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Assessment of COVID-19 outbreaks in long-term care facilities

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SUMMARY

Background: The B.1.167.2 (Delta) variant quickly became the predominant circulating SARS-CoV-2 strain in the USA during summer 2021. Missouri identified a high number of outbreaks in long-term care facilities (LTCFs) across the state with low vaccination rates among LTCF staff members and poor adherence to mitigation measures within local communities.

Aim: To describe COVID-19 outbreaks that occurred in Missouri LTCFs impacting staff and residents during the surge of the Delta variant.

Methods: Outbreaks of COVID-19 in 178 LTCFs were identified by the Missouri Department of Health and Senior Services. Case data from LTCFs with the highest burden of disease were analysed to assess disease transmission, vaccination status, and outcomes among residents and staff. Additional investigational measures included onsite visits to facilities with recent COVID-19 outbreaks in communities with substantial transmission to assess mitigation measures.

Findings: During April 22nd to July 29th, 2021, 159 COVID-19 cases among 72 staff members and 87 residents were identified in 10 LTCFs. More than 74.7% of resident cases were vaccinated compared to 23.6% of staff cases. Vaccinated residents had a lower proportion of hospitalizations and deaths reported compared to unvaccinated residents. Data analysis and contact-tracing efforts from a sample of the facilities suggest that staff members were likely a major factor in introducing SARS-CoV-2 virus into the facilities. Adherence to COVID-19 mitigation measures varied at the visited facilities.

Conclusion: Data showed that vaccination rates varied between staff cases and resident cases in facilities with high-burden outbreaks. Differences were identified in mitigation practices in at least two facilities.

Keywords

SARS-CoV-2; LTCF; Delta variant; Mitigation measures; Vaccine; COVID-19

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Introduction

Missouri experienced a third wave of COVID-19 in May 2021, attributable to the Delta variant, which was first identified in the state through genomic surveillance of wastewater systems [1]. By mid-July 2021, Delta was the predominant SARS-CoV-2 variant across all Missouri health jurisdictions, and multiple sources indicated that close to 90% of cases were infected with the Delta variant. On July 16th, 2021, 92% of Missouri's counties had 'substantial' to 'high' transmission (50–99 to 100 new cases per 100,000 persons respectively in the past seven days) and reports indicated that both rural and urban communities were heavily impacted [2]. Even though the Delta wave in Missouri preceded the nationwide spread, the variant quickly became the predominant strain across the USA, causing another surge in COVID-19-associated cases, hospitalizations, and deaths [3].

Missouri ranked between 39th and 41st in the USA for COVID-19 vaccination remaining relatively stable from April–May [2]. As of July 17th, 2021, 40% of all Missourians, including 73.6% of the Missouri population aged 65 years, were fully vaccinated [2]. Vaccination rates in Missouri trailed behind the national average despite state campaigns and local efforts to educate and incentivize communities living in low-uptake areas regarding the efficacy of COVID-19 vaccinations in reducing the likelihood of infection and severe disease [2,4]. The surge in the more transmissible Delta variant coupled with lower vaccination rates contributed to a high number of COVID-19 cases throughout the state.

Residents and staff in long-term care facilities (LTCFs) were among those most severely impacted by the Delta surge. To better understand disease transmission and identify barriers to prevention measures, case demographics, disease severity, vaccination status, and mitigation measures were analysed among a subset of COVID-19 outbreaks that occurred in Missouri LTCFs that reported higher burden outbreak.

Methods

Missouri Department of Health and Senior Services (DHSS) defined an LTCF outbreak as 1 confirmed case among residents or staff in a facility where no confirmed cases were detected during the four-week period prior to the week cases were identified. During April 22th to July 29th, 2021, at least 178 LTCFs reported active or recently resolved COVID-19 outbreaks across Missouri, totalling 482 cases among residents and staff. To provide a snapshot into the evolving Delta variant outbreaks, the Missouri DHSS identified facilities with the highest burden of disease out of the 178 outbreaks. Data were compiled on 11 facilities by DHSS and administrators of LTCFs and referred to a team of epidemiologists and data analysts from the Centers for Disease Control and Prevention (CDC) COVID-19 response.

