass quarantine in reception centres and refugee camps if physical distancing cannot be guaranteed and follow conventional strategies (eventually complemented by mass testing). As the pandemic unfolds and new variants emerge, implementation of the available guidelines on prevention of COVID-19 in refugee camps, aiming at reducing the number of individuals per accommodation unit, providing each household with individual sanitary facilities, and promoting access to hygiene and personal protective equipment such as face masks, as well as the development and implementation of appropriate and accessible multilingual vaccination programs, is paramount to effective prevention and control of SARS-CoV-2.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical issues

The research did not involve human subjects and used anonymous media reports. No ethical clearance was required.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jmh.2022.100084.

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