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ORIGINAL RESEARCH

# Characterizing Patient Diversity via Healthcare Access Determinants: A New Approach for Measuring Improvements in Clinical Trial Diversity in the United States

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## ABSTRACT

***Introduction***: Racial and ethnic minorities are frequently under-represented in biomedical research in the United States (US), and the under-representation is amplified in clinical trials in patients with rare diseases. The REthinking MeAsures of DivErsity (REMADE) study was conducted to develop and test a set of questions that may more accurately capture the diversity of patients via socioeconomic, cultural, and ethnic parameters.

***Methods***: A web-based survey was developed to assess race, ethnicity/culture, socioeconomic status, disability/mobility, and transportation issues. The survey responses included 5 racial categories as well as 17 cultures, heritages, and/or ethnicities and were multiselect. The survey was tested in US adults from under-represented populations. Survey results were compared with data collected with a pre-survey intake form (PSIF) that utilized historical categories for race and ethnicity.

***Results***: Of 219 total survey respondents, 59.8% (131/219) were assigned female sex at birth and 51.1% (112/219) were aged ≥ 18 to < 30 years. Respondents reported being predominantly Black [77.3% [163/211)] or white [19.0% (40/211)] in the PSIF. When respondents were allowed to assign percentages across multiple categories in the survey, only 34.2% (75/219) and 10.5% (23/219) identified as 100% Black or white, respectively. As with race, the REMADE ethnicity/cultural categories revealed greater diversity in the respondent population.

***Conclusions***: The REMADE survey results suggest that race and cultural identity are more multidimensional than historical questions/categories were able to capture. These insights, along with those generated on socioeconomic, disability, and transportation issues, will guide initiatives to support fair and equitable representation in clinical trials.

**Keywords:** Clinical trial diversity; Healthcare

Jeffrey Yu and Adrian Kielhorn are co-first authors.

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access determinants; Cultural identity; Race; Ethnicity

**Key Summary Points**

*Why carry out this study?*

Increasing diversity in clinical trials is critical for improving health equity and expanding the ability of under-represented populations to access potentially life-saving treatments.

However, the current standard set of demographic information collected on patients in clinical trials is usually limited to questions capturing age, sex, weight, race, and ethnicity.

The REthinking MeAsures of DivErsity (REMADE) study was conducted to develop and test a set of questions that may more accurately capture the diversity of patients via socioeconomic, cultural identity, and healthcare access parameters.

*What was learned from the study?*

In this sample of under-represented people of color, survey results characterized several known barriers to healthcare access and shed light on the fact that race and cultural identity are multi-dimensional.

We propose a simple set of questions that could be used not only to capture race and ethnicity more accurately, but to also assess other healthcare access determinants that affect clinical trial participation.

## INTRODUCTION

Racial and ethnic minorities are frequently under-represented in biomedical research in the United States [1], despite having a disproportionate disease burden for certain diseases relative to their proportional representation in the general population [2]. For example, although the incidence of Alzheimer's disease is almost two-fold higher in African Americans compared with other racial and ethnic groups [3], clinical trials evaluating potential treatments for Alzheimer's disease have included predominantly white participants [4]. The under-representation of racial/ethnic minorities is amplified in clinical trials in patients with rare diseases [5], defined in the United States as a disease that affects fewer than 200,000 individuals. Clinical trials in rare disease are smaller than those in non-rare diseases making it more difficult to adequately capture the community to be studied and ensure there is sufficient diversity among patients [5]. Increasing diversity in clinical trials is critical for improving health equity and expanding the ability of under-represented populations to access potentially life-saving treatments. More diverse clinical trials would also enhance the generalizability of trial results, ensure that patients are given access to care, increase prescriber willingness to prescribe treatments to a more diverse set of patients, and build trust and engagement with currently under-represented populations [6, 7].

The US Food and Drug Administration recently published draft recommendations for industry [8] on how sponsors can increase inclusion of historically under-represented racial and ethnic populations in clinical trials and on the importance of capturing other factors that contribute to health disparities and differential access to healthcare (e.g., sex, gender identity, age, socioeconomic status, disability, pregnancy status, lactation status, and co-morbidities). Historically, the standard set of demographic information collected on patients in clinical trials has been based on narrow categories and was limited to five questions capturing age, sex, weight, race, and ethnicity. Furthermore, questions regarding race and ethnicity, which were based on questions developed by the Office of Management and Budget (OMB) in 1997, provided limited categories from which patients can choose ("Black or African American," "white," "Asian," "Native Hawaiian or other Pacific Islander," and "American Indian or Alaska Native" for race and "Hispanic or Latino," "Not Hispanic or Latino," and "Unknown" for ethnicity) [9]. In March 2024, the OMB revised their approach to collection of race and ethnicity by using one combined question for race and ethnicity, encouraging

respondents to select multiple options and adding "Middle Eastern or North African" as a new category [10].

Furthermore, there are other socioeconomic, cultural, and ethnic factors (e.g., household income, employment status, health insurance, mobility, etc.) that may have an important role in influencing how different people interact with, and their ability to access, the healthcare system [8]. These healthcare access determinants should be included in the demographic data collected for patients who participate in clinical trials because expanding the way demographic data are collected will more accurately capture the diversity of clinical trial participants. This paper reports the results of the REthinking MeAsures of DivErsity (REMADE) survey research study. The primary objectives of the REMADE study were two-fold. First, to learn about which aspects of a person's identity affect their engagement with the healthcare system. Second, to develop and test a set of questions on healthcare access determinants that, when added to the demographic section of a clinical trial, could be used to better describe the diversity of patients.

