




Access to Health Care Improves COVID-19 Vaccination and Mitigates Health Disparities Among Medicare Beneficiaries

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Abstract

Background COVID-19 disproportionately impacts the elderly, particularly racial/ethnic minorities and those with low socioeconomic status (SES). These latter groups may also have higher vaccine hesitancy. We aim to evaluate if access to care improves COVID-19 vaccination rates and improves health disparities.

Methods We conducted a retrospective cohort study of Medicare patients receiving care in a high-touch capitated network across ten states. We collected type and date of COVID-19 vaccine and demographic and clinical data from the inpatient and outpatient electronic health records and socioeconomic status from the US census. Our primary outcome was completing vaccination using logistic regression.

Results Our cohort included 93,224 patients enrolled in the network during the study period. Sixty nine percent of all enrolled patients completed full vaccination. Those who completed vaccination did it with Pfizer (46%), Moderna (49%), and Janssen (4.6%) vaccines. In adjusted models, we found that the following characteristics increased the odds of being vaccinated: being male, increasing age, BMI, and comorbidities, being Black or Hispanic, having had the flu vaccine in 2020, and increasing number of office primary care visits. Living in a neighborhood with higher social deprivation and having dual Medicaid/Medicare enrollment decreased the odds of completing full vaccination.

Conclusions Increasing office visit in a high-touch primary care model is associated with higher vaccination rates among elderly populations who belong to racial/ethnic minorities or have low socioeconomic status. However, lower SES and Medicaid populations continue to have difficulty in completing vaccination.

Key points

- High COVID-19 vaccination rates of minorities enrolled in Medicare can be achieved.
- Lower socioeconomic status is associated with completing vaccination.
- Increasing office visits can lead to higher vaccination rates.

Keywords COVID-19 · Vaccines · Breakthrough infections

Introduction

COVID-19 has highlighted once again that significant health disparities persist in the United States (US) [1]. Racial and ethnic minority groups in the US have a higher risk of testing positive for COVID-19, being hospitalized, or requiring intensive care unit level care [2] even after adjusting for the comorbidities that have been considered mediators of the disparity [3]. Access to a COVID-19 vaccine or acceptance of it has emerged as important mediator of adverse outcomes among minority populations [4]. A report from the Kaiser Family Foundation showed that Black and Hispanic

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between January and June of 2021 had lower COVID-19 vaccinations than their White counterparts [5]. During the initial vaccine roll-out, there were significant disparities in vaccination rates between racial/ethnic minorities and the non-Hispanic White population [6]. An exception has been the Asian population who has achieved a rate of vaccination higher than any other group [5]. Siegel et al. [7] used compiled data from state health departments to report that as of May 17, 2021, Black and Hispanic populations were less likely to be vaccinated than their White counterparts in the overwhelming majority of the 50 states. Even though by October 2021 the significant efforts to reach minority groups had narrowed the Black-White and Hispanic-White vaccination disparities, the data from these first months of roll out can provide insights into culprits of health disparities. Among Medicare beneficiaries who account for 80% of the mortality cases, only approximately 61% reported being willing to be vaccinated. This willingness was reported as significantly lower among Black Medicare beneficiaries compared to their non-Hispanic White counterparts [8].

However, vaccine hesitancy only partially explained the racial disparities seen in the US. In fact, the willingness to be vaccinated has increased more rapidly over time among Black individuals than among non-Hispanic White, hinting that other factors are at play. Even though there is limited individual-level data investigating predictors of COVID disparities [9], the literature to date suggests that structural racism explains the significant differences in race-specific vaccination rates and that lower socio-economic status and limited access to care, to information, and to transportation play a significant role in lower vaccination uptake in socially vulnerable populations [9, 10]. Thus, increasing access to healthcare, vaccine equity, creating equitable health models, and addressing social determinants of health have been proposed as pivotal strategies to mitigate health disparities.

