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Clinical Investigation

The Houston HeartReach Registry: Recruitment Methods and Current Registry Demographics

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Abstract

Background: Although Houston, Texas, is a diverse city with opportunities for economic prosperity, many Houston residents have low socioeconomic status and poor access to health care. Cardiovascular disease rates in Houston differ by ethnicity. It is therefore crucial to understand how the risk of cardiovascular disease differs among diverse ethnic and sexual minority populations.

Methods: This study assessed the recruitment methods and demographic composition of the Houston HeartReach Registry, a database repository of cardiovascular disease trends and risk factors in Houston's population. The self-reported demographics of the participants recruited to date were analyzed with descriptive statistics. The primary end point of this interim study was the number of women recruited from each location by year, ethnicity, socioeconomic status, health care status, and sexual orientation. The number of women of each ethnicity recruited from each location was also examined.

Results: Currently, 1,476 women are enrolled in the registry, including 996 (67.48%) Hispanic women, 233 (15.79%) non-Hispanic White women, 190 (12.87%) Black women, 24 (1.63%) Asian women, and 29 (1.97%) women from other races and ethnicities. Of these 1,476 women, 352 (23.85%) had an annual income of $10,000 to $24,000, 375 (25.41%) had private health insurance, and 342 (23.17%) were heterosexual. Most women enrolled in the registry (1,082 [73.31%]), including most of the Hispanic participants, were recruited at BakerRipley events.

Conclusion: To date, 1,476 of a planned 5,000 participants have been enrolled in the Houston HeartReach Registry. At present, Hispanic women make up the majority of participants, indicating an underrepresentation of other ethnic demographics. The enrollment of individuals from sexual minority groups, from varied socioeconomic backgrounds, and with diverse health care statuses aligns proportionally with the total count of recruited women to date. The application of deliberate, culturally nuanced, and demographic-specific recruitment strategies should facilitate the inclusion of desired participants in a comprehensive manner.

Keywords: Cardiovascular diseases; registries; women's health

Introduction

Houston, Texas, is notable for its remarkable diversity, making it an ideal location to research the impact of different cultural and ethnic factors on health outcomes. The city's rich multicultural fabric enables researchers to investigate health disparities, cultural influences on disease prevalence, and variations in treatment responses, ultimately leading to more tailored and equitable health care interventions.

Since 2010, Hispanic citizens have represented the largest ethnic group in Harris County (where Houston is located), and by 2021, they made up 44% of the county's total population. Since 2000, Harris County's Asian American population has grown by 95%, its Hispanic population by 87%, and its Black population by 46%.[1] In 2022,

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the county's 3 largest ethnic groups were non-Hispanic White (23.6%), non-Hispanic African American (22%), and Hispanic (17.2%).[2] The median household income was $60,440, a 7.89% increase from $56,019 in 2021.

Although the mortality rate of heart disease decreased from 2007 to 2010 in Harris County, Black citizens consistently had the highest age-adjusted rate per 100,000 people (declining from 254 in 2007 to 229 in 2010), followed by non-Hispanic White citizens (210 to 181) and Hispanic citizens (146 to 118).[3] The age-adjusted coronary heart disease death rate from 2018 to 2020 followed the same trend in Black (111.0), non-Hispanic White (85.0), and Hispanic individuals (62.9).[4]

In the United States, minority populations encounter many different barriers when trying to access the health care system, including racial and ethnic disparities exacerbated by factors both inside and outside traditional health care systems. Lack of access to affordable, quality health care prevents timely treatment and results in fragmented and inconsistent monitoring, diagnosis, and lifesaving interventions. Disparities exist, however, even for populations with access to high-quality health care within 10 miles of their community, which is the case in Houston, home to the world's largest medical complex.

Despite Houston's potential for economic advancement, a substantial proportion of its population falls into low-income brackets, lacks insurance coverage, or possesses substandard insurance plans. Low income has been correlated with a higher incidence of CVD.[5] Income status and insurance coverage can also substantially influence access to primary and specialty health care, a phenomenon that can lead to delays in or even avoidance of essential cardiovascular treatment and care.[5-8]

Houston is home to a substantial lesbian, gay, bisexual, transgender, queer (or questioning), asexual (or allied), and intersex (LGBTQAI) community, concentrated in the Montrose area and dispersed across the city, which necessitates an understanding of whether these sexual minority groups face a higher risk of CVD. Lick et al[9] suggest that the stress arising from the stigma attached to being LGBTQAI may prompt unhealthy behaviors that negatively affect cardiovascular health. Current research indicates elevated CVD risk among LGBTQAI individuals, but these findings are not uniform. For instance, a study by Caceres et al[10] observed higher incidences of obesity, alcohol use, and smoking in lesbian and bisexual women than in their heterosexual counterparts, although heterosexual women reported lower levels of physical activity than lesbian and bisexual women in the same study. In contrast, a study by Blosnich et al[11] reported no significant difference in self-reported physical exercise in the past month among lesbian, bisexual, and heterosexual women.

Minority populations continue to face substantial challenges in accessing health care, challenges that contribute to persistent health disparities. These challenges branch from a complex interplay of historic, socioeconomic, cultural, and systemic factors, including structural barriers such as the geographic distribution of health care facilities, with fewer high-quality clinicians in minority communities, as well as transportation barriers in rural areas and in communities with limited public transit. Lack of diversity among health care professionals (potentially impairing cultural competence) and policies that disproportionately disadvantage minority populations, such as states choosing not to expand Medicaid coverage, compound barriers to health care access. Overlapping barriers at the intersection of race, ethnicity, sex, sexual orientation, disability status, and other characteristics can further limit some individuals' access to health care.

Key Points

- The HHR Registry was developed to examine CVD trends and risk factors in a diverse group of women.
- The Center for Women's Heart & Vascular Health collaborated with Houston organizations serving individuals who meet their desired demographic characteristics. Participants were recruited from community outreach events and private physician visits.
- Hispanic women make up most of the registry, while the representation of other ethnicities needs improvement. The distribution of SES, health care status, and sexual orientation in the registry is sufficient but could also be improved as recruitment and enrollment continue.

Abbreviations

ASCVD, atherosclerotic cardiovascular disease
CVD, cardiovascular disease
HDL, high-density lipoprotein
HHR, Houston HeartReach
LGBTQAI, lesbian, gay, bisexual, transgender, queer (or questioning), asexual (or allied), intersex
REDCap, Research Electronic Data Capture
SES, socioeconomic status

Supplementary Materials

For supplemental materials, please see the online version of this paper.

Minority populations' access to health care is also limited by socioeconomic factors, including lower rates of health insurance coverage, particularly among American Indian and Alaska Native, Black, Hispanic, and Native Hawaiian and Pacific Islander populations. Higher poverty rates make out-of-pocket health care costs difficult to afford. For example, data show that Black and Hispanic Texans are less likely to have health insurance and therefore access to medical facilities or preventive care; performance was low in Texas with 1 of the country's largest Asian American and Native Hawaiian and Pacific Islander populations.[12]

Language and cultural differences impede effective health care in several ways. Limited English proficiency can hamper communication with clinicians, the system may lack culturally appropriate health information and services, and cultural beliefs and mistrust of the health care system linger from historical mistreatment. For example, cultural and religious beliefs may affect lifestyle habits such as dietary choices. Some religious practices might even advocate for specific dietary restrictions that negatively affect overall health. Cultural beliefs also play a role in how patients cope with stress and manage emotional well-being.

