Clinical Infectious Diseases

BRIEF REPORT

Mitigation of a Coronavirus Disease 2019 Outbreak in a Nursing Home Through Serial Testing of Residents and Staff

Daniel J. Escobar,[1,2] Maria Lanzi,[3] Pouné Saberi,[2,3,4] Ruby Love,[5] Darren R. Linkin,[1,2,6] John J. Kelly,[1,2,6] Darshana Jhala,[2,7,8] Valerianna Amorosa,[1,2,6] Mary Hofmann,[2,5,9] and Jeffrey B. Doyon[1,2,6]

[1]Division of Infectious Diseases, Department of Medicine, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, USA, [2]Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, USA, [3]Division of Occupational and Environmental Medicine, Department of Emergency Medicine, Corporal Michael J. Crescenz Veterans Affairs Medical Center, Philadelphia, Pennsylvania, USA, [4]Division of Occupational and Environmental Medicine, Department of Emergency Medicine, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, USA, [5]Division of Geriatrics, Department of Medicine, Corporal Michael J. Crescenz Veterans Affairs Medical Center, Philadelphia, Pennsylvania, USA, [6]Division of Infectious Diseases, Department of Medicine, Corporal Michael J. Crescenz Veterans Affairs Medical Center, Philadelphia, Pennsylvania, USA, [7]Department of Pathology and Laboratory Medicine, Corporal Michael J. Crescenz Veterans Affairs Medical Center, Philadelphia, Pennsylvania, USA, [8]Department of Pathology and Laboratory Medicine, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, USA, and [9]Division of Geriatrics, Department of Medicine, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania, USA

Nursing homes and long-term care facilities represent highly vulnerable environments for respiratory disease outbreaks, such as coronavirus disease 2019 (COVID-19). We describe a COVID-19 outbreak in a nursing home that was rapidly contained by using a universal testing strategy of all residents and nursing home staff.

Keywords. nursing home; COVID-19; outbreak response; universal testing; SARS-CoV-2.

In the United States (US), >15 000 nursing homes (NHs) and long-term care facilities (LTCFs) care for the oldest and most chronically ill adults [1]. NHs have long been recognized as at-risk environments for respiratory infectious disease outbreaks [1]. With the emergence of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, NH residents have been identified as a highly vulnerable population to the SARS-CoV-2 virus, with 1 nursing home in Washington State reporting a case fatality rate of 34% [2]. The combination of inadequate testing capacity and the recent discovery that asymptomatic and presymptomatic viral shedding lead to viral transmission creates a high risk for outbreaks with potentially significant mortality rates in NHs [1, 3]. The Centers for Medicare and Medicaid Services surveyed 54% of NHs nationally and identified 60 439 NH resident cases, with >25 000 COVID-19–related deaths [4]. Testing of NH staff and residents is likely to play an important role in management of a COVID-19 outbreak, but the optimal breadth and frequency of testing have not been delineated. We describe the management of a COVID-19 outbreak in a NH and describe a strategy involving serial testing of residents and staff that led to its successful, rapid containment.

CASE REPORT

This NH in eastern Pennsylvania has 135 beds on 2 floors and provides care for residents with functional impairment, chronic stable conditions, short-term rehabilitation needs, and hospice. The first floor of the nursing home focuses on post–acute care, while the second floor houses long-term residents. In April 2020, 84 residents lived in the NH, 83 of whom were male. The average age of the residents was 74 years. Comorbid conditions were common among the residents (Supplementary Table 1). The NH is connected to a nonacademic medical center with infection control experts, infectious diseases physicians, quality management staff, employee occupational health (EOH) services, and onsite laboratory services. The NH had access to 2 SARS-CoV-2 polymerase chain reaction testing platforms with turnaround times of 3–24 hours.

On 5 March, the NH issued a no-visitor policy due to concern for an influenza outbreak. At that time, no COVID-19 cases had been identified regionally. On 9 March, universal symptom screening at the NH entrance was implemented and anyone with symptoms was excluded from the facility. Residential common areas, including the gym and the cafeteria, were closed on 17 March. The NH was closed to new admissions on 20 March. To minimize the potential for viral aerosolization, on 30 March, nebulizer use was transitioned to metered dose inhalers. Between 20 March and 6 April, 13 residents were tested for SARS-CoV-2 based on symptoms. All 13 residents tested negative.

The NH implemented a universal masking policy for employees on 1 April. Between 1 April and 8 April, 4 staff members tested positive for SARS-CoV-2 after self-referral for testing based on symptoms; these employees were kept out of work. On 10 April, a fifth employee tested positive for SARS-CoV-2 after developing symptoms. This healthcare worker, while asymptomatic, had been assigned 1:1 with a NH resident (index resident) in a second-floor unit, and had not worked with other NH residents. The index resident, though asymptomatic, tested positive for SARS-CoV-2. On 11 April, the remaining residents

Received 2 June 2020; editorial decision 14 July 2020; accepted 16 July 2020; published online July 20, 2020.