## METHODS

### Survey Development

The REMADE web-based survey was developed to capture key elements of ethnic, cultural, and socioeconomic identity based on the following objectives: (1) it could be completed within 10–15 min; (2) it would provide both race/ethnicity/socioeconomic variables alongside experiences with the healthcare system; and (3) it could be used as part of the baseline demographic assessment of patients in clinical trials or epidemiology studies.

The survey was developed by M&B Sciences in collaboration with the study Sponsor (Alexion, AstraZeneca Rare Disease) based on (1) the Urban Institute Well-Being and Basic Needs Survey [11], the General Social Survey [12], the 2020 US Census of Population and Housing [13], the Financial Well-Being Survey [14], the Harris Poll [15], Johns Hopkins Medical Mistrust Survey [16] and personal experience surveys conducted by Robert Wood Johnson Foundation [17]; (2) a literature review that focused on how race and ethnicity were captured by 2020 US Census, challenges encountered in recruiting participants to clinical trials; ways to measure racial identity, how scientists have used measures of race and ethnicity in research, and surveys that focus on race/ethnicity and health and economic well-being; and (3) interviews with focus groups.

The goal of the focus groups was to recruit and gather information directly from populations that are historically under-represented in clinical trials to collect qualitative data on the following: (1) the ways individuals described themselves in terms of race, ethnicity, and culture; (2) perceptions of how other people describe them based on their race/ethnicity; (3) experiences with healthcare and how such experiences may have been related to their racial/ethnic/cultural characteristics; (4) constraints that may prevent individuals from participating in medical research; and (5) feedback on typical questions used to collect baseline demographic data for medical research.

To ensure a diverse sample of participants, recruitment for the focus groups was conducted based on the following four factors: (1) geographic location, (2) race and ethnicity, (3) sex, and (4) age. To ensure geographic diversity, participants were recruited from seven different cities (Houston, Phoenix, San Francisco, Dallas, Atlanta, Detroit, and Miami) as well as rural areas in the United States. The rural focus group was recruited from the Midwest, South, and Southeast regions of the United States using social media campaigns in ZIP codes considered rural in the Rural–Urban Commuting Area coding scheme from the US Department of Agriculture [18]. Non-rural participants were recruited through social-media campaigns and community organizations that served specific groups of people, including Hispanic/Latino, Middle East and North African, Asian, Black populations. People received US$150 for their participation in a focus group.

A total of eight focus group sessions were conducted, one in each of the seven cities

and one for the combined rural area. All focus groups were conducted online using Microsoft Teams, except for the first focus group (Dallas, TX), which was conducted in person. Each session was moderated by M&B sciences and was approximately 90 min in duration.

For each participant, a unique identification number was generated and used for all data analyses to de-identify participants. All focus groups were audio-recorded and transcribed. The session transcripts were cleaned, de-identified, and uploaded into the NVivo© qualitative coding platform (Lumivero, Denver, CO, USA). A multistep coding process was used to analyze the data [19] based on a coding reference frame that was developed from the interview guide (see Sect. 2 of the Supplementary Appendix).

Qualitative data from the focus group research identified the following themes: affordability and access to healthcare (income, earners per household, and health insurance), mobility (general mobility, disability, transportation), disposition (employment and caregiver status), and cultural identity (race, ethnicity, and skin tone). In addition, representative quotes from the focus group research indicated that participants had difficulty answering the standard question on race because the available answer options were too restrictive (Table 1). Qualitative data from the focus group research informed the development of the REMADE web-based survey. The survey was then refined based on pre-testing feedback.

The final REMADE survey included questions that allowed participants to select more than one racial category (Black/African American, Asian, Native American or Alaskan, Native Hawaiian or other Pacific Islander, white, Other, or Unknown) and assign percentages to each category. For ethnicity, the REMADE survey allowed participants to select more than one option from a list of 17 cultures, heritages, and/or ethnicities, and were asked to describe their skin tone using a 10-point scale with 1 being the lightest and 10 being the darkest skin. This non-visual scale is similar to the Monk Skin Tone Scale [20]. Participants also were asked to share their experiences on the following questions using a 5-point Likert Scale ranging from "Strongly Agree" to "Strongly Disagree" (participants could also choose "Prefer Not to Answer"): "I am often treated with less courtesy or respect than other people," "People often act as if they think I am not smart," "People often seem afraid of me," and "People often harass or threaten me." The REMADE survey also assessed the following social determinants of health: affordability and access to healthcare (income, earners per household, and health insurance), mobility (general mobility, disability, and transportation), disposition (employment and caregiver status), and cultural identity (race, ethnicity, and skin tone). The final version of the REMADE survey is included in Sect. 3 of the Supplementary Appendix. It was developed for use on the internet in the XM™ platform (Qualtrics, Provo, UT USA).

### Participants and Survey Administration

People were eligible to participate if they were ≥ 18 years of age and were willing to provide written informed consent. Potential participants were identified by M&B Sciences' community partner organizations or through direct marketing materials. The community partners sent an invitation e-mail to potential participants, with the intent to oversample race/ethnicity backgrounds of interest (Black/African American, Hispanic, Middle Eastern, Asian, American Indian or Alaskan Native, and Native Hawaiian or Pacific Islander). Potential participants were provided a link to M&B Sciences' registration system. Direct marketing flyers containing the database invitation were used to recruit rural participants. Potential participants who registered and were entered in the M&B Sciences database were invited to take the survey. Survey participants completed a pre-survey intake form [9] (see Sect. 1 in the Supplementary Appendix) and the REMADE web-based survey. People received $30 for completing the survey.