Both explicit and implicit bias in the health care system contributes to care disparities when clinicians offer different levels or a different quality of care based on a patient's race or ethnicity.[13] Individuals from racial and ethnic minority groups continue to report the experience of discrimination in health care settings.[14] Lower health literacy rates among some minority populations can impair their ability to navigate the health care system and make informed decisions.[15]

Together, these barriers result in lower rates of preventive care and screening, delayed diagnoses and treatment, and higher rates of chronic disease and mortality for many conditions.[16] National data, data on CVD in Harris County, and findings from previous studies regarding these barriers to health care access prompted The Texas Heart Institute Center for Women's Heart & Vascular Health to create the Houston HeartReach (HHR) Registry to understand how differences in ethnicity, socioeconomic status (SES), health care access, and sexual orientation influence trends in the risk and development of CVD in women. This longitudinal research registry will also aid researchers in the recruitment, design, and execution of future studies. Here, the HHR's recruitment methods are discussed, and the demographic makeup of the participants recruited to date is assessed.

Patients and Methods

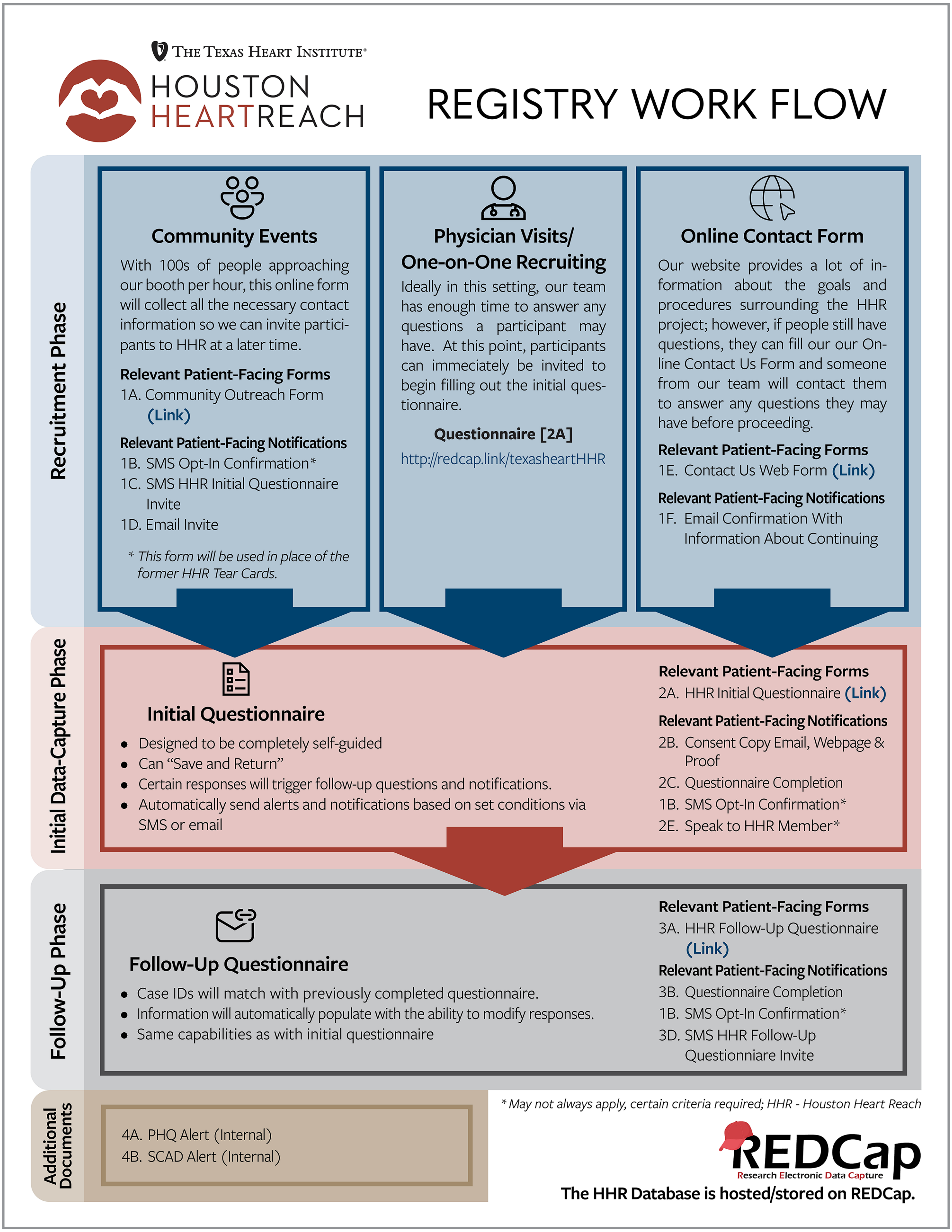
The HHR Registry is a database repository study that aims to collect biometric screening and questionnaire data from 5,000 participants. The primary end points of this interim study are the number of women of each ethnicity, SES, and sexual orientation in the registry. The number of participants recruited from each location was also examined, stratified by year and ethnicity. The process for recruitment, data collection, and data management and analysis is shown in Figure 1.

The WCG Clinical Services Institutional Review Board (formerly Western IRB) approved the study, procedures, and materials. The procedures and materials have undergone extensive changes since the study's launch in 2011, and each change was implemented with approval from the appropriate organizations. Participants were included in the study if they were aged 18 years or older, were born biologically female, identified as women, could provide consent, and were not pregnant. Prisoners and biological men who identified as men were excluded from the study.

The HHR Registry is maintained by the HHR program, a collaborative effort that joins the cardiovascular clinical and research expertise of The Texas Heart Institute's Center for Women's Heart & Vascular Health with community outreach organizations in the greater Houston area. Participants in HHR programs are invited to enroll in the HHR Registry.

The HHR program is offered through local community centers, employer health fairs, and doctors' offices. The program provides individuals the opportunity to learn more about their health by examining their biometric results and discussing these results with a qualified medical professional on-site.

The HHR investigators carefully select and recruit researchers across The Texas Heart Institute. These researchers are required to have completed Collaborative Institutional Training Initiative training and to possess relevant experience in clinical research and underserved community outreach. For HHR events where a substantial number of Spanish-speaking participants are anticipated, the HHR team includes Spanish-speaking staff. One-on-one training is provided to new outreach and clinical research team members before and during the events. Detailed registry workflows guide the HHR logistics teams, who are assigned roles that align with their skills. For example, Center for Clinical Research members are generally responsible for obtaining consent and providing questionnaire support to the participants,



THE TEXAS HEART INSTITUTE®

HOUSTON
HEARTREACH

REGISTRY WORK FLOW

Recruitment Phase

Community Events

With 100s of people approaching our booth per hour, this online form will collect all the necessary contact information so we can invite participants to HHR at a later time.

Relevant Patient-Facing Forms

1A. Community Outreach Form **(Link)**

Relevant Patient-Facing Notifications

1B. SMS Opt-In Confirmation*
1C. SMS HHR Initial Questionnaire Invite
1D. Email Invite

** This form will be used in place of the former HHR Tear Cards.*

Physician Visits/ One-on-One Recruiting

Ideally in this setting, our team has enough time to answer any questions a participant may have. At this point, participants can immeciately be invited to begin filling out the initial questionnaire.

