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Practice of Epidemiology

Impact of Racial Categorization on Effect Estimates: An HIV Stigma Analysis

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Suboptimal racial categorization potentially introduces bias in epidemiologic analysis and interpretation, making it difficult to appropriately measure factors leading to racial health disparities. As part of an analysis focused on predictors of experiencing human immunodeficiency status (HIV)-related stigma among men who have sex with men living with HIV in San Francisco, we struggled with the most appropriate ways to categorize people who reported more than 1 racial identity, and we aimed to explore the implications of different methodological choices in this analysis. We fitted 3 different multivariable linear regression models, each utilizing a different approach to racial categorization: the "multiracial," "othering," and "hypodescent" models. We estimated an adjusted risk difference in mean score for reported frequency of experiencing HIV-related stigma on a 4-point scale, adjusting for age, race, gender identity, injection history, housing, mental health concerns, and viral load. Use of a hypodescent model for racial categorization led to a shift in the point estimate through the null for Blacks/African Americans, and it improved precision for that group. However, it obscured the association of increased stigma and race for multiracial people, compared with monoracial counterparts. We conclude that methodological decisions related to racial categorization of participants can dramatically affect race-related study findings in predictor regression models.

HIV; multiracial categorization; race factors; racism; regression analysis; stigma

Abbreviations: HIV, human immunodeficiency virus; MSM, men who have sex with men; RD, risk difference.

The proportion of people in the United States who are multiracial is steadily increasing. It is now thought that at least 7% of Americans are multiracial, with 1 in 10 babies born in the United States being born to parents with 2 or more races between them (1). Race is a social construct and not a biological feature; racism, however, is a well-known cause of substantial health disparities between White persons and populations of color (2–6). Racial health disparities are not limited to monoracial (single-race) groups; the multiracial population experiences poorer health than monoracial groups of color in some cardiovascular, respiratory, and mental health outcomes (7, 8). Beyond racism, multiracial people may additionally experience monoracism—systematic oppression of the multiracial experience in daily life, education, and health-care settings—potentially explaining monoracial-multiracial health disparities (9–12). This pattern is obscured at least in part because the treatment of multiracial populations in health research is often fraught with both theoretical and analytical issues arising from racially essentialist methodologies (13). Race itself is commonly treated like a nuisance variable in statistical analyses, as though racial disparities are naturally occurring and uninteresting (3, 14–19). Meanwhile, cultural and institutional preferences for measuring race in health research using singular categories results in multiracial people being categorized inconsistently, lumped into a generic "other" category, or sometimes excluded completely, inhibiting the field's ability to meaningfully uncover and address health disparities that have real and profound effects on this group (20). These monoracist practices have strong historical links to demographic surveys such as the US Census. The 1890 Census introduced "Quadroon" and "Octoroon" categories; hypodescent, commonly known as the "one-drop rule," emerged from the 1930 Census, which stated that "any degree of Negro ancestry was sufficient for the designation of Negro." (21) Considerable evidence exists

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almost 100 years later that hypodescent models of racial classification persist in both formal and informal interactions (22, 23).

Since 2000, the Census has permitted individuals to check multiple racial categories, allowing for more specific individual identification, while also introducing new analytical challenges. Suboptimal racial categorization for ease of analysis potentially introduces bias in both analysis and interpretation, and mishandling of race in epidemiologic analyses makes it difficult to measure real implications of racism and other factors affecting racial health disparities. As part of an analysis focused on predictors of experiencing human immunodeficiency virus (HIV)-related stigma among a sample of men who have sex with men (MSM) living with HIV in San Francisco, we struggled with the most appropriate ways to categorize people who reported more than 1 racial identity.

HIV is a highly stigmatized disease in most circles, and HIV-related stigma can originate from judgmental attitudes toward social groups disproportionately affected by HIV, including MSM, people who inject drugs, and people of color (24, 25). HIV stigma is a major obstacle to health-care–seeking behavior and timely diagnosis (26), engagement in HIV care (27), and adherence to antiretroviral therapy (28). Intersecting stigmas related to multiple stigmatized identities have been shown to have a synergistic effect, often increasing the prevalence of poor health outcomes (29), and in the case of multiracial MSM living with HIV, we believed there was potential for intersecting stigma from having HIV, being MSM, being perceived as non-White, and, further, being perceived as not truly belonging to any monoracial groups. Here we present a case study of our exploration of the implications of different methodological choices in this analysis for obscuring or illuminating associations between HIV stigma and mono- or multiracial identities.