### Ethical Approval

The study was performed in accordance with the Helsinki Declaration of 1964 and its later amendments, and all study participants provided informed written consent. The REMADE study was granted a waiver from ethics

**Table 1** Selected feedback from focus groups that informed REMADE survey development

| | |
|---|---|
| Affordability and access to healthcare | "On several occasions, my doctor has even asked, 'What kind of insurance do you have? Can I even do this to you because it will be covered or not?' I guess I understand that doctors do want their paycheck, but that's their first question out of their mouth." |
| | "Several years ago, I needed to have both of my knees replaced. Well, I couldn't find a surgeon who would do the surgery because they didn't want to accept Medicaid payments. It wasn't enough for them, so I struggled for two years before I could find a surgeon who would actually do the surgery for me." |
| Mobility | "I don't have a car at the moment, so the distance between where I am to the hospital or whatever the clinic matters for me." |
| | "I have a lot of bad fibromyalgia, but then I also have bipolar. So sometimes when they interact together, it's just a bad day." |
| Disposition | "I guess I have to consider work and home life balance. That includes child rearing and domestic chores, and things like that. As well as balancing that with my career, or with my workload, and also aging father, and just other family members that I'm very involved with." |
| Cultural identity parameters | "For me, personally, I relate more to the ethnicity over a race. I don't look at things as a race really. It's more of how I grew, up what is the culture and the people I'm around throughout my whole life?" |
| | "This is something that I struggle with constantly because … I know my historical background and I know that I am of several different races. So, when I'm boxed in to … click one or check one it, it really irritates me. I don't feel that I fit into just one. I do end up checking three. I'm Puerto Rican, so I check African, I check Native, and I check Caucasian." |
| | "Race and ethnicity are both a socially constructed concept … To me, the race and ethnicity is really dependent [on] where I am at and who I'm talking to. In this group, now that we are in the United States, I suppose I'm Asian, but when I was growing up in Japan as a Korean, I never used the term Asian to describe ourselves. Nobody in Asia calls themselves as the Asian until you go to outside of Asia, and then … you put that whole like one-third of the [global] population into one race." |
| | "I think that, just generally speaking, as a Black woman, people talk down to me. I have a PhD. I understand medicine pretty well. I work in a medical facility. Overall, I feel I'm just not treated well, and I have a lot of distrust of the medical system because of that." |
| | "I've been seeing a lot of the check boxes for race or ethnicity. A lot of times, you are sometimes even a little slow to answer to that because you feel as though—You're wondering as though those boxes will actually affect how they treat you or how fast they call you back or how fast you get service, essentially. I do think that also does play a role in a reverse way where you're almost worried for what you're going to put into these boxes." |

committee approval following review of the protocol by the Advarra Institutional Review Board (Pro00067856). Written informed consent was obtained from all study subjects.

## Data Analysis

Data were exported from the XM™ platform to Stata® (StataCorp, College Station, TX, USA) and all identifying information was removed

(email, in-take database ID, internet protocol location, etc.). For each survey participant, a unique ID number was generated and used for all data analyses. Summary statistics were calculated for continuous variables, and numbers and percentages were provided for each category for categorical variables.

## RESULTS

### Participants

A total of 308 people were registered in the M&B Sciences database and invited to take the REMADE survey beginning on March 27, 2023. The survey remained open until May 2, 2023. Of the 308 people who were invited to participate, 219 completed the survey, for a response rate of 71.1%.

Demographic characteristics of survey participants are provided in Table 2. The majority of respondents (81.7%) were less than 40 years of age, 112 (51.1%) respondents were ≥ 18 to < 30 years of age, and 67 (30.6%) participants were ≥ 30 to < 40 years of age. A total of 131 (59.8%) respondents were assigned female sex at birth and 87 (39.7%) were assigned male sex at birth.

**Table 2** Survey participant demographics

| ***n* = 219** | **Respondents, *n* (%)** |
|---|---|
| Age in years | |
| ≥ 18 to < 30 | 112 (51.1) |
| ≥ 30 to < 40 | 67 (30.6) |
| ≥ 40 to < 50 | 23 (10.5) |
| ≥ 50 | 17 (7.8) |
| Sex assigned at birth | |
| Male | 87 (39.7) |
| Female | 131 (59.8) |
| Prefer not to answer | 1 (0.46) |

### Affordability and Access to Healthcare

A total of 138 (63.0%) respondents indicated they had annual household incomes of less than $50,000 and 179 (81.7%) indicated annual household incomes of less than $75,000 (Fig. 1a). The mean number of earners was greater than one in each income category, but there were 72 respondents who indicated just one earner in their household. Ninety-five percent of respondents lived in households with 3–6 members. Approximately half (53.4%) of respondents had health insurance; Medicaid was the most common (47.0%) type of insurance (Fig. 1b). Of participants who acquired health insurance through a health insurance marketplace, most (72.7%) received a tax credit or subsidy.