Correspondence: D. J. Escobar, Department of Medicine–Division of Infectious Diseases, Perelman Center for Advanced Medicine, University of Pennsylvania, 3400 Civic Center Boulevard, Philadelphia, PA 19104 (daniel.escobar@pennmedicine.upenn.edu).

Clinical Infectious Diseases® 2020;XX(XX):1–3

DOI: 10.1093/cid/ciaa1021

(16 total) who lived on the same hallway as the index resident were tested, and all tested negative. However, that evening, 1 resident in an adjacent hallway had a temperature of 37.8°C (100.2°F) and tested positive for SARS-CoV-2. This resident was isolated. Identification of the second resident from a different unit raised concern for an outbreak. On 12 April, the remaining residents who lived on the second floor (38 total) were tested for SARS-CoV-2, marking the initiation of universal, serial testing (Figure 1). Two residents from the second unit tested positive, confirming a widespread outbreak. All residents on the first floor tested negative.

On 14 April, a dedicated COVID-19 isolation unit was opened in the NH for SARS-CoV-2–positive residents (Figure 1). All routine care was provided in the resident rooms. Residents were not allowed to travel between units. Universal masking of all residents was implemented, and the residents were encouraged to quarantine in their rooms. Concurrently, use of eye shields for clinical staff was made mandatory and efforts were made to cohort the staff to work on specific units.

Given the widespread outbreak in the NH, on 12 April, EOH implemented SARS-CoV-2 screening of all staff who were either stationed at the NH or moved back and forth between the NH and the medical facility. By 30 April, 212 asymptomatic staff were screened and 67 were tested due to symptoms. Twenty-six symptomatic and 6 asymptomatic staff members tested positive. All SARS-CoV-2–positive employees were kept off site and returned to work based on the US Centers for Disease Control and Prevention's (CDC) symptom-based strategy [5].

Due to concern for asymptomatic transmission, serial testing of NH residents occurred approximately every 3–5 days, to capture as many early asymptomatic cases as possible while balancing resident uptake of the procedure. Each resident was tested an average of 4.4 times. By 20 April, 21 residents tested positive and a second dedicated COVID-19 unit was opened. On 21 April, a team of dedicated observers was deployed to identify opportunities to improve infection control practices. The last positive resident was identified on 23 April (Figure 1). In total, 27 residents tested positive, with an attack rate of 37%. Twenty-six of the positive residents were from the second floor. Among the positive residents, 14 were asymptomatic at the time of identification, and 13 developed symptoms after diagnosis. As of 1 July, no new cases have been identified among the NH residents. The NH has maintained universal masking precautions for residents and staff, as well as the no-visitor policy. Some common areas, such as the gym and the courtyard, have reopened for limited use. To date, all newly hired staff of the NH are tested for SARS-CoV-2, and 3 new hires have tested positive and have been kept out of work.

DISCUSSION

Delineating strategies to mitigate disease outbreaks in NHs is increasingly important as the number of Americans living in NHs is expected to double by 2050 [6]. Nursing home residents are generally at higher risk for transmissible infections due to host risk factors (chronic comorbidities, age-associated functional immunodeficiency), inherent risk from grouped living quarters, and contact with healthcare staff [6]. With COVID-19, the intrinsic challenges of disease outbreak in a NH are augmented by the high transmissibility of the virus in the asymptomatic phase [7, 8, 9]. These studies support modifying infection control measures to account for probable asymptomatic and presymptomatic transmission.

This case report highlights strategies used to rapidly control a COVID-19 outbreak in a NH. First, the implementation of

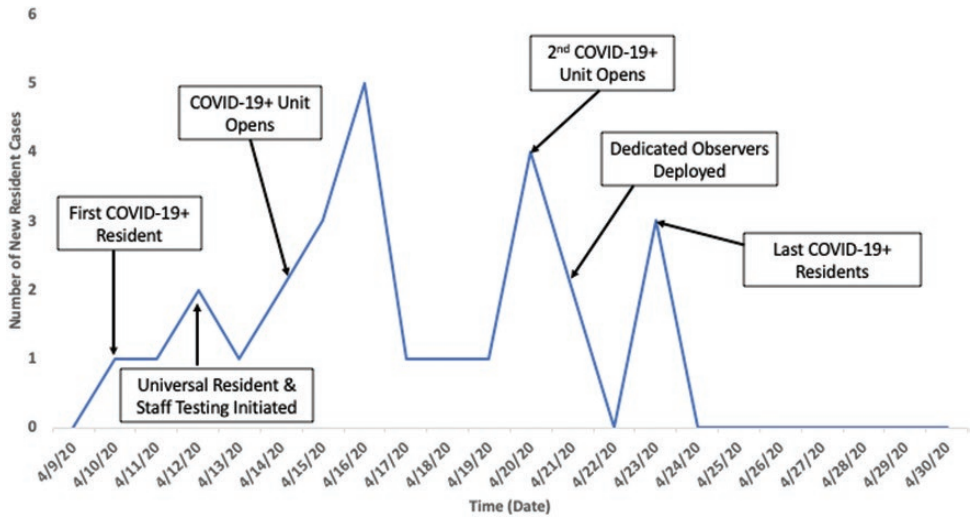

Figure 1. Total number of new daily severe acute respiratory syndrome coronavirus 2 cases in the nursing home. Key interventions in the nursing home are correlated with the date of implementation during the outbreak. Dates are presented as month/day/year. Abbreviation: COVID-19, coronavirus disease 2019; SARS-CoV-2+, severe acute respiratory syndrome coronavirus 2 positive.