Evaluating the impact of an enhanced equitable model of healthcare delivery on vaccination and COVID-19 disparities could help disseminate more equitable models of care in the US. At the same time, little is known about vaccination rates in elderly Medicare beneficiaries, a particularly vulnerable group. Thus, we aim to evaluate if higher access to care improves COVID-19 vaccination rates and mitigates health disparities in a large cohort of racially diverse economically disadvantaged elderly patients enrolled in a high-touch network of primary and specialty care clinics across 10 states.

Methods

Study Setting and Design

We conducted the study at Chen Senior Medical Centers (CSMC), JenCare Senior Medical Centers (JCSMC), and

Dedicated Senior Medical Centers (DSMC). These are fully capitated group network primary care practices located across ten states (see Appendix for detailed methods). Patients are insured through Medicare Advantage Plans that serve as fiscal intermediaries for processing claims. We conducted a retrospective cohort study on all network patients who were enrolled between January 1, 2021 and June 30, 2021. This network has implemented a high-touch primary care model [11] that delivers enhanced care through very frequent patient–provider encounters aimed at preventing or delaying the occurrence of complications of chronic conditions. A description of the model of care is included in the Appendix [12].

On January 2021, the clinic network implemented a multifaceted COVID-19 vaccination campaign taking advantage of the increased patient/(PCP) contact. This campaign included (1) PCP training in motivational interviewing [13] with a specific focus on vaccination discussions; (2) frequent educational sessions for all clinical and support staff promoting COVID-19 vaccination including scripting/role playing typical vaccine discussions [14]; (3) development of educational and promotional materials for staff and patients; (4) early outreach to all patients by phone and in office to develop lists of patients willing to be vaccinated early in the effort; (5) ongoing frequent outreach (at least monthly) to unvaccinated patients by text, phone calls, and office visits to continue to promote vaccination; (6) EMR alerts and automatic orders for patients needing COVID-19 vaccination; (7) frequent feedback about vaccination rates and opportunities to PCPs and their support staff. This campaign built on previous work improving seasonal flu vaccination rates in patients by more than 30% over 3 years. In addition, the network provided video visits to members interested in this method of healthcare delivery.

Vaccination Roll-out

Patients were vaccinated at the clinic network as long as supplies were available. To sustain the campaign regardless of availability, clinic staff also assisted patients with obtaining vaccinations through external providers by locating vaccination sites, making appointments, and providing transportation to the external providers. These included large state-run vaccination sites, hospitals, pharmacies, and other community vaccination sites.

Primary Outcome

The primary outcome was completing the vaccine regimen. We included all three vaccines authorized by the Food and Drug Administration (FDA) for emergency use in the US. In our network of clinics, one-third of the population received their vaccine in their respective clinic and two-thirds of the

population received the vaccine elsewhere. Vaccines were administered according to stock as provided by the state. For those patients who received vaccines elsewhere, we added the information to the EMR using information from the state vaccine registry. We defined completing the vaccine regimen as getting the two doses of Pfizer or Moderna and a single dose of Janssen.

Since the CDC does not have complete vaccination rates by race/ethnicity, we used as reference for comparison disparities in vaccination rates reported by Siegel et al. [7]. This report used racially stratified vaccination data collected from state health departments by May 17, 2021 by three health/media organizations: APM Research Lab, Kaiser Family Foundation, and Bloomberg (see Appendix). Since we report vaccination rates as of June 30, 2021, we also included in the Appendix the Black-White and Hispanic-White vaccination rate disparity reported by the Kaiser Family Foundation as of June 28, 2021.

Secondary Outcome

Our secondary outcomes were hospitalization and mortality. We obtained hospitalization status from our EMR and defined it as any patient who was admitted to the hospital for observation or for more than 24 h due to COVID-19. The EMR contains as text files the selected physician progress notes and procedures of each hospital admission. We captured mortality from our EMR as all-cause mortality. All-cause mortality was ascertained and defined as at least one of the following: (a) self-report from the patient's family during monthly calls conducted to all patients by the transitional care team, (b) hospitalization reports from the hospitalist team and (c) the Medicare claims flag. We also reported COVID-19-related death if the death occurred on a hospitalization due to COVID-19.