### Mobility

Large proportions of the survey sample reported having disability, mobility, and transportation issues. A total of 140 (63.9%) respondents reported some level of difficulty with mobility/getting around (Fig. 2a) and 87 (39.7%) of the respondents reported being disabled (Fig. 2b); the majority of respondents (59 of 87; 67.8%) who reported having a disability had a physical disability, 19 (21.8%) had an intellectual/developmental disability, and 9 (10.3%) had both physical and intellectual/developmental disabilities. The majority of respondents (129 of 182; 70.9%) reported an issue with transportation (Fig. 2c).

### Disposition

A total of 142 (65.2%) respondents were employed, with 32.6% employed full-time (Fig. 3). Thirteen respondents (6%) reported being a full-time caregiver. For respondents who were full-time caregivers, the mean household size was larger (mean household size of 5.1 vs. 4.5) and older (the mean number of household members over 19 years of age was

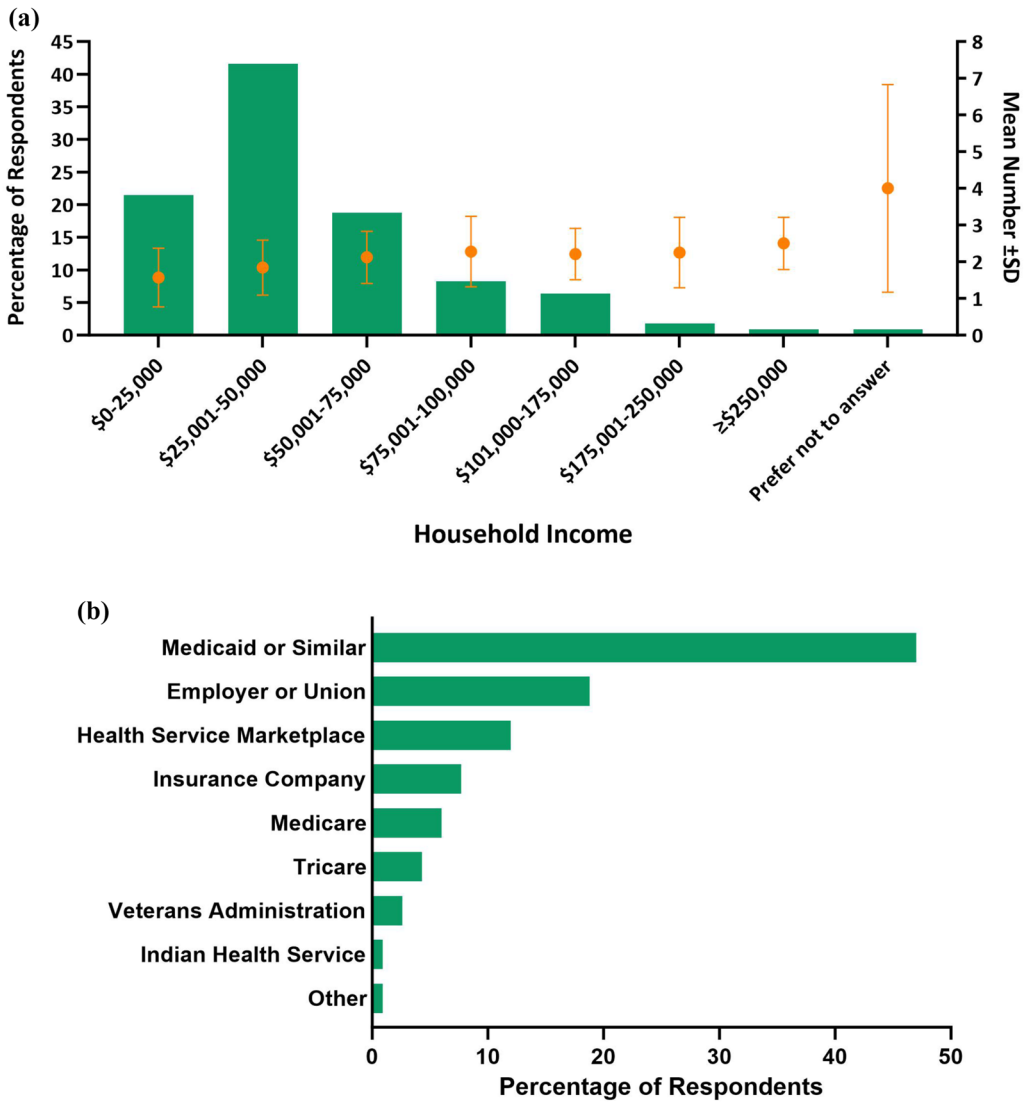


**Fig. 1** Measures of affordability and access to healthcare: **a** annual household income and mean number (± standard deviation [SD)] of earners per household ("What are your household earnings?", $n$ = 219) and ("How many earners contribute to your household income?", $n$ = 219); **b** type of health insurance ("Please indicate your types of health insurance or health coverage plans; Select all that apply", $n$ = 117). *VA* veterans administration

2.6 vs. 2.2) than respondents who were not full-time caregivers.

