Public attitudes about equitable COVID-19 vaccine allocation: a randomised experiment of race-based versus novel place-based frames

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ABSTRACT

Equity was—and is—central in the US policy response to COVID-19, given its disproportionate impact on disadvantaged communities of colour. In an unprecedented turn, the majority of US states used place-based disadvantage indices to promote equity in vaccine allocation (eg, through larger vaccine shares for more disadvantaged areas and people of colour).

We conducted a nationally representative survey experiment (n=2003) in April 2021 (before all US residents had become vaccine eligible), that examined respondents' perceptions of the acceptability of disadvantage indices relative to two ways of prioritising racial and ethnic groups more directly, and assessed the role of framing and expert anchors in shaping perceptions.

A majority of respondents supported the use of disadvantage indices, and one-fifth opposed any of the three equity-promoting plans. Differences in support and opposition were identified by respondents' political party affiliation. Providing a numerical anchor (that indicated expert recommendations and states' actual practices in reserving a proportion of allocations for prioritised groups) led respondents to prefer a lower distribution of reserved vaccine allocations compared with the randomised condition without this anchor, and the effect of the anchor differed across the frames.

Our findings support ongoing uses of disadvantage indices in vaccine allocation, and, by extension, in allocating tests, masks or treatments, especially when supply cannot meet demand. The findings can also inform US allocation frameworks in future pandemic planning, and could provide lessons on how to promote equity in clinical and public health outside of the pandemic setting.

INTRODUCTION

Communities of colour, particularly Alaskan Native, American Indian, Black and Hispanic groups, have been hit harder by COVID-19 on multiple dimensions, including disease incidence, mortality, social impact and economic burden.[1–4] This impact exacerbated prior disparities that are rooted in deep societal inequities and structural racism, that is, macrolevel conditions such as residential segregation, unequal access to healthcare and education that limit opportunities, resources and the well-being of people of colour.[5–7] This background raised a pressing question for vaccine allocation: should vaccines be allocated in a way that responds to ongoing and/or historical inequity? The frameworks used to inform and implement vaccination programmes may exacerbate existing inequities, maintain them or contribute to reducing them. A comprehensive framework on equitable vaccine allocation issued by the National Academies of Science, Engineering and Medicine (NASEM) at the request of the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH), expressly acknowledged the need to mitigate the pandemic's disparate impact. NASEM combined a traditional phased roll-out across priority groups with a novel recommendation to promote equity within each phase.[8 9]

Specifically, NASEM recommended that disadvantaged geographic areas should be prioritised within each allocation phase, using a measure such as the CDC's Social Vulnerability Index (SVI).[6] Indices such as SVI measure the average advantage or disadvantage of residents in a given area, integrating dimensions such as income, educational attainment and housing quality that are often clustered and can have cumulative and compounding effects.[10–13] Indices capture the intersection of health and disadvantage, and the over-representation of communities of colour among more disadvantaged communities due to structural racism.[7]

Practically, the NASEM framework recommended that 10% of federal vaccines to be distributed at any given time should be set aside to be added to the amounts that disadvantaged areas would otherwise receive, based on their population size.[6] Additionally, the framework recommended that planners should make special efforts to reach high-vulnerability areas (defined as the 25% highest vulnerability in a state).[6] While the ethical frameworks and operational guidance issued by the CDC's Advisory Committee on Immunisation Practices (ACIP) did not include the NASEM-recommended additional allocations for more disadvantaged areas,[14 15] the proposal was nonetheless rapidly and widely adopted. By late March 2021, 36 US states, that is, the majority, used disadvantage indices for allocation and programmatic purposes, including set-aside allocations ranging between 5% and 40%.[16] Some states also allocated vaccine explicitly by race and ethnicity for some periods. For example, Vermont offered vaccines to all residents who identify as Black, Indigenous, or a person of colour in April 2021, before opening eligibility to all adults.[17 18]