Questionnaire [2A]

http://redcap.link/texasheartHHR

Online Contact Form

Our website provides a lot of information about the goals and procedures surrounding the HHR project; however, if people still have questions, they can fill our our Online Contact Us Form and someone from our team will contact them to answer any questions they may have before proceeding.

Relevant Patient-Facing Forms

1E. Contact Us Web Form **(Link)**

Relevant Patient-Facing Notifications

1F. Email Confirmation With Information About Continuing

Initial Data-Capture Phase

Initial Questionnaire

- Designed to be completely self-guided
- Can “Save and Return”
- Certain responses will trigger follow-up questions and notifications.
- Automatically send alerts and notifications based on set conditions via SMS or email

Relevant Patient-Facing Forms

2A. HHR Initial Questionnaire **(Link)**

Relevant Patient-Facing Notifications

2B. Consent Copy Email, Webpage & Proof
2C. Questionnaire Completion
1B. SMS Opt-In Confirmation*
2E. Speak to HHR Member*

Follow-Up Phase

Follow-Up Questionnaire

- Case IDs will match with previously completed questionnaire.
- Information will automatically populate with the ability to modify responses.
- Same capabilities as with initial questionnaire

Relevant Patient-Facing Forms

3A. HHR Follow-Up Questionnaire **(Link)**

Relevant Patient-Facing Notifications

3B. Questionnaire Completion
1B. SMS Opt-In Confirmation*
3D. SMS HHR Follow-Up Questionnaire Invite

Additional Documents

4A. PHQ Alert (Internal)
4B. SCAD Alert (Internal)

** May not always apply, certain criteria required; HHR - Houston Heart Reach*

REDCap
Research Electronic Data Capture

The HHR Database is hosted/stored on REDCap.

Fig. 1 Workflow of on-site screening event or physician visit

HHR, Houston HeartReach; ID, identification; PHQ, Patient Health Questionnaire; REDCap, Research Electronic Data Capture; SCAD, spontaneous coronary artery dissection.

Center for Women's Heart & Vascular Health members help participants fill out the questionnaire, and consultants and volunteers are recruited for check-in and check-out activities. For events in communities with primarily Hispanic participants, the HHR team members, consultants, and volunteers must speak Spanish.

The HHR outreach team supports the HHR research staff and incorporates members of the partnering community into the event logistics team, ensuring that participants feel comfortable and included. Community involvement is a key part of the HHR approach, helping build trust and foster a sense of belonging among participants. These community members serve in roles unrelated to registry research.

Recruitment

To ensure a diverse sample, the Center for Women's Heart & Vascular Health at The Texas Heart Institute collaborated with various community organizations to provide basic cardiovascular screening at health fairs and to recruit participants. Long-term partnerships were developed with BakerRipley (formerly called Neighborhood Centers Incorporated), Lesbian Health Initiative of Houston, and the Elnita McClain Women's Center. Participants were also recruited during private physician visits with the principal investigator.

BakerRipley is a nonprofit organization that provides opportunities and resources to low-income and ethnically diverse individuals and families. Screenings and recruitment took place at 7 BakerRipley campuses from 2011 to 2019. The Lesbian Health Initiative of Houston is a nonprofit organization that promotes health education, health care access, and advocacy for LGBTQAI individuals. Recruitment occurred during Lesbian Health Initiative of Houston health fairs at 2 locations from 2012 to 2016. The Elnita McClain Women's Center is a member organization of the 10th Episcopal District of the African Methodist Episcopal Church Women's Missionary Society and provides educational programs on social awareness and health, primarily for Black individuals. Screening events were conducted at their location in the Third Ward.

Between 2011 and 2019, recruitment for screening events was conducted on-site during these events. The HHR Registry collaborated closely with community centers beforehand, relying on them to inform their members of the HHR's presence and the screening opportunities it offered. In return, the HHR actively participated in events organized by the centers, extended invitations to community members and their families for events held on The Texas Heart Institute campus, and consistently fostered a supportive relationship with the community. From 2016 to 2019, the HHR also recruited participants during physician visits with the principal investigator at The Texas Heart Institute Center for Cardiovascular Care.

In 2019, a new approach to recruitment was implemented by taking over the event advertising process from the community centers and introducing a system to track registration vs attendance. A few weeks before screening events, the HHR would set up a table at health fairs where responses were collected from individuals interested in attending HHR events. The responses were then recorded in the HHR database, providing a comprehensive list of potential attendees. To ensure maximum participation, the individuals who had responded were contacted as a reminder before the event, providing them with event details, confirming their attendance, and reminding them to fast before their blood work. On the day of the screening event, the HHR checked in the preregistered participants as they arrived, streamlining the process and facilitating a smoother experience for the participants and the HHR team. Once participants had been checked in, the consenting and screening procedures followed the same protocols as before (see Fig. 1 for registry workflow).

Consent

Informed consent was obtained in a face-to-face, 1-on-1 setting. Only HHR team members with appropriate consenting credentials could perform consent procedures and obtain informed consent from potential participants.

Questionnaire

The approved questionnaire was completed after informed consent was obtained. The participants completed the questionnaire independently on paper, but team members were available to assist and answer questions, if needed.

The initial questionnaire from 2011 contained sections on demographic and baseline health data. A section on medical history and medications was added in 2012. More elements were added in 2013: the Patient Health Questionnaire-2, which served as the questionnaire's depression section, and a series of questions on menopause status, diet, and physical activity. In 2015, the Patient Health Questionnaire-2 was replaced with the Patient Health Questionnaire-9, and the diet and physical activity sections were updated. The consent forms were updated each time a change was made to the questionnaire.

In 2018 and 2019, the study team requested that the latest approved consent form and questionnaire be made available on The Texas Heart Institute website under the Center for Women's Heart & Vascular Health Research Projects page. Although this site was not the primary source of recruitment, it was another way people could join the registry. Participants who completed the consent form and questionnaire online were unable to participate in the biometric screening and physician consult.

Biometric Screening

Participants from in-person events proceeded to the biometric screening, which was administered by a third-party medical laboratory company (Quest Diagnostics). The screening encompassed various point-of-care biometrics, including body composition, blood pressure, glucose levels, lipids, and an array of cardiac risk scores calculated after the screening event. For body composition, participants' height was measured in meters and centimeters, and weight was recorded using a standing scale in kilograms. Both body mass index and body fat percentage were calculated using a handheld body fat monitor during the screening. Examiners also measured waist and hip circumferences in centimeters before calculating waist to hip ratio. Blood pressure was recorded with an automatic cuff, and examiners were encouraged to take 2 readings and calculate their average (all measurements were recorded); during data analysis, when 2 successful readings were not available, only 1 successful reading was used. Pulse rate was measured in beats per minute using a fingertip pulse oximeter. Participants were instructed to fast before the screening; for participants who did not fast, nonfasting glucose levels were documented with fingerstick testing glucose meters. A lipid panel monitoring system was employed to collect results for various lipid parameters, including total cholesterol, triglycerides, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein cholesterol (calculated), total cholesterol to HDL ratio (calculated), and non-HDL cholesterol (calculated).

After the screening events, the patients' current 10-year, lifetime, and optimal American Heart Association/American College of Cardiology Atherosclerotic CVD (ASCVD) risk scores were calculated using the American College of Cardiology's ASCVD Risk Estimator Plus online calculator.[17] The information required to estimate ASCVD risk includes age, sex, race, total cholesterol, HDL cholesterol, systolic blood pressure, blood pressure–lowering medication use, diabetes status, and smoking status. The participants' Framingham Risk Score was also calculated; this measure was developed in the Framingham Heart Study and is also known as the general 10-year CVD risk prediction score using lipids.[18] Finally, an American Diabetes Association score was computed for all participants; this score is representative of the American Diabetes Association's Type 2 Diabetes Risk Test.[19] All 3 calculations were made using the participants' questionnaire and biometric data.

