



Published in final edited form as:

J Am Geriatr Soc. 2021 August ; 69(8): 2090–2095. doi:10.1111/jgs.17180.

Proportion of SARS-CoV-2 positive tests and Vaccination in VA Community Living Centers

James L. Rudolph, MD^{1,2,6,7}, Scotte Hartronft, MD², Kevin McConeghy, PharmD^{1,7}, Michael Kennedy, PhD³, Orna Intrator, PhD^{4,8}, Lisa Minor, RN, BSN, MSSSL², Terrence L Hubert, PhD⁵, Mary K. Goldstein, MD^{2,9}

¹Center of Innovation in Long Term Services and Supports, Providence VA Medical Center, Providence RI

²Office of Geriatrics and Extended Care, Veterans Health Administration, Department of Veterans Affairs, Washington DC

³Office of Healthcare Transformation, Veterans Health Administration, Department of Veterans Affairs, Washington DC

⁴Geriatrics and Extended Care Data Analysis Center, Veterans Health Administration, Canandaigua NY

⁵Healthcare Operations Center, Veterans Health Administration, Department of Veterans Affairs, Washington DC

⁶Division of Geriatric and Palliative Medicine, Warren Alpert Medical School of Brown University, Providence RI

⁷Center for Gerontology and Health Services Research, Brown University School of Public Health, Providence RI

⁸Department of Public Health Sciences, University of Rochester, Rochester NY

⁹Stanford Health Policy, Stanford University, Stanford, CA

Abstract

Background/Objectives: COVID-19 has caused significant morbidity and mortality in nursing homes. Vaccination against SARS-COV-2 holds promise for reduction in COVID-19. This operational analysis describes the proportion of SARS-COV-2 positive tests before, during, and after vaccination.

Design—Retrospective longitudinal cohort analysis from October 1, 2020 until February 14, 2021

Contact Author: James L. Rudolph, MD Providence VAMC, 830 Chalkstone Ave, Providence RI 02908 james.rudolph@va.gov

Twitter: @JimRudolphMD.

Contribution of Authors

Study concept and design: (Rudolph, McConeghy, Intrator, Goldstein); Acquisition of data (Hartronft, Kennedy, Intrator, Minor, Hubert, Goldstein), analysis and interpretation of data (Rudolph, Hartronft, McConeghy, Kennedy, Intrator, Minor, Hubert, Goldstein), and preparation of manuscript (Rudolph, Hartronft, McConeghy, Kennedy, Intrator, Minor, Hubert, Goldstein)

Conflict of Interests

The Authors have no conflicts of interest to declare

Setting—130 Department of Veterans Affairs (VA) Community Living Centers (CLC), analogous to nursing homes.

Intervention—Vaccination for SARS-CoV-2

Measurements—The primary measure is the proportion of SARS-CoV-2 positive tests among CLC residents. In a pooled analysis of weekly testing and vaccine data, the proportion of positive tests was compared for the unvaccinated, 1st dose, and 2nd dose. For each CLC, we identified the week in which 50% of CLC residents were vaccinated (index week). The analysis aligned the index week for CLCs and examined the proportion of SARS-CoV-2 positive tests at the CLC level before and after. As a reference, we plotted the proportion of positive tests in nursing homes in the same county as the CLC using publicly reported data.

Results—Within the pooled VA CLCs, the first SARS-CoV-2 vaccine dose was delivered to 50% of CLC residents within 1 week of availability and second dose within 5 weeks. Relative to the index week, the risk ratio of SARS-CoV-2 positive tests in the vaccinated relative to unvaccinated was significantly lower in week 4 (RR 0.37, 95% CI 0.20, 0.68). Throughout the study period, the proportion of SARS-CoV-2 positive tests in community nursing homes was higher compared to VA CLC and also declined after vaccine availability.

Conclusion—The proportion of SARS-CoV-2 positive tests significantly declined in VA CLCs four weeks after vaccine delivery and continued to decline in vaccinated and unvaccinated residents. The results describe the importance of SARS-CoV-2 surveillance and vaccination in VA nursing home residents.