## Cultural Identity

Of the 219 respondents who answered the race question in the REMADE web-survey, 211 (96.3%) completed the race question on the PSIF (see Supplementary Appendix), which required respondents to select only one category. Based on the PSIF, 163 respondents (77.3%) reported their race as Black/African American and 40 respondents (19.0%) reported their race as white (Fig. 4a). Results from the REMADE survey, which allowed respondents to select more than one category and to assign percentages to each selected category, showed that fewer respondents [$n$ = 75 (34.2%) vs. $n$ = 163 (77.3%) on the PSIF] indicated they were 100% Black/

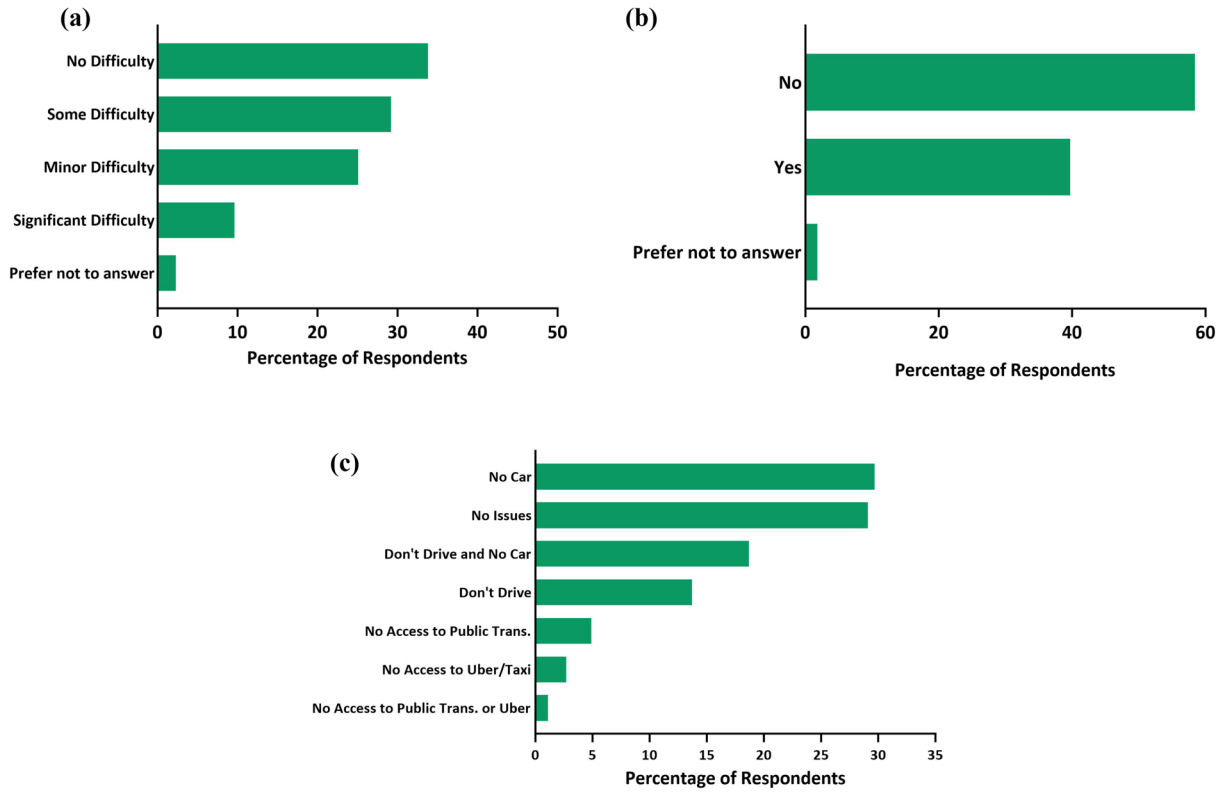


**Fig. 2** Measures of mobility including **a** general mobility ("Do you have any difficulties with mobility/getting around?", $n = 219$), **b** disability ("Are you disabled?", $n = 219$), and **c** transportation ("Do you have any transportation issues?, $n = 182$)

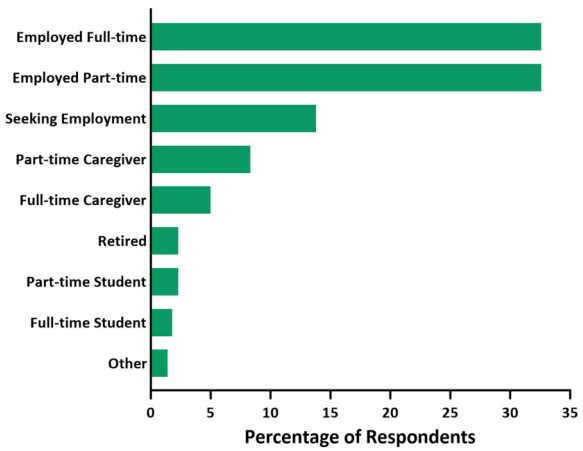


**Fig. 3** Self-reported employment status ("Your Employment Status; select all that apply", $n = 218$)

African American and fewer respondents [$n = 23$ (10.5%)] indicated they were 100% white. Furthermore, while just 1 respondent self-reported Asian ancestry on the PSIF, 40 respondents reported some Asian ancestry on the REMADE survey. Similarly, approximately 60 respondents to the REMADE survey selected American Indian or Alaskan Native, with just 1 respondent who self-reported 100% American Indian or Alaskan Native. Weighted means of the percentages assigned to each racial category also showed shifts in distribution in race (Fig. 4a).