Physician Consult

The participants received a copy of their results, and they could speak to HHR physicians if they wanted to review their results. Participants could also authorize the release of their medical records to the study team, but they were given no incentives to do so either during or after the completion of the questionnaire and screening.

Post-Event Procedures

After the community outreach screening events and physician visits, each completed questionnaire was scanned for secure backup in the HHR system. The study team then input the answers from the questionnaire and the biometric data into The Texas Heart Institute Research Electronic Data Capture (REDCap) database.

Statistical Analysis

Study data were collected and managed with REDCap tools hosted at The Texas Heart Institute.[3,4] As the REDCap citation page states, "REDCap is a secure, web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for data integration and interoperability with external sources."[20,21]

Microsoft Excel, version 16.62, and R, version 4.3.0 (R Foundation for Statistical Computing) software were used to generate demographic, biometric, and location-specific statistics. Demographic characteristics and location-specific data were reported as frequencies and proportions. Baseline biometric data were reported as mean (SD) values.

Because the survey questionnaire was periodically updated during the study, demographic data points not captured by early versions of the questionnaire were characterized as "not collected." The lower frequencies shown in the tables provide insight into biometric measurements being integrated with recent survey questionnaire versions.

Histograms and quantile-quantile plots were used to assess the normality of data for each biometric variable. Biometric data obtained from participant responses (eg, height, weight) that were likely to be erroneous were removed if they fell outside the biometric variable's normal distribution. For normally distributed variables, values with a z score higher than 3.5 or lower than –3.5 were not included in mean (SD) calculations. For non-normally distributed variables, response errors were removed under clinically relevant guidelines. The Shapiro-Wilk test was used to assess normality in the variables. Median (IQR) values are presented, and mean (SD) values are reported in Supplemental Table I. $P < .05$ suggests that the variables are not normally distributed.

Study analyses distinguished among answers not reported (ie, the participant left the question unanswered), answers not collected (ie, the question was not included in the version of the questionnaire the participant completed), and the answer "Prefer Not to Respond." Making these distinctions helped the study team update the language of the questionnaire to be more sensitive for working with vulnerable populations.

Results

Recruitment began on August 13, 2011. As of this writing, 1,476 participants have been enrolled in the HHR Registry (Table I). The most common race and eth-

TABLE I. Demographic Characteristics of Participants

Characteristic	Participants (N = 1,476)
Age, mean (SD), y	45 (13.44)
Race, No. (%)	
American Indian or Alaska Native	14 (0.95)
Asian	24 (1.63)
Black	176 (11.93)
Native Hawaiian or other Pacific Islander	3 (0.20)
White	1,199 (81.23)
Mixed race	34 (2.30)
Other race	18 (1.22)
Unknown or not reported[a]	8 (0.54)
Ethnicity,[b] No. (%)	
Non-Hispanic White	231 (15.65)
Latino or Hispanic	996 (67.48)
Black	194 (13.14)
American Indian or Alaska Native	10 (0.68)
Chinese	4 (0.27)
Filipino	4 (0.27)
Korean	2 (0.14)
Vietnamese	7 (0.47)
Other Asian ethnicity	7 (0.47)
Multiethnic	9 (0.61)
Middle Eastern	2 (0.14)
Other ethnicity	1 (0.07)
Not reported[a]	9 (0.61)

Continued

TABLE I. Demographic Characteristics of Participants, *Continued*

Characteristic	Participants (N = 1,476)
Annual income, No. (%)	
<$10,000	289 (19.58)
$10,000 to $24,999	352 (23.85)
$25,000 to $34,999	209 (14.16)
$35,000 to $49,999	147 (9.96)
$50,000 to $75,000	67 (4.54)
>$75,000	71 (4.81)
Prefer not to respond[c]	216 (14.63)
Not collected[d]	125 (8.47)
Insurance status,[e] No. (%)	
Private health insurance	348 (23.58)
Medicaid	17 (1.15)
Gold Card[f]	177 (11.99)
Uninsured	765 (51.83)
Prefer not to respond[c]	50 (3.39)
Not collected[d]	119 (8.06)
Sexual orientation,[g] No. (%)	
Heterosexual	344 (23.31)
Lesbian	150 (10.16)
Bisexual	16 (1.08)
Gay	16 (1.08)
Something else	2 (0.14)
Prefer not to respond[c]	828 (56.10)
Not collected[d]	120 (8.13)
Relationship status, No. (%)	
Civil union	39 (2.64)
Divorced	15 (1.02)
Domestic partnership	174 (11.79)
Legally married	643 (43.56)
Never married	13 (0.88)
Separated	50 (3.39)
Single	331 (22.43)
Widowed	62 (4.20)
Prefer not to respond[c]	29 (1.96)
Not collected[d]	120 (8.13)

Continued

TABLE I. Demographic Characteristics of Participants, *Continued*

Characteristic	Participants (N = 1,476)
Education status, No. (%)	
No education	188 (12.73)
Less than high school	125 (8.47)
Some school (grade 1-8)	265 (17.95)
Some school (grade 9-12)	136 (9.21)
Earned high school diploma or equivalency degree	185 (12.54)
2-y college or vocational or technical school	162 (10.98)
Some college	97 (6.58)
4-y college degree	31 (2.10)
Advanced degree	3 (0.20)
Prefer not to respond[c] or don't recall	146 (9.89)
Not collected[d]	138 (9.35)
Body mass index, No. (%)	
Underweight (<18.5)	10 (0.68)
Normal weight (18.5-24.9)	236 (15.99)
Overweight (25-29.9)	421 (28.52)
Obesity class I (30-34.9)	355 (24.05)
Obesity class II (35-39.9)	198 (13.42)
Obesity class III (>40)	141 (9.55)
Not collected[d]	111 (7.52)
Collected incorrectly	4 (0.27)
Self-reported currently smoking, No. (%)	
Yes	127 (8.60)
No	1,162 (78.73)
Prefer not to respond[c]	11 (0.75)
Not collected[d]	176 (11.92)
Self-reported depression, No. (%)	
Yes	186 (12.60)
No	1,108 (75.07)
Prefer not to respond[c]	7 (0.47)
Not collected[d]	175 (11.86)

[a] "Not reported" describes missing responses as a result of the participant leaving the question blank.
[b] "Japanese," "Hawaiian Native," "Samoan," "Guamanian or Chamorro," and "Other Pacific Islander" were also options for this question; however, no participants selected these options, so they were not included in the table.
[c] "Prefer not to respond" was an explicit answer option outside of leaving the question blank.
[d] "Not collected" describes missing responses as a result of the question not being asked in the questionnaire version the participant completed.
[e] "Don't Recall" was also an option, but no participants selected it.
[f] The Gold Card is also referred to as Harris Health's assistance program.
[g] "Gay (male)" and "Gay (female)" were also options for sexual orientation. "Gay (male)" was excluded from this table because this response was not possible given that biological men who identified as men were excluded from the study (thus, the 2 "Gay (male)" responses were disregarded as erroneous). "Gay (female)" was grouped under the "Lesbian" category.

nicity of participants is Hispanic (996/1,476 [67.48%]), followed by non-Hispanic White (231/1,476 [15.65%]), Black (194/1,476 [13.14%]), and other races and ethnicities (55/1,476 [3.72%]) (Fig. 2, Fig. 3). The most commonly reported annual income range was $10,000 to $24,999 (352/1,476 [23.85%]), the most commonly reported insurance status was private health insurance (348/1,476 [23.58%]), and the most commonly reported sexual orientation was heterosexual (344/1,476 [23.31%]).

