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Ryan White participation increased the prevalence of COVID-19 vaccination among PLWH in Michigan

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Abstract

Introduction: People Living with HIV (PLWH) have higher prevalence of adverse COVID-19 outcomes, and many reside in socially vulnerable communities. Our aim is to evaluate how engagement in HIV care may increase vaccination likelihood.

Methods: Michigan HIV surveillance data were extracted from the Enhanced HIV/AIDS Reporting System (eHARS) and matched at the person-level to COVID-19 vaccination records from the Michigan Care Improvement Registry (MCIR) (through December 31, 2021 (n=15,537)). Based on residential census tract, we classified PLWH into quartiles (<25th percentile (least vulnerable), 25th to <50th, 50th to <75th, 75th (most vulnerable)) of the 2018 CDC Social Vulnerability Index ¹. Using log binomial regression, we estimated the relative prevalence of COVID-19 vaccine series initiation among PLWH by quartile of social vulnerability and Ryan White participation; models were adjusted for covariates.

Results: By December 31, 2021, 67% of PLWH in Michigan had initiated a COVID-19 vaccine series; 47% resided in an area deemed most vulnerable and 54% had participated in Ryan White services. Compared to PLWH in the most vulnerable quartile, those who resided in least vulnerable quartiles had higher prevalence of vaccine initiation (Prevalence Ratio (95% Confidence Interval): 1.67 (1.50, 1.86)). Participants in Ryan White had greater prevalence of initiation (1.52 (1.42, 1.62)) compared to those who were not participants; initiation remained higher when adjusted for covariates including social vulnerability quartile.

Conclusion: Ryan White participation was associated with increased COVID-19 vaccine initiation regardless of community-level vulnerability. Wraparound services may be key in vaccine promotion interventions in this vulnerable population.

Keywords

COVID-19; Ryan White; Vaccination; HIV

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Introduction

People living with HIV (PLWH) are at higher risk of COVID-19 illness when immunocompromised, especially those who are not virally suppressed (<200 copies of virus per mL of blood) and in consistent HIV care². Nationally, PLWH had higher odds of COVID-19 death (OR: 1.3 (95% CI: 1.2, 1.4)) compared to non-HIV infected COVID-19 cases³. Each year approximately half of all PLWH in Michigan receive services through the Ryan White HIV/AIDS program, which provides medical case management, prescription coverage, and other essential support to low income and underinsured persons.⁴ The medical and wraparound services provided by Ryan White substantially improves viral suppression—a medical outcome and public health prevention goal—among enrolled clients. By the end of 2020 in Michigan, viral suppression was achieved by four of every five Ryan White participants in the past year (83%), but only half (52%) of those who were not Ryan White participants.⁴

Since vaccines for COVID-19 became available for administration across the United States on December 14, 2020, reports have highlighted differences in uptake by individual (age, sex, race/ethnicity), and community-level factors (urban-rural setting and social vulnerability)^{5,6,7} PLWH were designated a priority population for COVID-19 vaccination to prevent adverse COVID-19 outcomes due to having a weakened immune system. In a study among PLWH in the state of New York, vaccine coverage through mid-October of 2021 was lower (38.1%) among those who were not virally suppressed at the end of 2020 as compared to those who were virally suppressed (72.0%).⁶

Social vulnerability, or the potential for social stressors in a local environment to negatively affect a community⁸, is a community-level factor that has been associated with negative COVID-19 health outcomes, including the likelihood of a geographic region to become a COVID-19 hotspot⁹ or to have COVID-19 vaccination coverage.⁷ Social vulnerability has also been associated with higher rates of HIV and other chronic conditions.¹⁰ The Michigan Division of Immunizations allocated limited vaccine supply during January through April 2021 using a multiplier that incorporated the social vulnerability index (SVI): [*vaccine eligible population* * *SVI percentile* + 1]. Larger vaccine quantity per population was allocated to local health jurisdictions with a higher average SVI, resulting in increased appointment availability in those areas (unpublished).

PLWH have elevated risk for COVID-19 mortality and morbidity, and achieving broad COVID-19 vaccination coverage for this group remains an important public health goal. We estimated the prevalence of COVID-19 vaccine initiation by social vulnerability and Ryan White participation while accounting for person-level characteristics.