For ethnicity, on the PSIF, 99 respondents (46.9%) reported Hispanic or Latino ethnicity and 109 respondents (51.7%) reported Not Hispanic or Latino. Of the REMADE survey's 219 respondents, 63 (29.2%) selected more than one cultural heritage (Fig. 4b). The four most frequently chosen categories were North American, Central and South American, West African, and American Indian. Although approximately 50% of respondents reported Hispanic or Latino ethnicity, many of these respondents chose something other than Hispanic or Latino in terms

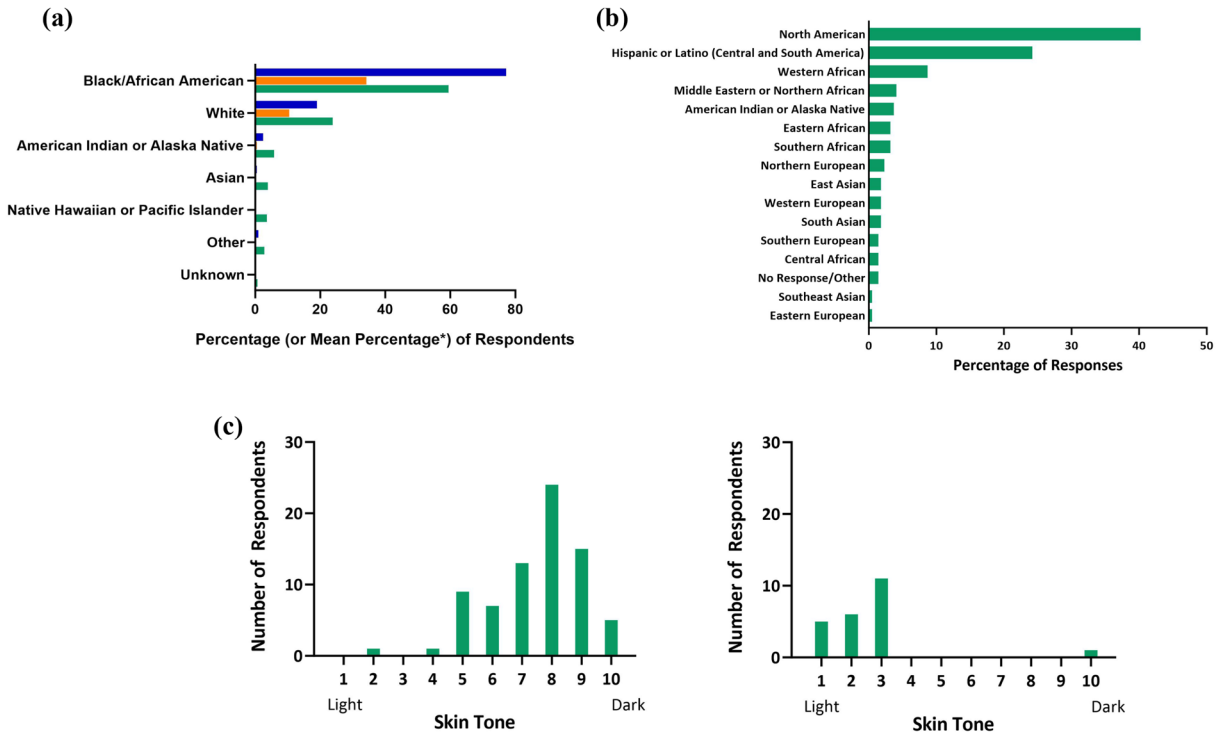


**Fig. 4** Measures of cultural identity. **a** Self-reported race using the 1997 Office of Management and Budget (OMB) categories using the following two approaches: (1) allowing participants to choose only one response in the pre-survey intake form (PSIF; *blue bars*) and (2) allowing participants to choose more than one response and to assign percentages to each category (REMADE survey; *orange and green bars*). The *orange bars* show the percentage of respondents who reported 100% of any one racial category on the REMADE survey and the *green bars* show the weighted mean percentage of respondents for each category. **b** Ethnicity ("Please select the best description(s) for your cultural, heritage, and ethnic identities; select all that apply), $n = 319$ responses). On the REMADE survey, respondents were allowed to select more than one option from a list of 17 cultures, heritages, and/or ethnicities (319 responses from 219 participants). Using the PSIF, 96.2% of respondents selected either Black/African American or white for race. However, allowing participants to select multiple categories and assign weightings to race and ethnicity categories revealed more diversity in the survey sample, with only 44.7% of respondents selecting either 100% Black/African American or 100% white. **c** Self-described skin tone (using a 10-point scale with 1 being the lightest and 10 being the darkest skin.) by respondents who reported themselves as 100% black ($n = 75$) (*left*) and those who reported themselves as 100% white ($n = 23$) (*right*) on the REMADE survey

of cultural identity. Of the 75 respondents who selected 100% Black/African American race, 60 respondents selected one culture/heritage, 34 selected North American cultural heritage, and 13 reported Latino cultural heritage. Of the 15 respondents who reported multiple heritages, the most common was Latino ($n = 10$) followed by West Africa ($n = 8$).