The baseline biometric data revealed notable findings about the body composition of female participants (Table II; Supplemental Table I). Female participants' mean (SD) body mass index (31.07 [7.01]) and mean (SD) body fat percentage (37.09% [7.05%]) were in the obese category (Fig. 4). In contrast, participants' average blood pressure values fell within the normal range for systolic (mean [SD], 118 [13] mm Hg) and diastolic readings (mean [SD], 79 [13] mm Hg). Assuming that participants answered honestly regarding whether they were not fasting, these values similarly show an otherwise healthy population, with fasting glucose levels in the normal range (mean [SD], 100.62 [37.82] mg/dL) and a low average nonfasting glucose level (mean [SD], 130.11 [78.87] mg/dL). Atherosclerotic CVD risk scores generally fell within the expected range for healthy indi-

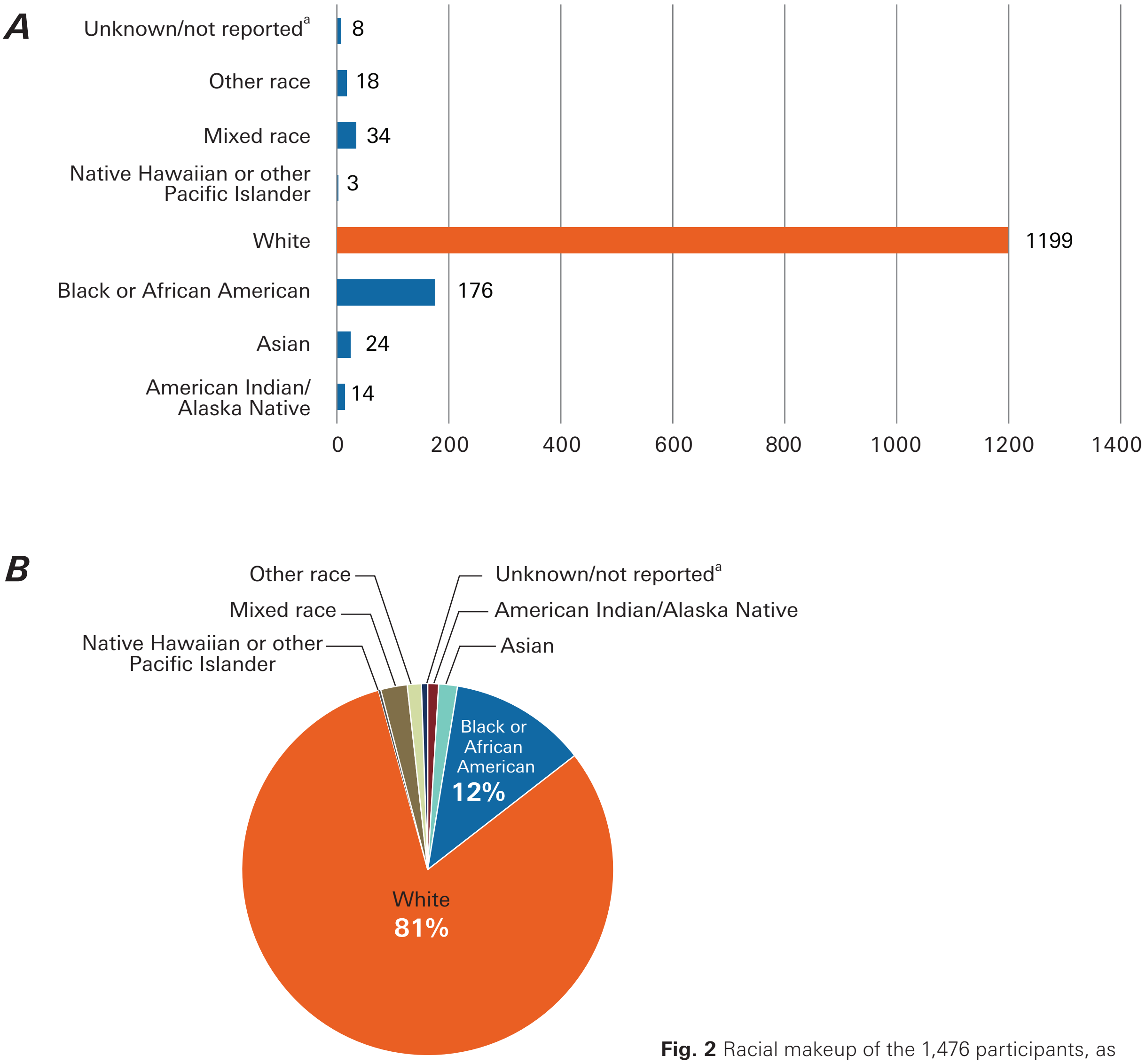


Fig. 2 Racial makeup of the 1,476 participants, as shown in (**A**) a bar graph and (**B**) a pie chart.