METHODS

Our HIV stigma analysis was conducted using electronic health record data from clients of a large San Francisco community-based organization. Data were included from patients who were diagnosed with HIV, aged 13 years or older, self-responded to a question about stigma as part of the data collection related to their regular care, and received sexual health services at the organization between July 2018 and December 2020. Of 1,690 total MSM otherwise meeting eligibility in the full data set, 584 (34.6%) had completed the stigma question and were included in this analysis. The level of HIV-related stigma experienced was determined by this question, "In the last 12 months, to what extent have you experienced stigma or discrimination (e.g. avoidance, pity, blame, rejection, verbal abuse or bullying) in relation to your HIV status?" The response had a 4-point Likert scale with answer choices of never (0), rarely (1), sometimes (2), or often (3). While a validated tool for measurement of stigma would have been preferable, this analysis of existing program data did not allow for prospective design and implementation of a more robust set of stigma-related questions. Participants were also asked to self-identify their race, by checking all boxes that applied to their racial identity; answer choices included Asian, Native Hawaiian or Pacific Islander, Black or African American, Hispanic or Latinx, Middle Eastern or North African, American Indian or Alaska Native, White, or "other (specify)."

Due to small numbers (<5) in the sample, we combined those who checked only the box for "Asian" or "Native Hawaiian or Pacific Islander" as "Asian/Pacific Islander" in the model, and combined those who checked only the box for "North African or Middle Eastern" or "American Indian or Alaska Native" as "other" in the model, along with those respondents who only checked the box for "other." While respondents were given a chance to specify their "other" race, this qualitative information was disregarded in this analysis for simplicity, as is commonly done. For similar reasons, we also collapsed those who reported their housing status as "homeless" or "unstable housing" as "homeless/unstably housed" in the model. However, we report the number and percent of respondents in those original groups in Tables 1 and 2, for reference. We then fitted 3 different multivariable linear regression models each illustrating a different common approach to racial categorization:

1. The "multiracial" model: Anyone who reported more than 1 race on their questionnaire was classified in the "multiple" race category. This is a very common handling of multiracial people in similar models.
2. The "othering" model: Anyone who reported more than 1 race on their questionnaire was classified in the "other" race category, along with those who checked the box for "other" or reported being of a racial group with small numbers (<5) in the sample. In other words, in the othering model only people who reported being monoracial in one of the major racial categories in the United States were classified in unique levels in this factor variable.
3. The "hypodescent" model: Anyone who checked multiple race boxes was assigned the lowest-status racial category (with Black/African American as lowest, then Hispanic/Latinx, then Asian/Pacific Islander, then other (including North African or Middle Eastern and American Indian or Alaska Native), with White as the most privileged group). This is in line with typical hypodescent models, which group individuals with multiple racial ethnicities into their most socially subordinate monoracial category (30).

The number of people in each racial category under each model can be found in Table 1. We estimated an adjusted risk difference (RD) in mean score for reported frequency of experiencing HIV-related stigma on the 4-point (0–3) stigma scale, adjusting for age category (13–29 years, 30–49 years, 50 years or older), race (as described in each model), gender identity (cisgender or trans/gender nonconforming), injection history for the last 12 months (yes; no), housing status (homeless: living outdoors or in a vehicle, navigation center, or a shelter or having no home; stable housing: living in stable housing, rented or owned; unstable housing: having unstable housing or couch surfing or living in treatment or transitional housing or living in a hotel or staying with a friend), mental health concerns (yes: have often felt down or depressed or hopeless or have often felt little interest or

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Table 1. Racial Classifications of Clients of a Large Community-Based Organization for Different Linear Regression Models, With Number of Participants per Subgroup, San Francisco, July 2018 to December 2020

