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Cardiovascular Disease in a Population-Based Sample of Transgender and Cisgender Adults

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INTRODUCTION

Evidence suggests that transgender populations experience disparities in cardiovascular health.[1,2] However, only 1 federal population-based survey, the Behavioral Risk Factor Surveillance Survey (BRFSS), reports on adult cardiovascular health by transgender identity. These data are limited because they are derived from an optional module used by less than two thirds of U.S. states.[3] Nonetheless, BRFSS data indicate that transgender adults experience disparities in tra ditional cardiovascular disease (CVD) risk factors and outcomes compared with cisgender adults.[4–7]

Gender-affirming hormones (i.e., exogenous estrogen and testosterone) are commonly taken by transgender people to align their bodies with their identities.[8] Observational studies have consistently identified an increased risk for venous thromboembolism (VTE) among transgender women taking estrogen.[9–12] However, data on other cardiovascular outcomes and their relationship to gender-affirming hormones have been more limited.[5] A systematic review found exogenous testosterone to be associated with elevated prevalence of cardiovascular risk factors (e.g., hypertension, insulin resistance, and dyslipidemia) in transgender men; however, there were no associations with CVD or death.[13] By contrast, population-based data found that transgender men had significantly higher odds of myocardial infarction (MI) than cisgender men (OR=2.53) and cisgender women (OR=4.90).[7] Transgender women had higher odds of an MI than cisgender women (OR=2.56) but not cisgender men.[7] Another study using the same data found that gender nonconforming individuals reported the highest prevalence of coronary heart disease or MI (17.8%) than transgender men (6.6%), transgender women (8.0%), cisgender men (9.0%), and cisgender women (4.8%).[6]

The gender minority stress model posits that transgender stigma and discrimination increase stress and drive health disparities.[14] Psychosocial stressors, such as discrimination and adverse childhood experiences (ACEs), play an important role in CVD risk.[15,16] An investigation of CVD determinants in 52 countries identified psychosocial stress as a powerful predictor of MI, comparable in impact with smoking.[17,18] Discrimination is a common stressor for transgender people and is associated with a range of negative health behaviors and out comes, including smoking and CVD.[19–21] Transgender people are more likely to experience ACEs than cisgen der people,[22] and ACEs have also been associated with smoking and CVD.[16,23] However, population-based data assessing the relationships between these psychosocial stressors and CVD among transgender people are absent.

In short, existing research on CVD among transgender people is limited. Existing data are inconsistent and are derived from nonrepresentative samples or popula tion-based data sets that do not include transgender-specific risk factors such as hormone use and psychosocial stressors. Research is needed that assesses both biological (e.g., hormone use) and psychosocial (e.g., discrimination) CVD risk factors. This study seeks to address this research gap.

The first aim is to describe the distribution of smoking, select CVD conditions, and VTE among transgender adults by gender identity and compared with those among cisgender adults using data from the first national probability sample of the U.S. transgender population. On the basis of previous literature, this study hypothesizes that transgender participants and transgender women in particular have higher odds of smoking, select CVD conditions, and VTE than cisgender participants.

The second aim is to assess the impact of psychosocial factors and hormone therapy on smoking, CVD condi tions, and VTE among transgender participants. The study hypothesizes that higher scores for everyday discrimination, psychological distress, and ACEs will predict higher odds of smoking, CVD conditions, and VTE. The study further hypothesizes that

transgender participants who have taken hormone therapy will have no higher odds of CVD conditions than transgender partic ipants who have never taken it.

METHODS

Study Sample

This analysis used data from the TransPop study, the first national probability sample of transgender adults in the U.S.[24] The survey collected demographic data, health outcomes and behaviors, experiences of discrimination, and gender-affirming interventions (e. g., hormone use).The study protocol was reviewed by the Gallup IRB and the IRBs at the University of California, Los Angeles and collaborating investigators' universities.

The TransPop data set used 2 sources. One source was a survey administered to a nationally representative sample of transgender adults in 2 waves: April 2016−August 2016 and June 2017
−December 2018. The second source included a comparable sur vey administered to a nationally representative sample of cisgen der respondents administered on February 19−23, 2018 and November 12, 2018−December 10, 2018.