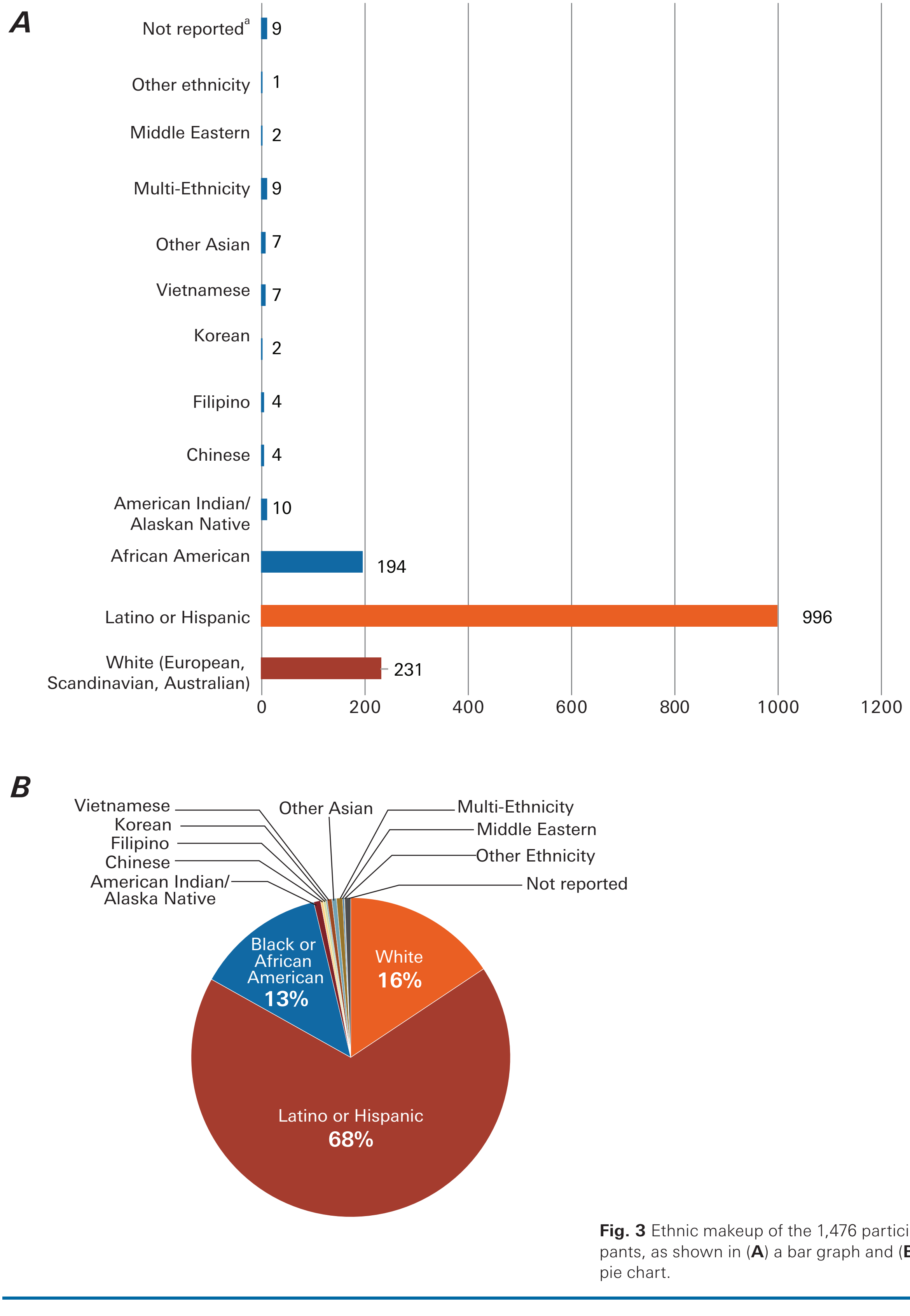


Fig. 3 Ethnic makeup of the 1,476 participants, as shown in (**A**) a bar graph and (**B**) a pie chart.

TABLE II. Baseline Biometric Data

Biometric data	Measurements	Shapiro-Wilk test *P* value
Body composition		
Height, median (IQR), cm	157 (152-163)	<.05
Weight, median (IQR), kg	74 (64-88)	<.05
Body mass index, median (IQR)	30.1 (26-34.9)	<.05
Body fat, median (IQR), %	38 (33-42)	<.05
Waist circumference, median (IQR), cm	94 (86-107)	<.05
Hip circumference, median (IQR), cm	107 (99-117)	<.05
Waist to hip ratio, mean (SD)	0.89 (0.08)	.306
Blood pressure, median (IQR)		
Systolic blood pressure,[a] mm Hg	117 (107-130)	<.05
Diastolic blood pressure,[a] mm Hg	78 (72-85)	<.05
Pulse, /min	70 (64-78)	<.05
Blood glucose, median (IQR), mg/dL		
Fasting glucose	93 (85-101)	<.05
Non-fasting glucose	111 (97-123.5)	<.05
Standard lipid panel, median (IQR)		
Triglycerides, mmol/L	120 (84-175)	<.05
Total cholesterol, mg/dL	183 (158-209)	<.05
HDL, mg/dL	49 (41-59)	<.05
Low-density lipoprotein, mg/dL	107 (89-130.5)	<.05
Total cholesterol/HDL, mg/dL	3.71 (2.97-4.58)	<.05
ASCVD risk scores, median (IQR)		
10-y	2 (0.8-6.1)	<.05
10-y optimal[b]	0.8 (0.5-2.6)	<.05
Lifetime	27 (8-39)	<.05
Lifetime optimal[b]	8 (8-8)	<.05
Framingham Risk Score[c]	2.8 (1.7-7.3)	<.05

ASCVD, atherosclerotic cardiovascular disease; HDL, high-density lipoprotein.
To convert mm Hg to kPa for blood pressure, multiply by 0.133.
To convert mg/dL to mmol/L for blood glucose, multiply by 0.0555.
To convert mg/dL to mmol/L for cholesterol, multiply by 0.0259.

[a] Average of 2 readings or value from only successful reading.

[b] Risk estimate with optimal risk factors as defined by the ASCVD Risk Estimator Calculator (total cholesterol ≤170 mg/dL [4.40 mmol/L], HDL cholesterol ≥50 mg/dL [1.30 mmol/L], systolic blood pressure ≤110 mm Hg, not taking medications for hypertension, no diabetes, and no tobacco use).

[c] Values >30 were set to 30.

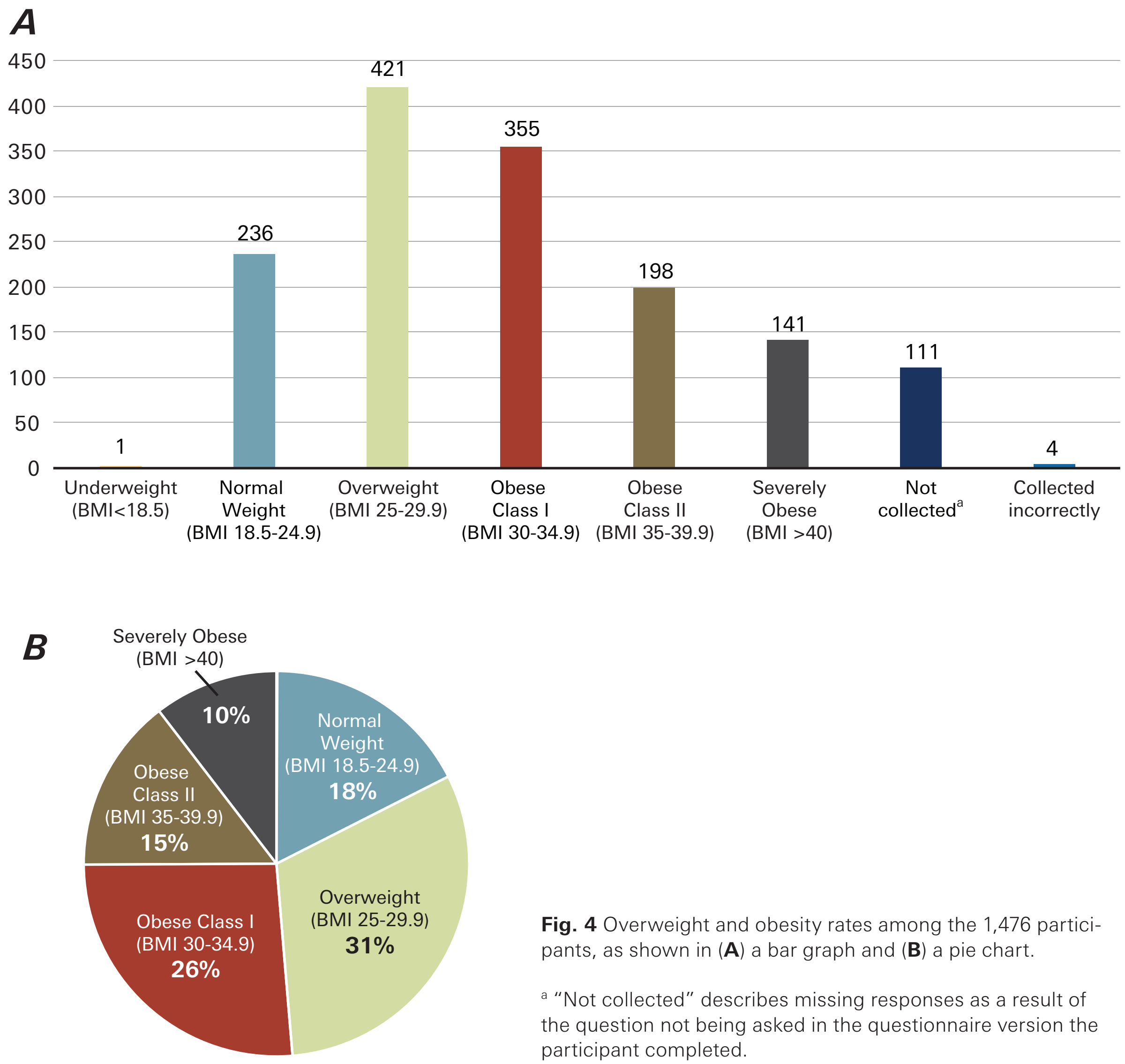


Fig. 4 Overweight and obesity rates among the 1,476 participants, as shown in (**A**) a bar graph and (**B**) a pie chart.