Racial Category	No.
As originally collected	
Asian	33
Native Hawaiian/Pacific Islander[a]	3
Black/African American	48
Hispanic/Latinx	142
White	258
American Indian/Alaska Native[b]	4
Middle Eastern or North African[b]	3
Other	8
Multiple[c]	42
Unknown	43
"Multiracial" model	
Asian/Pacific Islander	36
Black/African American	48
Hispanic/Latinx	142
White	258
Other	15
Multiple	42
"Othering" model	
Asian/Pacific Islander	36
Black/African American	48
Hispanic/Latinx	142
White	258
Other	57
"Hypodescent" model	
Asian/Pacific Islander	46
Black/African American	61
Hispanic/Latinx	154
White	258
Other	22

[a] The 3 people who checked only the "Native Hawaiian or Pacific Islander" box were included as Asian/Pacific Islander in all models, due to sparse data concerns.

[b] The 4 people who checked only the "American Indian or Alaska Native" and 3 people who checked only the "Middle Eastern or North African" box were included as "other" in all models, due to sparse data concerns.

[c] Any respondent who checked more than 1 race box was counted as "multiple."

Table 2. Individual Characteristics of Clients of a Large Community-Based Organization, San Francisco, July 2018 to December 2020

Characteristic	No.	%
Age, years		
13–29	96	16.4
30–49	298	51.0
≥50	190	32.5
Race		
Asian	33	5.7
Native Hawaiian/Pacific Islander	3	0.5
Black/African American	48	8.2
Hispanic/Latinx	142	24.3
White	258	44.2
American Indian/Alaska Native	4	0.7
Middle Eastern/North African	3	0.5
Multiple	42	7.2
Other	8	1.4
Unknown	43	7.4
Gender identity		
Cisgender	564	96.6
TGNC	20	3.4
Injection history		
Yes	72	12.3
No	512	87.7
Housing status		
Stable housing	502	86.1
Homeless	9	1.5
Unstable housing	72	12.3
Mental health concerns		
Yes	60	10.3
No	524	89.7
Viral load		
Undetectable	511	94.8
Detectable	28	5.2

Abbreviation: TGNC, trans/gender nonconforming.

pleasure in doing things; no), and viral load (detectable: >200 copies/mL; undetectable). As people living with HIV often experience stigma due to their affiliations with marginalized groups related to age, ethnic or racial identity, gender, substance use, homelessness, mental health, or failure to suppress viral load (31, 32), each of these covariates was determined to have potential as independent predictors of HIV stigma as an outcome.

Those with unknown ethnicity due to active refusal or nonresponse ($n = 43$) were excluded from this analysis. All analyses were performed using R (R Foundation for Statistical Computing, Vienna, Austria), version 3.6.2 (33).

RESULTS

Table 2 displays the overall distribution of respondents across each of the characteristics controlled for in all 3 models, with racial categories being reported according to the rules of the multiracial model (i.e., any respondent who

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Table 3. Human Immunodeficiency Virus Stigma Analysis According to Racial Categorization, Using Regression Models, San Francisco, July 2018 to December 2020

Category	Multiracial Model[a]			Othering Model[b]			Hypodescent Model[c]		
	RD	95% CI	*P* Value	RD	95% CI	*P* Value	RD	95% CI	*P* Value
Age, years									
13–29	0.234	−0.002, 0.470	0.053	0.235	0.000, 0.470	0.051	0.233	−0.004, 0.469	0.054
30–49	0.187	0.026, 0.348	0.023	0.188	0.027, 0.349	0.023	0.186	0.024, 0.347	0.025
≥50	0	Referent		0	Referent		0	Referent	
Race									
Asian/Pacific Islander	−0.018	−0.306, 0.270	0.904	−0.018	−0.306, 0.269	0.902	−0.018	−0.280, 0.244	0.893
Black/African American	−0.016	−0.279, 0.247	0.905	−0.016	−0.279, 0.246	0.902	0.058	−0.180, 0.297	0.631
Hispanic/Latinx	−0.141	−0.321, 0.039	0.126	−0.141	−0.320, 0.039	0.126	−0.110	−0.286, 0.067	0.223
White	0	Referent		0	Referent		0	Referent	
Multiple	0.213	−0.057, 0.482	0.123						
Other	0.149	−0.267, 0.564	0.484	0.195	−0.043, 0.433	0.108	0.179	−0.169, 0.527	0.313
Gender identity									
Cisgender	0	Referent		0	Referent		0	Referent	
TGNC	0.802	0.334, 1.270	<0.001	0.799	0.332, 1.266	<0.001	0.807	0.338, 1.276	<0.001
Injection history									
Yes	0.069	−0.148, 0.286	0.535	0.070	−0.147, 0.287	0.530	0.062	−0.156, 0.280	0.576
No	0	Referent		0	Referent		0	Referent	
Housing status									
Stable housing	0	Referent		0	Referent		0	Referent	
Homeless/unstably housed[d]	−0.363	−0.573, −0.153	<0.001	−0.359	−0.567, −0.151	<0.001	−0.366	−0.575, −0.156	<0.001
Mental health concerns									
Yes	0.308	0.077, 0.539	0.009	0.309	0.078, 0.539	0.009	0.318	0.088, 0.549	0.007
No	0	Referent		0	Referent		0	Referent	
Viral load									
Detectable	0.070	−0.250, 0.391	0.668	0.074	−0.245, 0.393	0.648	0.099	−0.221, 0.418	0.545
Undetectable	0	Referent		0	Referent		0	Referent	

