



COVID-19 disease trajectories among nursing home residents

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Abstract

Introduction: Older adults are at greater risk of both infection with and mortality from COVID-19. Many U.S. nursing homes have been devastated by the COVID-19 pandemic, yet little has been described regarding the typical disease course in this population. The objective of this study is to describe and identify patterns in the disease course of nursing home residents infected with COVID-19.

Setting and Methods: This is a case series of 74 residents with COVID-19 infection in a nursing home in central Indiana between March 28 and June 17, 2020. Data were extracted from the electronic medical record and from nursing home medical director tracking notes from the time of the index infection through August 31, 2020. The clinical authorship team reviewed the data to identify patterns in the disease course of the residents.

Results: The most common symptoms were fever, hypoxia, anorexia, and fatigue/malaise. The duration of symptoms was extended, with an average of over 3 weeks. Of those infected 25 died; 23 of the deaths were considered related to COVID-19 infection. A subset of residents with COVID-19 infection experienced a rapidly progressive, fatal course.

Discussion/Conclusions: Nursing home residents infected with COVID-19 from the facility we studied experienced a prolonged disease course regardless of the severity of their symptoms, with implications for the resources needed to care for and support of these residents during active infection and post-disease. Future studies should combine data from nursing home residents across the country to identify the risk factors for disease trajectories identified in this case series.

KEYWORDS

COVID-19, disease trajectory, long-term care, nursing home

INTRODUCTION

Approximately 40% of COVID-19-related U.S. deaths were among nursing home residents in 2020.¹ This is due to a combination of the vulnerability of older adults to the virus, the need for hands-on, prolonged care from caregivers, and the inherent risks of congregant settings. Inadequate supplies and personnel to address the crisis have been cited as contributors to outbreaks as well.² Given the high community spread, it is challenging to completely prevent entry of the virus into facilities from asymptomatic staff and then, once in the facility, to mitigate spread.²

Due to the immunophysiology of older adults and the high incidence of dementia in nursing homes, any acute illness in this population can present in an atypical manner.³ Some older adults may not mount a fever in response to infection^{4,5}; persons with dementia may be unable to report symptoms.⁶⁻¹⁰ A range of presentations may be present in a COVID-19 infection. At least one inpatient study of COVID-19 in older adults noted a rapid disease course preceding death.¹¹ Other hospital-based studies have noted a prolonged course for intubated patients regardless of age, with a high risk of mortality among older adults.^{12,13}

Most nursing home residents have cognitive impairment and those with moderate to advanced dementia, often have goals of care consistent with limited interventions or comfort care.^{14,15} Thus, if they are to become ill, the goal is to care for them in the nursing home. Little is known about the expected disease course for nursing home residents who elect not to pursue aggressive measures if infected with the novel coronavirus. Further, the longer-term sequelae of COVID-19 infection are only beginning to be understood.¹⁶ The objective of this study is to examine a case series of an outbreak of COVID-19 in a nursing home to identify the disease course pattern both for both decedents and survivors of the disease.

Setting

This is a case series describing the management and outcomes of residents during a COVID-19 outbreak in a privately managed nursing home in Indiana. During the outbreak, 74 out of 89 long-stay nursing home residents were infected with COVID-19. This outbreak is defined as the first positive test on March 29 to a positive case on June 17, 2020.

To prepare for a potential outbreak, facility-wide daily monitoring of residents' temperatures and oxygen levels started in mid-March. The first case diagnosed in

Key Points

- COVID-19 symptom burden is prolonged for nursing home residents (average of greater than 3 weeks).
- Caring for residents infected with COVID-19 in post-acute and long-term care is resource-intensive, including, PPE, testing, and staffing.
- A full understanding of the disease burden and trajectories of COVID-19 in a nursing home population aids preparation for outbreaks.

Why Does this Paper Matter?

