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Major Article

Analysis of COVID-19 outbreaks in 3 long-term care facilities in Graz, Austria

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Elderly**Background:** Nursing homes and long-term care facilities (LTCF) caring for elderly and chronically ill residents are at high risk to experience severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) outbreaks. We report an outbreak of coronavirus disease 2019 (COVID-19) in 3 LTCFs of the Geriatric Health Centres of Graz, Austria lasting from March 22 to April 14, 2020.**Aim:** The objectives of our study were: (1) to elucidate contributing factors and transmission pathways of SARS-CoV-2, (2) to analyze symptoms of COVID-19 in the residents and health care workers.**Methods:** We carried out a retrospective outbreak analysis.**Findings:** Thirty-six of 1277 residents of 3 LTCFs were infected with SARS-CoV-2. Only a quarter of COVID-19 cases among residents had fever $\geq 38.1^{\circ}\text{C}$ and 19% suffered from cough. Six of 36 residents remained asymptomatic. Hospitalization rate was 58% in residents. Overall, 33% (12/36) residents infected with SARS-CoV-2 died. Nineteen of 214 health care workers were tested positive for SARS-CoV-2. Universal rt-PCR testing for SARS-CoV-2 of all residents and health care workers as well as infection control measures contributed to ending the outbreaks.**Conclusions:** Delayed recognition of possible COVID-19 cases due to either mild symptoms or symptoms that were perceived as atypical early in the pandemic contributed to the transmission of SARS-CoV-2 in LTCFs. This emphasizes the importance of low-threshold testing in LTCF residents.© 2021 The Author(s). Published by Elsevier Inc. on behalf of Association for Professionals in Infection Control and Epidemiology, Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>)

On February 25, 2020, the first 2 cases of coronavirus disease 2019 (COVID-19) were detected in Austria. On March 16 schools, shops and restaurants were closed as part of the first national lockdown in Austria. The peak of the first wave of infections was reached at the end of March 2020 with 600 to 700 newly detected COVID-19 cases per day.¹ From the beginning of the pandemic there was evidence that residents of long-term care facilities (LTCF) and nursing homes are particularly vulnerable to severe COVID-19 infections and are affected by high mortality.^{2–4}

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On March 22, 2020, a resident of the LTCF A of the Geriatric Health Centres of Graz complained of general discomfort and displayed elevated temperature. At this time, national authorities defined a suspected case (1) as a person with at least one of the following symptoms, fever, cough, dyspnea, and a history of travel to areas with increased disease activity, or (2) as a person with any respiratory symptoms in the 14 days following contact to a confirmed case. As this definition did not apply to this patient testing for severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) was not performed at that time. On April 3, the patient deteriorated and a reverse-transcriptase polymerase chain reaction (rt-PCR) test for SARS-CoV-2 was positive. Through April 14, 2020, 36 residents of 3 LTCFs located all around the city of Graz were found to be positive for SARS-CoV-2 as well as 19 health care workers.

We report an outbreak of COVID-19 in 3 LTCFs of the Geriatric Health Centres of Graz lasting from March 22 to April 14, 2020. The objectives of our study were (1) to elucidate transmission pathways of SARS-CoV-2, (2) to analyze signs and symptoms of COVID-19 in

the residents and health care workers of LTCFs and (3) to identify risk factors for unfavorable outcomes.

METHODS

Study design

We carried out a retrospective outbreak analysis.

Setting

The Geriatric Health Centre of the City of Graz is a local institution comprising among others 4 LTCFs (total of 388 beds) situated all around the city. The LTCFs provide 312 single rooms with personal toilets and 38 double rooms. COVID-19 cases were detected in 3 LTCFs named A, B and C. These LTCFs are structured in smaller subunits of 13 to 15 residents sharing a living room. The local infection control team consists of 2 specialized nurses (infection prevention and control (IPC) practitioners) who visit each LTCF at least once a week. General practitioners who are located off-site are in charge of medical treatments (approximately ten general practitioners per LTCF).

rt-PCR testing

Specimen collection and diagnostic testing were conducted in accordance with national guidelines.¹ Swabs were taken from oropharynx. SARS-CoV-2 rt-PCR was performed at Institute for Hygiene, Microbiology and Environmental Medicine, Medical University of Graz using the Cobas SARS-CoV-2 test kit (Roche Diagnostics, Basel, Switzerland).

Data collection

A retrospective chart review was performed to collect the following data for all infected residents: age, gender, comorbidities, level of care as defined by national standards and described before,⁵ immunosuppressive therapy, symptoms during 7 days before and after rt-PCR test, need for treatment at the hospital and for supplemental oxygen and outcome. In May 2020, health care personnel who had been positive for SARS-CoV-2 were asked to complete a structured questionnaire to collect information on symptoms including onset, severity, need for treatment at the hospital and presumed origin of infection (work or private contact).