Public perceptions of race-based and place-based prioritisation are important for their normative

justifications,[19] and may shape policy-makers' willingness to endorse such strategies during legislative and regulatory debates. Accumulated research indicates a relationship between public preferences and policy action.[20] Further, public support can contribute to the policy implementation process[21 22]; that is, in this case, a supportive public would pose fewer obstacles to implementation of the resource allocation plan. Two factors are likely particularly important influences on public perceptions: (1) how the proposals are framed, that is how the different rationales underlying allocation strategies are presented[23] and (2) use of anchors, such as the inclusion of numerical information that is supported by experts.[24] Both of these factors can influence the public's understanding of complex decisions that are outside of one's everyday direct experience and knowledge, such as understanding of vaccine allocation,[25 26] and are particularly relevant to perceptions of policy affecting particular racial and ethnic groups, where the public's underlying attitudes (and sometimes stereotypes) about these groups are so salient.[27 28]

To minimise backlash, especially partisan resistance, some have argued that racial justice might best be advanced by communicating about policy goals in more implicit, rather than explicit, ways about racism.[29 30] Using disadvantage indices in public health policy is one way to do this, as these indices directly capture the interrelationship between racism, health and disadvantage, while genuinely recognising that forms of disadvantage beyond race also matter for social justice.[6 9]

Recent survey research with nationally representative samples that informed respondents that people of colour are at 'much higher risk of getting sick with and dying from COVID-19' found that a majority agree that these groups should have access 'before lower-risk groups',[31] and participants of public deliberations on vaccine access in New York City recognised that lower-income populations of colour and more disadvantaged neighbourhoods were at higher risk of COVID-19 infections.[32] However, our own earlier research aside,[18] we are unaware of prior work eliciting attitudes towards vaccine allocation in ways that foregrounds social, rather than exclusively medical risk, or that examines attitudes towards the approach underlying the actual use of disadvantage indices.

The objectives of our study were therefore to determine, in a between-subjects survey experiment:

1. Whether support for vaccine prioritisation varies if the policy benefits the same group, but is framed explicitly as benefitting: (1) disadvantaged racial and ethnic groups (2) disadvantaged racial and ethnic groups affected by structural racism, specifically and (3) disadvantaged groups defined in terms of place, that is, their geographical locations (inclusive of disadvantaged racial and ethnic groups);
2. Whether the provision of an anchor (ie, an expert recommendation for additional vaccine allocations for disadvantaged groups) affects respondents' support.

METHODS

The study was conducted with a representative sample of US adults participating in an omnibus survey fielded by Harris Insights & Analytics (see online supplemental eMethods). It was fielded on 13 April 2021–16 April 2021, just before eligibility for COVID-19 vaccines was extended to all US residents ages 16 and older (April 19).

Study design

In the first of two questions, participants were randomised to read one of three vaccine allocation plans, in which groups are offered larger shares of vaccines framed in ways that foreground the role of race, structural racism or place-based disadvantage (as captured by disadvantage-indices such as SVI), and asked to indicate their approval (see table 1 for the full instrument). Approval was measured using a 5-point Likert-scale (strongly oppose-strongly support). Measures of overall support and opposition were created by collapsing 'strongly support' with 'support' and 'strongly oppose' with 'oppose'. Variables provided by Harris International for use in the analysis included gender, age, employment status, educational attainment, income, political affiliation, and race and ethnicity.