Increasing awareness of the disease trajectory of COVID-19 among nursing home residents will improve care in the nursing home and prevent unnecessary hospitalizations and death.

the facility was in an individual recently admitted from the hospital who was tested on March 29 due to having a fever and asymptomatic hypoxia. This resident was isolated since admission from the hospital and remained in isolation; no other residents or staff exhibited symptoms.

The facility implemented facility-wide testing of all residents on April 16 fanning out from the first known facility-onset case. All residents were tested over a 5-day period. Residents who had close contact with those who were infected or who were symptomatic were placed in isolation until the test result was available. Those who tested positive were moved to a specially designated COVID-19 isolation wing. Due to the CDC's initial recommendation to obtain two negative test results to move a resident from the COVID-19 isolation unit, all residents with COVID were required to have two negative tests before they could be removed from isolation.

Test results during this outbreak took a minimum of 19 h to return and up to 4½ days. A clerical error in the laboratory led to one resident being falsely identified as having a negative test result that was later corrected to positive. Most of the residents of this facility share rooms, bathrooms, dining rooms, and other common space. Compassionate care visits by family members were allowed with nursing home residents with COVID-19 who were receiving comfort care, but many elected not to visit due to concerns about potential for infection.

At the time of this outbreak, treatment recommendations were for patients enrolled in clinical trials or who were hospitalized. Steroids were thought to potentially worsen COVID-19 infection. Thus, supportive cares were the mainstay of treatment with some additional interventions. Most residents were treated with thrombosis prophylaxis (enoxaparin) unless there was a contraindication, or unless they were already on an anticoagulant such as warfarin (Figure S1). Those not treated with an anticoagulant either had a contraindication or transferred to the hospital before initiation of the medication. Hypoxic patients received oxygen supplementation. No residents were given steroids or hydroxychloroquine during this outbreak. All residents had the frequency of vital sign monitoring increased and increased hydration support either orally with staff encouragement or via intravenous fluids.

METHODS

Data were collected from the electronic medical record (EMR) and from the medical director's notes. Data extracted from the EMR and notes included: signs and symptoms of infection, demographic information, comorbidities, acute care use, the number of COVID-19 tests during the outbreak, and the duration of the disease as measured by either the first positive COVID-19 test or first noted sign or symptom, whichever came earlier, and the end of isolation or residence in the COVID-19 unit, typically marked by a second negative COVID-19 test or greater than 30 days from the first noted sign or symptom of the disease. Weekday rounding occurred in a hybrid fashion, usually over the phone with facility staff to lessen potential spread of the virus and conserve Personal Protective Equipment (PPE). Telehealth and in-person visits occurred with residents.

The medical director and attending physicians were board-certified geriatricians, advanced practice providers were affiliated with the geriatrics division at the medical school, and there was an almost decade-long relationship between the division of geriatrics and the facility. Three authors (JLC, KML, KW) reviewed cases to determine whether COVID-19 was involved in the resident's death according to the National Center for Health Statistics Reporting Guidelines.¹⁷ The Indiana University IRB approved this study.

RESULTS

Of the 74 residents with confirmed COVID-19 infection, half were female; 43% were African American, and 57% were Caucasian (Table 1). Hypertension was the most

TABLE 1 Demographics and outcomes

Demographic information	Total n = 74 (%)
Mean age	81.01
Gender (% female)	37 (50%)
Race	
African American	32 (43%)
Caucasian	42 (57%)
Code status in facility	
DNR	46 (62%)
Full code	28 (38%)
Comorbidities	
Hypertension	60
Coronary artery disease	14
Heart failure	28
Atrial fibrillation	16
Diabetes	37
COPD/asthma	20
OSA	10
Dementia	38
Non dementia mental health (depression, bipolar, substance abuse, etc.)	32
CKD	24
Obesity	4
Cancer (not skin)	5
Stroke/TIA	11
History of DVT	9
Hypothyroid	11
Outcomes	
Symptom/Disease duration, mean days (range)	26.91 (3–52)
Transferred to ED/hospital	27
Reasons for transfer	
Hypoxia, respiratory distress, or other respiratory symptoms	15
Need for BIPAP	1
Tachycardia	1
Altered mental status	5
Fall	1
Chest pain	1
Abnormal labs	1
Gastrointestinal complaints	1
Hypotension	1
Mortality ^a	
Deceased in hospital	10
Deceased in nursing home	15

