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Examining general, physical, and mental health disparities between transgender and cisgender adults in the U.S.

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Abstract

Background With the proliferation of anti-transgender policies in some U.S. jurisdictions, this study examines the general, mental, and physical health of transgender and cisgender populations.

Methods Data from the 2020–2023 Behavioral Risk Factor Surveillance System were analyzed to examine associations between gender identity and health outcomes. Propensity score weighting was used to address potential imbalances among group characteristics. We conducted logistic regression for the binary outcome of self-rated health and quasi-Poisson regression for the number of days reporting poor mental and physical health.

Results Results reveal significant disparities in health outcomes, with transgender individuals reporting lower proportions of good general health and more days of poor mental and physical health compared to cisgender individuals. In the adjusted analyses, transgender individuals were significantly less likely to report good general health compared to cisgender peers (OR = 0.60, 95% CI = 0.52–0.69). Gender nonconforming (GNC), male-to-female (MTF), and female-to-male (FTM) individuals had lower odds of reporting good general health compared to cisgender individuals (GNC, OR = 0.46, 95% CI = 0.35–0.61; MTF, OR = 0.67, 95% CI = 0.53–0.85; FTM, OR = 0.71, 95% CI = 0.57–0.87). GNC individuals had an 86% higher frequency of poor mental health days (IRR = 1.86, 95% CI = 1.57–2.21) and a 37% higher frequency of poor physical health days (IRR = 1.37, 95% CI = 1.15–1.63) compared to cisgender counterparts. Similarly, MTF and FTM individuals had significantly higher frequencies of poor mental and physical health days.

Conclusions The study highlights significant health disparities faced by transgender individuals, who report poorer general, mental, and physical health. These findings underscore the need to address the unique challenges and improve health outcomes within the transgender community.

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Introduction

Gender minorities face unique health challenges [1, 2]. These challenges manifest in numerous physical, mental, and behavioral health disparities, with gender minorities experiencing a disproportionately high prevalence of adverse health outcomes [3, 4]. By 'gender minorities,' we refer to people whose gender does not correspond with the sex assigned to them at birth (e.g., transgender individuals), as well as those who define their gender outside of binary social constructs such as 'man' or 'woman' (e.g., gender diverse individuals) [5]. Prior research indicates that the gender minority population may be at greater risk for myocardial infarction and certain cancers compared to the non-gender minority population [6, 7]. Additionally, certain gender minority groups have a high prevalence of human immunodeficiency virus and other sexually transmitted infections [8–10]. Studies have also shown higher rates of alcohol, tobacco, and drug use among gender-minority individuals than among non-gender minority individuals [11–14]. Furthermore, compared to the general population or cisgender individuals, gender minorities have higher rates of psychiatric morbidities, including mood disorders, anxiety, depression, self-harm, and suicide [15, 16].

In addition to these health disparities, gender minorities report worse health-related quality of life than cisgender individuals. One study found that, in comparison with cisgender individuals, transgender individuals reported worse general health and more days per month of poor physical and mental health [17]. Another study found that gender minority adults were more likely than cisgender adults to report poor or fair overall health, limitations due to physical, mental, or emotional problems, and difficulty concentrating, remembering, or making decisions because of these issues [18]. An analysis by Downing and Przedworski revealed that transgender individuals were more likely to report worse mental health, and that gender minorities had higher odds of reporting poor quality of life compared to cisgender males or females [19].

The minority stress model offers valuable insights into understanding the disparities gender minorities face [20]. According to this model, marginalized groups face unique internal and external stressors, such as internalized negative attitudes, prejudice, and discrimination related to their socially stigmatized minority status [21]. These elevated stressors can contribute to adverse health outcomes or health disparities among minority populations [22, 23]. Evidence suggests that stigma contributes to transgender health inequalities in the U.S [24]. Systematic reviews have found associations between minority stressors and negative mental health outcomes, such as depression and suicidal ideation, among transgender and gender-nonconforming individuals [25, 26]. Another systematic review found that among transgender people, internalized stigma may have led to decreased physical health due to healthcare avoidance, reduced utilization, and delayed treatment, while internalized victimization led to decreased psychological health, including increased harmful behaviors such as substance use and attempted suicide [27]. Greater focus on minority stressors can benefit clinical practice and research into the pathways and causes of other adverse health outcomes, such as cardiovascular health [28, 29].