Keywords

COVID-19; vaccination; nursing home

INTRODUCTION

Nursing homes have borne the brunt of the COVID-19 pandemic, caused by the SARS-CoV-2 virus, with nearly one-third of COVID-19 related fatalities nationwide.¹ As congregate living facilities for persons requiring skilled care and assistance in daily function, these settings have the potential to rapidly escalate viral transmissions. Nursing home SARS-CoV-2 rates fluctuate with the community prevalence and size of the facility.²

The US Department of Veterans Affairs (VA) operates Community Living Centers (CLC), which are VA owned and operated nursing homes. CLCs have a strong focus on social living in a home-like environment. When COVID-19 was first reported, the CLC environment transformed with a focus on preventing viral transmission through infection control practices, in-line with national guidelines^{3, 4}. As the pandemic heightened, the VA CLCs adapted with protocols for symptom monitoring, resident and staff isolation, quarantine, and diagnostic and screen testing. When vaccines became available, the VA followed CDC guidance and prioritized vaccine delivery and administration to CLC residents and staff.⁵

The objective of this analysis is to describe the proportion of SARS-CoV-2 positive tests among CLC residents before and after vaccination.

METHODS

Cohort

This is a retrospective analysis of VA operational data. CLCs (n=130) operating across the United States and Puerto Rico were included. This analysis focuses on the time from October 1, 2020 to February 14, 2021. Consistent with CMS recommendations on hospital acquired infection⁶, the analysis excludes residents who tested positive for SARS-CoV-2 prior to or within 3 days of CLC admission. Summary characteristics of CLCs residents are provided from VA electronic records. This is a descriptive analysis of VA operational data conducted for non-research purposes, thus IRB approval was not required.

Variables

CLC testing and vaccination results were summarized weekly at the CLC level. The proportion of positive SARS-CoV-2 tests is calculated from both VA and non-VA facilities as the number of positive tests divided by the number of residents present in the week. Vaccination is reported as the number of residents within a CLC during a week who were administered the first dose, the second dose, and those who were not. For CLCs, the SARS-CoV-2 positive rate is summarized weekly for the total population in the CLC that week, and by vaccinated and unvaccinated residents.

For nursing homes in the county of CLCs, the proportion of positive SARS-CoV-2 tests were collected from the Centers for Medicare and Medicaid Services COVID-19 Nursing Home Data public website⁷ and reported. There are no publicly available data on non-VA nursing home vaccination at this time.

Analysis

The first analysis uses weekly testing and vaccine data to describe the proportion of SARS-CoV-2 positive tests among vaccinated (1st dose and 2nd dose) and unvaccinated CLC residents using data pooled across all CLCs.

The second analysis examined whether the proportion of SARS-CoV-2 positive tests were lower in the post vaccination periods. The index period was the first week when over 50% of CLC residents received their first dose. For reference, a line representing the proportion of SARS-CoV-2 positive tests in community nursing homes in the same county during the same periods has been added. Supplemental figures describe sensitivity analysis of using an index date with 25% and 75% vaccinated residents (Supplemental Figure 1).

After centering on the index date, the third analyses examines the proportion of positive COVID tests in vaccinated residents relative to unvaccinated residents is calculated weekly before and after the index date. The weekly-calculated relative risks with 95% Confidence Intervals (95% CI) are presented.

RESULTS

During the COVID-19 pandemic, CLCs (n=130) cared for an older (mean age 73.5 SD±3.8 years), male (96.1%), diverse (69% white, 22% black, 9% other) population with about half

having a diagnosis of dementia (52.4%) and the majority residing long-term (75%). VA CLCs vary in size (mean beds 84 SD±46). For the reference community nursing homes (n=4944), there were a mean 40 (SD±49) nursing homes per county with a CLC.

Figure 1 presents the weekly number of Veterans who received vaccination and the proportion of SARS-COV-2 positive tests. Pooled analysis of CLCs found that 50% of residents received their 1st vaccination by December 20, 2020, almost all of these received their 2nd dose by January 17, 2021. As of January 21, 2021, 82% had begun or completed the vaccination process, 13% refused and 5% were contraindicated.

Figure 2 presents the proportion of SARS-COV-2 positive tests in CLCs (n=130) and community nursing homes in weekly periods before and after the index date. In CLCs, the proportion of positive tests was stable in the weeks prior to and after index week. In community nursing homes, the proportion of positive tests peaked during the index week. Throughout the analysis period, the proportion of SARS-CoV-2 positive tests in CLCs is generally below the community nursing homes. The proportion of SARS-COV-2 positive tests dropped among all CLC residents at the 4th week after vaccination, including the unvaccinated. There is an approximately 75% drop in the proportion of SARS-CoV-2 positive tests in both CLC and community nursing homes after vaccine availability.