Abbreviations: CI, confidence interval; RD, adjusted risk difference; TGNC, trans/gender nonconforming.

[a] Multiracial model: Anyone who reported more than 1 race on their questionnaire was classified in the "multiple" race category.

[b] Othering model: Anyone who reported more than 1 race on their questionnaire was classified in the "other" race category.

[c] Hypodescent model: Anyone who checked multiple race boxes was assigned the lowest-status racial category (with Black/African American as lowest, then Hispanic/Latinx, then Asian/Pacific Islander, then other (including American Indian/Alaska Native and Middle Eastern/North African), with White as the most privileged group).

[d] Those reported their housing status as "homeless" or "unstable housing" were grouped into "homeless/unstably housed" in the model due to concerns about positivity violations.

checked more than 1 race box was counted as "multiple"). Further racial breakdown of multiracial respondents is available in Web Table 1 (available at https://doi.org/10.1093/aje/kwab289).

Table 3 displays the results of each of the 3 linear regression models. The choice of model had a negligible effect on the RD for all nonrace covariates in the model, as well as a negligible effect on the RD or precision of the estimate for people who were Asian/Pacific Islander, Hispanic/Latinx, and even "other," although, predictably, including those with more than 1 race in "other" (the othering model) improved precision of the RD for "other" by increasing the number of respondents in that stratum. However, the othering and hypodescent models had no single multiracial category and thus occluded the increase in stigma experiences reported by people who were multiracial, who had an RD of 0.213

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(95% confidence interval: 0.057, 0.482) in the multiracial model.

For respondents who were Black/African American only, the point estimate for the adjusted RD was negative (−0.016) in both the multiracial model and the othering model, suggesting that Blacks/African Americans had mild protection against HIV stigma compared with Whites. However, the confidence interval was extremely wide in both cases. Including people who reported being Black/African American and at least 1 other race in the Black/African American category (the hypodescent model) somewhat improved precision of this measure, as expected, but also shifted the point estimate through the null, with a mildly increased mean stigma score (by 0.058 points) among Blacks/African Americans compared with Whites in the hypodescent model, when controlling for each of the other characteristics in the model.

CONCLUSIONS

Unlike the multiracial and other models, which showed a less frequent experience of HIV stigma, on average, for monoracially Asian/Pacific Islander, Black/African American, or Hispanic/Latinx people compared with Whites, the hypodescent model of racial categorization led to a shift in the RD through the null for Blacks/African Americans. Shifting classification of Black multiracial people from multiracial to Black/African American brought findings in line with other studies that have found high rates of HIV stigma among Blacks/African Americans who are at risk for or living with HIV, both of which used self-identified Black identity (including monoracial or multiracial Blackness) to classify participants (34, 35). Other studies using models of categorization in line with our multiracial (36) or othering models (37) have suggested that HIV stigma may be reported more frequently among White people than among people of color—as our findings did, when using those classification schemes. As expected, the hypodescent model did obscure the association between increased stigma and race for multiracial people, compared with monoracial counterparts; this is an important limitation of the model, as other studies have found increased HIV-related stigma for multiracial people (38), with potential for worse health outcomes (39).