ORION guidelines were followed throughout this report.⁶ The study was approved by the local ethics committee (approval number: 32-565 ex 19/20 Medical University of Graz).

RESULTS

Outbreak situations in 3 LTCFs

On March 22, 2020, a resident (A1) of the subunit 1 of LTCF A of the Geriatric Health Centres of Graz complained of general discomfort and diarrhea. Temperature was elevated up to 38.4°C. From March 24 to April 3, 5 other residents (A2–A6) from the same subunit and one resident from subunit 2 located one floor below subunit 1 (A7) developed different symptoms including cough, dyspnea and slightly increased temperature. One patient (A2) was treated with amoxicillin/clavulanate for pneumonia, the others were treated symptomatically as they were thought to have common colds. At this time, national authorities defined a suspected COVID-19 case (1) as a person with at least one of the following symptoms, fever, cough, dyspnea, and a history of travel to areas with increased disease activity, or (2) as a person with any respiratory symptoms in the 14 days

following contact to a confirmed case. rt-PCR capacities were limited and access to testing was restricted. As complaints of patient A1 did not fit with the definition of suspected COVID-19 cases, a rt-PCR test was not performed. On April 3, 2020, the condition of resident A1 deteriorated and a rt-PCR test for SARS-CoV-2 was positive. The resident was transferred to a hospital. As soon as the positive test result became known all other symptomatic residents (A2–A7) and close contacts (residents) were tested and contact precautions were initiated. From April 6–9, 4 residents of subunit 3 (A8–A11) located one floor above subunit 1 developed symptoms including fatigue, loss of appetite and slightly elevated temperature. All patients were tested positive for SARS-CoV-2 on April 9. At this time, only symptomatic members of staff were tested. One nursing assistant developed fever and respiratory symptoms on April 4 and had a positive test result on April 7, 2020. Three members of staff (2 nursing assistants, 1 nurse) were found to be positive during general screening on April 12, 2020 (2 developed symptoms, one remained asymptomatic). During general screening of all residents on and April 12 and 13, 5 more residents were positive for SARS-CoV-2, 3 of which developed mild symptoms. Health care workers were shared between the 3 affected subunits before countermeasures were taken.

On March 21, 2020, a resident of LTCF B (B1) who was terminally ill due to pre-existing comorbidities developed elevated temperature up to 38.4°C. Because of her terminal condition, family members were allowed to visit her in spite of a visiting ban active from March 13, 2020. On March 23, the resident's son informed the institution of his positive rt-PCR test for SARS-CoV-2. Although the resident had been unable to leave her room, she was tested on March 23 and was found to be positive for SARS-CoV-2. She died of her pre-existing conditions on March 24, 2020. A nursing assistant who was in charge of the resident B1 on and March 12 and 13, developed symptoms (fever, rhinorrhea, cough) on March 15 and stayed at home thereafter. She was found to be positive for SARS-CoV-2 on March 26. From March 26 to April 2, 5 other residents living in the same subunit (B2–B6) developed different symptoms: fever in one case, elevated temperature (up to 38.1°C) associated with gastrointestinal symptoms, and fatigue and general weakness in 2 cases. On April 3, 2020, all of these residents were tested and were found to be positive for SARS-CoV-2. Three more members of staff were found to be positive during general screening (April 12 and 13).

On April 1 and 2, 2 residents (C1 and C2) of LTCF C who lived in 2 different subunits located in different buildings developed respiratory symptoms (cough and mild dyspnea). Resident C2 had had a visitor at the window who had not been registered and screened by the LTCF on March 28, 2020. On Saturday April 4, resident C1 was transferred to a hospital where SARS-CoV-2 rt-PCR was positive. The positive test result was communicated to LTCF C on Monday, April 6. On the same day, resident C2 was tested and found to be positive. From April 5–10, 2020, 6 more residents (C3–C8) developed symptoms: fever in one patient, slightly elevated temperature, fatigue, cough or gastrointestinal symptoms in the others. All of these patients were tested and found to be positive for SARS-CoV-2 from April 9–13, 2020. On April 8, 3 residents who were close contacts were also screened for SARS-CoV-2, all of whom were positive. Two of these residents (C9 and C10) remained asymptomatic, whereas the third person (C 11) complained of fatigue and nausea. On April 12, 2020, all residents and personnel were screened for SARS-CoV-2. Screening revealed 2 more positive residents (C12 and C13) and 11 positive members of staff. There were shared health care workers between the 2 subunits, eg, during night shifts as well as during breaks. In addition, a cleaning person who was tested positive during the general screening worked in both subunits.