Participants were recruited by Gallup, Inc., a survey research consulting company[25] using 2 methodologies that corresponded to changes over the study period. The first method recruited a probability sample of U.S. adults using random-digit dialing to reach cell phone and landline users. Following industry trends, the second method recruited a probability sample of the entire U.
S. adult population using address-based sampling that mailed the survey followed by a reminder mailing. All respondents were sent English language questionnaires to be self-administered online or on paper. This analysis was restricted to participants aged ≥40 years to correspond to the age when healthcare providers begin calculating CVD risk scores.[26] The analytic sample included 114 transgender and 964 cisgender individuals. Sample weights account for selection probability and are corrected for unit nonresponse.

Measures

Transgender respondents were identified using the question: *Do you, personally, identify as lesbian, gay, bisexual, or transgender?* Respondents who answered *yes* were then screened using a 2-step question, including self-reported gender identity (*Do you currently describe yourself as a man, a woman, or transgender?*) and sex assigned at birth (*On your original birth certificate, was your sex assigned as female or male?*). Respondents were categorized as transgender if they identified as man or woman and that differed from their sex assigned at birth or if they identified as transgender. Participants who selected *transgender* as their gender identity were asked whether they identified as a trans woman, trans man, or nonbinary/genderqueer. Additional eligibility included being aged ≥18 years, having ≥6 years of education, and competency in the English language. Detailed information about the methodology is provided elsewhere.[27]

Race was dichotomized as Black or non-Black to be consistent with the American College of Cardiology calculator for CVD risk.[26] Education was dichotomized as high school or less and more than high school. Employment was dichotomized as full-time or less than full-time employment. Poverty was calculated using weighted Census estimates for 2018 poverty thresholds; respondents were categorized as living in poverty (below 100% federal poverty level) or not on the basis of their reported household income and the number of people living on that income. Ever hormone use was measured by participant report of ever taking hormones for gender identity or transition.

All psychosocial measures are listed in Table 1. The Everyday Discrimination Scale assessed chronic experiences of unfair treatment.[28] Scale items asked respondents the frequency of discrimination experiences over the past year. Responses ranged from *often* to *never* on a 4-point Likert-type scale. Scale scores range from 1 to 4 such that higher values represent more discrimination.

Psychological distress was assessed using the Kessler-6.[29] Items asked about the frequency of various symptoms over the previous 30 days on a 5-point scale. Higher scores indicate greater distress. The ACEs[30] scale items asked respondents to *look back before you were 18 years of age* and included 8 items about adverse experiences. For scoring, all items were dichotomized (1=*yes, event occurred at*

least once vs 0=no, event never occurred). The final score sum[31] ranges from 0 to 8, with higher scores indicating more ACEs.

Participants who reported ever smoking ≥100 cigarettes in their lifetime were categorized as ever smokers. Those who reported smoking currently were considered current smokers. A binary composite variable classified participants who reported having been told by a doctor or health professional that they had any of the following as *yes*: heart condition or heart disease, angina, heart attack, hypertension, or stroke. Participants who reported none of these conditions were coded as *no*. For VTE, participants who reported having been told by a doctor or health professional that they had blood clots in their legs or lungs were coded as *yes*, otherwise they were coded as *no*.

Table 1. Survey Items Used for Psychosocial Measures

Questions
Everyday discrimination scale questions
In your day-to-day life, how often do any of the following things happen to you?
You are treated with less courtesy than other people.
You are treated with less respect than other people.
You receive poorer service than other people at restaurants or stores.
People act as if they think you are not smart.
People act as if they are afraid of you.
People act as if they think you are dishonest.
People act as if they’re better than you are.
You are called names or insulted.
You are threatened or harassed.
Kessler 6 scale questions
During the past 30 days, about how often did you feel.. .
.. . nervous?
.. . hopeless?
.. . restless or fidgety?
.. . so depressed that nothing could cheer you up?
.. . that everything was an effort?
.. . worthless?
Adverse childhood experiences questions
Look back to before you were 18 years of age...
Did you live with anyone who was depressed, mentally ill, or suicidal?
Did you live with anyone who was a problem drinker or alcoholic?
Did you live with anyone who used illegal street drugs or who abused prescription medications?
Did you live with anyone who served time or was sentenced to serve time in

a prison, jail, or other correctional facility?
Were your parents separated or divorced?
How often did your parents or adults in your home ever slap, hit, kick, punch or beat each other up?
Before age 18, how often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? Do not include spanking.
How often did a parent or adult in your home ever swear at you, insult you, or put you down?