For the second question, participants were rerandomised to a question that either had an expert anchor (shorthand below: 'NASEM/state') or no anchor, and asked 'what percentage of the overall allotment of vaccines do you think should be set aside and added to the amounts that [group frame] would otherwise be offered, based on their share of the population?' (see table 1 for complete wording). The purpose of the anchor was twofold. First, we were unsure to what extent respondents might have intuitions on the somewhat more technical question of the magnitude of increased allocations. By providing the context that NASEM had recommended a 10% set-aside, and states were implementing additional allocations between 5% and 40%, we provided respondents with real-world benchmarks—and by randomising half of the respondents to the same question without any anchoring, we were also able to gauge acceptable levels of additional allocations independent of actual policy recommendations and practice (as it was safe to assume that few, if any, of the respondents were aware of allocation policy at this level of detail). Second, from the earliest discussions around state-recommended policies such as social distancing, mask-wearing and related measures, it was clear that the public evaluation of public health policy was not merely focused on the scientific rationales, but also concerned with the justification of state authority, and trust in governments and policy-makers at different levels.[8 19 26] By splitting respondents in two groups who considered the question of the magnitude of additional allocations with and without information on what state governments were doing, we opened an opportunity to analyse potential differences that could be due to respondents' views on the authority of state governments in influencing equity through policy. In both versions of the question, respondents were asked to indicate what percentage of additional vaccines should be set aside by placing an indicator or a scale ranging from 0% to 100% (with 0.1 increments). Indicating 0% required dragging the slider to the scale's zero point, that is, all percentage allocations required an active choice). Responses were categorised into zero or non-zero (ie, amounts greater than 0%) allocations, and a total of five analytic bins in 20% increments were created.

Statistical analysis

Data were analysed using Analysis of Variance (ANOVA, linear regression and χ^2 tests to compare differences in the outcomes by randomised groups. Given the experimental design, we report all findings without adjusting for covariates.[33] All data were analysed using SPSS V.26 with weights provided by Harris Insights applied to retain nationally representative estimates. Statistical significance was set at 0.05.

RESULTS

A total of 2003 individuals participated in the study. The completion rate (according to standards of the American Association

Table 1 Experimental design for eliciting preferences towards race-based and place-based prioritisation for COVID-19 vaccines within priority groups

Currently, COVID-19 vaccines are generally only offered to priority populations, such as healthcare workers, essential workers, people with medical conditions, and older adults. From 19 April, vaccines will be offered in all US states to the general population. At that point, everyone who is not in a priority group, along with everyone who has not yet been vaccinated, will be eligible to get a vaccine. While there will be more vaccines, and relatively fewer people, it will still be the case that not everyone who would like a vaccine will be able to get one right away. There remain questions about how to allocate vaccines among the general population.		
(Race frame) Black, Indigenous and Hispanic communities have been hit harder by COVID-19. They experienced at least twice as many deaths compared with the white population. Deaths were most frequent for people who were economically disadvantaged in these groups. Policy-makers are considering a plan to address these issues. They suggest that once vaccines are offered to the general population, economically disadvantaged members of black, Indigenous and Hispanic communities should be offered a larger share of vaccines so that they are able to get a vaccine sooner.	(Race&Racism frame- changes vs race-only frame in italics) Because of structural racism, black, Indigenous and Hispanic communities have been hit harder by COVID-19. They experienced at least twice as many deaths compared with the white population. Deaths were most frequent for people who were economically disadvantaged in these groups. Policy-makers are considering a plan to address these issues. They suggest that once vaccines are offered to the general population, economically disadvantaged members of black, Indigenous and Hispanic communities, who have been affected disproportionately by structural racism, should be offered a larger share of vaccines so that they are able to get a vaccine sooner.	(Place frame) People living in economically disadvantaged neighbourhoods have been hit harder by COVID-19. They generally have less money, are more likely to live in crowded housing and are more frequently unemployed. While these people include all racial and ethnic groups, more Black, Indigenous, and Hispanic people live in disadvantaged neighbourhoods. These groups experienced at least twice as many deaths compared with the white population. Policy-makers are considering a plan to address these issues. They suggest that once vaccines are offered to the general population, people living in more economically disadvantaged areas should be offered a larger share of vaccines so that they are able to get a vaccine sooner.
Q1. How much do you support or oppose this plan? 1=strongly oppose—5=strongly support		
Q2. Under this plan, what percentage of the overall allotment of vaccines do you think should be set aside and added to the amounts that…		
(Race frame) …economically disadvantaged members of black, Indigenous and Hispanic communities	Race&racism frame] …economically disadvantaged members of Black, Indigenous, and Hispanic communities who have been affected disproportionately by structural racism…	(Place frame) …people living in more economically disadvantaged areas…
…would otherwise be offered, based on their share of the population? w/o Anchor Experimental Condition: The following text occurred in only three of the six experimental conditions: For your reference, a report by the National Academies of Science, Engineering and Medicine suggested that 10% should be set aside for related purposes, and currently 13 US states do so, by reserving between 5% and 40% If you think no additional allocations should be made, click the slider at 0.		

for Public Opinion Research) was 63%, see online supplemental eMethods. Respondent demographics are shown in table 2.