Methods

HIV surveillance data for people living with laboratory-confirmed HIV, residing in Michigan, and aged 16 years were extracted from the Enhanced HIV/AIDS Reporting System (eHARS) for all living PLWH as of December 31, 2021, then matched based on first name, last name and date of birth to records of immunizations administered December 14,

2020 through December 31, 2021 from the Michigan Care Improvement Registry (MCIR). Current residential address was drawn from eHARS and geocoded to census tract to classify individuals into quartiles of community-level vulnerability (<25th (least vulnerable), 25th to <50th, 50th to <75th, 75th (most vulnerable)) based on percentile rankings specific to the State of Michigan from the 2018 CDC Social Vulnerability Index (SVI). SVI is a composite score including four domains of community-level resources: socio-economic status, household composition and disability, racial/ethnic minority status and language, and housing type and transportation.⁸ PLWH whose census tract could not be identified (n=2,335; 12%) or did not have a percentile ranking (n=108; <1%) were excluded (<1% of whom were unhoused), resulting in a final analytic sample of 16,341 (87% of all PLWH in eHARS as of December 31, 2021).

PLWH were classified as either ‘initiated vaccination’ for COVID-19, defined as the receipt of 1 dose of any COVID-19 vaccine authorized by the Food and Drug Administration (FDA) (i.e., Pfizer-BioNTech, Moderna, or Janssen (Johnson & Johnson)), or as ‘not vaccinated’, defined as having no matching vaccination record.

Covariates were selected based on *a priori* knowledge and included age as of December 31, 2021, race/ethnicity, current gender, transmission risk (defined by sexual behavior, injection drug use, and/or gender of sex partner), Ryan White services received during 2021 (referred to as participation). All covariates were extracted from records in eHARS. Binary and ordinal covariates were found not to be collinear based on variance inflation factor testing. Differences in vaccine initiation status by covariates were tested using chi-square tests at significance of $p < 0.05$. Log binomial regression was used to estimate the prevalence ratio of COVID-19 vaccine initiation among PLWH in Michigan by SVI quartile as a measure of community-level vulnerability and by Ryan White participation as a measure of individual-level vulnerability. Binary and ordinal covariates were found not to be collinear based on variance inflation factor testing. All models were adjusted for potential confounders.

SAS (version 9.4; SAS Institute) was used to conduct all analyses. This evaluation of public health program data was reviewed by the CDC and was conducted consistent with applicable federal law and CDC policy: 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Results

This sample of PLWH in Michigan as of December 31, 2021 were predominantly aged 40 years (64%), non-Hispanic Black (55%), cisgender male (79%), men who have sex with men (59%), Ryan White participants (54%), and virally suppressed (85%). Residence within the most vulnerable census tracts (< 75th percentile) was common (n=7,692; 47%). Overall, 67% (n=10,885) of PLWH in Michigan had initiated a COVID-19 vaccine as of December 31, 2021 (Table 1).

Participation in Ryan White services in the past 12 months was associated with 52% higher prevalence of COVID-19 vaccine initiation (95% CI: 1.42–1.62) as compared to those who were not enrolled (Table 2). Adjustment for age, race/ethnicity, gender, transmission

risk, and SVI did not meaningfully change the relationship. Lower quartile of social vulnerability was associated with higher prevalence of vaccine initiation (least vulnerable, <25th percentile: (PR 1.67 (95% CI: 1.50, 1.86)); (25th to <50th (PR: 1.56 (95% CI: 1.41, 1.72)); (50th to <75th (PR: 1.32 (95% CI: 1.21, 1.43)) as compared to those residing in the most vulnerable quartile (75th percentile); adjustment for potential confounders attenuated the relationship across social vulnerability quartiles.

