Short Communication

Expanding COVID-19 vaccine access to underserved populations through implementation of mobile vaccination units

Priya Sarin Gupta [a,b,c,*], Amir M. Mohareb [a,b], Christine Valdes [e], Christin Price [f], Mimi Jollife [f], Craig Regis [c], Nehal Munshi [d], Eddie Taborda [c], Miriam Lautenschlager [c], Anne Fox [d], Diane Hanscom [d], Gina Kruse [a,b], Regina LaRocque [a,b], Joseph Betancourt [a,b], Elsie M. Taveras [b,c,d]

[a] Department of Medicine, Massachusetts General Hospital, Boston, MA, United States of America
[b] Department of Medicine, Harvard Medical School, Boston, MA, United States of America
[c] Massachusetts General Hospital Kraft Center for Community Health, Boston, MA, United States of America
[d] Mass General Brigham, Boston, MA, United States of America
[e] North Shore Physicians Group, Boston, MA, United States of America
[f] Brigham and Women's Hospital, Boston, MA, United States of America

ARTICLE INFO

ABSTRACT

COVID-19 has disproportionately impacted underserved populations, including racial/ethnic minorities. Prior studies have demonstrated that mobile health units are effective at expanding preventive services for hard-to-reach populations, but this has not been studied in the context of COVID-19 vaccination. Our objective was to determine if voluntary participants who access mobile COVID-19 vaccination units are more likely to be racial/ethnic minorities and adolescents compared with the general vaccinated population. We conducted a cross-sectional study of individuals who presented to three different mobile COVID-19 vaccination units in the Greater Boston area from May 20, 2021, to August 18, 2021. We acquired data regarding the general vaccinated population in the state and of target communities from the Massachusetts Department of Public Health. We used chi-square testing to compare the demographic characteristics of mobile vaccination unit participants and the general state and community populations that received COVID-19 vaccines during the same time period. We found that during this three-month period, mobile vaccination units held 130 sessions and administered 2622 COVID-19 vaccine doses to 1982 unique participants. The median (IQR) age of participants was 31 (16–46) years, 1016 (51%) were female, 1575 (80%) were non-White, and 1126 (57%) were Hispanic. Participants in the mobile vaccination units were more likely to be younger ($p < 0.001$), non-White race ($p < 0.001$), and Hispanic ethnicity ($p < 0.001$) compared with the general vaccinated population of the state and target communities. This study suggests that mobile vaccination units have the potential to improve access to COVID-19 vaccination for diverse populations.

1. Introduction

Since the start of the pandemic, COVID-19 has disproportionately impacted underserved populations, including racial/ethnic minorities and people living with unstable housing, food insecurities, and economic vulnerability. For example, in the state of Massachusetts, people who identify as Black or Hispanic had a 1.5–3 times higher risk of COVID-19 infection and higher age-adjusted mortality rates compared with people who identify as White (Massachusetts Department of Public

Health, 2021). Mobile health delivery systems have the potential to improve clinical outcomes for such populations: prior to the COVID-19 pandemic, mobile health units have been successfully used to expand preventive and clinical services for opioid use disorder, sexually transmitted infections, and family planning for to hard-to-reach populations, particularly racial and ethnic minority youth and people in low-income communities (Arya et al., 2014; Ellen et al., 2003). Despite their potential role in improving access to COVID-19 health services, there is limited published experience regarding the use of mobile health delivery

systems in COVID-19 outreach (Towns et al., 2020; Leibowitz et al., 2021).

In many parts of North America, racial and ethnic minorities were a hard-to-reach population for COVID-19 vaccination efforts in the first year after COVID-19 vaccines became available (Massachusetts Department of Public Health, 2021; Centers for Disease Control and Prevention COVID-19 Data Tracker, n.d.). Children and adolescents, particularly those living in racially and ethnically diverse neighborhoods, remain under-vaccinated when compared with other age groups. For example, three months after adolescents were approved to receive COVID vaccines in the U.S., only 32% of adolescents (age 12–17 years old) had completed their COVID-19 vaccination series (Murthy et al., 2021). Unvaccinated adolescents and young adults may be a high-risk population for COVID-19 transmission, especially if they live in multi-generational homes and as they attend schools and large social gatherings (Chua et al., 2021).