Statistical Analysis

Descriptive statistics were estimated using the unweighted data. Weighted means and CIs were estimated for psychosocial scores and age. Weighted percentages and CIs were calculated for CVD variables and sociodemographic characteristics other than age.

A total of 8 variables used in the analysis models had missing data, ranging from 0.28% to 7.4% missing. Missing values were multiply imputed across 50 data sets, and regression parameter estimates for each data set were pooled using Rubin's rules. All models used sampling weights to generate population estimates and Taylor series linearization for SE estimation. All statistical analyses were performed using Stata, version 16.1.[31]

Logistic regression models estimated the ORs and 95% CIs expressing the relationship between each outcome and a set of explanatory variables, controlling for age and race. Whether gender identity predicts differences in the odds of each CVD risk factor and outcome was modeled. Then, whether psychosocial factors predict CVD risk factors and outcomes was modeled, stratifying by gender identity and controlling for age and race. Finally, the effect of gender-affirming hormone therapy on CVD risk factors and outcomes for the transgender population alone was modeled.

RESULTS

Transgender respondents were younger than cisgender respondents with a mean age of 53.5

years compared with 59.8 years. A greater proportion of transgender

respondents identified as

Black than cisgender respond ents (18% vs 13.1%). A greater proportion of transgen der people

had an education level of high school or less; received food stamps or Special Supplemental

Nutrition Program for Women, Infants, and Children; and met criteria for poverty than cisgender

people. Mean scores for everyday discrimination, psychological distress, and ACEs were higher for

transgender people. There was little difference between cisgender and transgender people in the

ever smoking category; however, a greater proportion of transgender people were current

smokers. Approximately 40% of transgender participants had ever used gender-affirming

hormones. Data disaggregated by gender identity of transgender participants are available in

Table 2.

In models adjusted for age and race (Table 3), the odds of lifetime smoking were not different

between transgender and cisgender people. The estimated odds of current smoking were higher

for transgender than for cisgender people with the CI including the null. A greater proportion of

cisgender people had a history of a CVD condition; however, transgender people were more likely

to report a history of VTE.

The adjusted odds of having any of the measured CVD conditions were lower for transgender than

for cisgender people, but this was not statistically significant as indicated by

the CIs that include the null. However, transgender people had >3 times the odds of VTE than cisgender people (AOR=3.35), largely driven by the dif ference between transgender and cisgender women (AOR=3.94). Transgender women also had higher odds of reporting a history of VTE than cisgender men (AOR=1.90); however, this result was not statistically significant. CIs included the null for ORs comparing transgender men with cisgender women as well as transgender men with cisgender men for each outcome (i.e., any CVD condition, VTE, ever smoker, and current smoker). All analyses in Table 3 were repeated with pov erty in the model. No meaningful differences in effect sizes nor inferences were found between models with and without poverty.

Table 4 shows the relationships between psychosocial factors and CVD conditions stratified by gender identity. The odds of reporting any CVD condition increased significantly with increases in psychological distress for both transgender (AOR 1.15, 95% CI=1.02, 1.30) and cisgender (AOR=1.07, 95% CI=1.02, 1.12) participants. The odds of reporting any CVD condition increased with an increasing number of ACEs for both transgender (AOR=1.12, 95% CI=0.84, 1.51) and cisgender (AOR=1.12, 95% CI=1.00, 1.24) participants; however, results only met statistical significance for cisgender participants. None of the psychosocial factors were significantly associated with VTE.

Psychological distress was significantly associated with having ever

smoked for cisgender participants (AOR=1.04, 95% CI=1.00, 1.09), but the relationship did not reach statistical significance for transgender partici pants (AOR=0.98, 95% CI=0.89, 1.08). Likewise, higher ACEs scores were significantly associated with being a current smoker for cisgender participants (AOR=1.22, 95% CI=1.10, 1.35), but the relationship did not reach statistical significance for transgender participants (AOR=1.28, 95% CI=0.97, 1.70). Contrary to the results for having ever smoked, increased psychological distress (AOR=1.22, 95% CI=1.03, 1.46) and higher ACEs scores (AOR=1.60, 95% CI=1.02, 2.51) were significantly associated with being a current smoker for transgender but not for cisgender participants. All analyses in Table 3 were repeated with poverty in the model. No meaningful differences in effect sizes nor inferences were found between models with and without poverty. Transgender respondents with a history of hormone use had lower odds of any CVD (AOR=0.69, 95% CI=0.24, 2.00) than those without the history. A history of hormone use was associated with higher odds of VTE (AOR=1.49, 95% CI=0.21, 10.78). However, these results were not statistically significant.