Overall, 36 residents and 19 health care workers were tested positive for SARS-CoV-2 in 3 independent LTCFs. We investigated a possible connection between the outbreaks in LTCFs A, B and C. There was

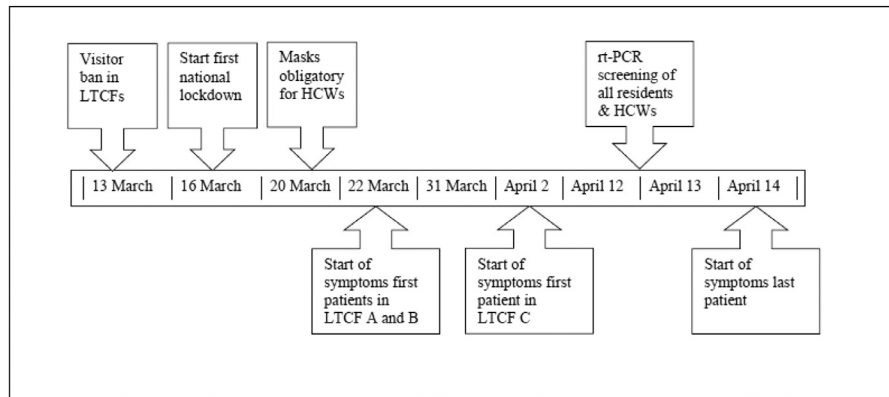


Fig 1. Timeline showing start of local countermeasures and start of symptoms. LTCFs, long-term care facilities; HCWs, health care workers.

no shared nursing personnel. However, several general practitioners, a specialist in geriatric medicine and other occupational groups such as a hairdresser, a pedicurist and a physiotherapist worked in more than one LTCF. We were not able to confirm an introduction of SARS-CoV-2 from one institution to the other.

Countermeasures

Confirmed COVID-19 cases were isolated in single rooms. Residents who were close contacts were asked to stay in their rooms. All residents who were able to tolerate a face mask were asked to wear one. Health care personnel was split in 2 teams: one care for uninfected residents and one for confirmed cases and close contacts only. Staff working in the COVID-19 areas used personal protective equipment (PPE) consisting of gowns, gloves, goggles or face shields, and respirator masks (FFP2 standard). Staff working in non-infectious areas used facemasks starting from March 20, 2020. Schedules for environmental disinfection were adapted. Hand hygiene measures were reinforced by the infection control team. Schedules for breaks of health care workers were adapted to reduce the number of possible contacts. On April 12 and 13, 2020, all health care workers ($n = 283$) and residents ($n = 367$) were tested for SARS-CoV-2 by rt-PCR in all 4 LTCFs, including the facility that had not been affected by the outbreak (Fig 1).

Patient characteristics

Demographic and clinical characteristics of persons with positive rt-PCR for SARS-CoV2 are outlined in Table 1. Table 2 summarizes residents' signs and symptoms of COVID-19. Overall, 33% (12/36) residents infected with SARS-CoV2 died. Half of the male residents who were infected with SARS-CoV2 died (6/12) compared to only 20.8% of females (5/24). However, this difference did not reach statistical significance ($P = .08$). There was no significant difference in age between residents who died with COVID-19 and those who survived (mean 84.3 ± 7.6 years vs 86.1 ± 8.1 years). There was no difference in comorbidities between those residents who died compared to those who survived COVID-19.

Personnel

Overall 19/283 members of staff were tested positive for SARS-CoV2. In LTCFs A and B 6% of site staff were affected, whereas in LTCF C 15% (11/74) were tested positive. In LTCF D no staff member was infected. The 19 health care personnel worked in the following occupational categories: nursing assistant, cleaner, nurse and head nurse. Twelve of 19 returned the questionnaire. Eight suspected the origin

Table 1

Demographic and clinical characteristics of persons with positive rt-PCR for SARS-CoV-2

	Residents n = 36	Personnel n = 19
Median age (years, range)	87 (68–97)	41 (23–59)
Gender n = (%)		
Male	11 (30)	2 (10)
Female	25 (70)	17 (90)
LTCF, n = (%)		
A	16 (44)	4 (21)
B	7 (19)	4 (21)
C	13 (36)	11 (58)
Median level of care (range)	4 (2–7)	n.a.
Chronic underlying conditions, n = (%)		
Neurologic disease	3 (8)	n.d.
Arterial hypertension	27 (75)	n.d.
Cardiac disease	16 (44)	n.d.
Renal disease	14 (39)	n.d.
Liver disease	0	n.d.
Diabetes mellitus	5 (14)	n.d.
Pulmonary disease	4 (11)	n.d.
History of cancer	5 (13)	n.d.
Dementia/ cognitive impairment	11 (30)	n.d.