After data cleaning, an analysis was performed on de-identified data from 10 facilities that included demographic information, positive polymerase chain reaction (PCR) and/or antigen test results, vaccination status, and genomic sequences of positive samples. Cases with a specimen collection date during April 22nd to July 29th, 2021, were identified through antigen point-of-care testing and/or laboratory-based PCR testing. Administrators at the

LTCFs reported whether persons identified as cases were symptomatic and their associated outcomes, including hospitalizations and deaths. For this investigation, breakthrough cases were defined as residents or staff who completed their primary series of vaccination at least 14 days prior to receiving a positive COVID-19 test result. Persons who were partially vaccinated did not receive the last dose <14 days or complete the primary series before testing positive. χ^2 -Testing in SAS (version 9.4, SAS Institute) compared differences in disease severity among vaccinated and unvaccinated (did not receive any COVID-19 vaccine) cases.

The CDC team was invited during the assessment window by Missouri DHSS and LTCF administrators to visit Missouri LTCFs with active COVID-19 outbreaks. Two facilities were identified and selected by Missouri DHSS based on LTCF staff availability, severity of outbreak, and location. Both facilities were located in rural areas with a seven-day rolling average in the community of 100 new cases per 100,000 population during the week that the case was first identified [5]. The team conducted semi-structured interviews with facility administrators to understand infection prevention and control and other mitigation measures, strategies being utilized to increase vaccine uptake, and other factors that may have contributed to the observed outbreaks. These activities were reviewed by CDC and conducted consistent with applicable federal law and CDC policy (see, for example, 45 C F R. part 46, 21 C F R. part 56; 42 U S C. §241(d); 5 U S C. §552a; 44 U S C. §3501).

Results and discussion

During April 22nd to July 29th, 2021, 159 COVID-19 cases were reported from 10 LTCFs (median: 10; range: 5–39 per LTCF) (Table I). The facilities had a total of 560 residents and 858 staff and experienced 87 (54.7%) cases among residents and 72 (45.3%) cases among staff. The median age of cases was 66 years (82 years for residents and 34 years for staff). The majority of residents and staff identified as non-Hispanic White (59.8% and 56.9%) and female (55.2% and 81.9%). Due to resource constraints, genomic sequencing was only conducted on 28 specimens from four of the LTCFs; all of which identified Delta as the infecting variant. Through testing and contact tracing efforts, staff members were identified as possible index patients in these four LTCFs and in four of the other facilities, or 80% of high-burden outbreaks.

Eighty-two (51.6%) cases occurred among fully vaccinated individuals: 65 (74.7%) residents and 17 (23.6%) staff. Such breakthrough cases were reported from nine of the 10 LTCFs. They occurred on average 122 days (range: 36–168) or four months after completion of a two-dose vaccine series. This suggests that there may have been waning immunity among some of the breakthrough cases as it was later established that being up to date with COVID-19 vaccines is critical for preventing waning immunity in persons [6]. Fifty-one (70.8%) staff cases were not vaccinated, and vaccination coverage was low among all ages. DHSS noted that vaccines were available and prioritized for LTCF staff; however, they received reports from LTCF administrators that this prevention measure was not utilized by all staff. Overall, only five (3.1%) cases were partially vaccinated: three (3.4%) residents and two (2.8%) staff.

The majority of infected staff (55, 76.4%) reported symptoms; the only staff case who was hospitalized was unvaccinated and no deaths were reported (Table II). A higher proportion of hospitalizations and deaths occurred among resident cases compared to staff, demonstrating younger age as a predominant factor against COVID-19-related outcomes [7]. Among residents, 10 (15.4%) hospitalizations and five (7.7%) deaths occurred among those fully vaccinated, while four (22.2%) hospitalizations and four (22.2%) deaths occurred among those who were not vaccinated. Though the differences in rates of hospitalizations and death among vaccinated and non-vaccinated residents were not statistically significant, risk reduction of severe disease in vaccinated persons compared to unvaccinated persons has been well established [8,9]. Among partially vaccinated cases, one resident was hospitalized and no deaths occurred.

The CDC team visited two of the 10 facilities included in the investigation. Staff at these two LTCFs anecdotally described limited staff compliance with CDC-recommended community mitigation measures, particularly inconsistent or absent mask use outside of the workplace in public spaces. However, the visited LTCFs reported implementing facility-level mitigation measures, including routine testing and required masking. During the outbreaks, both facilities reported testing all staff and residents twice per week using rapid antigen tests to identify infected persons. In one facility, several staff were observed not wearing masks, or wearing them improperly (e.g. under the chin or with some straps not worn as intended) by three observers during the CDC site visits. Both facilities restricted communal activities during outbreaks; one facility allowed non-infected residents and staff to eat in a common area to facilitate food service amid staffing shortages. One facility reported educating staff and residents on the benefits and potential side-effects of COVID-19 vaccines. Neither facility mandated vaccination due to extreme staffing shortages and concerns about losing staff should such a policy be implemented.