^aTwo of the 25 deceased residents died from non-COVID-19 related illnesses. Abbreviations: DNR, do not resuscitate; COPD, chronic obstructive pulmonary disease; OSA, obstructive sleep apnea; CKD, chronic kidney disease; TIA, transient ischemic attack; DVT, deep vein thrombosis; ED, emergency department; BIPAP, bilevel positive airway pressure.

common comorbidity (81%) followed by dementia (51%) and diabetes (50%) and non-dementia mental illness (43%) (Table 1).

Three of the 74 residents did not have any appreciable symptoms and of those, two were managed in the facility whereas the other resident was admitted to the hospital for an unrelated medical condition. The most common documented COVID-19 sign or symptom was a fever of 99F or higher (74%), followed by malaise (62%), and anorexia (62%). Hypoxia (55%) and cough (51%) were the next most common presentations; dyspnea was only present in 26% of the cases. Altered mental status was reported in 32% of the cases. None of the residents in this nursing home outbreak reported headaches.

Respiratory symptoms or hypoxia were the most common reasons for a hospital transfer and 36% of residents with COVID-19 were transferred to the Emergency Department or admitted to the hospital (Table 1). Altered mental status was the only other symptom that precipitated more than one hospital transfer. At least one resident, who was clinically stable, had to be hospitalized due to long-term use of nightly Bilevel Positive Airway Pressure (BiPAP) and thus could not stay in the facility due to lack of a negative pressure airflow room.

Residents with COVID-19 infection appeared to fall into four disease trajectory categories (Figure 1). There were a few residents who had minimal to no symptoms ($n = 17$), residents who survived but experienced significant (greater than 3) symptoms ($n = 32$), residents who