Overall support for additional allocations was highest under the place-based frame at 51.5%, followed by the race frame (47.5%) and structural racism frame (42.1%; see figure 1A). Overall opposition was lowest under the place-based frame (15.6%), while similar under the race (20.1%) and structural racism frames (20.1%). Differences in support across frames were statistically significant (p=0.005).

Support and opposition varied by political affiliation: The majority of respondents identifying as Democrats supported additional allocations under all three frames almost equally (range 65.8%–66.9%). Support was weaker among Republicans, and differed across frames: 39.5% supported the strategy under the place-based frame, 31.3% under the race frame and 24.9% under the structural racism frame (all differences by political affiliation across frame were significant at 0.001, see figure 1B, online supplemental eTable 1). While political affiliation demonstrated the strongest group differences in support by frame, online supplemental file 1 shows that respondents with higher educational attainment were more supportive under the structural racism and disadvantage frames, and that more Black, Hispanic and Asian respondents indicated support under the structural racism frame.

Figure 2 depicts the second component of the experimental design, assessing whether respondents' preferences for allocating additional quantities of vaccines varied if they were informed about NASEM's proposal and states' practice. When provided this anchor, more respondents selected lower values of allocations, as demonstrated by the bars in figure 2. We found a statistically significant impact of the anchor (p<0.001); specifically, mean amounts of additional allocations were lower under the anchor (M=37.35, SD=29.54) compared with those who did not receive the anchor (M=41.66, SD=29.33). There were also statistically significant interactions between frame and the expert anchor (figure 3). Specifically, mean allocations were relatively consistent across frames for those respondents who received the anchor: 41.9% under the structural racism frame, 43.2% race frame and 44% under the place-based frame. But differences across frames were greater when no anchor was provided: 47.6% (structural racism), 43.5% (race), 51.6% (place-based); compared with respondents' allocations under the expert anchor condition, allocations were higher in the structural racism frame and disadvantage frame.

In additional analyses examining the interactions by political affiliation, anchor and frame for whether or not respondent selected a non-zero allocation, we found statistically significant interactions. Specifically, being a Democrat significantly increased the likelihood of making a non-zero additional vaccine allocation for those exposed to the structural racism frame (b=1.48, Wald χ^2=9.32, p=0.002).

DISCUSSION

To our knowledge, this is the first examination of public response to widely adopted use of disadvantage indices to promote equity in vaccine allocations,[16 34] and of alternative approaches that focus more narrowly on targeted allocations to specific racial groups. Just one-fifth of respondents opposed any of the equity-promoting strategies. Increasing allocations through the use of disadvantage indices met with majority support and least opposition, while the inverse was the case

Table 2 Overall respondent demographics (weighted and unweighted)

	Weighted		Unweighted	
	N	%	N	%
Gender				
Male	979	47.5	905	43.9
Female	1064	51.6	1141	55.3
All Others	18	0.9	17	0.8
Age				
18–44	942	45.6	850	41.2
45–65	684	33.1	673	32.6
65+	439	21.3	540	26.2
Employment				
Employed (FT, PT or self)	1157	56.1	1034	50.1
All other (unemployed, retired, student, homemaker, etc)	906	43.0	1029	49.9
Education				
Less than HS degree	193	9.4	103	5.0
HS degree to <4 years college degree	1130	54.7	1069	51.8
4 years college degree or more	741	35.9	891	43.2
Income				
< US$50k	599	29.1	815	39.5
US$50k–US$74.9k	331	16.1	422	20.5
US$75k–US$99.9k	270	13.1	282	13.7
>US$100k	800	38.8	484	23.5
Political affiliation				
Republican	597	31.2	617	32.2
Democrat	817	42.6	791	41.3
All others	502	26.2	509	26.6
Race				
White (not Hispanic)	1310	63.5	1544	74.8
Hispanic	309	15.0	166	8.0
Black	249	12.1	178	8.6
Asian	122	5.9	83	4.0
All others	72	3.5	92	4.5

FT, full time; PT, part time; Self, self employed.