Predictors

All covariates were collected from the EMR and the US census. We included two types of covariates: socio-economic and clinical characteristics. Our socio-economic predictors included age, gender, race, insurance, census-based median household income, and the social deprivation index (SDI). We defined race and ethnicity as non-Hispanic White, non-Hispanic Black, and Hispanic, and the three groups were mutually exclusive. We linked the EHR and census variables and constructed the SDI, a weighted composite measure of social determinants of health that includes 17 social factors. The 5-year estimates of 2018 American Community Survey American Community Survey data were used for calculating the SDI and each of the composite measures, using an approach as described by Singh et al. Higher raw

SDI corresponds to more deprivation and therefore lower socioeconomic status (SES) [15].

The clinical predictors from the EHR included the Charlson score as a measure of disease burden [16], body mass index, and history of a flu vaccine in 2020. We also included the number of total visits during the study timeframe and classified those visits as office (when the visit occurred in person), phone and video.

Statistical Analysis

We reported baseline characteristics by race and ethnicity and compared baseline characteristics using ANOVA and chi-square. We used multivariate logistic regression to calculate the odds ratio (OR) and corresponding 95% confidence interval (CI) for the primary and secondary outcomes. We evaluated for collinearity and removed income from the model as it was collinear with SDI. To avoid collinearity, we also analyzed the effect of different types of visits in separate models. To evaluate the effect of the number of visits, we divided the number of total visits in tertiles and included a dummy variable that used tertile 1 (lowest number of visits) as the reference in the multivariate model. The models adjusted for demographics, insurance, comorbidities, and social deprivation index.

The fitness of the data was assessed using the deviance ratio. Analyses were performed using STATA version 14 (College Station, Texas), and all significance tests were two-tailed.

Results

Baseline Characteristics

We identified 93,224 patients enrolled in the network of clinics during the study window of observation. Table 1 presents the baseline characteristics of the entire cohort and stratified by race and ethnicity. Our entire cohort consisted of 45% non-Hispanic White (NHW), 43% non-Hispanic Black (NHB), and 12% Hispanic. The average age was 71.4 years and 59% were female. Black patients had more comorbidities, were more likely to have Medicare and Medicaid dual enrollment, and resided in neighborhoods with more social deprivation than NHW and Hispanic patients. The number of total visits was higher for NHW.

Completing Full COVID-19 Vaccination

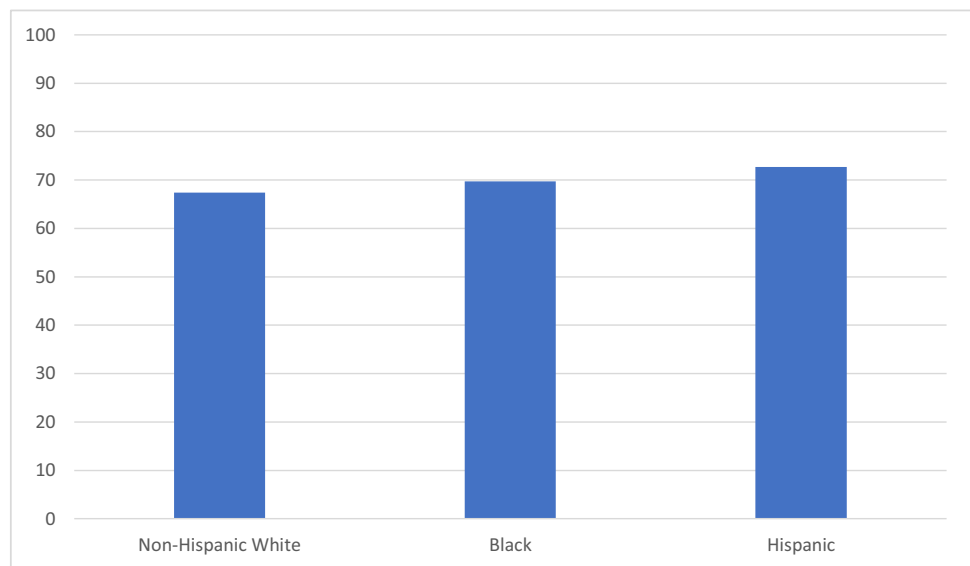
Of the 93,244 elderly patients, 69% completed full vaccination with Pfizer (46%), Moderna (49%), or Janssen (4.6%) vaccines by June 30, 2021. Figure 1 shows vaccination rates by race and ethnicity. We found that