Table 1 displays the relative risk of SARS-CoV-2 positive tests in the vaccinated relative to unvaccinated for the weeks surrounding the index. The relative risk of SARS-CoV-2 vaccinated to unvaccinated is significantly reduced in the index week (RR 0.28, 95% CI 0.17, 0.46) is not significant in Weeks 1 to 3, and returns to a significant reduction in week 4 (RR 0.37, 95% CI 0.20, 0.68).

DISCUSSION

This analysis described the delivery of SARS-COV-2 vaccination to nursing home residents and the change in the proportion of SARS-CoV-2 positive tests. We observed a decrease in the proportion of SARS-CoV-2 among Veterans four weeks following the first dose which continued through the second dose. The proportion of SARS-CoV-2 positive tests in CLCs trended with community nursing homes. Clinically, these analyses highlight the importance of SARS-CoV-2 testing and vaccination in CLCs.

The prioritization of SARS-CoV-2 vaccine to nursing home residents within VA and non-VA is critically important.⁸ Temporally, the decline in the proportion of positive SARS-CoV-2 tests among vaccinated was evident prior to the second vaccine dose and continued afterward. Among CLC residents without vaccination, the proportion of positive tests also declined. During this time, there was a decline in SARS-CoV-2 positive tests among non-VA nursing home residents in counties of CLCs and the United States general population.⁹ It is possible that with a sufficient proportion of both CLC residents and staff vaccinated, herd immunity was reached. However, the vaccination threshold necessary for herd immunity is unknown. The decline in the proportion of positive tests within the community nursing homes and general population during this time limits the herd immunity interpretation.

The COVID-19 pandemic was stressful on all within long term care - residents, staff, clinicians, and administrators. As an integrated federal health system, VA CLCs were able to navigate the pandemic better than smaller nursing home systems.¹⁰ CLCs had access to infection control experts and epidemiologists. The first VA guidance on infection control was disseminated to CLCs on March 5, 2020 – less than a week after the first reported nursing home case in King County, Washington.¹¹ VA CLCs operate with an employed staff and restricted those staff to the CLC. Further, CLCs restricted the entrance of non-essential staff to the CLC. This action limited exposure to other high-risk environments such as other nursing homes or inpatient units by the CLC staff and limited the potential introduction of the virus by staff who had previously been in these other environments.¹² As a large integrated healthcare delivery system, VA managed (and continues to manage) personal protective equipment, virus testing, and vaccination on a system level ensuring that adequate supply availability to the CLCs. Finally, with a common electronic medical record, VA was able to identify, advise, and assist CLCs with multiple cases. While VA navigated the course, there are still profound system impacts from COVID-19.

The infection control measures necessary to protect nursing home residents have reversed decades of work to transform the nursing facility environment into the resident's home. While this transformation was necessary, vaccination offers hope that residents may again return to a home-like environment. While vaccination may provide real protection against SARS-CoV-2, new variants require continued vigilance. More importantly, this pandemic reinforces the need to be vigilant for all infectious diseases in the vulnerable nursing home population.

This analysis has strengths and limitations. The VA COVID-19 surveillance system allows analyses to demonstrate the reduction in the proportion of positive SARS-CoV-2 tests with vaccine delivery. However, individual resident-level data would allow more detailed analysis of individual effects from vaccine and infection. In addition, resident-level data that incorporated prior testing and vaccination would enable reactions to vaccine after COVID-19 infection. Similarly, the community nursing home data is self-reported through CMS, but do not report on the testing and vaccination practices of nursing homes, which likely differ from CLCs. There are also major differences in patient populations between VA CLCs and CMS-certified nursing homes. Additionally, we lack staff vaccination data for this analysis which may be a critical factor in the decline among CLCs and nursing homes. The large geographic spread of the VA system allows a nationwide sampling, but limits the detail on local variation in practices.

The proportion of SARS-CoV-2 positive tests decreased in VA CLC residents after vaccination beginning with the first dose and impacting all residents with time. These findings highlight the push to vaccinate nursing home residents and staff. Systems developed for widespread monitoring are important for continued vigilance as COVID variants develop. The long-term impact of COVID-19 and vaccination on safety, quality, and cost of long-term care is yet undescribed and additional study will be required.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

We are appreciative of the analytic core of the VA Long Term Services and Supports Center of Innovation, particularly Christopher Halladay, MS and Frank Devone, MS for their work on the analyses. Drs. Rudolph and McConeghy, Mr Halladay, and Mr. Devone are supported by VA Health Services Research and Development (CIN 13-419; C19 20-213) and the National Institute of Aging (3P01AG027296-11S2). The authors are VA employees. The opinions expressed are those of the authors and do not reflect the official policies of the United States Government or the US Department of Veterans Affairs.