As seen in Fig. 4c, there was a variety of skin tones reported in respondents who indicated they were 100% Black/African American ($n = 75$) and those who indicated they were 100% white ($n = 23$) on the REMADE survey. Large numbers of respondents answered "Strongly Agree" or "Agree" to the statements "I am often treated with less courtesy or respect than other people" ($n = 107$, 48.9%), "People often act as if they think I am not smart" ($n = 116$, 53.0%), "People often seem afraid of me" ($n = 70$, 32.0%), and "People often harass or threaten me" ($n = 71$, 32.4%). Of the participants who responded with "Strongly Agree" or "Agree" on the four questions above, the most common reasons they reported for other

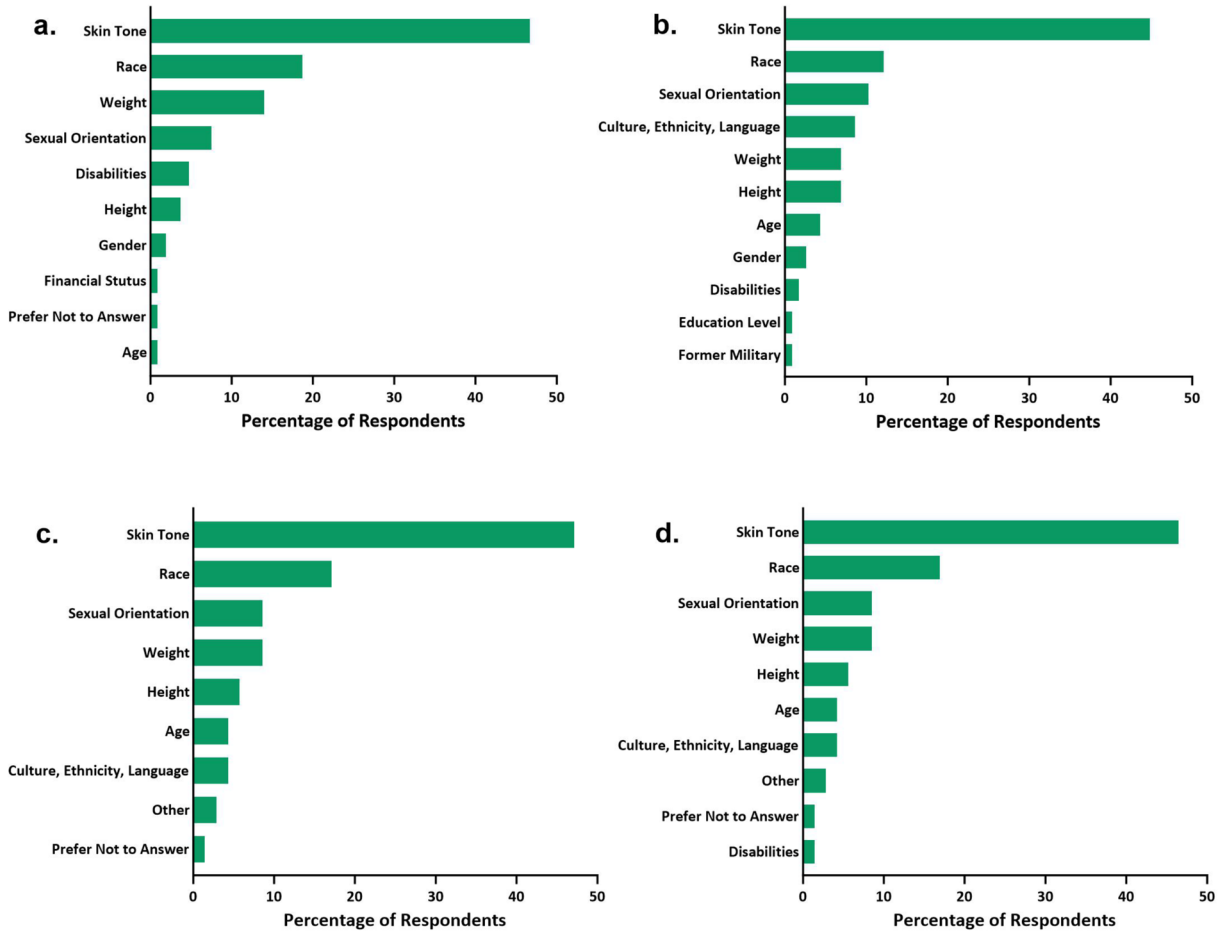


**Fig. 5** Reasons for responding "Strongly Agree" or "Agree" to the statements **a** "I am often treated with less courtesy or respect than other people" ($n = 107$), **b** "People often act as if they think I am not smart" ($n = 116$), **c** "People often seem afraid of me" ($n = 70$), and **d** "People often harass or threaten me" ($n = 79$)

people's reactions to them were skin tone and race (Fig. 5).

## DISCUSSION

The REMADE study was conducted to understand the key elements of under-represented populations' ethnic, cultural, and socioeconomic identity that affect their engagement with the healthcare system, and then use this information to develop a questionnaire that could better assess patient baseline demographics for potential use in clinical trials. The resulting set of questions capture parameters related to affordability and access to healthcare, mobility, disposition, and cultural identity. We propose that these healthcare access determinants should be captured as part of clinical trials and other areas of population research in medicine.

The results of the REMADE survey support a new approach using the OMB categories [10]. In the REMADE web survey, respondents were allowed to select more than one answer to the questions on race and ethnicity and were allowed to assign percentages among the categories. This allowed respondents to capture the true complexity of their race and ethnicity, which often included that of mixed heritage. Using the historical 1997 OMB classification scheme in the PSIF, 96.2% of respondents

selected either Black/African American or white for race. However, allowing participants to select multiple categories and assign weightings to race and ethnicity categories revealed more diversity in the survey sample, with only 44.7% of respondents selecting either 100% Black/African American or 100% white. These results suggest that the singular categorical classification schemes traditionally used in clinical trial intake forms do not adequately capture the racial and ethnic diversity of under-represented people of color. Allowing multiple choice and weightings of racial categories resulted in a more accurate characterization of the diversity of populations than suggested by traditional categorizations. Furthermore, allowing the allocation of percentages (e.g., 25% Native American, 75% white) simplified reporting because a weighted average of the proportion of participants who choose a certain category could be calculated and reported.