Mobile health delivery systems may be well positioned to address this disparity. However, there is little published data regarding the effectiveness of mobile COVID-19 vaccination units in the U.S. in improving vaccine access for hard-to-reach populations. Our objective was to compare the demographic characteristics (age, race, and ethnicity) of people vaccinated through a mobile vaccination program in Massachusetts with people vaccinated through the general vaccination efforts of the state.

2. Methods

2.1. Study design

We conducted a cross-sectional study of individuals who presented to mobile vaccination units in the Greater Boston area from May 20, 2021-August 16, 2021. We compared demographic characteristics (age, sex, race, and ethnicity) between study participants and the general vaccinated population of the state of Massachusetts and the communities targeted by the mobile vaccination units.

2.1.1. Population and setting

We implemented three low-barrier, mobile walk-in COVID-19 vaccination units. The vans have offered free COVID-19 testing since January 4, 2021, as well as COVID-19 prevention kits (i.e., hand sanitizer and masks) and referral for social determinants of health (i.e., food support, prescription drug assistance, etc.) (Leibowitz et al., 2021). We deployed these mobile vaccination units in close coordination with local government, departments of public health, and community organizations. Vans were staffed by trained, multi-lingual care teams and included clinicians as community messengers to answer questions from community members. Vans were primarily equipped with the BNT162b2 mRNA vaccine and at times also offered the JNJ-78436735 and mRNA-1273 mRNA vaccines. We situated the mobile vaccination units in Chelsea, Everett, Revere, Lynn, Roxbury, Jamaica Plain, Dorchester, and Mattapan (combined 2020 population = 439,762), communities with high social vulnerability indices and a disproportionately high burden of COVID-19 illness in the state of Massachusetts (Ellen et al., 2003). Mobile vaccination units were operational for 4- and 8-h shifts, including evening and weekend hours, for a total of 20 to 24 h per week.

2.1.2. Data sources

We collected demographic data for individuals accessing the mobile vaccination units held from May 20, 2021- August 16, 2021, including participant age, sex, race/ethnicity, insurance status, primary care provider, and zip code. We included all persons who completed vaccination on the mobile units during the study period in our analysis (n = 1982). We collected summary data for age, sex, and race/ethnicity of the general vaccinated population in Massachusetts using the state's online COVID-19 Vaccination Dashboard (https://www.mass.gov/info-details

/Massachusetts-covid-19-vaccination-data-and-updates) which collects information about residents who receive their vaccination in the state of Massachusetts (Massachusetts Department of Public Health, 2022). We used archival state vaccination summary data on age, sex, and race/ethnicity grouped by zip code of persons who received any dose of vaccine from May 20, 2021- August 18, 2021, which most closely approximated our study dates. Because of the reporting of state-level data, we analyzed age as a categorical variable in 5- and 10-year intervals. We assumed anyone who was not recorded in the state database as "Hispanic" was "non-Hispanic" to allow for comparison with the van participant data, and we tested this assumption in sensitivity analyses (Appendix A).

2.2. Outcome measures

Our primary outcome was the proportion of people who received the COVID-19 vaccine who were non-White, Hispanic, or adolescent (12–19 years old) through the mobile vaccination units. We compared this proportion with the general vaccination efforts of the state and the local communities of the mobile unit participants. Because we situated our mobile clinics in minority communities in the Greater Boston area, we anticipated that the demographic characteristics of the participants in the mobile vaccination efforts would more resemble those communities than the general state population. Therefore, we also sought to compare the demographic characteristics of mobile unit participants to those communities (i.e., the local population). We selected a comparison local population of target communities by identifying the zip codes most commonly used by mobile vaccine unit participants (Appendix A), which included the cities listed above where we based our mobile vaccination efforts.

2.3. Statistical analysis

We report categorical variables as frequencies (percentages) and continuous variables as median (inter-quartile range [IQR]). We used chi-square testing to compare demographic characteristics of people vaccinated through the mobile vaccination units with the general vaccinated population of the state and target communities. The data sets cannot be linked through an identifier; thus, we could not remove the mobile van population from the remaining state and local populations. Therefore, our statistical comparisons were not of two independent population groups. However, it comprises only 1.6% and 0.3% of the local/community and state-wide populations, respectively. Hence, we estimated that this limitation would not impact our findings as the subgroup vaccinated through the mobile units comprised of <2% of the total population (Lillian, 2006; Akinbami et al., 2019). We considered $p < 0.05$ as our threshold of significance. We used R version 4.0.3 for all statistical analyses. This study was approved by the institutional review board of Mass General Brigham (protocol #2021P002626).

3. Results

From May 20, 2021, to August 18, 2021, the mobile COVID-19 vaccination units held 130 sessions and administered 2622 COVID-19 vaccine doses to 1982 unique participants. The median (IQR) age of participants was 31 (16–46) years, 1016 (51%) were female, 1575 (80%) were non-White, and 1126 (57%) were Hispanic. There were significant differences in age, race, and ethnicity between the participants in the mobile vaccination units and the general vaccinated population of the state and of the target communities (Table 1). Compared with the general vaccinated population of the communities targeted by the mobile vaccination unit, mobile unit participants were more likely to be adolescents (36.5% versus 27.8%, $p < 0.001$), non-White race (81.7% versus 61.3%, p < 0.001), and Hispanic ethnicity (60.9% versus 39.6%, p < 0.001). Mobile unit participants were less likely to report Black race compared with the vaccinated population of targeted communities

Table 1

Sociodemographic characteristics of participants receiving one or more doses of vaccine through the mobile COVID-19 vaccination unit compared with general vaccinated and total population of target cities and state of Massachusetts.

Variable, n (%)		Total vaccinated population			Local vaccinated population		
		Mobile clinic (n = 1982)	General Population (n = 708,221)	*p*-value	Mobile clinic (n = 1595)	General Population (96,485)	p-value
Age group (years)				<0.001			<0.001
	12–15	450 (22.3)	158,837 (22.6)		394 (24.7)	17,065 (17.7)	
	16–19	214 (10.8)	71,206 (10.1)		189 (11.8)	9825 (10.1)	
	20–29	284 (14.3)	127,888 (18.1)		223 (14.0)	19,365 (20.1)	
	30–39	341 (17.2)	109,532 (15.6)		256 (16.1)	17,662 (18.3)	
	40–49	280 (14.1)	85,972 (12.2)		227 (14.2)	13,691 (14.2)	
	50–59	242 (12.2)	81,011 (11.5)		183 (11.4)	10,352 (10.7)	
	60–64	69 (3.5)	27,941 (4.0)		47 (3.0)	3274 (3.4)	
	65–69	42 (2.1)	16,284 (2.3)		33 (2.1)	2094 (2.2)	
	70–74	31 (1.6)	10,835 (1.5)		19 (1.2)	1336 (1.4)	
	75–79	11 (0.6)	5934 (8.4)		8 (0.5)	777 (0.8)	
	80 and above	18 (0.9)	7940 (1.1)		16 (1.0)	1023 (1.1)	
Female		1016 (51.2)	358,680 (50.1)	0.75	821 (51.4)	48,150 (49.9)	0.25
Race				<0.001			<0.001
	Asian	38 (1.9)	50,543 (8.7)		32 (2.0)	5529 (8.9)	
	Black	230 (11.6)	71,353 (12.3)		178 (11.2)	20,219 (32.5)	
	White	407 (20.5)	376,532 (65.2)		292 (18.3)	22,226 (35.7)	
	Other	399 (20.1)	57,617 (10.0)		792 (49.7)	8230 (13.2)	
	Not reported	908 (45.8)	21,732 (3.8)		301 (18.9)	5983 (9.6)	
Ethnicity				<0.001			<0.001
	Hispanic	1126 (56.8)	128,583 (18.2)		971 (60.8)	34,304 (35.6)	
	Non-Hispanic	529 (26.7)	555,953 (78.7)		382 (23.9)	56,198 (58.2)	
	Other	327 (16.5)	21,732 (3.1)		242 (15.1)	5983 (6.2)	
Known PCP							
	Yes	1088 (55)	N/A		880 (55.2)	N/A	
	No	170 (8.6)	N/A		130 (8.2)	N/A	
	Unknown	724 (36.5)	N/A		585(36.7)	N/A	
Insurance							
	Private payer	380 (19.2)	N/A		274 (17.2%)	N/A	
	Public (Medicare/ Medicaid)	1324 (66.8)	N/A		1114 (70.0)	N/A	
	Unknown	278 (14.0)	N/A		207 (13.0)	N/A	
Vaccine							
	BNT162b2	1830 (92.3)	N/A		1491 (93.5)	N/A	
	mRNA-1273	1 (7.6)	N/A		1 (<0.1)	N/A	
	JNJ-78436735	151 (<0.1)	N/A		103 (6.5)	N/A	

Footnote to Table 1: The "total vaccinated population" refers to all participants in the mobile vaccination effort and the general population of the State of Massachusetts. The "local vaccinated population" refers to the participants in the mobile vaccination effort who lived in target communities compared with the general population of those communities.

(11.2% versus 32.5%, p < 0.001).

4. Discussion

In the current phase of the pandemic in the U.S., COVID-19 morbidity and mortality is particularly high in unvaccinated populations. Therefore, novel strategies of vaccine outreach are needed to immunize the proportion of the nation that remains unvaccinated (Centers for Disease Control and Prevention COVID-19 Data Tracker, n. d.). In this study, we found that participants who accessed mobile vaccination units in the Greater Boston area were more likely to be adolescents, non-White race, and Hispanic ethnicity compared with the general vaccinated population in their communities. Mobile vaccination unit participants were less likely to be Black compared with the population in the target communities, which may reflect the lower number of days in which the mobile units were situated in predominantly Black communities (Appendix B) and the need to invest in tailored outreach to Black communities with trusted messengers.

Despite widespread availability of COVID-19 vaccines for the general population in the U.S., demographic disparities persist in immunization (Massachusetts Department of Public Health, 2021; Centers for Disease Control and Prevention COVID-19 Data Tracker, n.d.). Survey-based studies have found that people from low-income and traditionally marginalized communities may be more likely to express skepticism for COVID-19 vaccination (Willis et al., 2021; Khubchandani et al., 2021).

Young people, particularly adolescents of racial/ethnic minority backgrounds, may express a high level of vaccine hesitancy due to a low self-perceived risk of COVID-19 infection (Batley et al., 2021). Reasons for vaccine hesitancy are complex and multifactorial, though studies suggest that many of them can be overcome with transparent communication from trusted healthcare providers and community members (Momplaisir et al., 2021). In this mobile vaccination program, van staff were multi-lingual, frequently persons of color, and trained in COVID-19 prevention and vaccination counseling. Importantly, the mobile COVID-19 vaccination units were implemented with community and stakeholder engagement, and sites were chosen to target high foot-traffic locations.

The results of this study are subject to several limitations. First, workflow requirements limited the amount of data we were able to obtain from study participants during van operations. It is unknown whether participants in the mobile units would have received vaccination through other means. Reporting differences between the state and mobile unit data may result in misclassification of race and ethnic designations, though a sensitivity analysis testing our methodological assumptions on this data reporting did not change the study's underlying results (Appendix B). These data are from one major metropolitan center in the U.S. and should be confirmed with studies in other cities.

5. Conclusions

Our study demonstrates that a mobile COVID-19 vaccine unit has the potential to reach adolescents and racial/ethnic minorities in underserved communities. Future work will address mobile unit outreach in predominantly Black communities in this region.

Funding

This work was supported by the National Institutes of Health [NIH RADx-Up Grant: NIH P50 CA244433-02S1] and Mass General Brigham.

Declaration of Competing Interest

The authors declare no competing financial interests.

Data availability

Data will be made available on request.

Acknowledgments

Mass General Brigham, MGH Kraft Center, MGH Center for Community Health Improvement, MGH Kraft Community Care Van Team, Lead Scientist and Statistician Daniel Gundersen (Dana Farber Cancer Institute).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2022.107226.

References

Akinbami, L.J., Santo, L., Williams, S., Rechtsteiner, E.A., Strashny, A., 2019. Characteristics of asthma visits to physician offices in the United States: 2012-2015 National Ambulatory Medical Care Survey. Natl Health Stat Report. 128, 1–20.

Arya, M., Kumar, D., Patel, S., Street Jr., R.L., Giordano, T.P., Viswanath, K., 2014. Mitigating HIV health disparities: the promise of mobile health for a patient-initiated solution. Am. J. Public Health 104 (12), 2251–2255. https://doi.org/10.2105/AJPH.2014.302120.

Batley, P.N., Batley, N.J., Mushfiq, H., et al., 2021. COVID stress factors, willingness to be vaccinated, and reasons for vaccination hesitancy amongst ethnic minorities and youth. SSRN. https://doi.org/10.2139/ssrn.3815669.

Centers for Disease Control and Prevention COVID-19 Data Tracker. Available from. https://covid.cdc.gov/covid-data-tracker (Accessed November 11, 2021).

Chua, G.T., Wong, J.S.C., Lam, I., et al., 2021. Clinical characteristics and transmission of COVID-19 in children and youths during 3 waves of outbreaks in Hong Kong. JAMA Netw. Open 4 (5), e218824. https://doi.org/10.1001/jamanetworkopen.2021.8824.

Ellen, J.M., Bonu, S., Arruda, J.S., Ward, M.A., Vogel, R., 2003. Comparison of clients of a mobile health van and a traditional STD clinic. J. Acquir. Immune Defic. Syndr. 32 (4), 388–393. https://doi.org/10.1097/00126334-200304010-00007.

Khubchandani, J., Sharma, S., Price, J.H., Wiblishauser, M.J., Sharma, M., Webb, F.J., 2021. COVID-19 vaccination hesitancy in the United States: a rapid national assessment. J. Community Health 46 (2), 270–277. https://doi.org/10.1007/s10900-020-00958-x.

Leibowitz, A., Livaditis, L., Daftary, G., Pelton-Cairns, L., Regis, C., Taveras, E., 2021. Using mobile clinics to deliver care to difficult-to-reach populations: a COVID-19 practice we should keep. Prev. Med. Rep. 24, 101551 https://doi.org/10.1016/j.pmedr.2021.101551.

Lillian, J., 2006. Hayes, Geoffrey berry, comparing the part with the whole: should overlap be ignored in public health measures? J. Public Health 28 (3), 278–282. https://doi.org/10.1093/pubmed/fdl038.

Massachusetts Department of Public Health, 2021. COVID-19 Response Reporting. https://www.mass.gov/info-details/covid-19-response-reporting. (Accessed 4 November 2021).

Momplaisir, F., Haynes, N., Nkwihoreze, H., Nelson, M., Werner, R.M., Jemmott, J., 2021. Understanding drivers of COVID-19 vaccine hesitancy among blacks. Clin. Infect. Dis. ciab102. https://doi.org/10.1093/cid/ciab102.

Murthy, B.P., Zell, E., Saelee, R., et al., 2021. COVID-19 vaccination coverage among adolescents aged 12–17 years — United States, December 14, 2020–July 31, 2021. MMWR Morb. Mortal. Wkly Rep. 70, 1206–1213. https://doi.org/10.15585/mmwr.mm7035e1external icon.

Towns, R., Corbie-Smith, G., Richmond, A., Gwynne, M., Fiscus, L., 2020. Rapid deployment of a community-centered mobile Covid 19 testing unit to improve health equity. NEJM Catalyst Innovations in Care Delivery. 1 (5), 5. https://doi.org/10.1056/CAT.20.0522.

Willis, D.E., Andersen, J.A., Bryant-Moore, K., et al., 2021. COVID-19 vaccine hesitancy: race/ethnicity, trust, and fear. Clin Transl Sci. https://doi.org/10.1111/cts.13077.