Given the recent shift regarding the proliferation of anti-transgender policies in some jurisdictions in the U.S. [30], it is crucial to monitor the health of gender minorities at the population level, particularly using recent population-based data. These policies can exacerbate existing health inequities and introduce new challenges for gender minorities. Additionally, addressing subgroup variations within the transgender population is essential to avoid masking potential differences in outcomes [31]. For instance, transgender men, transgender women, and transgender nonconforming individuals may experience distinct health challenges and stressors that require tailored interventions. This study utilizes 2020–2023 data to examine associations between gender minority status and self-reported general, physical, and mental health. By using recent, probability-based sampling to investigate these associations, this study contributes to the growing gender minority health literature. Furthermore, we apply a propensity score weighting method to account for potential imbalances in observed characteristics. We hypothesize that transgender individuals report poorer general, physical, and mental health compared to cisgender individuals.

Methods

Data

This study utilized data from the 2020–2023 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS, conducted annually by the Centers for Disease Control and Prevention, is one of the world's largest health-related surveys. It gathers data through telephone interviews from residents in all 50 states, the District of Columbia, Puerto Rico, the US Virgin Islands, and Guam. The survey aims to collect comprehensive information on health-related risk behaviors, chronic health conditions, healthcare access, substance use, and the use of preventive services. The BRFSS employed two sampling strategies: a disproportionate stratified sample (DSS) design for landline telephone numbers and a random sample design for cellular telephone numbers. In the DSS design, telephone numbers were divided into high-density and medium-density strata based on the likelihood of belonging to a household. The BRFSS used a commercially available cellular telephone sampling frame, drawing random

samples from cellular numbers sorted by area code and exchange. The target population included adults aged 18 and older residing in private homes or college housing with a working telephone. Many states used geographic stratification to ensure sufficient representation of smaller, geographically defined populations. The data for this analysis comes from an optional state module on sexual orientation and gender identity, which participating states could choose to include in their survey. Not all states opted to include this module. A detailed list of states that included this module for each year is provided in Supplement Table 1.

Measures

Dependent variables

This study examined three dependent variables: general health, mental health, and physical health. General health was assessed using the question, "Would you say that in general, your health is:" with response options of "Excellent," "Very good," "Good," "Fair," and "Poor." For analysis purposes, the responses "Excellent," "Very good," and "Good" were grouped into a "Good" category, while "Fair" and "Poor" were grouped into a "Poor" category. Mental, and physical health were measured through the following questions: "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" and "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" Participants reported either "none" or the number of days their health was not good. For analysis, "none" was recorded as zero days. Both mental health and physical health variables were treated as count variables, capturing the number of days participants reported their health was not good during the past 30 days.

Independent variables

The primary independent variable of interest in this study was gender identity. Gender identity was assessed using a two-part question: "Do you consider yourself to be transgender?" For those who responded affirmatively, a follow-up question was asked: "Do you consider yourself to be male-to-female, female-to-male, or gender nonconforming?" We operationalize gender identity in two ways. First, participants were categorized into two broad groups: cisgender (individuals who do not identify as transgender) and transgender (those who do). Second, a more detailed classification was employed, where participants were grouped into four categories: cisgender, male-to-female (MTF), female-to-male (FTM), and gender nonconforming (GNC). This approach enabled the capture of both binary and more detailed aspects of gender identity for subgroup analysis.

In addition to gender identity, several variables were included in the analysis to control for potential influences. These variables were age (categorized as Age 18 to 24, Age 25 to 34, Age 35 to 44, Age 45 to 54, Age 55 to 64, and Age 65 or older), race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Other, and Hispanic), marital status (Married, and Not Married), education level (Did Not Graduate High School, Graduated High School, Attended College, and Graduated College), health insurance status (Yes or No), and housing situation (Own, Rent, and Other). The "Non-Hispanic Other" race/ethnicity category included respondents who identified as non-Hispanic Asian, non-Hispanic American Indian or Alaska Native, non-Hispanic Native Hawaiian or Other Pacific Islander, and individuals who identified as multiple non-Hispanic races. Additionally, the survey year (2020 to 2023) was included as a predictor variable in the outcome models to account for temporal trends.

