

UC Riverside

UC Riverside Previously Published Works

Title

COVID-19 vaccine booster willingness among Asian Americans: Influence of racial discrimination and social determinants.

Permalink

<https://escholarship.org/uc/item/806758gd>

Journal

Human Vaccines & Immunotherapeutics, 20(1)

Authors

Li, Qiuxi

Subica, Andrew

Publication Date

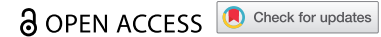
2024-12-31

DOI

10.1080/21645515.2024.2417520

Peer reviewed

BRIEF REPORT



COVID-19 vaccine booster willingness among Asian Americans: Influence of racial discrimination and social determinants

Qiuxi Li  and Andrew M. Subica 

School of Medicine, University of California, Riverside, CA, USA

ABSTRACT

Uptake of COVID-19 vaccine booster doses is an important public health topic of study to prevent morbidity and mortality in underserved U.S. populations. However, limited research exists on COVID-19 vaccine booster use and willingness – including its associated factors – among Asian Americans (AA): the fastest growing racial group in the U.S. This study collected survey data from 447 AA adults from three large AA subgroups: Chinese, Korean, and Filipino. Data were collected as part of a community-driven county-wide needs assessment conducted in collaboration with AA community organizations in Riverside County, California. Data indicated that nearly 24% of AA participants received at least four doses of the COVID-19 vaccine, with 36% expressing definite willingness to receive future booster doses. Participants reported experiencing an average of 1.6 instances of racial discrimination across their lifetime. Ordered logistic regression and marginal effects analysis revealed ethnicity, education, racial discrimination, preexisting health conditions, and the number of prior COVID-19 vaccine doses received significantly predicted willingness to receive future vaccine doses. The study suggests that key social factors such as racial discrimination may play an important role in influencing public health efforts to promote vaccine uptake in diverse Asian American populations.

ARTICLE HISTORY

Received 10 August 2024
Revised 7 October 2024
Accepted 13 October 2024

KEYWORDS

Asian American; COVID-19; racial discrimination; vaccine willingness; social determinants of health

Introduction

While the declaration of COVID-19 as a global health emergency has been lifted, the virus's persisting transmission dynamics and the emergence of new variants causing repeated waves of COVID-19 infection and disease across the U.S. underscore COVID-19's enduring threat to public health. Therefore, uptake of vaccine boosters against COVID-19 remains highly recommended to mitigate the risk of infection and its adverse outcomes.^{1,2}

Extensive research during the pandemic has investigated vaccine uptake and hesitancy across various U.S. populations;^{2–7} although research on Asian Americans (AA) – who comprise the fastest growing U.S. racial population – remains scarce. Nationally representative studies have shown that COVID-19 vaccine acceptance rates range widely across populations between 53.6% and 84.4%.⁸ This variability is influenced by many factors, including concerns over vaccine safety and efficacy, distrust in health-care systems or information sources, disbelief in the severity of COVID-19, misinformation on social media platforms, political affiliations, and cultural or religious beliefs.^{3,6,9} Additionally, sociodemographic determinants such as younger age, low-income status, female gender, lower educational background, and minority racial backgrounds have been associated with lower vaccine acceptance rates and increased hesitancy.^{4,5,7}

Research also indicates that people's attitudes toward COVID-19 vaccines vary over time, with studies showing fluctuating acceptance rates throughout the pandemic. While

many studies reported an increase in vaccine acceptance rates from the fourth quarter of 2020 to the first and second quarters of 2021,^{7,10} others observed a decline in willingness to be vaccinated as the pandemic progressed.^{11,12} Despite extensive investigation into vaccine uptake and hesitancy within the general U.S. population and disparities between groups, a significant gap remains in understanding factors influencing Asian Americans' willingness to use the COVID-19 vaccine and its boosters.

