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Outbreak of COVID-19 at three nursing homes in Bergen

ORIGINAL ARTICLE

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BACKGROUND
Nursing home residents are generally old and frail, and at high risk that COVID-19 will take a serious course. Outbreaks of COVID-19 have not previously been described in Norway, and it is important to identify mechanisms for spread of the infection and course of disease for nursing home residents with this pandemic disease.

MATERIAL AND METHOD
We included residents from three nursing homes with outbreaks of COVID-19 in a retrospective observational study, and we retrieved information on the number of staff for whom SARS-CoV-2 was confirmed or who were placed in quarantine. We present resident characteristics, course of disease and mortality associated with COVID-19 in the nursing homes, as well as providing a brief description of the outbreaks.

RESULTS
Forty residents were included, 26 of whom were women. The average age was 86.2 years. Thirty-seven of the residents had atypical symptoms, nine of them were asymptomatic at the time of diagnosis, and 21 died during the coronavirus infection. Contact tracing indicated that the outbreaks may have originated from staff in the pre-symptomatic or early and mild phase of the disease. SARS-CoV-2 was detected in forty-two staff members, and a further 115 were placed in quarantine.

INTERPRETATION
Many residents had atypical disease presentation, and the mortality from COVID-19 was high. Spread of infection may have originated from staff, also before they displayed obvious symptoms, and contributed to extensive spread of SARS-CoV-2 in the three nursing homes.

Main findings

SARS-CoV-2 spread rapidly in the three nursing homes with outbreaks.

Atypical symptoms of coronavirus infection occurred frequently.

About half of the residents with COVID-19 died.

Nursing home residents tend to constitute a vulnerable and frail population of older people. Among older patients, the proportion with a serious course of COVID-19 is high, both in nursing homes and elsewhere (1–4). The potential for rapid spread of SARS-CoV-2 in nursing homes appears to be considerable,

as evidenced by, for example, the outbreaks at nursing homes in King County, Washington, USA, where the infection spread rapidly, including between institutions, and more than one hundred patients developed COVID-19 (4, 5). Atypical disease presentation is a regular occurrence for infectious diseases among older people whose organ reserves are reduced, and has also been documented for COVID-19 (6–8). Limiting the spread of SARS-CoV-2 in nursing homes is therefore a challenge, since the prevalence of chronic end-organ disease is high and infection prevention and control measures can be difficult to implement because many residents have cognitive impairments.

Here we describe three outbreaks of COVID-19 in long-term wards at nursing homes in Bergen municipality in the period 19 March to 25 April 2020. The purpose of the study was to identify the COVID-19 infection pathways, course of disease and resident mortality rates.

Material and method

Residents with confirmed SARS-CoV-2 infection from three nursing homes were included retrospectively in the study. All were tested for SARS-CoV-2 from the throat or nasopharynx using qualitative real-time polymerase chain reaction (RT-PCR) (9). Information on the course of disease, treatment and comorbid conditions was obtained retrospectively by searching live patient records and reviewing diagnostic codes and laboratory data. Information on symptoms at the time of testing was obtained from a structured record form (Screening COVID-19), which was developed prior to the outbreaks for use in clinical practice. Anonymised data on the number of staff with COVID-19 or in quarantine were obtained through interviews with the infection control officer in the municipality and the manager or department head of the three nursing homes.

The symptom burden of residents was assessed based on a discretionary review of medical records. In cases where medical notes were sparse, the course of disease was also discussed with nursing home doctors, managers and care staff.

Ethics

The project was submitted to and evaluated by the Data Protection Officer in Bergen local authority and was carried out pursuant to Section 1 of the Personal Data Act, cf. GDPR Art. 9 (2) (i), cf. Section 3–1, third paragraph, of the Health and Care Services Act, cf. first paragraph.

No interventions were carried out in the study, which was primarily designed to evaluate the management of the outbreaks. A total of 33 of the 40 residents in the study had a known cognitive impairment. The mortality rate during the outbreaks was high, and the majority of surviving residents were so badly affected by COVID-19 that they were unable to give informed consent. Therefore, in accordance with the assessment by the Data Protection Officer, no consent was obtained from the residents, but information letters about the study were sent to their next of kin. The information letter was also sent to nursing home managers.

Results

Forty residents had COVID-19: 7 at nursing home A, 10 at nursing home B and 23 at nursing home C. A total of 115 residents were tested for SARS-CoV-2 during the outbreaks. A total of 168 staff members were tested for SARS-CoV-2, and 42 of these tested positive. A further 115 staff members were quarantined due to close contact with residents or other staff with confirmed COVID-19.

