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Successful containment of Covid-19 outbreak in a large maternity and perinatal center while continuing clinical service

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Abstract

With increasing number of SARS-CoV-2 infections and COVID-19 patients to be taken care of by the health system, more and more health workers become affected by the disease. It has been reported that right from the beginning of the outbreak in Lombardy up to 20% of the doctors and nurses became infected. Under these circumstances, the regular operation of health institutions already suffering from a shortage of staff becomes difficult. This has led to complete or partial shutdowns of hospitals, either due to a lack of uninfected personnel or because of uncontrollable chains of infection endangering patients. In one of the largest university perinatal center in Bavaria with more than 3000 births per year, an outbreak of COVID-19 occurred in March 2020, affecting 36 staff members, including doctors, nurses, and midwives. Here, we describe the outbreak and present the measures contributing to the successful containment of the outbreak within three weeks. At the same time, clinical services could be maintained, however, not without deployment of personnel exposed to employees infected with SARS-CoV-2. Apart from massive testing of personnel in pre-defined phases and increased hygiene measures, including a general obligation to wear surgical face masks, we identified the need to monitor cases of illness across all groups of employees, to ensure social distancing within personnel and to evaluate contacts of clinical personnel outside of the hospital environment, in order to be able to interpret chains of infections and to disrupt them. Overall, only a bundle of measures is needed to contain such an outbreak.

KEYWORDS

containment, COVID19, hygiene, outbreak, pediatric, SARS-CoV-2

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[Correction added on 2 July 2020, after first online publication: URL for peer review history has been corrected.]

1 | THE OUTBREAK

On March 8, a midwife returned from a skiing vacation in Ischgl, Tyrol, to start working again at the Regensburg University hospital birth clinic. During nightshift on March 9, she developed acute respiratory symptoms and fever and took leave from work. The same day she had attended the duty roster planning meeting of the midwives. Within 3 days, another 5 midwives became ill, including the midwife coordinator (March 12). Since this happened at the peak of influenza season and the incidence of SARS-CoV-2 infections outside distinct high-risk areas such as Italy and China were still thought to be low, these sick leaves did not raise immediate suspicion. Only on the eve of March 13, Tyrol was announced to be a high-risk region for SARS-CoV-2 infection by the German Robert Koch Institute (RKI), the German government center for disease control and prevention. At the same time, the Germany minister of health tweeted a recommendation that travelers returning from Italy, Austria, and Switzerland should go into self-quarantine. The next day, on March 14, it was made public in Germany that the Tyrolian ski resort of Ischgl had become one of the hot spots for spreading the new coronavirus all across Europe, a fact that was recognized by the Icelandic health authorities already on March 6, as we became aware of later. Based on that new knowledge as of March 14, the midwife coordinator now reported the increased number of sick leaves within the midwives and a SARS-CoV-2 RT-PCR test from throat rinsing fluid was initiated in one of the still symptomatic midwives (see Figures 1 and 2). This and further tests were performed according to the Drosten protocol with very high specificity and high sensitivity.[1]

On March 15, the positive test result was communicated by the testing university laboratory, and immediately, all other symptomatic midwives were contacted, advised, and invited to take a SARS-CoV-2 test (test ring 1, Figure 2). One midwife who showed shortness of breath when contacted by phone was hospitalized that day. At the same day, it became apparent that also a number of doctors from the maternity service had developed respiratory symptoms and fever, and also in these employees' tests were initiated immediately (also test ring 1, Figure 2). A general order to wear face masks in the delivery room and perinatal center was issued, and contact persons to the diseased individuals were identified. In addition, it became evident that a large number of now diseased hospital's midwives had taken part in a regional meeting of midwives within the incubation period, prior to the development of first symptoms.

On March 16, test results showed that 9 out of 10 sick staff members were infected by SARS-CoV-2. Consequently, now all personnel in the maternity service and the perinatal center were tested for the new coronavirus (test ring 2, Figure 2). The samples were shipped to a number of different laboratories in the region that were accredited for SARS-CoV-2 testing, but due to restricted test capacities, some samples had to be redirected and tests were delayed. Since simultaneous tests for influenza and RSV were all negative, an additional outbreak of these diseases was excluded. Therefore, it became more likely that respiratory symptoms of staff members may be attributable to the new coronavirus. The general order to wear face masks was now extended to all personnel of the whole University's Mother and Child Hospital.