DISCUSSION

Contrary to the hypotheses and some previous literature, this study found no statistically significant differences between cisgender and transgender participants in smoking or CVD conditions, possibly owing to the younger age of transgender participants in this study. Consistent with previous research,[32] this study found an increased odds of VTE among transgender women compared with those among cisgender women. However, among transgender participants who had ever received gender-affirming hormone therapy, the CI for the AOR of VTE was wide and included the null, likely owing to small sample sizes. Subanalyses by the sex assigned at birth were not possible owing to limited sample size. Future studies with larger samples are needed. Additional research using adjudicated CVD conditions will be important to advance knowledge on CVD disparities. Routinely assessing assigned sex at birth and gender identity in existing, ongoing CVD cohorts would be an important step in this direction.[1] Social determinants such as poverty and minority stress may be the main

drivers of CVD risk rather than hormone use or identity per se; these factors should be incorporated into future research.

Consistent with previous literature, transgender participants reported greater psychosocial stressors. Draw ing on the gender minority stress model,[14] it was expected that participants who experienced more psychosocial stressors would be more likely to smoke and have a CVD condition than participants with fewer psychosocial stressors. The larger effect size of psychological distress on CVD conditions for transgender people is consistent with this model. The lack of statistically significant relationships between CVD conditions and psy chological distress or ACEs for transgender participants could be a product of limited statistical power. However, it may also suggest that psychological distress (possibly caused by discrimination and childhood trauma) played a more powerful role in negative health outcomes.

Current smoking was more common among transgender people, as has been found in previous studies,[33] and was significantly associated with psychological distress and ACEs for transgender participants. The largest effect size for the relationship between ACEs and current smoking was among transgender participants. Together, these data suggest that childhood trauma and current psychological distress (both more common among transgender than among cisgender participants) may lead to increased CVD risk behaviors (i.e., continued smoking), which then lead to increased risk of a CVD condition.

These findings support the gender minority stress model. In applying the model to CVD, this study expands beyond its typical application to mental health. More research is needed on the pathways by which psy chosocial factors affect cardiovascular health. Smoking is one CVD risk behavior impacted by psychosocial stressors. Transgender-inclusive studies with representative samples should explore the role of psychosocial stressors for other health behaviors (e.g., diet, exercise) and metabolic changes (e.g., blood pressure, cholesterol) that are key to cardiovascular health.[1,34] A growing body of research is examining psychosocial stress as a driver of increased allostatic load and chronic inflammation that elevate the risk for CVD.[35–37] Such studies should include a robust number of transgender

participants to ensure that findings are applicable to this population. Ideally, such studies would be longitudinal to allow for mediation analyses that could support causal inference.

Limitations

This study has limitations. Data collection periods for transgender and cisgender participants did not overlap, potentially introducing bias. However, the general population prevalence of CVD and VTE did not change sig nificantly during the data collection periods,[38] suggesting minimal temporal bias. All measures were self-reported. Transgender people are more likely to delay or avoid seeking medical care because of discrimi nation.[39] Therefore, self-report may under-represent their CVD burden. In addition, information was unavailable on the types, dose, or duration of hormone use as well as on their temporality with outcomes. This limitation precluded making inferences about relationships between hormone use and CVD conditions or VTE. The number of gender nonbinary participants was too small for disaggregated analyses, and data were not available for gender-diverse people who did not identify as transgender. Little is known about the health of non- binary people, and much more research is needed.

Transgender participants were significantly younger than cisgender participants. Given this age difference, transgender participants had a shorter period in which to develop a CVD condition or VTE. Hence, this analy sis may have underestimated the risk of CVD for trans gender people. However, the younger age distribution as well as the higher proportion of transgender