While this analysis was neither designed nor powered to detect race-based differences in experiences of HIV stigma, it provides a useful illustration of the importance of thoughtfully categorizing race of respondents in epidemiologic analyses where race is included as a model covariate. The choice of how best to do this remains complicated, as racial category reflects not only identity but sense of belonging to a dominant or oppressed group. Strategies such as those employed in the hypodescent model (40) relate to a long history of hypodescent in the United States, where classification of individuals by their lowest-status racial group has been strategically used to reinforce white supremacy (13). However, some research has demonstrated the power of multiracial individuals choosing their own dominant racial identity through hypodescent, as a method of connecting to others with similar experiences of oppression and even subverting the status quo (41). On the other hand, other studies have found that multiracial people are often exotified in everyday life (42), which can lead to sexualization and disparate sexual health outcomes for this diverse group; in fact, we did see a substantial increase in HIV stigma scores for multiracial people in our multiracial model, indicating the multiracial MSM have a unique experience not captured by the other models.

As this was a retrospective analysis of programmatic data collected for other purposes, we did not have information on socially assigned race or discordance between perceived race and self-identified race. These issues can be exacerbated for multiracial people, who may self-identify as multiracial but be perceived as monoracial by others, in a way that either confers privilege or disadvantage (10, 11, 42). For these reasons, it may be true that perceived or socially assigned race would have shown a stronger association with HIV stigma, had we had this information available for our analysis. Further, racial disparities may partially result from the structural factors influencing the health outcomes of a racial group, but also from the level of concordance between individual racial identity and the race assigned to them by others (12). The potential for physical and mental stress related to this discordance is particularly true for people who are multiracial. Much research has been done on the impacts of self-perceived race versus race that is assigned to multiracial people by researchers or society (16, 43). Improving the intentionality by which race is categorized in epidemiologic analyses meant to illuminate racial disparities is critical to improving our collective understanding of these real-life nuances, with strong public health implications related to racial competency in health care (i.e., preventing instances of multiracial microaggressions in health care settings) as well as supporting racial concordance within racial affinity-based support groups, or patient-provider relationships (44).

This study has a number of limitations. First, it was not intended as an analysis of the associations between race and HIV stigma, and the client questionnaire was not designed to assess the association between multiracial identity and experiences of HIV stigma; therefore, there was no attempt to collect data on respondents' racial self-identification or provider-perceived race for these individuals. Such issues would be beneficial to explore in future analyses. Second, to avoid sparse data we collapsed Asian and Native Hawaiian or Pacific Islander into a single category, and we grouped people who reported a monorace of American Indian, Alaska Native, North African, or Middle Eastern into the "other" race category. Neither choice was ideal; they conceal the meaningful differences in stigma and health outcomes that people in these racial groups experience. However, this regrouping applied only to a small number of people who were monoracial and therefore should not have substantial impact on our findings related to methods of categorization of multiracial people. Third, this sample was restricted to a sample of MSM living with HIV in a single US city, and while the total number was 584 people, small numbers in the strata of this multivariable model led to wide confidence intervals for many estimates. Further, given the small sample sizes within each racial grouping, recategorization from model to model may have resulted in increased precision in model estimates simply as a function of increased stratum

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sample size; nonetheless, all findings remained below the level of statistical significance at $\alpha < 0.05$. Despite the high levels of uncertainty in many of the estimates presented here, the overall effect of choices in racial categorization remains evident.

In conclusion, epidemiologists often expend much effort determining which covariates to include in regression models, but the decisions made about classifying respondents within factor variables—particularly those that are socially constructed—can dramatically affect study findings. Our findings in this analysis align with those of Shiao et al. (17), who found that models that dichotomize people as (any) Black/non-Black may be more accurate than models that dichotomize people as White/non-White, as is much more commonly done. The effectiveness of our public health response to racial health disparities—not just the accuracy of our model outputs—depends in part on these decisions. Researchers should contextualize their choices of categorization scheme based on theory rather than convenience of analysis.

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