Statistical analysis

Participants' characteristics were described using weighted relative frequencies for each survey year, accounting for the complex design of the BRFSS survey. This study applied a propensity score (PS) approach to address confounding by balancing observed characteristics between groups by transgender status. In observational studies, PS aims to create a pseudo-randomized experiment by weighing individuals based on their estimated propensity scores to address observed characteristics imbalance [32, 33]. We employed gradient-boosted models to estimate propensity score weights [34]. These flexible machine-learning models can automatically handle nonlinearities and interactions among covariates, offering improved bias reduction and lower mean squared error compared to traditional parametric approaches [34, 35]. The analysis iteratively fits regression trees, where each subsequent iteration selects a new tree to best fit the residuals from the prior iteration [34, 36]. The PS models included participants' age, race/ethnicity, marital status, education level, health insurance status, and housing situation. The year-specific sampling weights were proportionally included in the PS models to account for the survey selection design [37–39]. We assessed the balance of observed characteristics between groups by calculating the absolute standardized mean difference (ASMD) before and after weighting [40]. An ASMD of less than 0.1 indicated a negligible imbalance between groups.

After deriving PS weights, we conducted separate regression analyses to examine the association between gender identity and three dependent variables: general,

mental, and physical health. Each regression model was adjusted for the survey year to control for temporal confounding, ensuring robust estimates. We performed a total of six regression models. Specifically, two logistic regression models were used to examine the association between gender identity (using both broad and detailed classifications) and general health. Four quasi-Poisson regression models were employed to analyze the relationship between gender identity (using both broad and detailed classifications) and mental and physical health outcomes [41]. Additionally, we conducted a sensitivity analysis using ordinal logistic regression models to examine the association between gender identity (using both broad and detailed classifications) and general health. To account for the BRFSS's complex survey design, all analyses incorporated propensity score weights, survey strata, and cluster variables. All statistical analyses were conducted using R software [42].

Results

The study analyzed data from the BRFSS (2020–2023) with a sample size of 919,786 individuals (Table 1). Most respondents identified as cisgender, with the proportion who identified as GNC increasing from 2020 to 2023. The proportion of older adults (65 years and above) increased from 22.29% in 2020 to 24.10% in 2023, while

Table 1 Weighted characteristics of the study sample from the BRFSS (2020–2023)