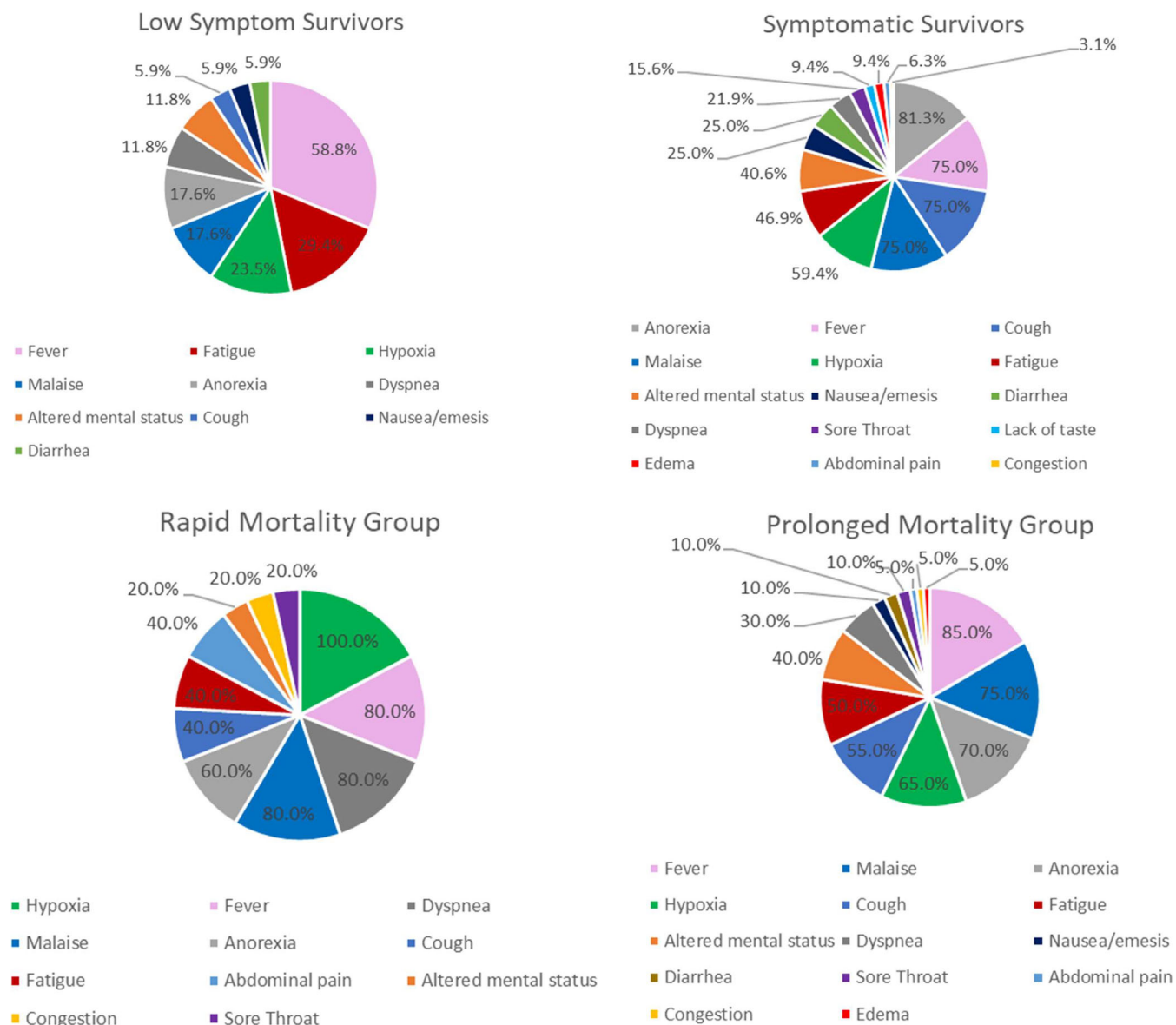


FIGURE 1 Trajectory group symptom distribution

TABLE 2 Disease trajectory groups and outcomes

Testing and outcomes	Low symptom survivors (<i>n</i> = 17)	Symptomatic survivors (<i>n</i> = 32)	Rapid mortality (<i>n</i> = 5)	Prolonged course (<i>n</i> = 20) ^a	Total
Number of COVID tests, mean (range)	4 (0–11)	5 (3–7)	2.2 (2–3)	3.95 (2–7)	4.30 (0–11)
Disease duration (days)	26.6 (15–36)	31.7 (17–49)	4.8 (3–7)	25.05 (10–52)	26.91
Deceased in hospital	0	0	1	9	10
Deceased in nursing home	0	0	4	11	15

^aTwo of the residents from this group died from non-COVID-19 related illness.

died after a rapidly progressive course (less than 7 days) (*n* = 5) and residents who died after a prolonged course with significant symptom burden (*n* = 20).

Residents were tested for COVID-19 anywhere from 0 to 11 times during the study timeframe (Table 2). One resident was presumed positive and was unable to be tested due to inability to cooperate with the nasopharyngeal swabbing process. Fever was a less common symptom in the group of survivors with low symptom burden, although over half of the members of this group still had fevers (59%). Except for the subset (*n* = 5) who rapidly died after the onset of symptoms, most residents were symptomatic for an average of 3 weeks. There was a facility Do Not Resuscitate (DNR) order for 62% of residents infected with COVID-19. One-third of the residents infected with the novel coronavirus during this outbreak died. Of those, two of the deaths were not related to COVID-19 infection. More than half of the deceased residents (60%) died in the nursing facility.