Discussion

Overall, 67% of PLWH in Michigan initiated COVID-19 vaccination, and Ryan White participation increased vaccination prevalence, while living in a socially vulnerable area decreased vaccination prevalence. Vaccination campaigns focused on PLWH should be based on both community and individual need. During 2021, community vulnerability was used to increase supply of COVID-19 vaccines in vulnerable health jurisdictions in Michigan, yet vaccine initiation remained lower in high vulnerability jurisdictions: Detroit was allocated 24% more doses per population than the statewide average, but as of December 31, 2021 had only 43% of residents initiating vaccine compared to 60% of statewide residents.¹¹ It is unclear whether other service-related barriers (e.g. appointment availability, proximity) or structural issues (e.g. lack of childcare, limited time off work) may have affected vaccination context.

PLWH participating in Ryan White services had higher prevalence of vaccination compared to those who were not participating. Sustained efforts to link people to regular, free, wraparound care may be a strategy for improving COVID-19 vaccination rates, where shared decision-making has been shown to build client trust of medical service providers¹², mistrust being one cause of vaccine hesitancy for some vulnerable populations.¹³ Service-related inequities may be overcome by bridging transportation needs, providing appointment assistance and health systems navigation.

Eligibility criteria for Ryan White enrollment includes an income threshold (<500% the federal poverty level), so those participating in Ryan White services are likely to have both unmeasured individual vulnerability as well as measured community vulnerability. In Michigan, Medical Monitoring Project (MMP) data during 2015—2020 has shown that while 89—97% of survey participants were eligible for Ryan White based on income, only 72% were enrolled in this service coverage.⁴ Viral suppression among those enrolled (89%) was significantly higher than those not enrolled (77%); maximizing participation for eligible PLWH could improve HIV viral suppression outcomes and vaccination coverage in this population.

In an analysis using data from Oregon, PLWH were more likely to initiate COVID-19 vaccination if they had a history of vaccination for influenza or were enrolled in AIDS Drug Assistance Program (ADAP).¹⁴ The authors suggested that ADAP case workers facilitated access to vaccination, and that prior vaccination for influenza demonstrated confidence in medical technology and the health care system. Efforts to address health disparities by SVI should consider mechanisms to engagement in medical and preventative care: drug assistance and co-pay assistance (including but not limited to Michigan Drug

Assistance Program), case management, peer support groups, housing assistance, and re-entry assistance for formerly incarcerated persons.

Race/ethnicity and age may be important indicators on which to base outreach and intervention activities for PLWH in vulnerable communities. Likelihood of vaccination increased with age among PLWH, as has been found in the general population.⁵ Latinx and Black/African American PLWH had lower levels of vaccine initiation as compared to White PLWH; this may relate to medical mistrust among Black PLWH¹³, including health beliefs, and trust of vaccine safety and effectiveness.¹⁵

PLWH who are engaged in HIV care and other services (e.g., virally suppressed or participating in Ryan White) were more likely to be vaccinated; this suggests that stable connection and engagement with a medical provider may improve vaccination in this high-risk population and may operate through a mechanism of improved vaccine access and acceptance paired with lower levels of mistrust. National studies demonstrate addressing mental health, transportation, housing, and other health conditions improve HIV outcomes¹⁶, and addressing these barriers may also be useful in program development to increase COVID-19 vaccinations.

This study had at least four limitations. First, community-level factors do not reflect the social status of individuals, however, some individual characteristics were included and may serve as proxies to person-level vulnerability. Second, unmeasured confounding for individual level income, education, stigma, and experiences of discrimination(all of which relate to health-seeking behaviors¹³) may have biased our findings toward or away from the null. Third, these results may not be generalizable to all PLWH in Michigan, especially those who may be most vulnerable facing houselessness or with no access to health screenings as this study included only people with a diagnosed HIV infection. Estimates show that 13% of PLWH in Michigan are unaware of their infection.⁴ Those diagnosed PLWH excluded due to incomplete addresses appear to be from random errors in address data entry that are unlikely to cause bias. Fourth, matching between datasets was based on an exact match algorithm and is imperfect; changes in name or date of birth across data systems may have led to missing outcome data. The MCIR database for COVID-19 immunizations is generally limited to vaccines administered in Michigan and thus does not include the records of Michigan residents vaccinated out of state.