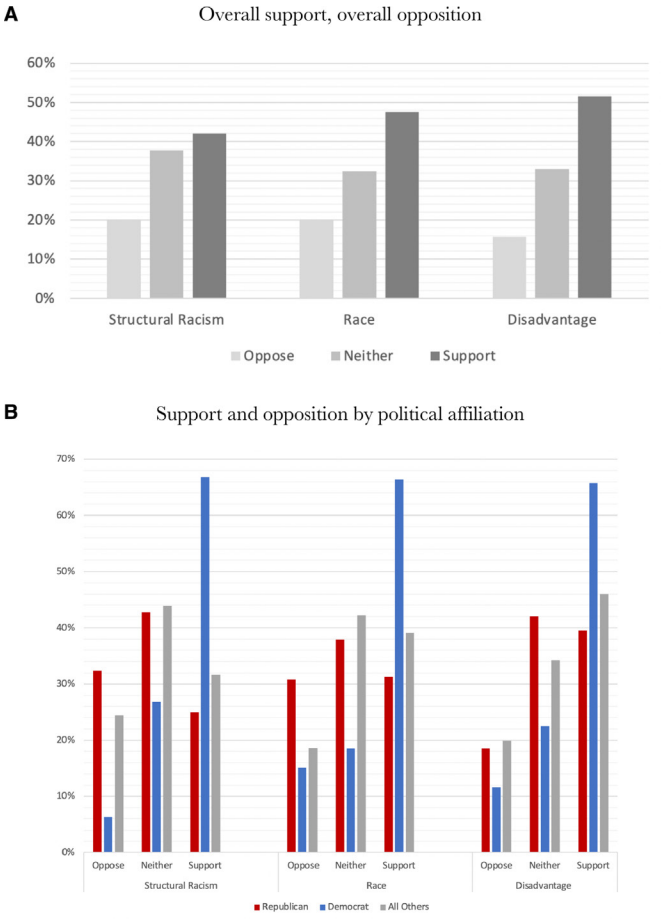
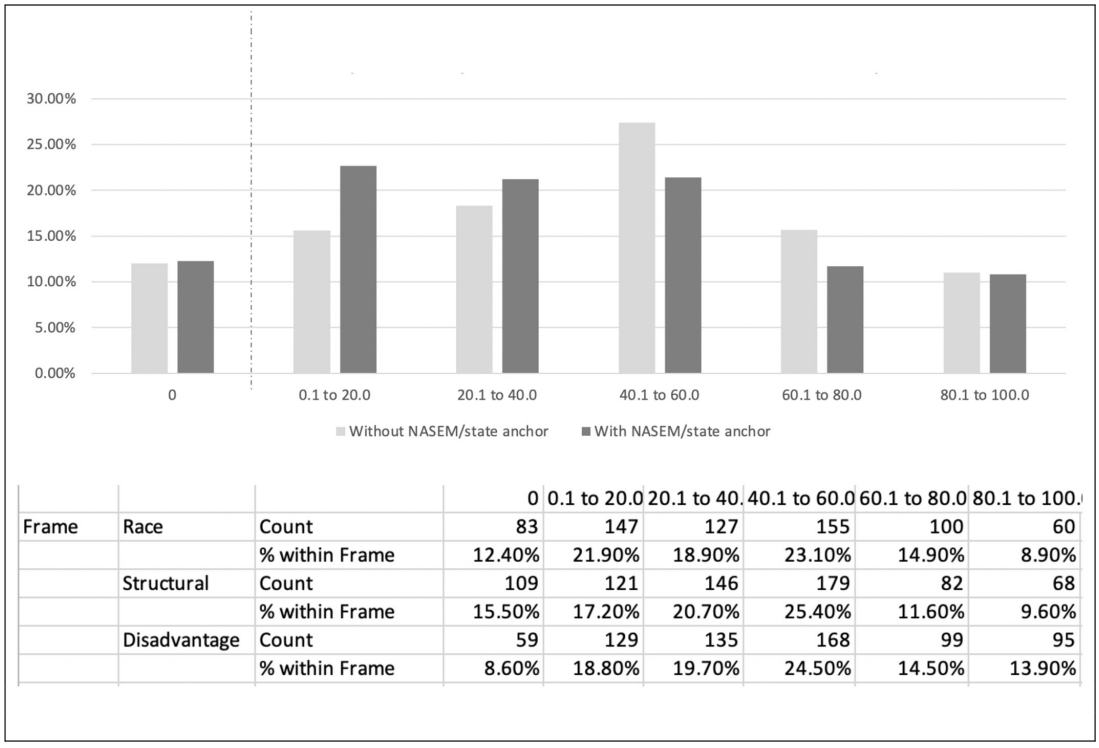