Thirty-three residents were found to have SARS-CoV-2 in the first throat or nasopharyngeal tests. Seven residents who tested negative in the first test were subsequently diagnosed with coronavirus in a new test after developing symptoms consistent with COVID-19.

Tables 1 and 2 show the residents' characteristics, comorbid conditions, symptom burden and mortality. Thirty-five residents had three or more comorbid conditions that may have contributed to the serious course of COVID-19 they experienced. Nine of them were asymptomatic at the time of diagnosis, while all developed one or more symptoms consistent with COVID-19 during the course of the disease. Twenty of the residents experienced an exacerbation of their cognitive impairment or a marked change in behaviour, and 16 developed gastrointestinal symptoms such as nausea, vomiting, diarrhoea and/or abdominal pain. Fourteen of the residents never developed symptoms of acute respiratory infection.

Table 1

Residents' characteristics and comorbid conditions in residents with confirmed SARS-CoV-2 at three nursing homes with an outbreak of COVID-19 in Bergen (n = 40). Number (%) unless otherwise specified.

Variable	Number
Resident characteristics	
Age (years), mean (median, range)	86.2 (89, 69–98)
Women	26 (65)
Died	21 (53)
Comorbid conditions	
Cognitive impairment	33 (83)
Hypertension	21 (53)
Chronic heart disease	16 (40)
Smoker, now or previously	13 (33)
Diabetes	12 (30)
BMI >30 or < 18	11 (28)
Chronic pulmonary disease	10 (25)

Variable	Number
Cancer	9 (23)
Chronic renal failure	9 (23)
≥ 3 comorbid conditions	35 (88)
≥ 2 comorbid conditions	38 (95)

Table 2

Symptoms of residents with confirmed SARS-CoV-2 at three nursing homes in Bergen, at the time of the first test (n = 33), second test (n = 7), and throughout the course of the disease until the end of the study (n = 40) respectively. Number (%).

Symptom	First test	Second test	During course of disease
Marked reduction in general condition	25 (75)	7 (100)	34 (85)
Acute confusion and/or change in behaviour	13 (39)		20 (50)
Dyspnoea	6 (18)	6 (85)	19 (48)
Cough	6 (18)	6 (85)	17 (43)
Acute gastrointestinal symptoms[1]	7 (21)		16 (40)
New or increased risk of falling	9 (27)		13 (33)
Fever	6 (18)	3 (43)	9 (23)
Other[2]	8 (24)		8 (20)
Asymptomatic	9 (27)		0

[1]Nausea, vomiting, abdominal pain, diarrhoea

[2]Muscular pain, sore throat, acute urinary incontinence, headache

As of 25 April, six residents had recovered, three of whom had this confirmed in a clinical assessment. Because of the difficulty in identifying when some residents were no longer symptomatic, six were retested in the days following their assumed first symptom-free day. Three of these residents tested positive, while three had two negative tests taken more than 24 hours apart. It was recorded in 30 of the residents' advance care planning directive forms that hospitalisation was only necessary if adequate palliation could not be administered in the nursing home. For the remaining ten residents, the level of treatment was clarified by telephone with a nursing home doctor.

Eighteen of the 21 who died developed respiratory failure, and 16 residents appear to have received good palliative end-of-life care. The five patients who received insufficient palliative care had respiratory failure, some with a dyspnoea crisis, combined with severe anxiety and a fear of dying.

As of 25 April, three residents had been hospitalised, and a total of 21 had died. The average time from diagnosis to death was 9.5 days.

Course of outbreak

Nursing home A

After SARS-CoV-2 was detected in one resident, the remaining eight residents in the ward were quarantined, six of whom developed symptoms consistent with COVID-19 over the next eleven days. All were confirmed with SARS-CoV-2. Five of the seven residents with COVID-19 died. Since care staff had worked on various wards in the nursing home prior to the outbreak, it was decided, in consultation with the municipal infection control office, to test a total of 63 staff members and 42 residents for SARS-CoV-2.

Contact tracing showed that the outbreak may have originated from a pre-symptomatic staff member on the ward. A total of 60 staff were either quarantined or went into self-isolation, and seven of them tested positive for coronavirus.