Table 1 Baseline characteristics of the entire cohort and stratified by race/ethnicity

Characteristic	Entire cohort	Non-Hispanic White	Non-Hispanic Black	Hispanic
Number (%)	93,244	41,731 (45)	40,201(43)	11,292 (12)
Age, SD	71.4±9.3	71.5±9.2	71.4±9.1	71.3±8.4
Female gender, %	59	58	60	59
Medicaid, %	10	8	13	5
Hypertension, %	54	52	59	49
Body mass index, SD	30±6.5	29.9±6.4	30.2±6.6	29.9±6.1
Charlson score, SD	3.47±2.26	3.39±2.2	3.61±2.3	3.26±2.1
Flu vaccine in 2020, %	79	79	80	71
Social deprivation index, SD	74.1±22.5	62.0±23.6	87.1±11.5	72.5±22.5
Median household income, IQR	32,159 (28,694–35,897)	35,652 (32,223–47,332)	31,850 (28,964–35,897)	44,976 (33,616–52,830)
Number of total yearly visits	12.7±5.8	12.8±5.5	13.0±5.4	11.2±5.5
Number of yearly office visits	9.4±4.2	9.2±4.1	9.1±4.1	8.9±3.8
Number of yearly video visits	4.7±2.7	4.6±2.7	4.7±2.7	4.5±2.7
Number of yearly phone visits	2.1±1.3	2.0±1.4	1.9±1.3	1.8±1.3

All comparisons between White, Black, and Hispanics were significant

Fig. 1 Completing vaccination by race/ethnicity among 93,244 Medicare patients



67.4% of the NHW completed vaccination compared to 69.7% of NHB and 72.7% of Hispanics ($p < 0.01$). Table 2 presents the ORs of completing vaccination. In adjusted models, we found that the following characteristics increased the odds of being vaccinated: being male, increasing age, BMI, and comorbidities; being Black or Hispanic; having had the flu vaccine in 2020; having more office, video, and phone visits. Living in a neighborhood with higher social deprivation and having dual Medicaid/Medicare enrollment decreased the odds of completing full vaccination. A previous COVID infection or the state where the patient lived in did not impact the odds of vaccination.

Number of Visits and Vaccination

Table 3 shows vaccination rates and odds ratios by tertile of number of visits. The ORs for the highest tertile of visits were 3.79; 95% CI 3.73–3.84.

Race and COVID-Related Hospitalization

Of the 93,244 subjects, 508 (0.5%) had a COVID-related hospitalization. Of these, 41% were NHW, 50% were NHB, and 9% were Hispanic. In univariate models, NHB were hospitalized more frequently than NHW and Hispanics but

Table 2 Multivariate predictors of complete vaccination among 93,244 elderly primary care patients

Predictor	OR (95% CI)	<i>p</i> -value
Age, years	1.01 (1.01–1.02)	<0.01
Male gender	0.86 (0.83–0.90)	<0.01
Medicaid insurance	0.86 (0.81–0.91)	<0.01
Body mass index	1.01 (1.00–1.01)	<0.01
Charlson score, SD	1.01 (1.00–1.02)	<0.01
Black	1.78 (1.61–1.96)	<0.01
Hispanic	2.03 (1.80–2.30)	<0.01
Social deprivation index	0.99 (0.99–0.99)	<0.01
Flu vaccine in 2020	2.02 (1.93–2.12)	<0.01
Positive COVID in 2020	1.04 (0.94–1.16)	0.39
Number of total visits	1.16 (1.16–1.17)	<0.01
Number of office visits	1.07 (1.05–1.09)	<0.01
Number of video visits	1.50 (1.48–1.52)	<0.01
Number of phone visits	2.36 (2.30–2.43)	<0.01

in adjusted models that relationship disappeared and only increasing comorbidity score increased the risk of hospitalization while the OR of being fully vaccinated decreased it (Tables 2 and 3 Appendix).