Figure 1 Per cent support and opposition for prioritising groups within three frames, overall and by political affiliation*. *Per cent respondents answering net oppose, neither or net support within each frame, that is, collapsing strongly support +support and strongly oppose +oppose. (A) The differences in the distribution of support across frame are statistically significant. Pearson $\chi 2$ 14.96, p=0.005). (B) The differences in the distribution of support across political affiliation within each frame are also statistically significant; race: 67.668(<0.001); structural racism: 112.240 (<0.001), disadvantage: 37.678 (<0.001).

when more equitable allocations were framed with reference to structural racism. While the effects of frames was fairly small, framing effects differed by respondents' political affiliation, with the least partisan differences associated with the use of disadvantage indices, suggesting that using disadvantage indices can be an effective way for policy-makers to promote racial and ethnic justice in parallel to social justice.[30] While public policy should be justified independent of public opinion (as was the case with NASEM's frameworks and the US states adoption of it,[16] it is imperative in politically charged policy areas to be mindful of public reception, and it is hence reassuring that there was considerable alignment regarding policy-makers' decisions and public preferences.[29 30]

More subtle nuances were found when study respondents were provided with information about the fact that increased allocations were in response to NASEM's recommendation and states' practices, which led respondents to prefer marginally lower amounts of additional vaccine for at risk populations under all frames, compared with respondents' preferences without the anchor. The experimental design does not permit us to point to a specific explanation for this difference, but it does align with research demonstrating tensions in the public acceptance of government-driven public health policy.[8 19 26 35 36] The policy implication are somewhat paradoxical, in that they would imply that for public support to be strongest, endorsement by state, city or other governments should be as subtle as possible—yet, on grounds of accountability, and in terms of working towards a climate where addressing racism and other forms of inequity are not third rails but necessary components of public policy, it would be desirable not to shy away from being transparent. Given, however, that even the lower allocations preferred under the expert anchor aligned with NASEM's recommendation and what states implemented,[8 9] it seems like being clear about the rationales for using disadvantage indices offers a promising way forward.

Further, our findings are supported by a prior survey experiment we conducted. In this work, we focused on the time point when vaccine eligibility was opened to the general population, and found support for opening eligibility earlier for disadvantaged communities, with a majority supporting the place-based



			0	0.1 to 20.0	20.1 to 40.	40.1 to 60.0	60.1 to 80.0	80.1 to 100.
Frame	Race	Count	83	147	127	155	100	60
		% within Frame	12.40%	21.90%	18.90%	23.10%	14.90%	8.90%
	Structural	Count	109	121	146	179	82	68
		% within Frame	15.50%	17.20%	20.70%	25.40%	11.60%	9.60%
	Disadvantage	Count	59	129	135	168	99	95
		% within Frame	8.60%	18.80%	19.70%	24.50%	14.50%	13.90%

Figure 2 Overall shares of respondents' preferences for additional allocations, by anchor. Differences in the distribution of respondents' preferences for allocations by anchor were statistically significant ($\chi 2$ 29.20, p<0.001).