[a] "Not collected" describes missing responses as a result of the question not being asked in the questionnaire version the participant completed.

viduals[17]; however, the lifetime ASCVD calculated risk was high (mean [SD], 28.30 [14.15]). The Framingham Risk (mean [SD], 5.81 [6.80]) and American Diabetes Association Type 2 diabetes scores (mean [SD], 4.74 [1.83]) were similarly not indicative of any concerning health trend.

The recruitment totals for each year and location are shown in Table III. Most of the participants were recruited during community outreach screening events at BakerRipley locations (1,082/1,476 [73.31%]), followed by Lesbian Health Initiative of Houston health fairs (299/1,476 [20.26%]), private physician visits (62/1,476 [4.20%]), and interactions with the Elnita McClain Women's Center (18/1,476 [1.22%]).

The number of individuals of each ethnicity recruited from each location is shown in Table IV. Latina participants were primarily recruited from BakerRipley screening events. Black participants were recruited at all locations. Most White participants were recruited from Lesbian Health Initiative of Houston screening events and physician visits. Other races and ethnicities were recruited in low numbers across the 11 locations.

Discussion

Study recruitment strategies led to 1,476 individuals enrolling in the registry. Hispanic women are well

TABLE III. Participants Successfully Recruited at Each Location, by Year

Location	2011, No.	2012, No.	2013, No.	2014, No.	2015, No.	2016, No.	2017, No.	2018, No.	2019, No.	2020, No.	Total, No. (%)
BakerRipley Cleveland	–	–	98	74	55	–	44	–	43	–	314 (21.27)
BakerRipley Gulfton	–	–	23	34	40	60	38	–	–	–	195 (13.21)
BakerRipley Harbach Campus	–	–	65	14	36	–	–	1	–	–	116 (7.86)
BR Harbach Ripley Campus	120	–	1	–	1	34	41	43	–	–	240 (16.26)
BakerRipley Independence	–	–	42	–	–	–	–	–	–	–	42 (2.85)
BakerRipley Leonel Castillo	–	–	–	11	31	–	15	–	–	–	57 (3.86)
BakerRipley Ripley House	–	–	25	17	31	28	17	–	–	–	118 (7.99)
Physician visit	–	–	–	–	–	39	22	–	1	–	62 (4.20)
Elnita McClain Women's Center	–	–	–	–	–	–	13	–	5	–	18 (1.22)
Lesbian Health Initiative of Houston, Inc, Houston Area Community Services	–	–	4	40	43	34	–	–	–	–	121 (8.20)
Lesbian Health Initiative of Houston, Inc, Legacy	–	38	101	39	–	–	–	–	–	–	178 (12.06)
Online	–	–	–	–	–	–	–	–	2	13	15 (1.02)
Total, No. (%)	120 (8.13)	38 (2.57)	359 (24.32)	229 (15.51)	237 (16.06)	195 (13.21)	190 (12.88)	44 (2.98)	51 (3.46)	13 (0.88)	1,476

represented in the registry, but the recruitment and enrollment of other ethnicities need improvement. The representation of LGBTQAI individuals, individuals with various insurance types, and individuals with low to middle SES is adequate but could be improved.

Most of the Hispanic participants in the registry were recruited from outreach events at the BakerRipley locations, which are in predominantly Hispanic areas of Houston. This trend illustrates the importance of adopting targeted and culturally tailored recruitment methods. Much like the current study, a cardiometabolic registry and biorepository study by Shaibi et al[22] enrolled 531 Latino adults in Phoenix, Arizona, by building genuine relationships with the community and engaging with community stakeholders and leaders to develop culturally tailored recruitment methods.

Houston HeartReach includes several doctors (both MD and PhD) and key coordinators who speak Spanish fluently or were trained by medical systems in Latin American countries, including Mexico, Costa Rica, and South America. One investigator was present at all the outreach events and conducted the majority of 1-on-1 consultations, which built trust with the communities. In some cases, the study team screened individuals from multiple generations of the same family (eg, daughter, mother, grandmother).

In all, 190 Black women were recruited for the study, which was fewer than expected. Chadiha et al[23] enrolled 1,273 older Black individuals into their registry from 2003 to 2009 by providing health education to the community in a variety of settings (eg, churches, community centers, senior living facilities) throughout the year, holding an annual health screening event, and

TABLE IV. Ethnicities of Registry Participants Recruited at Each Location

Ethnicity	BakerRipley Cleveland, No.	BakerRipley Gulfton, No.	BakerRipley Harbach Campus, No.	BakerRipley Harbach Ripley Campus, No.	BakerRipley Independence, No.	BakerRipley Leonel Castillo, No.	BakerRipley Ripley House, No.	Physician visit, No.	Elnita McClain Women's Center, No.	Lesbian Health Initiative of Houston, Inc, Houston Area Community Services, No.	Lesbian Health Initiative of Houston, Inc Legacy, No.	Online, No.
White–non-Hispanic	5	6	1	1	–	3	6	44	–	57	93	6
White–Latino or Hispanic	296	176	70	193	40	51	107	3	–	30	28	3
Black	5	8	44	39	1	2	2	7	15	27	37	3
American Indian or Alaska Native	–	–	–	–	–	–	–	–	–	–	4	–
Chinese	–	–	–	–	–	–	–	1	–	1	–	1
Filipino	1	–	–	–	–	–	–	2	–	–	–	–
Korean	–	–	–	–	–	–	1	–	–	–	–	–
Vietnamese	–	–	–	–	–	–	–	2	–	–	3	1
Other Asian	–	4	1	–	–	–	1	1	–	–	1	1
Other ethnicity	–	1	–	–	–	–	–	–	–	–	–	–
Multiethnic	4	–	–	1	–	1	1	1	1	6	12	–
Middle Eastern	–	–	–	–	–	–	–	1	–	–	–	–
Unknown	1	–	–	6	–	–	–	–	2	–	–	–

working with a Black community advisory board. In addition, Green et al[24] reported that direct recruitment efforts (eg, outreach, ongoing studies, public database) and indirect recruitment efforts (eg, online, radio, email communication) were crucial in enrolling 608 individuals in the Project CONNECT registry, most of whom were Black.

Individuals in the LGBTQAI communities were recruited from the Lesbian Health Initiative of Houston. The current ratio of heterosexual to LGBTQAI individuals enrolled in this study is on par with the ratios in other registries. Clark et al[25] used 4 cancer registries to recruit and enroll 353 heterosexual and 127 LGBTQAI individuals in their study—a ratio similar to the one in the current study.