While racial disparities in COVID-19 outcomes were significant during the COVID-19 pandemic, AA populations reported relatively lower rates of cases and deaths compared to Black, Latino, and sometimes White populations.^{13,14} Despite a narrowing of racial disparities in cases and deaths over the course of the pandemic, a vaccination gap persists, with AA populations continuing to maintain an advantage with the highest reported rates of individuals receiving at least one dose of the COVID-19 vaccine and receiving bivalent booster vaccines versus other racial groups in the U.S.¹³

However, despite these favorable vaccination outcomes, AA communities have been disproportionately targeted by a surge in discrimination and hate incidents throughout and following the pandemic stemming from xenophobic narratives linking the virus to AA heritage. Due to such narratives of COVID-19 as “kung flu” and “Wuhan virus,” STOP AAPI Hate¹⁵ documented 11,409 reports of hate acts against AAPI individuals in the U.S. in the first two years of the pandemic alone. This surge in discriminatory incidents has exacerbated the systemic

discrimination that has plagued AAs in the U.S.¹⁶ posing significant challenges to the well-being and safety of AA populations.

Previous research has explored how experiencing discrimination or racially based unfair treatment can lead to medical distrust and reduce affected individuals' likelihood to seek health services, a phenomenon observed among various racial/ethnic minority groups.^{6,17,18} Some of these discriminatory experiences may occur within health-care provider or research settings, leading individuals to postpone care and ignore medical advice.^{19,20} However, current research examining the relationship between racial discrimination and vaccine hesitancy is limited, particularly with regard to the role of racial discrimination as a predictor of COVID-19 vaccine hesitancy. In the few studies that have examined these relationships, a small number have suggested a potential association between racial discrimination and COVID-19 vaccine hesitancy,^{4,21} while other studies found no association.⁶

To address this empirical gap, the present study investigated COVID-19 vaccine uptake and willingness in three large understudied AA populations: Chinese, Filipino, and Korean Americans who represent the 1st, 3rd, and 4th largest AA subgroups in the U.S., respectively. It aimed to explore: 1) the status of COVID-19 vaccine uptake and willingness to receive the vaccine/booster in the future and 2) key social determinants, including experiences of racial discrimination, associated with the willingness to get the COVID-19 vaccine/booster. This research will provide valuable insights into the factors influencing vaccine acceptance among AA communities, potentially contributing to the development of targeted interventions to improve COVID-19 vaccination rates and reduce disparities.

Methods

Study sample and recruitment

The institutional review board at the approved all study protocols. To obtain a diverse sample across AA ethnicities and trained AA community health workers, our partner organizations (Chinese, Korean, Filipino) recruited adults (aged ≥ 18 years) from their respective communities in Riverside County during outreach activities. This effort was part of our CDC-funded project, which is built on an established partnership between the community organizations, the county public health department, and our institution. As a result, 447 participants were recruited between November 2022 and July 2023. Since the project required active community engagement, data collection was conducted during these outreach efforts. While this involved convenience sampling, it was a strategic approach to connect with participants from specific ethnic backgrounds.

Measures

The survey assessed participants' sociodemographic factors, experiences of racial discrimination, existing health conditions, general and mental health status, COVID-19 outcomes, vaccine uptake, and perceived vaccine barriers. Specifically, we

measured participants' AA ethnicity (Filipino, Chinese, and Korean), age, gender, marital status, and education. We also measured the total frequency of racial discrimination that these AA participants have experienced on nine occasions using the widely utilized Experiences of Discrimination (EOD) scale.²²

To assess participants' health status, they were asked if they had any existing health conditions, including coronary heart disease, angina, stroke, asthma, cancer, and/or diabetes (yes = 1, no = 0). In addition, mental health status was rated on a 5-point scale, ranging from excellent to poor, with fair/poor responses coded as 1 and otherwise as 0. For COVID-19-related questions, participants indicated if they had contracted COVID-19 or had a close family member who died from the virus (yes = 1, no = 0). They reported the number of COVID-19 vaccine doses received (0 to more than 4) and their willingness to receive future doses (from "Definitely get" (5) to "Definitely not get" (1)). We categorized 1 and 2 doses as the primary series because the primary series of mRNA vaccines consists of two doses and Johnson & Johnson vaccine consists of a single dose. For both types of vaccines, 3, 4, and more doses are considered booster doses. Additionally, we queried participants about their perceived vaccine barriers, which included concerns about potential side effects (i.e. side effects and long-term effects), lack of adequate vaccine information, physical barriers to vaccine access (i.e. no transportation and limited appointment availability), and disbelief in COVID-19's threat (yes = 1, no = 0).