The findings in this report are subject to several limitations. First, this analysis was limited to case data collected during a four-month period because of limited staff capacity. LTCFs were not able to collect and submit data on associated non-infected persons. Second, data on characteristics of symptomatic disease and underlying medical conditions were incomplete, precluding more detailed analyses of these features. Third, contact-tracing efforts varied per LTCF, and genomic sequencing was not available for all infected persons; thus, there is limited evidence to link residents to staff members, and vice versa. Finally, adherence to infection prevention and control measures was not assessed systematically.

In conclusion, during the Delta variant surge among LTCFs in Missouri, vaccination rates varied between staff cases and resident cases in those facilities with high-burden outbreaks. Differences were identified in mitigation practices in at least two facilities. Prevention measures noted in this study can help prevent the spread of SARS-CoV-2 and limit transmission [10].

Whereas this study occurred during the Delta variant surge, the increased transmissibility of the Omicron variant produced another surge of SARS-CoV-2 infections among residents and staff in LTCFs [9]. As COVID-19 variants of concern emerge, appropriate use of available prevention measures will benefit these populations [9,10].

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Conflict of interest statement

None declared. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

References

- [1]. The Sewershed Surveillance Project. COVID-19 tracking tool. 2021. Available at: <https://storymaps.arcgis.com/stories/f7f5492486114da6b5d6fdc07f81aacf> [last accessed December 2021].
- [2]. Data strategy and execution workgroup, joint coordination cell/white house. COVID-19 state profile report Missouri. 2021. Available at: [HealthData.gov](https://www.healthdata.gov) [last accessed July 2021].
- [3]. Herlihy R, Bamberg W, Burakoff A, Alden N, Severson R, Bush E, et al. Rapid increase in circulation of the SARS-CoV-2 B.1.617.2 (Delta) variant – Mesa County, Colorado, Aprile–June 2021. *Morb Mortal Wkly Rep* 2021;70:1084–7.
- [4]. Missouri Department of Health & Senior Services. 2021. Available at: <https://covidvaccine.mo.gov/win/vips/> [last accessed December 2021].
- [5]. Centers for Disease Control and Prevention. COVID data tracker. 2021. Available at: https://covid.cdc.gov/covid-data-tracker/#county-view?list_select_state=Missouri&data-type=Risk [last accessed August 2021].
- [6]. Centers for Disease Control and Prevention. COVID-19 vaccination schedules. 2022. <https://www.cdc.gov/vaccines/covid-19/downloads/COVID-19-vacc-schedule-at-a-glance-508.pdf> [last accessed July 2022].
- [7]. Centers for Disease Control and Prevention. Risk for COVID-19 infection, hospitalization, and death by age group. 2022. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html> [last accessed July 2022].
- [8]. Scobie HM, Johnson AG, Suthar AB, Severson R, Alden N, Balter S, et al. Monitoring Incidence of COVID-19 cases, hospitalizations, and deaths, by vaccination status – 13 U.S. jurisdictions, April 4–July 17, 2021. *Morb Mortal Wkly Rep* 2021;70:1284–90.
- [9]. Vilches TN, Nourbakhsh S, Zhang K, Juden-Kelly L, Cipriano LE, Langley JM, et al. Multifaceted strategies for the control of COVID-19 outbreaks in long-term care facilities in Ontario, Canada. *Prev Med* 2021;148:106564. [PubMed: 33878351]
- [10]. Centers for Disease Control and Prevention. Interim infection prevention and control recommendations to prevent SARS-CoV-2 spread in nursing homes. 2022. Available at: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/long-term-care.html> [last accessed January 2022].