Table 2. Characteristics Among Study Participants Aged ≥40 Years

Characteristics	%[a] or mean[a] (95% CI)[a]						
	Transgender (*n* = 114)	Cisgender (*n* = 964)	Transwoman (*n* = 70)	Transman (*n* = 25)	GNB (*n* = 19)	Ciswoman (*n* = 517)	Cisman (*n* = 447)
Sociodemographic characteristics							
Age (mean age in years)	53.5 (51.12, 55.97)	59.8 (58.65, 60.97)	55.6 (52.30, 58.90)	50.6 (46.77, 54.46)	51.9 (46.30, 57.56)	59.1 (57.44, 60.80)	60.6 (59.05, 62.19)
Race, %							
Black	18.0 (9.3, 31.8)	13.1 (9.8, 17.4)	12.2 (4.8, 27.8)	31.5 (11.3, 62.5)	15.5 (2.7, 55.1)	16.6 (11.5, 23.4)	9.1 (5.6, 14.3)
Not Black	82.0 (68.2, 90.7)	86.9 (82.6, 90.2)	87.8 (72.2, 95.2)	68.5 (37.5, 88.7)	84.5 (44.9, 97.3)	83.4 (76.6, 88.5)	90.9 (85.7, 94.4)
Educational level, %							
High school or less	48.6 (35.7, 61.7)	33.9 (29.3, 38.8)	42.4 (26.9, 59.6)	53.7 (27.9, 77.7)	59.3 (28.8, 84.0)	34.0 (27.8, 40.7)	33.9 (27.3, 41.1)
More than high school	51.4 (38.3, 64.3)	66.1 (61.2, 70.7)	57.6 (40.4, 73.1)	46.3 (22.3, 72.1)	40.7 (16.0, 71.2)	66.0 (59.3, 72.2)	66.1 (58.9, 72.7)
Full-time employed, %	32.1 (21.6, 44.9)	30.3 (26.3, 34.5)	28.3 (17.3, 42.7)	33.7 (13.2, 62.9)	40.2 (15.8, 70.6)	25.1 (20.2, 30.7)	36.4 (30.4, 42.8)

Assistance receiving food stamps or WIC, %	36.0 (22.4, 52.3)	10.4 (7.6, 14.0)	27.2 (12.3, 50.1)	55.0 (25.8, 81.1)	27.9 (9.7, 58.2)	15.6 (11.1, 21.5)	4.2 (2.3, 7.6)
Poverty, %	39.3 (26.6, 53.5)	12.2 (9.1, 16.3)	36.3 (20.9, 55.3)	53.0 (25.2, 79.0)	32.6 (11.4, 64.4)	15.8 (11.2, 21.9)	7.9 (4.5, 13.6)
Psychosocial factors							
Everyday discrimination	1.92 (1.74, 2.10)	1.60 (1.54, 1.65)	1.93 (1.68, 2.18)	1.7 (1.34, 2.12)	2.1 (1.79, 2.41)	1.6 (1.51, 1.66)	1.6 (1.53, 1.69)
Psychological distress	7.2 (5.89, 8.52)	4.3 (3.88, 4.73)	7.5 (5.96, 9.02)	5.9 (2.95, 8.82)	1.58 (5.11, 11.32)	0.32 (4.28, 5.52)	0.28 (3.04, 4.16)
Adverse childhood experiences	2.56 (1.92, 3.19)	2.14 (1.91, 2.37)	3.15 (2.41, 3.89)	1.67 (0.77, 2.57)	2.28 (0.68, 3.88)	2.37 (2.03, 2.71)	1.89 (1.60, 2.19)
CVD conditions							
Any CVD condition, %	38.5 (27.1, 51.3)	51.2 (46.8, 55.6)	42.3 (27.9, 58.2)	29.3 (12.1, 55.4)	40.6 (15.4, 71.9)	48.4 (42.4, 54.5)	54.5 (48.0, 60.7)
Blood clots in legs or lungs, %	7.8 (3.0, 18.7)	3.1 (1.9, 4.9)	6.8 (2.5, 17.4)	2.1 (0.5, 8.8)	18.0 (3.1, 60.2)	2.0 (1.2, 3.2)	4.4 (2.3, 8.3)
CVD risk factors							
Ever smoker, %	47.3 (34.7, 60.3)	50.0 (45.6, 54.4)	53.2 (37.4, 68.4)	50.2 (24.5, 75.9)	27.7 (10.4, 55.9)	48.1 (42.1, 54.2)	52.2 (45.9, 58.5)
Current smoker, %	44.1 (26.6, 63.2)	33.1 (27.0, 39.7)	46.7 (24.8, 70.0)	44.3 (13.7, 79.9)	30.5 (6.9, 72.2)	35.2 (27.1, 44.2)	30.7 (22.2, 40.8)

Lifetime hormone therapy, %	40.2 (28.4, 53.3)	NA	49.8 (34.1, 65.5)	28.8 (11.3, 56.2)	28.8 (8.1, 64.8)	NA	NA

[a]Based on weighted data.