Sponsor's Role:

This is an operational analysis of the United States Department of Veterans Affairs (the sponsor). The VA built and provided the COVID-19 data for operational purposes. VA employees meeting authorship criteria are included. The Veterans Health Administration reviewed and approved the manuscript for publication. The opinions expressed are those of the authors and do not reflect the official policies of the United States Government or the US Department of Veterans Affairs.

Funding:

Drs. Rudolph and McConeghy receive funding from VA Health Services Research and Development (CIN 13-419; C19 20-213) and the National Institute of Aging (3P01AG027296-11S2). All authors are US Department of Veterans Affairs employees

REFERENCES

- [1]. Chidambaram P, Garfield R, Neuman T, <https://www.kff.org/policy-watch/covid-19-has-claimed-the-lives-of-100000-long-term-care-residents-and-staff/>. COVID-19 Has Claimed the Lives of 100,000 Long-Term Care Residents and Staff. In: Kaiser Family Foundation, ed. <https://www.kff.org/policy-watch/covid-19-has-claimed-the-lives-of-100000-long-term-care-residents-and-staff/>, 2020.
- [2]. Bagchi S, Mak J, Li Q, et al. Rates of COVID-19 Among Residents and Staff Members in Nursing Homes - United States, May 25-November 22, 2020. *MMWR Morb Mortal Wkly Rep.* 2021;70: 52–55. [PubMed: 33444301]
- [3]. Center for Clinical Standards and Quality/Survey & Certification Group. Interim Final Rule (IFC), CMS-3401-IFC. In: Centers for Medicare and Medicaid Services, ed., Volume QSO-20–38-NH. Baltimore, MD, 2020.
- [4]. Center for Clinical Standards and Quality/Quality SOG. Upcoming Requirements for Notification of Confirmed COVID-19 (or COVID19 Persons under Investigation) Among Residents and Staff in Nursing Homes. In: Centers for Medicare & Medicaid Services, ed., Volume QSO-20–26-NH. Baltimore, MD, 2020.
- [5]. Dooling K, McClung N, Chamberland M, et al. The Advisory Committee on Immunization Practices' Interim Recommendation for Allocating Initial Supplies of COVID-19 Vaccine - United States, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69: 1857–1859. [PubMed: 33301429]
- [6]. Centers for Medicare & Medicaid Services. Conditions of Participation. 85 CFR 54873. 2020;CMS-3401-IFC.
- [7]. Centers for Medicare & Medicaid Services. COVID-19 Nursing Home Data. 2021.
- [8]. National Academy of Sciences. A Framework for Equitable Allocation of Vaccine for the Novel Coronavirus. 2020.
- [9]. Johns Hopkins Coronavirus Resource Center. United States Coronavirus Trends. Volume 2021, 2021.
- [10]. Clancy C, Boyd T, Hartroft S. Vigilance at VA Community Living Centers in the Time of COVID-19. *Federal Medicine.* 2020.

- [11]. Kimball A, Hatfield KM, Arons M, et al. Asymptomatic and Presymptomatic SARS-CoV-2 Infections in Residents of a Long-Term Care Skilled Nursing Facility - King County, Washington, March 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69: 377–381. [PubMed: 32240128]
- [12]. Kosar CM, White EM, Feifer RA, et al. COVID-19 Mortality Rates Among Nursing Home Residents Declined From March To November 2020. *Health Aff (Millwood).* 2021: 101377hlthaff202002191.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

KEY POINTS

Protection against SARS-CoV-2 is vital for nursing home residents.

Once available, VA Community Living Centers rapidly disseminated the SARS-CoV-2.

VA Community Living Centers observed a reduction in the proportion of positive SARS-CoV-2 following vaccination

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Why does this matter?