Definitions of race are based on social and political characteristics rather than biological characteristics because the categories change over time and vary across societies [21, 22]. In addition, the categorizations of "Black" and "white" restrict descriptions of groups of people making them seem less diverse than they are. In fact, self-reported race may be more about self-identification or cultural affiliation. Without a scientific definition of race [21], appearance (skin color) is likely used as a racial determinant by researchers and patients; skin color was more often mentioned than race by participants as a cause of discrimination. While the currently used racial categories dichotomize skin into white or Black, the 75 respondents who selected 100% Black/African American race on the traditional measure reported a wide range of skin tones (using a 10-point scale with 1 being the lightest and 10 being the darkest skin tone), with 18 respondents (24.6%) selecting a tone less than 7 and five respondents (7%) selecting 10 (darkest skin tone). Assessing skin tone in the REMADE survey revealed diversity in respondents who classified themselves as 100% Black/African American without using racial categories that have a negative historical association [23]. Hence, the results of the REMADE study suggest that assessing skin tone may more accurately describe the diversity of clinical trial patients compared to the most frequently reported race categories of white, Black and Asian. In addition, skin color may be more accurate in detecting colorism and discrimination in clinical trials.

Race has traditionally been often used as a proxy for many other factors that are important but remained unmeasured, such as household income, health insurance, or education level [22]. In this survey, we captured these more nuanced cultural socioeconomic characteristics of under-represented populations. Consistent with previous research [24–30], REMADE survey results from this sample of under-represented people of color characterized several known barriers to healthcare access, including low income, inadequate health insurance coverage, and mobility/transportation issues. In the REMADE study, approximately 60% respondents lived in low-income households and only half of respondents had health insurance; of those who had health insurance, the majority had Medicaid. In addition, 39.7% of survey respondents had disabilities, 63.9% had mobility limitations, and 70.9% had issues with transportation. These are all significant barriers to healthcare access [25, 26]. Instead of using race as a proxy, these parameters should be captured directly.

Barriers to access may also limit the ability of people to participate and stay in clinical trials [7]. The parameters identified and tested in this research should be captured in addition to the existing set of questions recommended by the OMB in clinical trials and epidemiological research. This would offer several benefits. First, it would allow for a more precise matching of the profiles of patients living with the disease with those needed to participate in trials. Second, the healthcare access determinants would reveal barriers to participate in research studies on the basis of which clinical trial diversity actions could be designed. We hypothesize that identifying barriers to healthcare access may help sponsors to develop strategies for overcoming those barriers to include more diverse patient populations in clinical trials, which would ultimately improve the generation of evidence regarding safety and effectiveness across the entire population.

The REMADE study has limitations. Cultural identity and ethnic diversity are much more complex than we included in our survey. However, our purpose was not to develop a comprehensive measure of cultural identity. Rather, we were seeking to develop a measure short enough to be included in clinical trial research. Also, we wanted to highlight the limitations of the existing questions used to measure the diversity of patients in clinical trials. An additional limitation is that the survey sample make up was relatively limited with regard to age. Participants in the survey sample were relatively young, with > 50% of participants less than 30 years of age and > 80% less than 40 years, which limits the generalizability of the results. It is unknown if we would have obtained different results, particularly with regard to household income and health insurance coverage, with a sample that included more adults older than 40 years of age. Finally, as with any survey research, there are inherent biases in self-reported data, particularly with regard to sensitive topics such as household income, skin tone, race, ethnicity, and other people's perceptions.

In summary, the REMADE survey, which was administered to a group of healthy volunteers from under-represented people of color, shed light on the fact that the currently used questions capturing race and ethnicity are insufficient to describe the diversity of patients in clinical trials. Cultural identity is multidimensional and there is a need to expand how it and other healthcare access determinants are collected and described. We propose a simple set of additional questions that could be used to not only more accurately capture racial and ethnic diversity but to also assess other healthcare access determinants that affect clinical trial participation.

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***Data Availability.*** Alexion, AstraZeneca Rare Disease will consider requests for disclosure of clinical study participant-level data provided that participant privacy is assured through methods such as data de-identification, pseudonymization, or anonymization (as required by applicable law), and if such disclosure was included in the relevant study informed consent form or similar documentation. Qualified academic investigators may request participant-level clinical data and supporting documents (statistical analysis plan and protocol) pertaining to studies sponsored by Alexion, AstraZeneca Rare Disease. Further details regarding data availability and instructions for requesting information are available in the Alexion Clinical Trials Disclosure and Transparency Policy at https://www.alexionclinicaltrialtransparency.com.

### *Declarations*

***Conflict of interest.*** Adrian Kielhorn, Jeffrey Yu, Kelly McNeil-Posey, Barbara Mungin, Yiyi Xia, Wendy Erler, and Nuwan C. Kurukulasuriya are employees of Alexion, AstraZeneca Rare Disease, the study sponsor. James Murdoch, Eddilisa Martin, and Marcus Martin received payment from Alexion, AstraZeneca Rare Disease to assist with the design and conduct of the study.

***Ethical approval.*** The study was performed in accordance with the Helsinki Declaration of 1964, and its later amendments, and all study participants provided informed written consent. The REMADE study was granted a waiver from ethics committee approval following review of the protocol by the Advarra Institutional Review Board (Pro00067856). Written informed consent was obtained from all study subjects.



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