All Cause and COVID-19 In-Hospital Mortality by Race

During the period of observation, 2445 (2.6%) subjects died of any cause. Of these, only 111 died during a COVID-related hospitalization, and of those who died from a COVID-related hospitalization, 97% were unvaccinated. Stratified by race/ethnicity, 0.05% of NHW, 0.10% of Blacks, and 0.05% of Hispanics ($p = 0.02$) died during a COVID-19-related hospitalization. In univariate models, NHB had a higher rate of death, and in adjusted models, increasing age, comorbidity score, Black race, and social deprivation index increased the risk of all-cause mortality while full vaccination decrease these odds (OR 0.34; 95% CI 0.27–0.43) (Tables 4 and 5 Appendix).

Table 3 Completing vaccination by number of visits (tertile)

Tertile	Number	Range	% complete vaccination	OR(95% CI) complete vaccination
1 (reference)	32,432	0–3	25	Reference
2	32,430	3–6	92	3.68 (3.53–3.73)
3	28,432	> 6	93	3.79 (3.73–3.84)

Adjusted for age, gender, race/ethnicity, BMI, Charlson score, social deprivation index, prior flu vaccine

Discussion

In a large outpatient primary care network with a preventative, high-touch model of care serving minority populations across states that had significant racial/ethnic vaccination disparities during the initial months of the roll-out, an intentional strategy to increase vaccine access and uptake led to higher rates of vaccination series completion among non-Hispanic Black and Hispanic patients when compared to NHW. Other predictors of completing the vaccination series were having comorbidities that increase COVID-19 risk, having had the flu vaccine in 2020, and seeing your primary care provider more often. Of concern, we found that residing in a more deprived neighborhood and having dual enrollment increased the risk of not getting the vaccine. Although having a complete vaccination series significantly decreased the risk of hospitalization and all-cause mortality, increasing comorbidity score, age, Black race, and social deprivation still increased the mortality risk in this population,

This analysis of a large capitated system that implemented a vaccination campaign and had access to all hospitalization data for its enrollees revealed that during the period of observation, less than 1% of the total population had a COVID-19-related hospitalization, and even a smaller percentage died during this hospitalization. These risks were significantly reduced by vaccination. These rates are even more significant when considering that the population served in this network of clinics was at a very high risk for vaccine hesitancy [17] and COVID-related hospitalization and mortality during the period of study [18]. Reports have consistently identified elderly subjects with multiple comorbidities, racial/ethnic minorities particularly Black patients, and individuals residing in socially vulnerable communities or in Southeastern states as groups with worst vaccine uptake and highest/worse peaks of COVID-19 incidence.

On the other hand, factors previously associated with vaccine hesitancy such as having a low income or education level, limited access to information little, or no fear of COVID-19 infection and low trust in vaccines in general align with the predictors we found for vaccine series completion [19]. Our finding that NHB achieved a higher rate of vaccination when compared to NHW is congruent with more recent reports that Black individuals have experienced larger increases in vaccination intention than White individuals over time. Padamsee et al. [4] found that this increase may be related to a change in the belief that the vaccines are necessary for protection, which also occurred more frequently among Black responders. Thus, the authors concluded that vaccine hesitancy is a modifiable risk factor and that structural barriers to vaccination may play a more significant role in vaccination disparities. Siegel et al. evaluated and confirmed this hypothesis. These authors report

that the magnitude of the Black-White and Hispanic-White vaccination disparities found across many states, including those where these clinics are located, correlated with the level of structural racism found in each of those states.