approach (54.5% of all respondents; 95% CI 51.6% to 57.5%), and a substantial proportion supporting the race-based plan (40.3% of all respondents; 95% CI 37.3% to 43.4%). Support was higher among Democrats compared with Republicans.[18] They also align well with related recent work demonstrating support by Americans for prioritising people of colour presented as being at higher health risk,[31] as well as a study comparing public attitudes across 13 countries and finding that across these, 'the public feel that a broader set of economic factors should be taken into account in prioritisation policies (including low income groups)'. Last, our findings are consistent with survey work emphasising the need to ensure alignment of allocation policy with public preferences to avoid threatening society's social contract.[26] We believe that the findings from this study can be used to develop equitable allocation policies that align with public preferences in the US regarding other healthcare resources (eg, masks, tests, COVID-19 boosters, non-Covid vaccines) in the future.

In terms of policy implications, our findings highlight an important omission in guidance issued by the ACIP.[14 15] Just as NASEM recognised in their guidance, a significant portion of the public recognises that equity matters in allocating vaccines, and just 15.6% expressly oppose these special prioritisation efforts via tools such as disadvantage indices. Yet, this element of

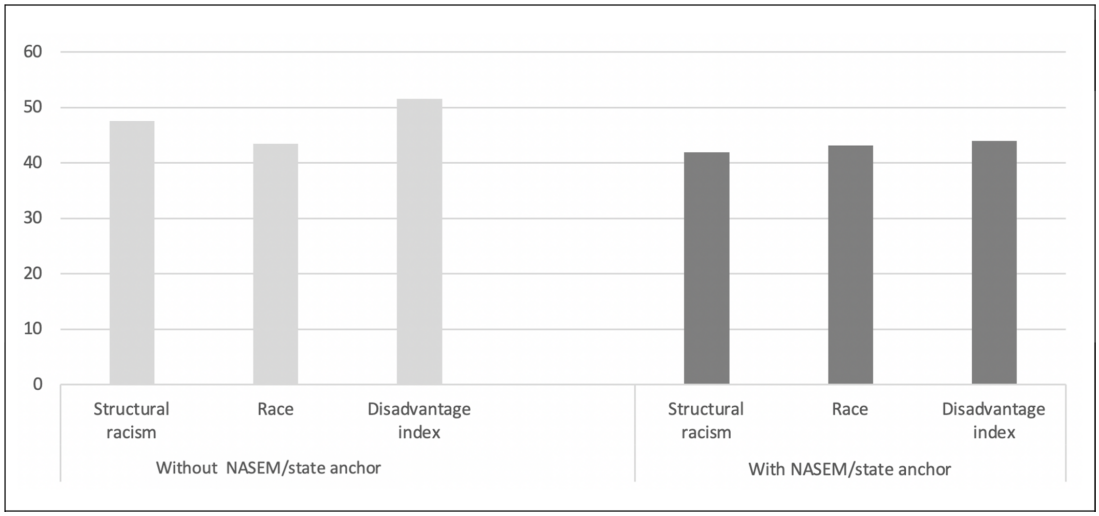


Figure 3 Mean allocation by frame and anchor (among those who choose to allocate any vaccine). Tests of differences (based on ANOVA) identified a significant anchor effect (F=12.209, p<0.001), a significant frame effect (F=4.26, p=0.01) and an interaction between anchor and frame that approached significance (F=2.808, p=0.06). NASEM, National Academies of Science, Engineering and Medicine; ANOVA, Analysis of Variance.

within-population prioritisation was not included in ACIP's guidance, which focused on promoting equity in the traditional sense (through the sequence of priority groups; see also the US 2018 influenza pandemic allocation plan, which focused on professional and health-status groups only).[37] While ACIP emphasises equality of opportunity to receive vaccines across all allocation phases,[14 15] our results show support for equity-based prioritisation plans. Note also that in June 2021, the CDC in collaboration with the US Department of Health and Human Services' Office of Minority Health launched the Minority Health SVI, which is built on the SVI, but, among other changes, expands its Minority Status and Language theme to include statistics for specific race and ethnicity categories and languages.[10 38] This development indicates both a perception among federal policy-makers that disadvantage indices can play important roles in improving equity in the allocation of scarce COVID-19 resources, and that they can be an instrument for addressing racial and ethnic equity.