Statistical methods

Descriptive analyses were performed to summarize the key characteristics of the study participants. We then conducted ordered logistic regression to evaluate the relationship between these factors and participants' willingness to receive future COVID-19 boosters, using a 5-point scale as the dependent variable. While selecting variables for the model, we excluded household income in favor of educational attainment to avoid collinearity, as these two factors are highly correlated. Additionally, the high non-response rate for household income (40.5%) compared to education (8.5%) influenced our decision, making educational attainment a more reliable indicator in our analysis. To validate the model, we also performed a robustness check by consolidating the original 5-point scale into three categories – "definitely get," "probably get/neutral," and "probably not/definitely not get" – and rerunning the model. This categorization aligns with the Centers for Disease Control and Prevention's²³ grouping for vaccine intent, as it simplifies the data by distinguishing clear positive decisions from uncertainty. The results remained largely consistent, confirming the stability and reliability of our model.

Results

Sample demographic characteristics, discrimination, and health indicators

The survey included 447 AA participants, comprised of 136 (30%) Chinese, 209 (47%) Korean, and 102 (23%) Filipino

Table 1. Characteristics of survey participants.

Characteristics	Asian Americans (n = 447)
Socio-demographic, Discrimination, and Health Indicators	
Chinese American	136
Korean American	209
Filipino American	102
Age, y, mean (SD)	54.22 (17.90)
Women, %	61.5
Married or living as married, %	74.8
Education Attainment, %	
High school or less	19.1
Some college	19.3
Bachelor's degree or higher	61.6
Household Income, %	
< \$60,000	48.5
\$60,000-\$99,999	24.8
\$100,000+	26.7
Lifetime Discrimination (EOD, 9-item)	
Total frequency, mean (SD)	1.62 (3.18)
Existing health conditions, %	26
Fair/poor mental health, %	16.1
COVID-19 Outcomes, Vaccine Uptake, Willingness and Attitudes	
Diagnosed COVID-19, %	46.6
Family member died from COVID-19, %	5.4
COVID-19 vaccine dose(s), %	
0	6
1	3
2	21.2
3	46
4 or more	23.8
Willingness to get COVID-19 Booster in the Future	
Definitely not get	8.1
Probably not get	7.2
Neutral	33.8
Probably get	15.2
Definitely get	35.8
Concerns vaccine effects	44.9
Lack of vaccine information	10.1
Vaccine access barrier	8.7
Do not believe COVID-19 a threat	0.9

adult participants. As shown in Table 1, the average age of the participants was 54 years. A majority of the respondents were women (62%), married (75%), and had some college education or a college degree (81%). The average frequency of racial discrimination experiences was 1.6 incidents. In terms of health status, 26% of the participants reported having existing health conditions such as diabetes, and 16% rated their mental health as fair/poor.

COVID-19 outcomes, vaccine uptake, willingness, and attitudes

For COVID-19, 47% of the participants reported being diagnosed with COVID-19, and about 5% experienced the death of a close family member due to the virus. Vaccine uptake varied among participants, with about 6% reporting they were never vaccinated, 24% reporting they received one or two primary vaccine doses, and 70% reporting they had received booster doses, including those with three, four, or more doses in total.

Regarding the willingness to get vaccine booster in future, 36% indicated they would definitely get the booster dose, 49% said they would probably get it or were unsure, and 15% indicated they would probably or definitely not get the booster dose. Additionally, 45% expressed concerns about vaccine side effects and long-term effects, 10% felt they needed more

information about the vaccine, 9% faced physical access barriers such as transportation and appointment difficulties, and 1% did not perceive COVID-19 as a significant health threat, all of which represent key barriers contributing to COVID-19 vaccine hesitancy.

Ordered logistic regression

The ordered logistic regression analysis (Table 2) identified several significant predictors of willingness to use the COVID-19 vaccine booster. Ethnicity emerged as a significant factor, with Chinese and Korean individuals being substantially less willing to use the vaccine compared to Filipinos (Chinese: OR = 0.25, $p < .01$; Korean: OR = 0.21, $p < .01$). Additionally, education was significantly associated with vaccine willingness (OR = 1.45, $p < .1$) as well as existing health conditions (OR = 1.62, $p < .05$). Specifically, individuals with at least some college education and those with preexisting health conditions were more willing to use the vaccine booster dose.