Nursing home B

After SARS-CoV-2 was detected in one resident, it was decided in consultation with the municipal infection control office to test 49 staff members as well as the remaining 28 patients in the ward, all of whom were quarantined (10). A total of ten residents tested positive and developed symptoms consistent with COVID-19, while none of the remaining 19 residents were confirmed with SARS-CoV-2. As of 25 April, three of the ten patients with COVID-19 had died.

Contact tracing showed that the outbreak may have originated from a staff member who had first tested negative for SARS-CoV-2 in connection with an acute, mild respiratory infection. The staff member returned to work after recovering and then tested positive after developing new symptoms consistent with COVID-19 (10). A total of 32 employees were either quarantined or went into self-isolation, and eight of them tested positive for coronavirus.

Nursing home C

SARS-CoV-2 was detected in one resident in a 12-bed ward. The test result was not available until three days after it was taken, and by then SARS-CoV-2 had also been detected in two staff members and one other resident had developed symptoms consistent with the coronavirus infection. The remaining ten patients in the ward were quarantined, and nine of them were tested for SARS-CoV-2. Since the care staff had worked on various wards in the nursing home prior to the outbreak, it was decided in consultation with the municipal infection control office to test all 44 residents at the nursing home and 56 of the staff. As of 25 April, 23 residents had tested positive and developed symptoms consistent with COVID-19, seven of whom were confirmed as having coronavirus after retesting. All of the wards at the nursing home had one or more residents with COVID-19. Twelve of the sick residents were eventually

moved to an emergency ward and a municipal nursing home in Bergen, both set-up for receiving patients/residents with COVID-19. As of 25 April, 13 of the 23 residents with COVID-19 had died.

Contact tracing revealed that the outbreak may have originated from a pre-symptomatic staff member working on the ward. A total of 65 staff members were either quarantined or went into self-isolation, and 27 of them tested positive for coronavirus.

Discussion

Our findings illustrate several important aspects of COVID-19 outbreaks in nursing homes. There is reason to believe that the spread of infection originated from staff in the pre-symptomatic or early symptomatic phase, since a ban on visitors was introduced at all three nursing homes several weeks before the first outbreak. It has been shown that the SARS-CoV-2 infection can be transmitted in the early symptomatic phase, but that people who are asymptomatic or pre-symptomatic are also contagious (5, 11, 12). Several of our residents were asymptomatic at the time of diagnosis, but all developed one or more symptoms consistent with COVID-19 during the course of the disease. Similar observations were also made in one of the nursing homes in King County with a coronavirus outbreak, where about half of the residents were initially asymptomatic, but 90 % of these developed symptoms during the course of the disease (13).

About one-third of our residents never developed symptoms of acute respiratory infection, and the majority had relatively non-specific symptoms of coronavirus. COVID-19-associated functional impairment was also frequently observed in King County and is also described in an elderly person in Norway with chronic end-organ disease (4, 5, 7).

Another interesting observation in our study was that nearly half of the residents developed acute gastrointestinal symptoms. This may support the hypothesis that a high density of SARS-CoV-2 binding ACE-2 receptors in the small intestine has a clinical significance in COVID-19 (14). In a recent study from Bærum Hospital, approximately 15 % of patients admitted with COVID-19 had such symptoms, while only three of the 23 patients with confirmed SARS-CoV-2 in one of the nursing homes in King County had acute gastrointestinal symptoms (5, 15).

Overall, our findings indicate the need for a very low threshold for performing SARS-CoV-2 diagnostics in nursing home residents, including those with acute functional impairment or new-onset gastrointestinal symptoms with no sign of acute respiratory infection. For COVID-19 outbreaks in nursing homes, consideration should also be given to early testing of asymptomatic staff and residents in affected wards.

The Norwegian Institute of Public Health (NIPH) recommends taking COVID-19 patients/residents in healthcare institutions out of isolation seven days after showing no symptoms, or 21 days after symptom onset, or if they are asymptomatic after testing negative for SARS-CoV-2 in two tests taken a

minimum of 24 hours apart (16). In older, frail individuals, it can be challenging to determine exactly when they are asymptomatic, and six of the residents in this study were retested for SARS-CoV-2 after being considered asymptomatic, three of whom still tested positive. Whether this is an expression of active viral replication or of the presence of viral RNA is uncertain. It has been documented that individuals with mild symptoms have the highest viral shedding in the first week of the disease, but for some, SARS-CoV-2-RNA can also be detected in sputum tests more than three weeks after the onset of symptoms (17). Prolonged isolation of nursing home residents is not desirable, and it is conceivable that retesting may extend the isolation period of non-infectious residents. Future decisions on taking patients out of isolation will therefore primarily be based on clinical indications, but consideration will still be given to retesting selected nursing home residents with COVID-19 before taking them out of isolation, primarily those with a productive cough more than 21 days after the onset of symptoms.