Cis, cisgender; CVD, cardiovascular disease; GNB, gender nonbinary; NA, not applicable; Trans, transgender; WIC, Special Supplemental Program for Women, Infant, and Children.

Table 3. AORs of Any CVD Condition, VTE, and Smoking Status by Gender Identity

Gender identites	AOR[a] (95% CI)			
	Any CVD condition	VTE	Ever smoker	Current smoker
Trans versus Cis	0.79 (0.43, 1.44)	3.35 (1.07, 10.46)	0.98 (0.55, 1.76)	1.58 (0.70, 3.62)
Trans woman versus Cis woman	0.94 (0.46, 1.93)	3.94 (1.24, 12.51)	1.26 (0.62, 2.57)	1.44 (0.49, 4.17)
Trans woman versus Cis man	0.76 (0.37, 1.55)	1.90 (0.53, 6.81)	1.12 (0.54, 2.27)	1.56 (0.52, 4.66)
Trans man versus Cis woman	0.61 (0.16, 2.26)	1.60 (0.32, 7.95)	1.29 (0.39, 4.31)	0.98 (0.20, 4.84)
Trans man versus Cis man	0.49 (0.13, 1.81)	0.77 (0.14, 4.25)	1.13 (0.34, 3.80)	1.07 (0.21, 5.36)

Note: Boldface indicates statistical significance ($p<0.05$). Comparisons for gender nonbinary participants were not conducted owing to small sample size.

[a]All models adjusted for age and race.

Cis, cisgender; CVD, cardiovascular disease; Trans, transgender; VTE, venous thromboembolism.

Table 4. AORs of CVD, Blood Clots, and Smoking Status by Psychosocial Characteristics and Gender Identity

Variables	AOR[a] (95% CI)			
	Any CVD condition	VTE	Ever smoker	Current smoker
Everyday discrimination				
Transgender	1.61 (0.88,	1.33	2.09	2.58 (0.77,

	2.97)	(0.34, 5.26)	(0.99, 4.43)	8.68)
Cisgender	1.44 (0.96, 2.14)	1.30 (0.47, 3.60)	1.07 (0.75, 1.53)	1.16 (0.70, 1.91)
Psychological distress				
Transgender	1.15 (1.02, 1.30)	1.04 (0.91, 1.20)	0.98 (0.89, 1.08)	1.22 (1.03, 1.46)
Cisgender	1.07 (1.02, 1.12)	1.01 (0.92, 1.12)	1.04 (1.00, 1.09)	1.04 (0.98, 1.11)
ACEs				
Transgender	1.12 (0.84, 1.51)	0.80 (0.42, 1.52)	1.28 (0.97, 1.70)	1.60 (1.02, 2.51)
Cisgender	1.12 (1.00, 1.24)	0.91 (0.72, 1.15)	1.22 (1.10, 1.35)	1.01 (0.86, 1.18)

Note: Boldface indicates statistical significance ($p<0.05$).

[a]All models adjusted for age and race.

ACE, adverse childhood experience; CVD, cardiovascular disease; VTE, venous thromboembolism.

people who identified as Black are consistent with BRFSS data.[40,41] Studies specific to aging transgender people are warranted.

CONCLUSIONS

This study found no difference in smoking and CVD conditions between cisgender and transgender participants; however, transgender participants had 3 times the odds of VTE compared with cisgender participants— driven by the differences between transgender and cis- gender women. This study makes a contribution to the nascent literature on cardiovascular health among transgender people. It is one of the very few studies to provide estimates from a nationally representative sample of transgender people. Unlike the BRFSS, this study was designed specifically for transgender people. Therefore, it used a gender-ascertainment method that allowed for a distinction between assigned sex at birth and current gender identity, and it included data on hormone therapy as well as minority stressors. To advance the knowledge base on CVD and transgender health, research is needed that

includes adjudicated CVD measures, follows longitudinal cohorts to assess mediating factors, and includes larger samples of gender nonbinary and older transgender people.

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TP conceived and designed the analysis; SD, WB, and IHM contributed data or analysis tools; SD performed the analysis; and TP and CS wrote the first draft of the paper. All coauthors edited the paper and approved the final submitted version.

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