Moreover, the frequency of racial discrimination experiences was inversely associated with COVID-19 vaccine willingness, as more frequent experiences of racial discrimination were linked to lower willingness to take the COVID-19 vaccine booster (OR = 0.91, $p < .01$). Furthermore, the number of

Table 2. Ordered logistic regression analysis of COVID-19 vaccine willingness with odds ratios.

Variable		β	SE	OR	95% CI
Ethnicity (Ref: Filipino)	Chinese	-1.370***	0.297	0.254	[0.145, 0.446]
	Korean	-1.581***	0.285	0.206	[0.119, 0.358]
Age		-0.005	0.006	0.995	[0.983, 1.007]
Gender (Ref: Male)	Female	0.053	0.191	1.054	[0.718, 1.548]
Marital status (Ref: Unmarried)	Married	-0.056	0.232	0.946	[0.601, 1.488]
Education (Ref: Less than some college)	At least some college	0.368*	0.214	1.445	[0.953, 2.190]
Lifetime Racial discrimination frequency		-0.091***	0.033	0.913	[0.855, 0.975]
Existing health conditions (Ref: No)	Yes	0.484**	0.235	1.623	[1.025, 2.572]
Fair/poor mental health (Ref: No)	Yes	0.020	0.236	1.020	[0.639, 1.629]
Diagnosed COVID-19 (Ref: No)	Yes	-0.053	0.191	0.948	[0.646, 1.391]
Family member died from COVID-19 (Ref: No)	Yes	0.605	0.452	1.832	[0.755, 4.446]
COVID-19 vaccine dose (s) (Ref: 0 doses)	Primary series (1 and 2 doses)	1.240***	0.371	3.456	[1.682, 7.100]
	Booster doses (3, 4 or more doses)	2.005***	0.349	7.429	[3.787, 14.571]
Concerns vaccine effects (Ref: No)	Yes	-0.039	0.193	0.962	[0.672, 1.377]
Lack of vaccine info (Ref: No)	Yes	-0.509	0.299	0.601	[0.336, 1.074]
Vaccine access barrier (Ref: No)	Yes	0.194	0.343	1.214	[0.618, 2.384]
Do not believe COVID-19 a threat (Ref: No)	Yes	-0.228	0.886	0.796	[0.129, 4.911]

Ref (reference); β (Coefficient); SE (Standard error); OR (Odds ratio); CI (Confidence interval).

*** $p < .01$, ** $p < .05$, * $p < .1$.

COVID-19 vaccine doses previously received was a strong predictor of willingness to continue the vaccination. Compared to individuals who had never received a dose, those with primary series (1 and 2 doses) (OR = 3.46, $p < .01$) and booster doses (3, 4 or more doses) (OR = 7.43, $p < .01$) were more willing to take the vaccine booster.

Discussion

Despite the gradual decrease in the pandemic's impact on daily life, the threat to public health posed by the virus remains significant. Our findings provide valuable insights into the COVID-19 vaccine status and the determinants of vaccine willingness, particularly the role of racial discrimination, among underserved AA populations – an area that remains understudied in the current vaccine literature. By April 2023, a notable 94% of AA participants had received at least one dose of the COVID-19 vaccine, with one-fourth fully vaccinated with at least four doses, including boosters. Additionally, over one-third of AA participants expressed a definite intent to continue receiving COVID-19 vaccine boosters, surpassing the national rates of 10% observed in the second quarter of 2023.²³

The study's findings carry significant implications for public health policy and practice. Developing culturally appropriate interventions is essential, as the study reveals that Chinese and Korean individuals are notably less willing to receive the COVID-19 vaccine compared to Filipinos. This disparity may stem from various factors, including historical experiences, cultural beliefs, misinformation, and language barriers, all of which influence these communities' perceptions and acceptance of vaccines. Therefore, tailored health communication strategies are crucial to effectively address the specific concerns and barriers faced by these minority groups.