DISCUSSION

Nursing home residents infected with SARS-CoV-2 may present with atypical and nonspecific symptoms such as malaise, anorexia, and less likely with dyspnea. Others have found that delirium occurs in more than half of the COVID-19 patients in a critical care setting.¹⁸ In our study, although fever was a common symptom, it was not a universal symptom among residents infected with the novel coronavirus. Anorexia was an important symptom noted in the cohort, unlike many hospital-based descriptions of the trajectory of COVID-19. Delirium and anorexia are both important indicators of acute illness in nursing homes and this holds true for COVID-19 in older adults including nursing home residents.^{8,19,20} In addition to highlighting the symptomatology that was common in nursing home resident populations, other findings that merit discussion include overall disease trajectories.

Decedents experienced more of the symptoms than the survivors. Past studies have demonstrated that

nursing home residents with select acute illness can still be managed in-house.^{21,22} Our case fatality rate is 31.1%, which is near the upper end of the spectrum of what has been reported in other nursing homes.⁶ Future research can pool data from multiple nursing facilities to better predict which disease trajectory a patient infected with the novel coronavirus is likely to take.

Other than those who experienced a rapid demise, most residents with COVID-19, were symptomatic for several weeks. Other studies have found a high rate of asymptomatic carriers in nursing homes.²³ We found that nursing home residents will have a low symptom burden but will still have some indicator of infection. The long symptom burden necessitates prolonged isolation, extensive use of PPE and can significantly impact the quality of life of this patient population.²⁴ Although the disease course of COVID-19 may be difficult to predict and leads to increased mortality, most residents infected with COVID-19 can be managed in the nursing home with appropriate staff and resources, including abundant PPE and testing capacity. That said, policies must be implemented to support nursing home management of these patients. Without adequate staff to encourage hydration, monitor frequent vitals, and administer other supportive treatments, residents will need to be transferred to the hospital. Older adults, especially those in the shared space environment of nursing homes, will continue to be susceptible to novel infections. Thus, it is imperative that future pandemic preparation include expertise in geriatrics and gerontology, including nursing home care.

As new variants of SARS-CoV-2 disseminate in the population, it is unclear how protective currently approved vaccines will be.^{25,26} Given that nursing home residents experience symptoms for an extended duration and may be susceptible to infection with virus variants, other treatment options are necessary to prevent further devastation of the nursing home population. With shortened duration of symptoms and decreased likelihood of severe illness residents who are unlikely to need

hospitalization could benefit from newer treatments such as monoclonal antibodies and steroids.^{27,28}

Limitations

For residents who were transferred to the hospital, detailed information about their hospital course was limited. The first mention in the EMR of a symptom may not truly represent first occurrence of a symptom, however, it is not anticipated there would be greater than a 1 or 2-day lag in the recording. During this early outbreak in the pandemic, access to testing was limited and regular surveillance testing was not mandated for several months. It is possible that asymptomatic infected residents were missed.

CONCLUSION

The clinical course of COVID-19 among residents of the nursing home studied was variable. Most experienced at least some signs or symptoms of COVID-19, though they may be atypical symptoms such as anorexia or delirium. For those who survived, the duration of symptoms is long and these residents will require extended support.

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CONFLICT OF INTEREST

Author Kathleen T. Unroe is the CEO and Founder of Probari, a business intended to disseminate the OPTIMISTIC clinical care model. All other authors have no conflicts of interest.

AUTHOR CONTRIBUTIONS

Study concept and design: Lauren Albert, Ellen Kaehr, Kristi M. Lieb, Kathleen T. Unroe, Jennifer L. Carnahan, Kamal Wagle. Acquisition of data: Kristi M. Lieb, Lauren Albert, Kamal Wagle, Jennifer L. Carnahan, Ellen Kaehr. Analysis and interpretation of data: Lauren Albert, Ellen Kaehr, Kristi M. Lieb, Kathleen T. Unroe, Kamal Wagle, Jennifer L. Carnahan. Drafting of the manuscript: Jennifer L. Carnahan. Critical revision of the manuscript for important intellectual content: Lauren Albert, Ellen Kaehr, Kristi M. Lieb, Kathleen T. Unroe, Kamal Wagle, Jennifer L. Carnahan.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

Figure S1 Anticoagulation treatment of nursing home residents with acute COVID-19 infections.

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