In light of such findings, others have reported that in geographic areas with high social vulnerability, just adding vaccination sites was not enough to mitigate vaccination disparities and that addressing structural barriers was key [20]. These insights offer an explanation for the success achieved by this and other vaccination initiatives. Our campaign relied in three basic principles reported as promising by others: (1) Leveraging health IT infrastructure to identify unvaccinated individuals and facilitate ordering, (2) having frequent and patient-centered conversations regarding the importance and value of the vaccine in order to decrease hesitancy, and (3) removing access barriers by assisting with scheduling appointments and providing transportation to the clinic or to vaccination sites. These strategies in concert with a preventive model of care that relies in relationship building may mitigate structural barriers related to economic or educational challenges, segregation, isolation, or discrimination.

Ultimately, the shift from the initial roll-out that prioritized healthcare workers, older adults, and patients with comorbidities to a health equity strategy that aimed at mitigating health disparities is probably responsible for the significant improvement in vaccination rates among non-Hispanic Black and Hispanic groups during later stages of the campaign.

With respect of health outcomes [21], our study supports other reports describing that although Black subjects are more likely to be hospitalized, the increased risk of death for Black patients is attenuated by hospitalization, the inclusion of comorbidities, social deprivation, and vaccination status. Yehia et al. described that among hospitalized patients, the Black-White difference in mortality disappeared after adjusting for demographic characteristics, comorbidities, and neighborhood deprivation [22]. Other analyses have revealed that increased mortality risk among Black patients is attenuated by hospitalization [23].

Even though our adjusted models still found that NHB had a higher mortality risk, the overall mortality rates were very low in this population. Our data supports the Centers for Disease Control and Prevention (CDC) call for vaccine equity as an important goal. It defined equity as preferential access and administration to those who have been most affected by COVID-19. Clinic networks such as ChenMed offering primary care to Medicare beneficiaries residing in economically disadvantaged communities can seize a significant opportunity to reach populations most affected by COVID with more equitable models of care that can mitigate health disparities. This network of clinics has previously reported that their high touch model of

primary care achieves high quality of care metrics across 8 states [24]. The strategies used to reach high levels of vaccination and adequate control of baseline comorbidities [24, 25] are tools to consider in the pursuit of more equitable delivery of care.

The COVID-19 vaccination effort described in the methods took advantage of frequent patient/PCP contact by training and encouraging PCPs and their support staff to discuss COVID-19 vaccination with their patients during every encounter. The program also included support through EMR prompts, educational materials, and ongoing outreach to unvaccinated patients. While our study cannot determine how each part of this effort contributed to the reported vaccination rates, it does show that an increasing number of PCP visits are associated with significantly increased vaccination rates. We believe this finding offers a key strategy to improving vaccine equity. High touch care can build a relationship with the patient, and this, in turn, could be associated with higher levels of trust. Trust in healthcare relationships is a key ingredient of effective and high-quality care and is the cornerstone to fight vaccine hesitancy particularly in the Black community. Although the direct influence of trust on healthcare outcomes has long been recognized, only recently has it been proven to enhance behavior change and medication adherence. Greater interaction between patients and providers can help develop an environment of accountability and can help providers favor a more aggressive approach towards treatment as we have seen in our prior studies [12, 24, 25].

Our study has several limitations. First, we did not have a control group, and this limits our ability to determine if the high touch program is the only factor improving COVID-19 vaccination; however, comparing the same timeframe with national or state vaccination rates, we report higher vaccination rates among minorities. At the same time, the source comparators do not report specifically the rates on elderly adults in specific states. Second, our results come from a single integrated health care system with different resources than other systems and the generalizability of the results could be limited. Third, our study has a retrospective cohort design, and information bias could limit our ability to correctly identify important variables like the data reported from state registries and other variables like COVID-19-related death. Fourth, we only included three racial/ethnic groups as they represented the majority of our patients.

In summary, in a network of clinics providing high-touch quality primary care, non-Hispanic Black and Hispanic patients were more likely to achieve full vaccination and to experience low rates of adverse COVID-19 outcomes. Efforts to mitigate structural racism and social determinants of health should be a priority to mitigate health disparities.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s40615-022-01343-1>.

Declarations

Competing Interests The authors declare no competing interests.

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