By reducing infection, SARS-CoV-2 vaccination holds promise as a mechanism to decrease pandemic related isolation of nursing home residents.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

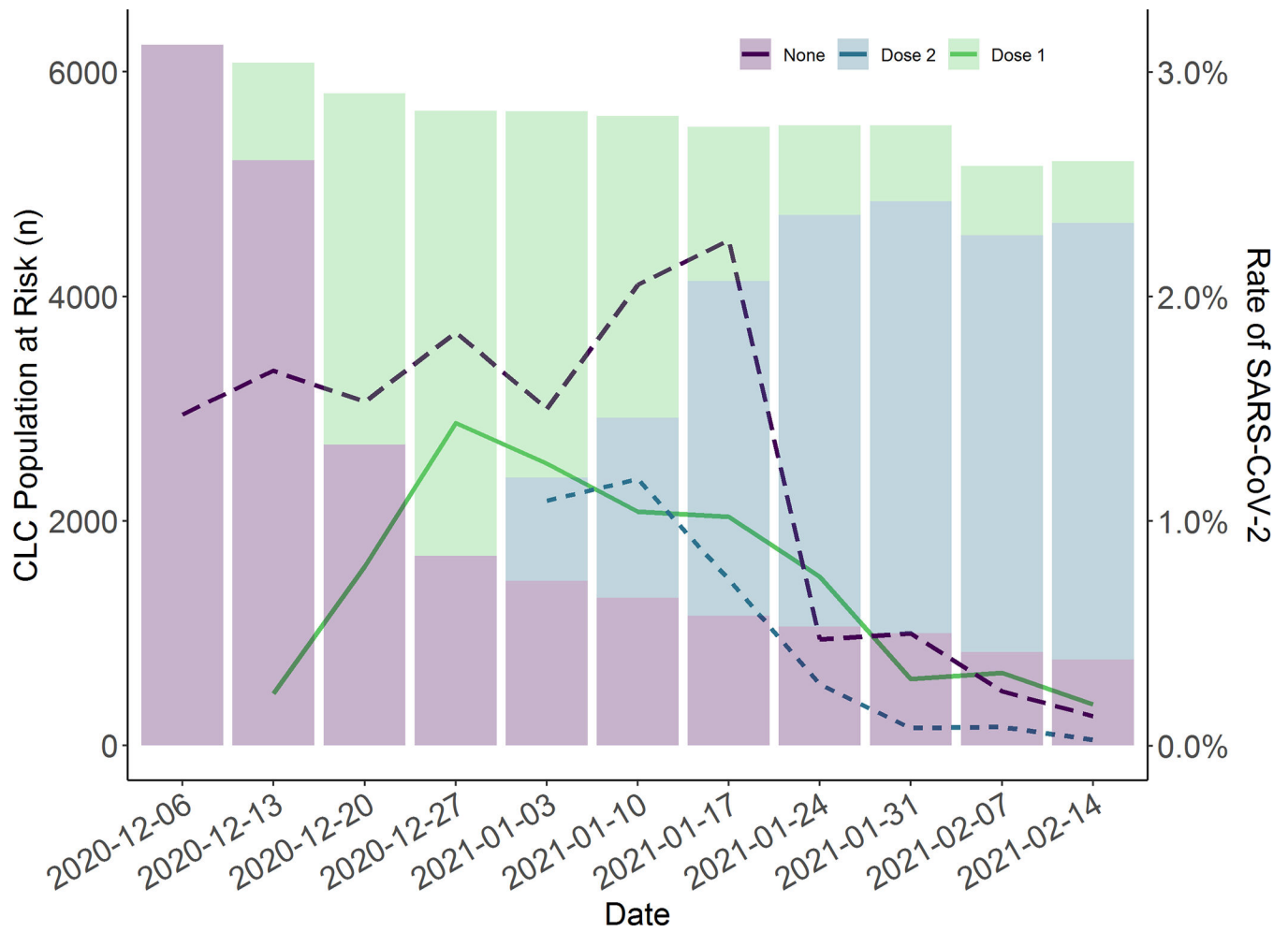


Figure 1: SARS-CoV-2 Vaccination of Community Living Center (CLC) Residents. These results are pooled across 130 CLCs. The line represents the proportion of SARS-CoV-2 positive tests (left Y-axis) according to vaccination status. The bars represent the number of residents in the CLCs during the week according to vaccine status (right Y-axis). Vaccines were approved on December 11, 2020 and December 18, 2020 (week 3 of 2021). The proportion of SARS-CoV-2 positive tests declined in the unvaccinated group as well as the vaccinated groups.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