On March 17, first results of test ring 2 showed that a number of employees in transversal functions such as physiotherapy and social care that had only minor contact with personnel in the maternity service and perinatal center were tested positively even though they were still asymptomatic. Therefore, it was impossible at this point to oversee the true extent of the virus spreading in the hospital and test ring 3 was started (Figure 2), inviting all hospital employees to take SARS-CoV-2 testing. However, due to shortages in laboratory capacities, not all the collected samples could be processed, not even in this very critical situation of a hospital outbreak. Therefore, we had to adapt our test strategy to the reality, and from now on, only symptomatic personnel could be tested further (Figure 2). Based on this test policy, 41 staff members were tested within the next 14 days and 6 infected individuals were identified. However, with increasing time interval to the start of the outbreak, chains of infection were less clear, and in a number of later cases, community-acquired infections become much more likely explanations for infections.

All infected personnel were sent into quarantine for at least 14 days and had to test negative twice before returning back (Figure 3). Staff members who had close contact with infected colleagues were closely monitored for symptoms and were tested

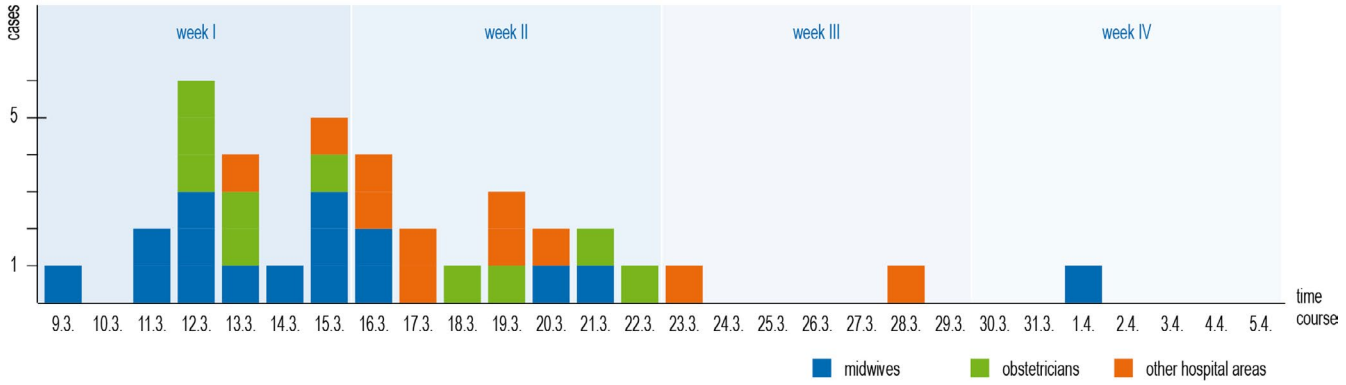

FIGURE 1 Time course of COVID-19 outbreak in the hospital. The timepoint when symptoms first occurred in respective employee is given. If personnel remained asymptomatic, the day of positive testing is depicted [Colour figure can be viewed at wileyonlinelibrary.com]

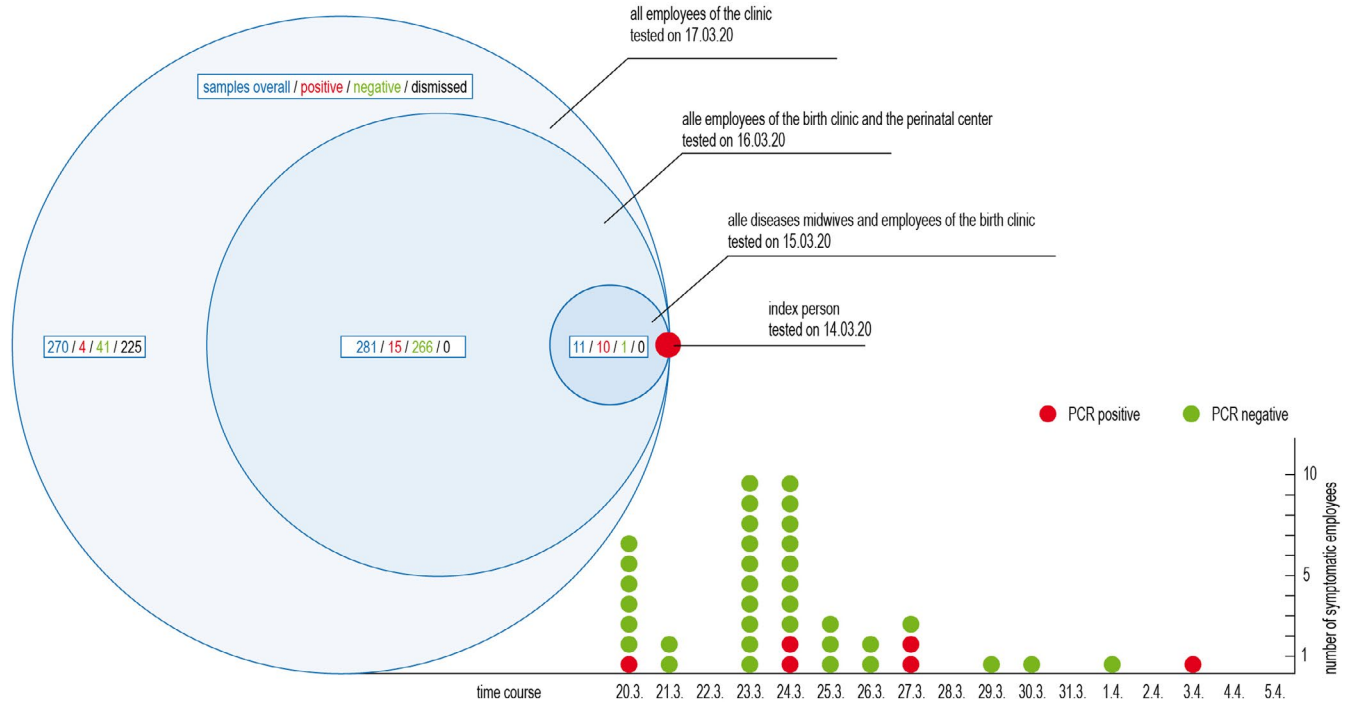

FIGURE 2 Strategy for SARS-CoV-2testing in the course of the outbreak. Every ring corresponds to a wave of testing (test ring) in a specific area of the hospital at a given timepoint in the outbreak. The number of samples taken, positive and negative tests, and samples that had to be dismissed is given [Colour figure can be viewed at wileyonlinelibrary.com]

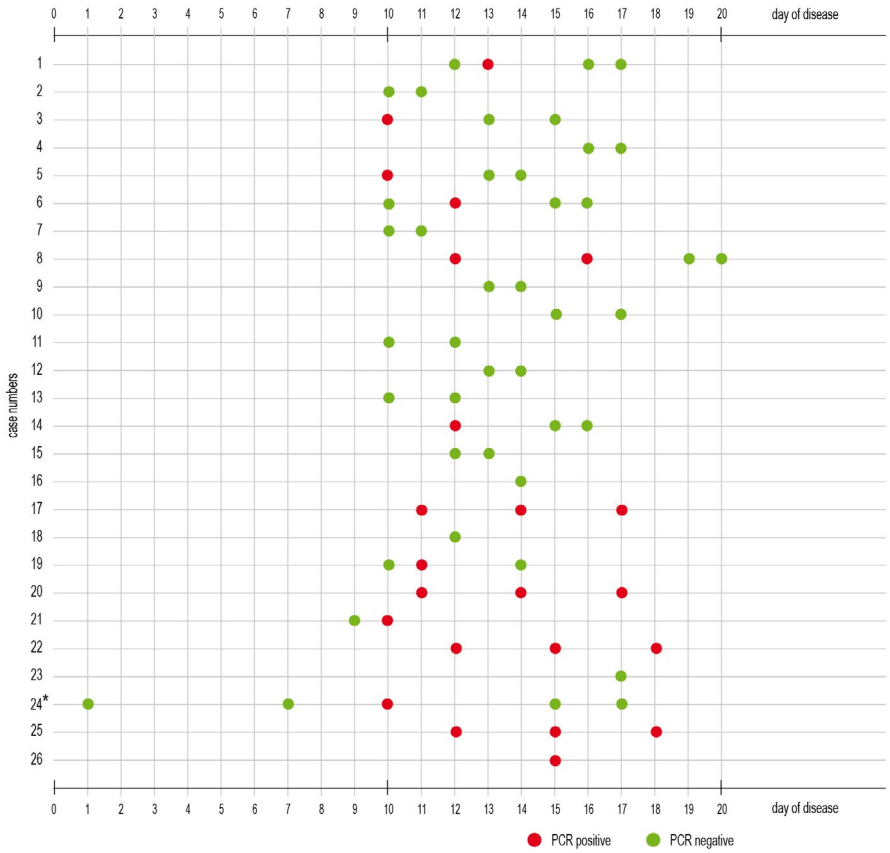

FIGURE 3 Results of convalescent testing in personnel recovered clinically from COVID-19. Until day 13 (from start of symptoms), 46% of tests were still positive, and from day 13 onwards, only 30% of tests were positive. *This individual (24) was initially tested negatively twice despite moderate respiratory symptoms and fever. Only after recovery, the test was positive [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Summary of measures for containment of SARS-CoV-2 in a hospital outbreak

- Extensive testing in rings around identified index person
- Application of face masks as extensively as possible, at least in all personnel of the departments most affected (depends on availability)
- Central monitoring of sick leaves from all employees and personnel working in the hospital (including service companies)
- Measures to ensure social distancing in the staff cantina and break rooms
- Continuous on-site visits by hygiene experts and continuous staff training (also for social behavior changes)
- Transparent, timely, and direct communication of measures to all personnel and patients

regularly but continued to work. Within 14 days, the outbreak was put to a halt by implementing a number of measures (Table 1).

2 | DISCUSSION

Based on our experience, we conclude that SARS-CoV-2 can spread with enormous speed in a medical institution and that every day counts in the containment of the virus and timing matters. In hospitals in Lombardy, which were hit much more unexpectedly and harder, up to 20% of hospital staff were obviously infected in no time.[2] Reports from China suggest that an unproportional 4% of all SARS-CoV-2-infected persons were health workers.[3] An earlier public awareness of the situation in Ischgl, earlier warning by the RKI, or an earlier close down of Ischgl by the Austrian authorities most likely would have prevented the outbreak in our hospital from the start. This case shows clearly that closer collaboration of health authorities within Europe but also worldwide is needed rather than shutting down WHO. New ways of distributing this kind of information globally during a pandemic to all relevant parties need to be implemented rather earlier than later.

Only the index person returning from Ischgl became sick during work and spread the disease in the hospital when sick. In all other cases attributable to the outbreak, we are confident due to close follow-up and reconstruction of contact times within staff members, that infection of coworkers occurred within the incubation time, in general within 2 days prior to the start of symptoms when the respective index person was still asymptomatic. At least 2 staff members who were tested positive remained asymptomatic for good.[4]

In addition to fast and wide testing according to WHO recommendations (test, test, test!) and the strict application of wearing face masks (surgical face and nose masks) as general measures of containment, we identified several additional points to be necessary to contain the outbreak successfully (Table 1). Only tight monitoring of all sick leaves of all personnel across all department borders and institutions including service companies for cleaning and catering allows for a timely identification of infection hot spots in the complex environment of modern hospitals. Beyond doubt, such tight and all-embracing monitoring and the massive testing in an outbreak situation bind substantial human resources in a short time, as we experienced first-hand.