Additionally, efforts to reduce racial discrimination and its adverse effects on public health engagement are essential for building trust and encouraging vaccination, particularly in AA communities. As a minority group who reported experiencing on average more than one and a half instances of racial

discrimination in their lifetimes, exposure to greater discrimination was associated with lower willingness to take COVID-19 vaccine booster doses. This finding aligns with previous research indicating that negative social experiences, such as racial discrimination, can erode minority individuals' trust in health-care systems and their willingness to engage in preventive health measures.^{6,17,18,24} Thus, our results highlight the importance of promoting public health trust and implementing culturally sensitive communication to ensure the success of vaccination campaigns, especially in racial/ethnic minority communities.

Education campaigns should continue to emphasize COVID-19 vaccination benefits, particularly targeting those with lower educational attainment to bridge the gap in health literacy. Our findings indicated a positive relationship between at least some colleges and higher likelihoods of vaccination, consistent with previous studies linking higher education with better health literacy and increased propensity for preventive health behaviors.^{4,5,7}

Moreover, having preexisting health problems, such as asthma or diabetes, significantly influences willingness to receive the COVID-19 vaccine. Individuals with these health conditions are generally more inclined to take the vaccine, likely due to their perceived vulnerability to severe outcomes from the virus.^{5,25} In contrast, healthier individuals may perceive a lower risk of severe COVID-19 outcomes, leading to reduced motivation for vaccination. Notably, our findings align with studies that indicate no significant relationship between mental health conditions and vaccination willingness,²⁵ emphasizing that perceived vulnerability due to specific health conditions plays a more critical role in motivating vaccine uptake.

Furthermore, the strong positive relationship between the number of vaccine doses received and willingness to get further doses suggests that previous vaccine uptake is crucial for long-term uptake. This finding supports the strategy of phased vaccination campaigns that prioritize accepting and using initial doses to build a foundation for subsequent booster campaigns.⁵

However, initial doses are the beginning with continuous education, outreach, and support essential to maintaining high levels of vaccination and achieving long-term public health goals.

While several factors identified in our study align with existing literature, we also discovered certain factors that did not show a significant relationship to COVID-19 vaccine willingness, despite their previously suggested importance. These include personal pandemic experiences (e.g., death of a family member), aging, gender, and other concerns or barriers for the vaccine.^{5,24} This lack of association may reflect specific community dynamics or regional differences within our sample, which might not align with broader national trends. Furthermore, the sample size may limit the power to detect some associations reported in larger studies, or these factors may have become less relevant as the pandemic evolved.

In addition to sample size, another limitation of our study is the extended survey period, during which the evolving COVID-19 pandemic and social conditions may have influenced participants' responses and perceptions. However, this prolonged period was necessary as we integrated community outreach with in-person survey collection in AA communities to build lasting relationships. While this approach may have limited the representativeness of our participant selection and affected the generalizability of our findings, it was essential for achieving the broader goals of the project. Additionally, future research should consider including a more diverse range of AA groups, such as Indian, Vietnamese, and Japanese Americans, to further broaden the scope and applicability of the findings. Despite these limitations, this research is one of the few that provides crucial insights into AA communities, helping to fill a significant gap in the vaccine literature.

In conclusion, this research provides valuable insights into the factors influencing COVID-19 vaccine booster willingness among AAs – an underserved racial group that despite having one of the highest national rates of COVID-19 vaccination and lowest rates of severe COVID-19 outcomes during the pandemic appears heavily impacted by racial discrimination. Our findings highlight significant associations between ethnicity, frequency of racial discrimination, existing health conditions, and the number of COVID-19 vaccine doses previously received with the willingness to receive the COVID-19 vaccine or booster. These results underscore the need for sustained public health efforts, particularly culturally sensitive interventions tailored to the unique concerns of the AA community. Addressing vaccine hesitancy through targeted health communication, reducing discrimination, and continuous education and outreach are essential strategies to maintain high vaccination levels and protect public health in the long term.

Acknowledgments

We would like to express our sincere gratitude to Riverside University Health System – Public Health for their support throughout the process, and to our partnered community organizations – ICAA, YouStar, and PVFAA – for their active participation in this study and their ongoing commitment to promoting health equity in Asian American communities. Their invaluable support and collaboration were essential to the success of this research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Centers for Disease Control and Prevention, under grant [CDC OT21-2103].