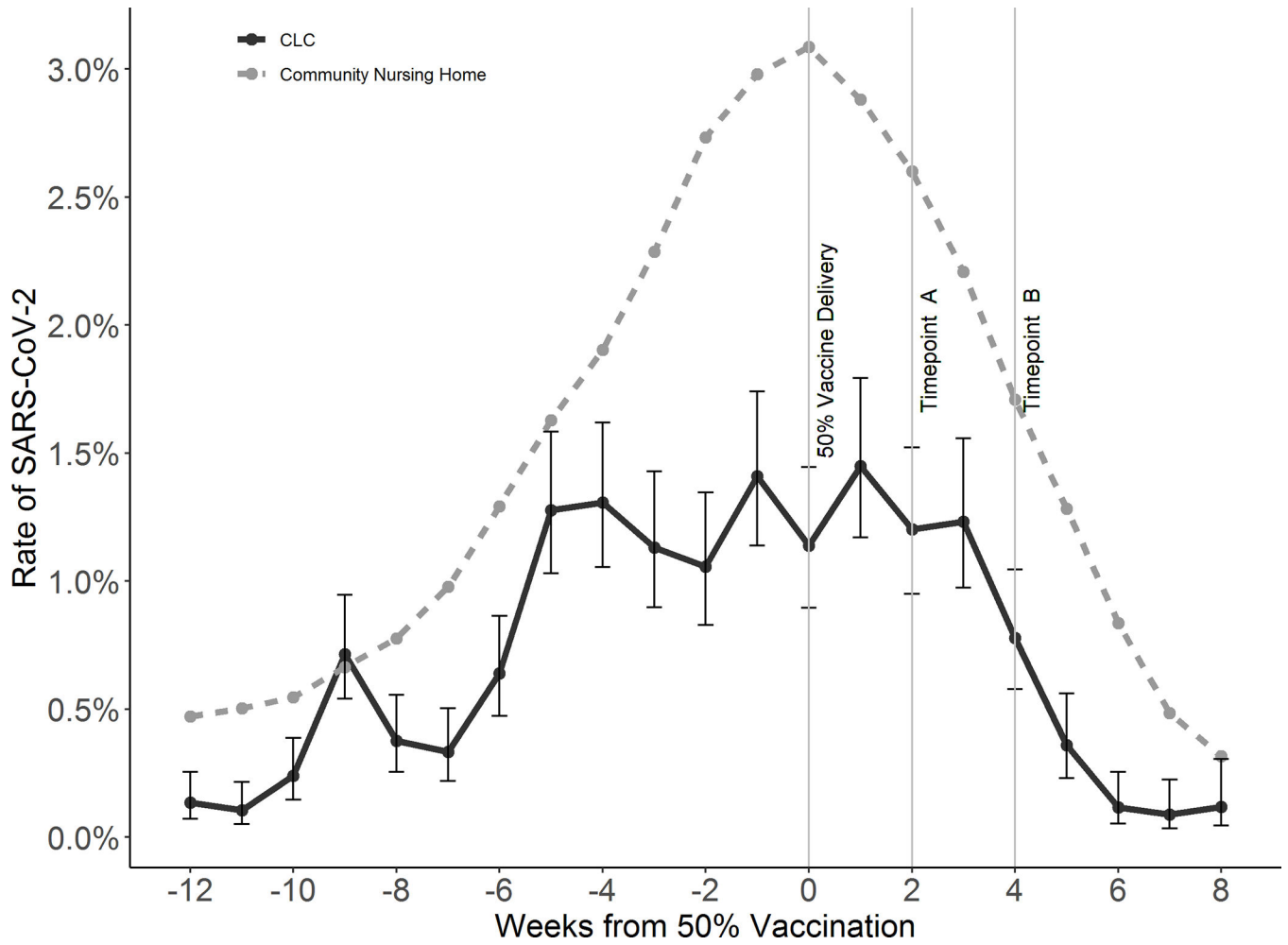


Figure 2: The proportion of SARS-CoV-2 positive tests in Community Living Centers relative to 50% Vaccination. For each CLC the time of 50% first dose vaccination is determined and used to center the CLCs on the graph (index week 0). The proportion of positive tests in community nursing homes in the same counties of CLCs is displayed in as a dashed line.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1:

Proportion of positive SARS-CoV-2 Tests and Relative Risk for Weeks around Vaccination.

Week	Vaccinated		Unvaccinated		RR	95%CI
	N Positives	N At Risk	N Positive	N At Risk		
-2	<10	243	68	5842	0.71	0.17, 2.87
-1	<10	996	75	4966	0.60	0.30, 1.19
Index	25	3952	41	1845	0.28	0.17, 0.47
1	54	4169	29	1567	0.70	0.45, 1.10
2	49	4239	19	1415	0.86	0.51, 1.46
3	48	4331	21	1267	0.67	0.40, 1.11
4	25	4364	18	1165	0.37	0.20, 0.68

Week 0 represents 50% vaccination within a CLC.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript