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Frailty, vaccination, and hospitalization following COVID-19 positivity in older veterans

INTRODUCTION

Since the start of the COVID-19 pandemic there have been multiple efforts to predict individual-level risk for adverse outcomes following infection.[1] Frailty, which attempts to capture physiologic vulnerability, is a risk factor for poor outcomes following both infection and hospitalization with COVID-19.[2,3] Frailty has also been identified as a confounder when assessing vaccine effectiveness.[4] However, if frailty is associated with altered vaccine effectiveness against hospitalization among individuals with COVID-19 is not yet known.[5] We provide a preliminary assessment of frailty and protection against hospitalization among COVID-19 positive individuals in a large urban healthcare system.

METHODS

We assembled a cohort from administrative data of all veterans aged 50 or older who had a positive COVID-19 PCR or antigen test at the VA Greater Los Angeles Health Care System from December 1, 2021 to January 31, 2022, covering the Omicron variant wave. Individuals were classified as fully vaccinated if they had completed a COVID-19 vaccine series and had received or were not yet eligible for a booster; partially vaccinated if they had an incomplete vaccine series or were eligible for but had not received a booster; and unvaccinated if they had not received any COVID-19 vaccination. Frailty was assessed using the VA frailty index.[6] Individuals were classified as non-frail, frail, or severely frail (FI < 0.2, 0.2–0.4, and >0.4, respectively) using data from the 36-month period leading up to the date of testing positive for COVID-19. The outcome was hospital admission within 30 days of the positive test result. Analysis was by logistic regression on vaccination status, frailty, age, and gender conducted in R version 4.0.5.

This study was approved by the Institutional Review board of the VA Greater Los Angeles Health Care System.

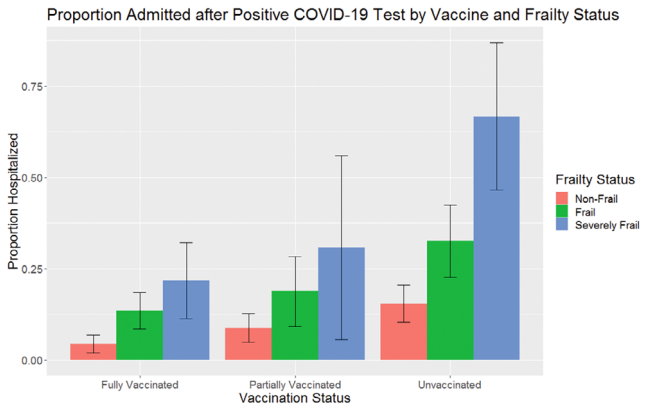

FIGURE 1 Proportions of veterans hospitalized within 30 days following positive COVID-19 test by frailty and vaccination status

RESULTS

TABLE 1 Results of logistic regression of 30-day hospital admission following positive COVID-19 test on age, vaccination status, and frailty status

Variable	Odds ratio (95% CI)	*p* value
Age (years)	1.03 (1.01–1.05)	<0.001
Male gender	1.35 (0.59–3.71)	0.513
Vaccination status		
Fully vaccinated	1	Reference
Partially vaccinated	1.85 (1.13–3.03)	0.014
Unvaccinated	4.13 (2.72–6.36)	<0.001
Frailty status		
Non-frail (FI < 0.2)	1	Reference
Frail (FI 0.2–0.4)	2.41 (1.61–3.62)	<0.001
Severely frail (FI > 0.4)	5.18 (2.96–9.03)	<0.001

Abbreviation: FI, Frailty index.

There were 1091 individuals with a positive COVID-19 test result with 155 admitted. 1026 (94%) were male, median (IQR) age was 67 (60–76). 519 (48%) were fully vaccinated, 271 (25%) partially vaccinated, and 301 (28%) unvaccinated. 662 (61%) were non-frail, 335 (31%) frail, and 94 (9%) severely frail.

Figure 1 shows vaccine effectiveness by frailty. For each vaccination status, those with greater degrees of frailty were more likely to be admitted. However, crude relative risk (95% CI) of admission for fully vaccinated versus unvaccinated are similar: 0.28 (0.15–0.54) for non-frail, 0.42 (0.26–0.67) for frail, and 0.33 (0.18–0.57) for severely frail. Absolute risk differences (95% CI) for fully vaccinated versus unvaccinated increase with greater frailty: 11% (5–17) for non-frail, 19% (8–30) for frail, and 45% (22–68) for severely frail.

Table 1 shows logistic regression results for 30-day admission following positive test. The odds of hospitalization are greater for partially- and un-vaccinated individuals relative to fully-vaccinated individuals, and greater for frail and severely-frail individuals relative to non-frail individuals.

DISCUSSION

We provide early evidence that vaccination against COVID-19 protects infected individuals against hospitalization, regardless of frailty status. Crude relative effectiveness of full vaccination was similar across the levels of frailty we considered, and crude absolute risk reduction was greatest among severely frail individuals. Adjusted analyses confirmed that vaccination against COVID-19 protects against hospitalization among infected individuals. These demonstrate that up-to-date vaccination against COVID-19 is beneficial regardless of frailty. Partial vaccination offered less protection. These results also confirm that, adjusting for vaccination status and age, frail individuals are more likely to be admitted after infection.

Our study is limited by representing a single health system. Sample size restricted assessment of interaction between frailty and vaccination. The outcome includes COVID-related and -unrelated admissions. Finally, due to power we aggregate individuals with incomplete primary vaccine series and those eligible for—but had not received—a booster; these groups may have different outcomes.

In conclusion, this provides evidence that COVID-19 vaccination protects against hospitalization after infection even among frail individuals. Regardless of vaccination status, frail individuals are at higher risk for hospitalization following infection. As preventive measures such as mask requirements are discontinued, clinicians should realize that frail patients remain at higher risk. Frailty may help with prioritizing antiviral therapy when resources are limited and may be an indication for future COVID-19 boosters. Further work should consider vaccine effectiveness against additional outcomes across levels of frailty to inform how well vaccination protects those most vulnerable.

AUTHOR CONTRIBUTIONS

Benjamin Seligman, Kevin Ikuta, and Matthew Bidwell Goetz conceptualized and designed the study. Greg Orshansky collected and curated study data. Analysis was performed by Benjamin Seligman and Kevin Ikuta. The initial draft was prepared by Benjamin Seligman. All authors participated in finalizing the manuscript for submission.

CONFLICT OF INTEREST

The authors have no conflicts of interest to report.

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This study was not sponsored.

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COMMENTS

A call to action to enhance understanding of long COVID in long-term care home residents

The COVID-19 pandemic has highlighted significant vulnerabilities in the long-term care (LTC) sector, with widespread outbreaks and high rates of mortality in LTC homes (including nursing homes and assisted living facilities). In Canada, where our team is based, 81% of all COVID-19 deaths in the first wave of the pandemic were among LTC residents.[1] By the end of 2020, there had been ~44,000 COVID-19 cases and 9200 related deaths among residents in Canadian LTC homes.[2] Although most LTC residents survived acute COVID-19 infection, this does not mean they escaped the lasting impacts of long COVID. There are few studies investigating COVID-19 survivorship, including long COVID prevalence, management, and outcomes among LTC residents.

There has been increasing recognition and research on post-acute sequelae of COVID-19 (PASC), commonly known as long COVID. PASC is a complex and poorly defined syndrome with several possible mechanisms (e.g., viral persistence, immune dysregulation,