LTCF, long-term care facility; n.a., not applicable; n.d., not done.

of infection to be work contacts, whereas 2 persons reported private contacts as most likely source (2 reported unknown origin). Signs and symptoms suggestive of COVID-19 as self-reported by staff is shown in Table 2. Two females reported to have had no signs or symptoms suggestive of COVID-19.

DISCUSSION

In the early phase of the SARS-CoV-2 pandemic in Austria (first national lock-down started on March 16, 2020), most LTCFs were ill-prepared for such a situation, as has been reported from other parts of the world.^{2,4} From March 21 to April 14, 2020, 36/277 residents of 3 LTCFs in Graz, Austria, were infected with SARS-CoV-2. Two-thirds of these were transferred to a hospital and one third (12/36) died with COVID-19. The mortality rate is comparable to studies recently published from other European countries.^{4,7,8} During the same period, 8% of health care workers became infected.

Although authorities and health care workers were aware of the high vulnerability of LTCFs to respiratory disease outbreaks, delayed recognition of COVID-19 cases in this population—due to the definition of cases suggestive of COVID-19 at that time and limited rt-PCR-testing capacities—contributed to the spread of the disease in our

Table 2
Signs and symptoms of persons with positive SARS-CoV-2 rt-PCR test

	Residents n = 36	Personnel n = 12*
Body temperature, n = (%)		
up to 38°C	27 (75)	6 (50)
≥38.1°C	9 (25)	6 (50)
Sore throat	0	5 (41)
Cough	7 (19)	7 (58)
Dyspnea	9 (25)	5 (41)
Myalgia	3 (8)	4 (33)
Headache	2 (5)	6 (50)
Loss of taste or smell	0	7 (58)
Gastrointestinal symptoms	8 (22)	5 (41)
No symptoms	6 (16)	2 (16)
Hospitalized, n = (%)	21 (58)	2 (16)
Died, n (%)	12 (33)	0

*12/19 health care workers who were positive for SARS-CoV-2 returned the questionnaire.

LTCFs. Only a quarter of COVID-19 cases among residents had fever ≥ 38.1°C throughout the course of their disease which is comparable to data published by Graham et al.⁷ In their study on 4 nursing homes in the United Kingdom, only 23.8% of SARS-CoV-2 positive residents developed fever.⁷ One third developed respiratory symptoms (cough/breathlessness).⁷ Similarly in our study, 19% and 25% of infected residents respectively had cough and dyspnea. The large number of atypical presentations (eg, gastrointestinal symptoms) and the fact that initial cases in LTCFs A and B were thought to be “too mild” to be COVID-19, led to a delay in testing.

Different factors played a role in the spread of SARS-CoV-2 in the 3 LTCFs. Introduction of the virus into LTCFs happened either through health care workers or visitors. In 2 LTCFs shared health care workers and cleaning personnel may have contributed to the transmission. At least in one case (LTCF C), delayed communication of a positive test result led to a loss of time in terms of initiation of contact precautions. We were not able to detect a connection between the outbreaks in the 3 LTCFs. Other factors that are likely to have contributed to the outbreak development were: official case definitions that did not reflect the state of the pandemic, limited availability of rt-PCR testing and limited access to testing capacities.

A bundle of measures including isolation of confirmed cases and contacts, use of PPE, reinforcement of hand hygiene guidelines was taken to counteract the outbreaks. Testing of all residents and health care workers regardless of symptoms on April 12 and 13 had a significant impact on ending the outbreaks, as the last resident became symptomatic on April 14, 2020. Other reports from nursing homes also point to universal testing as an important step to end COVID-19 outbreaks.⁹

Following the outbreaks the following measures were taken: (1) a PCR testing system for symptomatic health care workers was initiated and personnel was encouraged to get tested even if only mildly symptomatic; (2) PCR testing was implemented for residents even with very mild symptoms; (3) visitors were allowed to visit residents only in designated areas wearing masks and following hand hygiene protocols. During the months following the outbreaks up until December 7, 2020 (end of second national lockdown) only 2 residents, one in LTCF A and one in LTCF C, were found to be positive for SARS-CoV-2. All other residents living in the same subunits were tested but remained negative and asymptomatic. This indicates that measures taken together with an increase in test capacities were effective in preventing another spread of SARS-CoV-2 in our institutions.

This investigation had a number of limitations. Not all general practitioners and other occupational groups such as a hairdresser who worked in more than one LTCF could be interviewed, which could have led to an under-ascertainment of infections. Not all staff returned the questionnaire, so the onset of symptoms could not be determined. This hampered assessment of chains of infection.

CONCLUSIONS

Delayed recognition of possible COVID-19 cases in LTCFs A and B due to either mild symptoms or symptoms that were perceived as atypical early in the pandemic contributed to transmission within these institutions. A bundle of IPC measures and universal rt-PCR testing of residents and health care workers contributed to ending the outbreaks.

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