Demographics and characteristics of infected persons among staff ($N = 858$) and residents ($N = 560$) in 10 long-term care facilities with higher burden COVID-19 outbreaks in Missouri during the Delta variant surge, April 22nd to July 29th, 2021 ($N = 159$)

Table 1

Variable	Total cases $N = 159$	Residents $N = 87$	Staff $N = 72$
Cases per LTCF, median (range)	10 (5–39)	6 (2–28)	6 (2–16)
Age (years), median (range)	66 (17–107)	82 (21–107)	34 (17–72)
Race/ethnicity			
White, non-Hispanic	91 (57.2%)	52 (59.8%)	41 (56.9%)
Black, non-Hispanic	1 (0.6%)	0	1 (1.4%)
Hispanic/Latino	3 (1.9%)	0	3 (4.2%)
Not reported	62 (39.0%)	35 (40.2%)	27 (37.5%)
Gender			
Male	37 (23.3%)	28 (32.2%)	9 (12.5%)
Female	118 (74.2%)	59 (55.2%)	59 (81.9%)
Not reported	15 (9.4%)	11 (12.6%)	4 (5.6%)
Genomic sequencing			
Yes, identified Delta	28 (17.6%)	26 (29.9%)	2 (2.8%)
Not performed	131 (82.4%)	61 (70.1%)	70 (97.2%)
Vaccination status			
Fully ^a	82 (51.6%)	65 (74.7%)	17 (23.6%)
Partially ^b	5 (3.1%)	3 (3.4%)	2 (2.8%)
No	69 (43.4%)	18 (20.7%)	51 (70.8%)
Not reported	3 (1.9%)	1 (1.2%)	2 (2.8%)
Type of vaccine received			
Moderna	50 (61.0%)	38 (58.5%)	12 (70.6%)
J&J	3 (3.7%)	1 (1.5%)	2 (11.8%)
Pfizer	29 (35.4%)	26 (40.0%)	3 (17.6%)
Disease severity			
Symptomatic			
Yes	110 (69.2%)	55 (63.2%)	55 (76.4%)
No	34 (21.4%)	21 (24.1%)	13 (18.1%)

Variable	Total cases N = 159	Residents N = 87	Staff N = 72
Not reported	15 (13.6%)	11 (12.6%)	4 (5.6%)
Hospitalized			
Yes	16 (10.1%)	15 (17.2%)	1 (1.4%)
No	140 (88.1%)	69 (79.3%)	71 (98.6%)
Not reported	3 (1.9%)	3 (3.5%)	0
Death			
Yes	9 (5.7%)	9 (10.3%)	0
No	150 (94.3%)	78 (89.7%)	72 (100%)

LTCF, long-term care facility.

^aFully vaccinated is defined as at least two weeks post receiving their primary series of COVID-19 vaccines.

^bPartially vaccinated is defined as <14 days since completing the primary series or did not complete the series.

Table II

Disease severity of infected persons by vaccination status among staff and residents in 10 long-term care facilities with higher burden COVID-19 outbreaks in Missouri during the Delta variant surge, April 22nd to July 29th, 2021 (N = 151)^a

Variable	Total cases			Residents			Staff			P-value ^b
	Unvaccinated N = 69	Fully vaccinated N = 82	Unvaccinated N = 18	Fully vaccinated N = 65	Unvaccinated N = 51	Fully vaccinated N = 17	Unvaccinated N = 17	Fully vaccinated N = 0		
Symptomatic										
Yes	50 (72.5%)	54 (65.9%)	11 (61.1%)	40 (61.5%)	39 (76.5%)	14 (82.4%)	14 (82.4%)	0	0.84	0.92
No	14 (20.3%)	19 (23.2%)	5 (27.8%)	16 (24.6%)	9 (17.7%)	3 (17.7%)	3 (17.7%)	0	-	-
Missing	5 (7.3%)	9 (11.0%)	2 (11.1%)	9 (13.9%)	3 (5.9%)	0	0	0	-	-
Hospitalized										
Yes	5 (7.3%)	10 (12.2%)	4 (22.2%)	10 (15.4%)	1 (2.0%)	0	0	0	0.55	0.56
No	64 (92.8%)	69 (84.2%)	14 (77.8%)	52 (80.0%)	50 (98.0%)	17 (100.0%)	17 (100.0%)	0	-	-
Missing	0	3 (3.7%)	0	3 (4.6%)	0	0	0	0	-	-
Died										
Yes	4 (5.8%)	5 (6.1%)	4 (22.2%)	5 (7.7%)	0	0	0	0	0.08	-
No	65 (94.2%)	77 (93.9%)	14 (77.8%)	60 (92.3%)	51 (100.0%)	17 (100.0%)	17 (100.0%)	0	-	-
Missing	0	0	0	0	0	0	0	0	-	-

^aEight cases with partial or unknown vaccination status were not included in the table.

^bχ²-Test.