Limitations

Our study is cross-sectional in nature, and demonstrates an immediate effect of framing on support for vaccine allocation plans; thus this study may be evidence of an only-transient effect. Findings cannot be extrapolated to reach conclusions about broader public understanding, which happens over time and across multiple exposures to messaging and/or via deliberation. Further, we asked about the public's willingness to increase allocations in April 2021 when scarcity persisted,[39 40] but some areas were beginning to face new challenges in not being able to distribute all available vaccines. Possibly, respondents were aware of this, and correspondingly more likely to disapprove of additional allocations. Still, we found substantial overall support. We elicited views on prioritisation at a point when the general population had become eligible, so it is unclear what our findings mean for prioritisations within populations in earlier phases, which NASEM also recommended (such as older-age groups, or different types of essential workers). However, related research suggests that support for additional allocations to more disadvantaged groups is not limited to allocations made once all priority groups have been offered vaccines (and the general population is offered them), but also found before this stage.[31] As shown in table 2, the sample was somewhat skewed towards higher income groups: however, we applied the weights provided by Harris to obtain nationally representative estimates. Insofar as there might be a larger share of higher-income respondents, this should only strengthen our findings, as they are indicating a willingness to deprioritise themselves (in offering larger shares to more disadvantaged groups, first).

CONCLUSION

Our study demonstrates that while there are differences in support for allocation schemes depending on how policies are framed, there is substantial public support for prioritisation of COVID-19 vaccines by means of disadvantage indices, which is opposed by fewer than 2 in 10 people.

Our findings are also important given that disparities in vaccination coverage remain, and that the gap between the most and least disadvantaged groups has increased since the entire US population has become eligible for vaccines, rather than decreased[3 41 42] (even if, plausibly, at magnitudes that are lower than had states not adopted disadvantage indices). Our study suggests that there could be significant public support for policies that continue to seek to reverse this trend for primary and secondary vaccinations, and likewise for boosters and efforts seeking to ensure equitable allocation of vaccines to children.

Further, at the time of writing, new variants spread across the world and brought the question of whether new vaccines or additional boosters may be required for new variants into sharper focus. In such cases, there might again be an initial gap between demand and supply, and prioritisation of more disadvantaged populations as per NASEM's recommendation and states' practice would become relevant once more. Finally, longer term, our findings matter for future pandemic planning, and can also warrant exploring whether there is broader support for using disadvantage indices outside of the vaccine allocation context for other resource allocation purposes in clinical and public health. For example, the SVI has been used to describe disparities in influenza vaccination rates,[43] that differ across racial and ethnic groups in ways that are very similar to the patterns seen in COVID-19: Indices could be used no only descriptively, but to increase rates through uses such as targeted outreach, or vaccination site planning. Parallel uses that could be explored and would build on the use of the SVI in the literature would be improving surgical outcomes among patients undergoing hepatopancreatic surgery (authors highlight, among other things, risk-stratifying patients and planning food assistance for higher vulnerability patients),[44] or addressing disparities in the social determinants of health as a means to mitigate racial disparities in kidney transplantation.[45]

Contributors HS and SJS had the idea for the study and jointly designed the initial instrument, revised substantially after further input from SG, ES, AB. SJS led all data analyses, with assistance from ES and guidance from SG, AB, HS. HS wrote the first draft of the manuscript and led all subsequent revisions; all authors critically reviewed and revised the manuscript. Guarantors: HS, SJS.

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Ethics approval The study was determined to be exempt by the Institutional Review Board of the University of Pennsylvania. Participants gave informed consent to participate in the study through processes facilitated by Harris International before taking part.

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Data availability statement Data are available on reasonable request.

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