The previously mentioned studies suggest that large numbers of racial, ethnic, and sexual minority participants can be recruited for registries by cultivating trust within minority communities[22,26] and working in collaboration with community members and minority-focused organizations. These studies also provide a framework that could be adapted to increase the representation of each racial, ethnic, and sexual minority in the HHR registry.

The SES and health care status of participants is dependent on individual circumstances. Because individuals of lower SES are considered vulnerable,[27] studies suggest collaborating with local primary care and free clinics in disadvantaged areas for referrals[23,28]; using media platforms; and targeting frequently visited locations,[24,29] such as churches and community centers, to recruit participants from vulnerable populations.[30]

Study Limitations

Given the study's limited staff and how the data-collection process operated from 2011 to 2019, keeping up with the increasing demand for enrollment in the registry was challenging. Working with vulnerable individuals also presents unique challenges and considerations. Factors such as limited resource access, potential biases, and unique socioeconomic and cultural contexts may have influenced the study outcomes.

A surprisingly large number of participants either left questions unanswered or indicated a preference not to disclose certain pieces of information. Many of these questions notably pertain to personal aspects of the participants' lives. This observation highlights a potential "trust gap" that persists between research institutions and the communities they engage with, particularly those considered vulnerable.

This apparent hesitation to share personal information underscores the need for a more in-depth examination of the dynamics between researchers and their study participants. Despite the study staff fostering close partnerships with the communities involved, some patients chose to leave questions blank or selected the "Prefer Not to Respond" option. These deliberate nonresponses suggest that, at times, participants harbored reservations or concerns about how their information would be used or stored or how disclosure could affect their social, economic, or legal status; they may also suggest unfamiliarity with the subject matter of the question.

More than half of the respondents did not report their sexual orientation. This phenomenon could represent nonresponse bias and may have caused the study staff to underestimate the prevalence of individuals with sexual minority orientation, may have distorted the relationships among the variables, and may have introduced self-selection bias if individuals with stronger opinions on the topic were more likely to participate in the survey. This level of nonresponse limits the generalizability of findings to the broader population, which could result in inaccuracies in correlations between sexual orientation and health outcomes.

One measure that helped garner more responses was the repeated involvement of the same agencies and recruitment efforts at the same locations. This approach made these settings feel more comfortable and familiar to participants. Another measure that promoted trust was the study team's emphasis that certain questions were optional and that not answering them would not result in any negative consequences or judgments. These strategies may prove essential for bridging the trust gap and building stronger relationships between research institutions and the communities they seek to understand and support.

Study participants were recruited at more than 40 health fairs and other events hosted at several BakerRipley campuses that serve many neighborhoods and communities in Houston's north, southeast, southwest, east, and central downtown zip codes. A campus in Pasadena, approximately 2 miles east of Houston, serves Houston Ship Channel residents living near the refineries. Events were also conducted at the centrally located Legacy Community Health (on California Street in the Montrose neighborhood, near downtown Houston). The Elnita McClain Women's Center is located in central Houston; participants at that site included members of various churches affiliated with the 10th District African Methodist Episcopal churches.

Although the registry includes participants from zip codes across the greater Houston area, Black, Asian, and non-Hispanic White individuals may be underrepresented in the registry because a large proportion of the participants were recruited from BakerRipley sites serving Hispanic populations.

Disparities in access to education, transportation, and adequate housing have a domino effect on health care and may have limited the study's ability to reach the Black community. Although 1 of the study's partners was a well-established organization serving the Black community, screenings were conducted only at a location that was not a large community center and that was far away from where many of the organization's constituents live. Most of the study's engagement with this community is through educational programs during Heart Month, during which the study reaches 500 to 700 members of the community affiliated with the African Methodist Episcopal churches.

This study has certain limitations. Because most of the nonbiometric registry data are self-reported, their reliability and validity come into question. The study team, however, reviews the questionnaire with the participant during a consultation checkout and verifies self-reported conditions such as hypertension, dyslipidemia, and diabetes by cross-checking with the medications the participants report taking in the medication sections of the questionnaire. Achieving the study's goal of understanding CVD trends in Harris County minority populations was also hampered by the lack of sufficient representation of individuals of some racial and ethnic minority groups.

Conclusion

The study's recruitment and enrollment of Hispanic participants compared with participants from other ethnic groups is disproportionate. Its current representation of individuals of differing sexual orientations, SES, and levels of access to health care is satisfactory. Incorporating recruitment methods to intentionally reach minority and historically hard-to-reach groups, building community trust, and collaborating with desired participants will be crucial to reaching the registry's makeup and enrollment goals. Completing enrollment will allow the study staff to understand better how differences in demographic factors influence CVD trends in Harris County.

Beginning in fall 2023, the inclusion criteria for enrollment in the registry changed. Pregnant women are now included because of increasing evidence that cardiovascular complications during pregnancy can increase the risk of CVD later in life. Men and all sexual identities and orientations will also be included in the registry.

In response to the COVID-19 pandemic, the study staff recognized the need to implement digital recruitment and outreach mechanisms because they were required to shift from in-person to virtual community engagement. The REDCap platform was used to convert the study questionnaire into a digital format. In addition, secure third-party applications were integrated into the study's REDCap project to enable text-based messaging, emailing, and other forms of communication between the study team and participants. This conversion streamlined the data-collection process and established mechanisms for outreach capabilities in addition to in-person events.

Minimizing the use of paper-based data-collection methods and expanding use of online technology will reduce the steps in and substantially expedite the data-collection process, allowing for quicker statistical analysis. This new approach will also eliminate the risk of post-event data entry errors by staff. Participants will be responsible for entering their responses in the secure REDCap software, ensuring the collected data's accuracy and integrity.

Finally, with study materials now easily portable in their digital format, outreach methods can be extended to virtually any location, allowing the study staff to reach out to diverse populations. This newfound mobility empowers the team to engage with individuals and groups in various settings, such as conferences, workshops, and community events.

The potential impact of HHR on public health policies and community health interventions is substantial if the participants can be reached for follow-up and if health evaluations show that early intervention and education changed the trajectory of disease manifestation or slowed the progression of disease by encouraging participants to make healthy lifestyle changes, secure a medical home, or get regular check-ups.

Article Information

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Author Contributions: Karla Campos, Keri Sprung, and Stephanie Coulter developed the concept for the study. Jackie Ferrufino, Symone Taylor, Karla Campos, Keri Sprung, and Stephanie Coulter curated the data, conducted the investigation, and validated its results. Jackie Ferrufino, Symone Taylor, Karla Campos, Matthew W. Segar, and Stephanie Coulter conducted formal analysis. Jackie Ferrufino, Karla Campos, Keri Sprung, Matthew W. Segar, and Stephanie Coulter formalized the study's methodology. Matthew W. Segar and Stephanie Coulter performed formal analysis. Karla Campos, Keri Sprung, and Stephanie Coulter supervised the study and visualized its data. Symone Taylor, Keri Sprung, and Stephanie Coulter acquired funding. Jackie Ferrufino, Karla Campos, Keri Sprung, and Stephanie Coulter administered the project and procured study resources. Jackie Ferrufino, Karla Campos, and Keri Sprung procured software to support and conduct the study. Jackie Ferrufino, Symone Taylor, and Keri Sprung wrote the original draft of the investigation, and Jackie Ferrufino, Karla Campos, Keri Sprung, Matthew W. Segar, and Stephanie Coulter reviewed and edited drafts of the investigation.

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