Furthermore, social behavior of medical staff must be taken into account and this needs to be part of the strategy to minimize SARS-CoV-2 spreading. To prevent SARS-CoV-2 outbreaks, it is largely insufficient to concentrate only on the risk infected patients pose, as hospitals have trained their personnel for years with respect to other pathogens. Due to the incredible speed with which the new coronavirus can spread, the risk of infection from contact between coworkers requires at least as much attention as when dealing with infected patients. However, this is not yet enough reflected in most current hygiene concepts. Specifically, that implies to set rules for social distancing during breaks, when taking meals. These profound behavior changes require continuous education and training, while at the same time to the organization must be adapted significantly to provide enough time and space to facilitate adherence to these new rules. In addition, social contacts between coworkers can also add significantly to the spreading of the disease as this was the case in our outbreak, when it became apparent that within 3 days between March 9 and March 11 a duty roster planning meeting, a regional meeting of midwives and a private birthday party attended by 8 obstetricians took place. The fact that health workers of an institution often spend time together also outside the hospital setting needs to be taken into account when trying to contain an outbreak successfully.

In our case, maintaining full clinical service was imperative, as closing down a major midwifery and one of the largest perinatal centers in Germany could not have been compensated by other hospitals in a radius of more than 100 kilometers. Thus, closing was not an option as reported in other cases.[5] Consequently, medical staff with close contact with personnel infected by SARS-CoV-2 had to continue patient care despite their exposure history. Under strict surveillance, increased hygiene measures and repeated testing, none of these employees was involved in further chains of infections, once the general order to wear face masks for all personnel and patients (as far as possible) was applied. In our experience, wearing face masks as part of an increased hygiene strategy is a useful tool to prevent SARS-CoV-2 infections. This stresses the essential necessity to provide protective gear to all health workers in an effort to maintain patient care not only for COVID-19 patients but patients in general.

When our employees recovered from COVID-19, it was still unclear when they may return to their workplace without causing a further risk to spread the disease. Neither scientific knowledge nor undisputed rules exist, and we tried to follow guidelines from RKI [6], regulations of the Bavarian state health office, and those 8 regional health offices that were involved in the management of the outbreak (The place of residence of every employee individually determines the administrative authority for each case). Overall, we were advised to test for the presence of viral RNA by RT-PCR in the convalescents, starting 10 days after the onset of symptoms and at least 48 hours after symptoms had ceased. Two negative tests at least 24 hours apart were the requested before an employee was

considered non-infectious and could return to work. We display the course of these tests in Figure 3 for those convalescents, in whom results were already available at the time being. Until day 13, only 54% of the tests were negative, while later on 70% of tests were negative. Thus, we concluded that testing after day 14 is most sufficient at a time when test capacities are sparse, and we changed our procedures accordingly.

In addition, it became obvious that at least four employees who had recovered clinically form COVID −19 were repeatedly tested positive for virus RNA in throat rinsing fluid, even 20 days after the onset of symptoms (15% of convalescents). If and how that relates to infectiousness is not yet clear at this point. Obviously, these employees did not return to work while tests remained positive.

Finally, we are glad to report that all our affected personnel have recovered from COVID-19 and no severe courses were observed, even though 3 of them were hospitalized for a few days as a precaution at some point in the course. Also, patients who were infected in the course of the outbreak experienced mild-to-moderate courses of COVID-19 and, soon, we will be able to provide information on the clinical courses and the development of immune reactions in patients and personnel in a separate report.

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AUTHOR CONTRIBUTION

Michael Kabesch: Conceptualization (lead); Data curation (lead); Investigation (lead); Methodology (lead); Project administration (lead); Supervision (lead); Validation (lead); Writing-original draft (lead); Writing-review & editing (equal). **Samra Roth:** Investigation (supporting). **Susanne Brandstetter:** Data curation (lead); Investigation (supporting). **Sebastian Häusler:** Investigation (supporting). **Eva Juraschko:** Investigation (supporting). **Marco Weigl:** Investigation (supporting). **Sven Wellmann:** Data curation (supporting); Writing-review & editing (equal). **Thomas Lang:** Investigation (supporting). **Barbara Schmidt:** Investigation (supporting). **Bernd Salzberger:** Conceptualization (equal). **Andreas Ambrosch:** Investigation (equal); Methodology (equal); Validation (equal); Writing-review & editing (equal).

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