Ryan White participation and community-level social vulnerability were associated with vaccination among PLWH, and the impact of wraparound services remained significant when adjusted for social vulnerability. These data can inform the design of HIV care program interventions aimed at improving COVID-19 prevention strategies as well as other immunizations and preventive health care for this population. Expansion of Ryan White eligibility, and replication of the same wraparound service model in programs for ineligible people may improve COVID-19 vaccination coverage among PLWH in Michigan and other jurisdictions receiving this funding. Further, addressing the root causes of social and individual vulnerability and inequity, such as housing, transportation, income, and education on a policy level will lead to downstream improvements in the associated health outcomes including vaccination rates.

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Table 1:

Characteristics of People Living with HIV (PLWH) in Michigan as of December 31, 2021 by status of COVID-19 vaccination as of December 31, 2021

Characteristic	Initiated vaccine		No vaccine	
	n	%	n	%
All PLWH	10885	67%	5456	33%
Ryan White Participation *				
Services Received in 2021	6443	73%	2360	27%
No Services Received in 2021	4442	59%	3096	41%
SVI Quartile *				
Least Vulnerable (<25th percentile)	1528	73%	570	27%
25th to <50th percentile	1878	71%	751	29%
50th to <75th percentile	2668	68%	1254	32%
Most Vulnerable (75th percentile)	4811	63%	2881	37%
Age Category *				
16–24	380	52%	348	48%
25–29	756	51%	719	49%
30–39	2217	59%	1542	41%
40–49	2035	67%	1012	33%
50–59	3076	73%	1160	27%
60	2421	78%	675	22%
Race/Ethnicity *				
Black/African American	5757	64%	3306	36%
Latinx	651	58%	474	42%
White	4013	74%	1440	26%
Other race or multiracial	461	66%	234	34%
Gender *				
Cisgender Male	8870	69%	4077	31%
Cisgender Female	1866	60%	1246	40%
Transgender Female	146	53%	131	47%
Transgender Male	2	50%	2	50%
Transmission Risk *				
Men who have sex with men	6809	70%	2884	30%
Persons who inject drugs	476	61%	300	39%
Men who have sex with men and inject drugs	442	67%	216	33%
Men who have sex with only women	362	58%	258	42%
Women who have sex with men	1389	61%	897	39%
Perinatal exposure	76	55%	63	45%

Characteristic	Initiated vaccine		No vaccine	
	n	%	n	%
	Other transmission risk	38	81%	9
Unknown transmission risk	1293	61%	829	39%
Viral Suppression *				
Recent viral load <200 c/ml	9768	70%	4147	30%

* Statistically significant difference in vaccination rate across groups defined as $p < 0.05$ based on chi-squared test

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Table 2.

Association between Social Vulnerability or Ryan White and COVID-19 vaccine initiation as of December 31, 2021 among People Living with HIV (PLWH) in Michigan

Relative Prevalence of Vaccine Initiation						
<i>Model 1: Ryan White Participation</i>						
	Unadjusted Prev. Ratio	95% CI	aPR *	95% CI	aPR **	95% CI
Services Received in 2021	1.52	1.42–1.62	1.62	1.52–1.74	1.67	1.55–1.79
No Services Received in 2021	1.00	(reference)	1.00	(reference)	1.00	(reference)
<i>Model 2: Social Vulnerability Quartile</i>						
	Unadjusted Prev. Ratio	95% CI	aPR *	95% CI	aPR ***	95% CI
Least Vulnerable (<25th percentile)	1.67	1.50–1.86	1.28	1.14–1.45	1.42	1.26–1.59
25th to <50th percentile	1.56	1.41–1.72	1.26	1.13–1.39	1.32	1.18–1.46
50th to <75th percentile	1.32	1.21–1.43	1.19	1.10–1.30	1.21	1.11–1.32
Most Vulnerable (75th percentile)	1.00	(reference)	1.00	(reference)	1.00	(reference)

* Adjusted Prevalence Ratio (aPR): Models adjusted for age, race/ethnicity, gender, transmission risk

** Adjusted Prevalence Ratio (aPR): Models adjusted for age, race/ethnicity, gender, transmission risk, social vulnerability index

*** Adjusted Prevalence Ratio (aPR): Models adjusted for age, race/ethnicity, gender, transmission risk, Ryan White participation in 2021