About half of the residents included in the study died, mostly during the second week of the disease. COVID-19-associated mortality among the oldest hospitalised patients in Italy and the USA has been 20–30 % (1, 3), while just under 30 % of residents in long-term wards in King County died with COVID-19 (4). The low number of residents in our study does not allow us to draw conclusions in relation to this difference in mortality rates, although it is conceivable that our residents with COVID-19 were particularly vulnerable and frail. Despite the high mortality rate associated with the three outbreaks, very few of the residents were hospitalised. This indicates that thorough efforts were made to clarify the level of treatment for individual residents prior to the COVID-19 pandemic.

Respiratory failure in COVID-19 patients is typically seen in the second week of the disease and can develop rapidly (18). In order to provide the best possible end-of-life palliative care, both non-medicinal measures and treatment with palliative drugs are important (19, 20). Our experience from these three outbreaks is that almost all of the residents who died had respiratory failure. A few developed acute dyspnoea crisis, and all needed subcutaneous or intravenous administration of morphine and/or midazolam in the final stage. We have therefore urged nursing home doctors in our municipality to prescribe medication when needed to all residents with COVID-19, regardless of their symptom burden at the time of diagnosis. We have also set up a daytime and evening helpline, staffed by senior consultants who specialise in palliative care, and established two 'corona teams' to assist nursing homes in the event of an outbreak of COVID-19.

The agency for nursing homes in Bergen Municipality has had a strong focus on preparing for the COVID-19 pandemic. Web-based guidelines have been drawn up for infection prevention, outbreak management, diagnostics, hospital admission criteria, treatment and palliative care, and a link is given to the treatment algorithm for acute dyspnoea crisis that was developed by the palliative care team in Western Norway Regional Health Authority (21).

In our structured medical record system, we have also helped develop a guide for the diagnosis of COVID-19, which includes both typical and atypical symptoms. The unit managers at the nursing homes have been urged to limit the flow of healthcare personnel between different wards, ensure that the individual staff members have close contact with a limited number of residents, and reduce the workload outside the nursing homes as much as possible. NIPH's recommendations on infection prevention and control measures relating to testing, confirmed COVID-19 among residents or staff, and outbreak management have also been followed (22). Despite these measures, there have been three extensive outbreaks of COVID-19 in nursing homes in Bergen in the first phase of the pandemic, with a high mortality rate and a very difficult death for some. We have therefore worked with the local infection control office to devise a new procedure to limit any future outbreaks.

Given that the three outbreaks may have originated from staff in the pre-symptomatic or early and mild symptomatic phase of the disease, there is an ongoing discussion about whether it may be sensible for staff who are in close contact with nursing home residents to use face masks. If such a measure is implemented, guidelines for use must be drawn up and there must be a continuous focus on ensuring that rules on good hand hygiene and recommended physical distancing are adhered to.

Limitations

The number of residents included in the study was small and from a limited geographical area, making it difficult to draw clear conclusions. However, we believe that our findings may be generalisable to other Norwegian nursing homes, as residents in long-term wards constitute a relatively homogeneous group. Retrospective retrieval of medical record data, which was sparse due to the chaotic conditions during the outbreaks, limits the precision in interpreting the course of the disease in individual patients. In addition, a majority of residents had cognitive impairments, which can impact on the assessment of symptoms. The use of structured record forms, such as *Screening COVID-19*, and the scoring tools *National Early Warning Score 2 (NEWS 2), Clinical Frailty Scale* (for assessing frailty) and *CRB-65* (for assessing the severity of pneumonia) was limited, and the lack of doctors and marginal care staff numbers during the outbreaks made medical record-keeping a challenge. We are now working to ensure that structured record forms and scoring tools are used systematically in future cases of COVID-19 in nursing homes.

Conclusion

The three outbreaks described illustrate the infectious potential of SARS-CoV-2 and the serious course that COVID-19 can have for nursing home residents. Early identification of residents and staff with suspected infection, rapid implementation of enhanced infection prevention and control measures and painstaking contact tracing are key to preventing and limiting new outbreaks.

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The article has been peer-reviewed.

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