Notes on contributor

Dr. Qiuxi Li is a postdoctoral scholar at the University of California Riverside School of Medicine, specializing in health disparities. She holds a Ph.D. in Geography and Spatial Science and an M.S. in Disaster Science. Dr. Li's research employs mixed methodologies and community-engaged approaches to support racial and ethnic minorities, Indigenous populations, and socially vulnerable groups across various contexts, including natural hazards, environmental disasters, health crises, and social changes. Her work emphasizes collaborating with communities to build resilience and address the diverse challenges they encounter.

ORCID

Qiuxi Li  <http://orcid.org/0000-0003-3554-0069>
Andrew M. Subica  <http://orcid.org/0000-0001-6424-7668>

Availability of data and materials

The datasets generated and analyzed in this study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study received ethics approval from the Institutional Review Board (IRB) at the University of California Riverside. All participants provided informed consent prior to their participation in the study.

References

1. World Health Organization. COVID-19 advice for the public: getting vaccinated [Internet]. 2023 [cited 2024 May 6]. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/covid-19-vaccines/advice#:~:text=Take%20whatever%20vaccine%20is%20made,infections%20and%20confers%20longer%20protection.>
2. Centers for Disease Control and Prevention. Interim clinical considerations for use of COVID-19 vaccines in the United States [Internet]. 2024 [cited 2024 May 6]. <https://www.cdc.gov/vaccines/covid-19/clinical-considerations/interim-considerations-us.html#:~:text=COVID%2D19%20vaccination%20is%20recommended,date%20with%20COVID%2D19%20vaccination.>
3. Yasmin F, Najeeb H, Moeed A, Naeem U, Asghar MS, Chughtai NU, Yousaf Z, Seboka BT, Ullah I, Lin C-Y. COVID-19 vaccine hesitancy in the United States: a systematic review. *Front Public Health.* 2021;9:770985. doi:10.3389/fpubh.2021.770985.
4. Willis DE, Montgomery BE, Selig JP, Andersen JA, Shah SK, Li J, Reece S, Alik D, McElfish PA. COVID-19 vaccine hesitancy and racial discrimination among US adults. *Preventative Med Rep.* 2023;31:102074. doi:10.1016/j.pmedr.2022.102074.
5. Reifferscheid L, Lee JSW, MacDonald NE, Sadarangani M, Assi A, Lemaire-Paquette S, MacDonald SE. Transition to endemic: acceptance of additional COVID-19 vaccine doses among Canadian adults in a national cross-sectional survey. *BMC Public Health.* 2022;22(1):1745. doi:10.1186/s12889-022-14025-8.
6. Allen JD, Fu Q, Shrestha S, Nguyen KH, Stopka TJ, Cuevas A, Corlin L. Medical mistrust, discrimination, and COVID-19 vaccine behaviors among a national sample US adults. *SSM-Popul Health.* 2022;20:101278. doi:10.1016/j.ssmph.2022.101278.
7. Szilagyi PG, Thomas K, Shah MD, Vizueta N, Cui Y, Vangala S, Kapteyn A. National trends in the US public's likelihood of getting