serial SARS-CoV-2 testing with rapid turnaround allowed for the identification, isolation, and cohorting of likely infectious but asymptomatic residents. Second, NH leadership developed a comprehensive plan for a SARS-CoV-2 isolation ward in advance of the outbreak, allowing for rapid cohorting and obviating the need to transfer to the affiliated acute care hospital. Third, a multidisciplinary team of physicians, nurses, and administrators with expertise in infection prevention, quality improvement, and geriatrics met daily to round in the NH. Fourth, EOH quickly implemented universal testing of employees, identifying and isolating several asymptomatic staff members, including staff with simultaneous duties at both the NH and the affiliated acute care hospital. Fifth, quality management staff were engaged during the outbreak as dedicated observers to prevent lapses in infection control practices, with education reinforcement and maintenance of appropriate personal protective equipment. After implementing these interventions, we observed a reduction in transmission of SARS-CoV-2 in NH residents, with the last case in a resident detected <2 weeks after the first case.

The cornerstone of the highlighted interventions was serial testing of all residents and employees, regardless of symptomatology. The US CDC guidelines for LTCFs to prepare for COVID-19 outbreaks support point prevalence surveys of all residents and staff, if testing capacity is available [5]. This case report provides support for serial testing of residents and staff in short time intervals (testing residents every 3–5 days)—a higher frequency compared with prior studies [3, 6, 10]. This testing strategy led to early isolation and cohorting, likely preventing additional transmission. Universal testing of staff allowed for identification of positive presymptomatic staff members. A similar testing strategy was recently utilized in a COVID-19 outbreak in a Veteran's Affairs NH in Los Angeles, with comparable results [10]. There are limitations to this approach that may restrict its generalizability to other NHs. These challenges include lack of access to rapid testing; inadequate staffing, including infection control experts [11]; and lack of an affiliation with a medical center. Given the likely added value of these components, building partnerships between NHs and medical centers may be key to improving responses to future outbreaks. Collectively, we provide a compelling blueprint for NHs to rapidly interrupt transmission of COVID-19.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Note

Potential conflicts of interest. The authors: No reported conflicts of interest. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest.

References

1. American Geriatrics Society. American Geriatrics Society policy brief: COVID-19 and nursing homes. J Am Geriatr Soc **2020**; 68:908–11.
2. McMichael TM, Currie DW, Clark S, et al. Epidemiology of Covid-19 in a long-term care facility in King County, Washington. N Engl J Med **2020** 382:2005–11.
3. Roxby AC, Greninger AL, Hatfield KM, et al. Outbreak investigation of COVID-19 among residents and staff of an independent and assisted living community for older adults in Seattle, Washington. JAMA Intern Med **2020**. doi:10.1001/jamainternmed.2020.2233.
4. Centers for Medicare and Medicaid Services. Nursing home COVID-19 data. Available at: https://www.cms.gov/files/document/6120-nursing-home-covid-19-data.pdf. Accessed 24 May 2020.
5. Centers for Disease Control and Prevention. Coronavirus disease 2019 (COVID-19). **2020**. Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/long-term-care.html. Accessed 6 May 2020.
6. Juthani-Mehta M, Quagliarello VJ. Infectious diseases in the nursing home setting: challenges and opportunities for clinical investigation. Clin Infect Dis **2010**; 51:931–6.
7. Arons MM, Hatfield KM, Reddy SC, et al. Presymptomatic SARS-CoV-2 infections and transmission in a skilled nursing facility. N Engl J Med **2020**; 382:2081–90.
8. He X, Lau EHY, Wu P, et al. Temporal dynamics in viral shedding and transmissibility of COVID-19. Nat Med **2020**; 26:672–5.
9. Gandhi M, Yokoe DS, Havlir DV. Asymptomatic transmission, the Achilles' heel of current strategies to control Covid-19. N Engl J Med **2020**; 382:2158–60.
10. Dora AV. Universal and serial laboratory testing for SARS-CoV-2 at a long-term care skilled nursing facility for veterans—Los Angeles, California, 2020. MMWR Morb Mortal Wkly Rep **2020**; 69:651–5.
11. Davidson PM, Szanton SL. Nursing homes and COVID-19: we can and should do better. J Clin Nurs **2020**; 29:2758–9.