- a COVID-19 vaccine—April 1 to December 8, 2020. *JAMA*. 2021;325(4):396–398. doi:10.1001/jama.2020.26419.
8. Wang Y, Liu Y. Multilevel determinants of COVID-19 vaccination hesitancy in the United States: a rapid systematic review. *Preventative Med Rep*. 2022;25:101673. doi:10.1016/j.pmedr.2021.101673.
 9. Agarwal R, Dugas M, Ramaprasad J, Luo J, Li G, Gao G. Socioeconomic privilege and political ideology are associated with racial disparity in COVID-19 vaccination. *Proc Natl Acad Sci*. 2021;118:e2107873118.
 10. Daly M, Jones A, Robinson E. Public trust and willingness to vaccinate against COVID-19 in the US from October 14, 2020, to March 29, 2021. *JAMA*. 2021;325(23):2397–2399. doi:10.1001/jama.2021.8246.
 11. Fridman A, Gershon R, Gneezy A, Capraro V. COVID-19 and vaccine hesitancy: a longitudinal study. *PLOS ONE*. 2021;16(4):e0250123. doi:10.1371/journal.pone.0250123.
 12. Durojaiye C, Prausnitz S, Elkin EP, Escobar P, Finn L, Chen Y-F, Lieu TA. Changes in COVID-19 vaccine intent among a diverse population of older adults, June 2021–February 2022. *The Perm J*. 2022;26(4):78. doi:10.7812/TPP/22.075.
 13. Hill L, Artiga S, Ndugga N. COVID-19 cases, deaths, and vaccinations by race/ethnicity as of Winter 2022 [Internet]. 2023. <https://www.kff.org/coronavirus-covid-19/issue-brief/covid-19-cases-deaths-and-vaccinations-by-race-ethnicity-as-of-winter-2022/>.
 14. California Department of Public Health. COVID-19 age, race and ethnicity data [Internet]. 2023. <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Age-Race-Ethnicity.aspx>.
 15. Community Reports to Stop AAPI Hate 2020–2022 key findings [Internet]. 2023. <https://stopaapihate.org/wp-content/uploads/2023/10/23-SAH-TaxonomyReport-KeyFindings-F.pdf>.
 16. McMurtry CL, Findling MG, Casey LS, Blendon RJ, Benson JM, Sayde JM, Miller C. Discrimination in the United States: experiences of Asian Americans. *Health Serv Res*. 2019;54(S2):1419–1430. doi:10.1111/1475-6773.13225.
 17. Mays VM, Cochran SD, Barnes NW. Race, race-based discrimination, and health outcomes among African Americans. *Annu Rev Psychol*. 2007;58(1):201–225. doi:10.1146/annurev.psych.57.102904.190212.
 18. Benkert R, Cuevas A, Thompson HS, Dove-Medows E, Knuckles D. Ubiquitous yet unclear: a systematic review of medical mistrust. *Behavioral Med*. 2019;45(2):86–101. doi:10.1080/08964289.2019.1588220.
 19. Blanchard J, Lurie N. R-E-S-P-E-C-t: patient reports of disrespect in the health care setting and its impact on care. *J Fam Pract*. 2004;53(9):721–730.
 20. Quinn SC, Jamison A, Freimuth VS, An J, Hancock GR, Musa D. Exploring racial influences on flu vaccine attitudes and behavior: results of a national survey of white and African American adults. *Vaccine*. 2017;35(8):1167–1174. doi:10.1016/j.vaccine.2016.12.046.
 21. Savoia E, Piltch-Loeb R, Goldberg B, Miller-Idriss C, Hughes B, Montrond A, Kayyem J, Testa MA. Predictors of COVID-19 vaccine hesitancy: socio-demographics, co-morbidity, and past experience of racial discrimination. *Vaccines*. 2021;9(7):767. doi:10.3390/vaccines9070767.
 22. Krieger N, Smith K, Naishadham D, Hartman C, Barbeau EM. Experiences of discrimination: validity and reliability of a self-report measure for population health research on racism and health. *Soc Sciamp; Med*. 2005;61(7):1576–1596. doi:10.1016/j.socscimed.2005.03.006.
 23. Centers for Disease Control and Prevention. Concerns about bivalent COVID-19 vaccine and reasons for non-vaccination among adults who completed a primary series – omnibus survey [Internet]. 2023. https://www.cdc.gov/covidvaxview/publications/reasons-non-vaccination-among-adults.html?CDC_AAref_Val=https://www.cdc.gov/vaccines/imz-managers/coverage/covidvaxview/pubs-resources/covid-vaccine-reasons-non-vaccination.html.
 24. Peña JM, Schwartz MR, Hernandez-Vallant A, Sanchez GR. Social and structural determinants of COVID-19 vaccine uptake among racial and ethnic groups. *J Behavioral Med*. 2023;46(1–2):129–139. doi:10.1007/s10865-023-00393-y.
 25. Batty GD, Deary IJ, Altschul D. Pre-pandemic mental and physical health as predictors of COVID-19 vaccine hesitancy: evidence from a UK-wide cohort study. *Ann Med*. 2022;54(1):274–282. doi:10.1080/07853890.2022.2027007.