	2020 Weighted % (95% CI)	2021 Weighted % (95% CI)	2022 Weighted % (95% CI)	2023 Weighted % (95% CI)	Overall Weighted % (95% CI)
Sample Size (*n*)	218,124	216,333	230,625	254,704	919,786
Gender Identity Broad Classification					
Cisgender	99.46 (99.35, 99.57)	99.40 (99.33, 99.47)	99.28 (99.22, 99.34)	99.18 (99.09, 99.26)	99.33 (99.29, 99.37)
Transgender	0.54 (0.43, 0.65)	0.60 (0.53, 0.67)	0.72 (0.66, 0.78)	0.82 (0.74, 0.91)	0.67 (0.63, 0.71)
Gender Identity Detailed Classification					
Cisgender	99.46 (99.35, 99.57)	99.40 (99.33, 99.47)	99.28 (99.22, 99.34)	99.18 (99.09, 99.26)	99.33 (99.29, 99.37)
Male-to-Female	0.18 (0.14, 0.22)	0.17 (0.14, 0.20)	0.21 (0.18, 0.24)	0.24 (0.19, 0.29)	0.20 (0.18, 0.22)
Female-to-Male	0.21 (0.11, 0.30)	0.19 (0.15, 0.24)	0.23 (0.19, 0.27)	0.23 (0.19, 0.27)	0.22 (0.18, 0.25)
Gender Nonconforming	0.15 (0.12, 0.19)	0.23 (0.19, 0.27)	0.28 (0.24, 0.32)	0.35 (0.30, 0.41)	0.25 (0.23, 0.28)
Age					
Age 18 to 24	11.32 (10.95, 11.68)	9.81 (9.51, 10.12)	10.01 (9.71, 10.31)	9.96 (9.67, 10.26)	10.30 (10.14, 10.46)
Age 25 to 34	16.14 (15.75, 16.53)	16.40 (16.07, 16.73)	16.34 (16.00, 16.67)	15.85 (15.52, 16.18)	16.17 (15.99, 16.34)
Age 35 to 44	16.37 (15.99, 16.75)	16.99 (16.66, 17.31)	17.21 (16.88, 17.53)	17.11 (16.77, 17.44)	16.90 (16.73, 17.08)
Age 45 to 54	16.36 (15.97, 16.75)	16.04 (15.74, 16.35)	15.84 (15.53, 16.15)	15.99 (15.66, 16.32)	16.07 (15.90, 16.24)
Age 55 to 64	17.52 (17.14, 17.90)	17.60 (17.29, 17.91)	17.35 (17.03, 17.66)	16.99 (16.66, 17.32)	17.35 (17.18, 17.52)
Age 65 or older	22.29 (21.91, 22.67)	23.16 (22.85, 23.47)	23.26 (22.95, 23.58)	24.10 (23.77, 24.43)	23.21 (23.04, 23.38)
Race/ethnicity					
Non-Hispanic White	60.33 (59.82, 60.85)	67.74 (67.32, 68.15)	64.61 (64.19, 65.02)	59.05 (58.61, 59.49)	62.65 (62.42, 62.88)
Non-Hispanic Black	11.29 (10.98, 11.60)	11.63 (11.34, 11.93)	12.22 (11.93, 12.52)	11.49 (11.22, 11.77)	11.64 (11.49, 11.78)
Non-Hispanic Other	9.39 (8.99, 9.79)	7.27 (7.04, 7.50)	9.36 (9.09, 9.64)	11.01 (10.67, 11.35)	9.35 (9.18, 9.51)
Hispanic	18.98 (18.48, 19.48)	13.36 (13.00, 13.72)	13.81 (13.46, 14.16)	18.44 (18.03, 18.85)	16.37 (16.16, 16.58)
Marital Status					
Not Married	48.03 (47.52, 48.55)	46.09 (45.67, 46.51)	46.68 (46.26, 47.10)	47.02 (46.59, 47.46)	47.00 (46.77, 47.23)
Married	51.97 (51.45, 52.48)	53.91 (53.49, 54.33)	53.32 (52.90, 53.74)	52.98 (52.54, 53.41)	53.00 (52.77, 53.23)
Education Level					
Not Graduated High School	12.67 (12.24, 13.11)	10.04 (9.71, 10.38)	9.68 (9.35, 10.01)	10.55 (10.22, 10.89)	10.80 (10.62, 10.99)
Graduated High school	27.04 (26.59, 27.49)	27.72 (27.34, 28.11)	27.29 (26.90, 27.68)	26.08 (25.70, 26.46)	26.99 (26.78, 27.19)
Attended College	31.13 (30.64, 31.62)	31.28 (30.88, 31.68)	31.14 (30.73, 31.54)	31.03 (30.62, 31.45)	31.14 (30.92, 31.36)
Graduated from College	29.16 (28.75, 29.56)	30.96 (30.62, 31.29)	31.90 (31.55, 32.25)	32.34 (31.96, 32.72)	31.07 (30.88, 31.26)
Health Insurance Status					
No	12.06 (11.69, 12.42)	8.35 (8.05, 8.64)	8.00 (7.73, 8.27)	7.82 (7.52, 8.11)	9.11 (8.96, 9.27)
Yes	87.94 (87.58, 88.31)	91.65 (91.36, 91.95)	92.00 (91.73, 92.27)	92.18 (91.89, 92.48)	90.89 (90.73, 91.04)
Housing Situation					
Own	68.45 (67.99, 68.91)	72.66 (72.30, 73.03)	73.09 (72.74, 73.44)	71.97 (71.61, 72.33)	71.44 (71.25, 71.64)
Rent	25.63 (25.21, 26.05)	21.91 (21.58, 22.24)	21.41 (21.10, 21.72)	22.64 (22.31, 22.97)	22.99 (22.81, 23.17)
Other	5.92 (5.68, 6.16)	5.43 (5.23, 5.62)	5.50 (5.30, 5.71)	5.39 (5.20, 5.59)	5.57 (5.46, 5.67)

Weighted % refers to the Weighted Percentage, and 95% CI denotes the 95% Confidence Interval

the proportion of younger age groups (18–24) declined. Non-Hispanic White participants were the largest group, with their percentage peaking at 67.74% in 2021. Hispanic respondents varied, with a low of 13.36% in 2021 and a high of 18.44% in 2023. Approximately half of the respondents were married yearly, with about 53% in 2023. The number of participants reporting college graduation increased from 29.16% in 2020 to 32.34% in 2023. Health insurance coverage increased from 2020 to 2023. Most participants owned their homes.

Table 2 indicates significant disparities in health outcomes between cisgender and transgender individuals. For general health, a high proportion of cisgender individuals reported good health, ranging from 81.39 to 85.78% over the years, and an overall percentage of 83.62%. In contrast, transgender individuals reported lower proportions of good general health, with percentages decreasing from 80.96 to 63.89%, and an overall percentage of 71.43%. When examining mental health, cisgender individuals reported a mean of 4.53 days in the past 30 days where their mental health was not good, with yearly means ranging from 4.15 to 4.78 days. Transgender individuals reported significantly higher means, with an overall mean of 12.05 days and yearly means ranging from 10.41 to 13.19 days. Similarly, for physical health, cisgender individuals reported a mean of 3.72 days in the past 30 days where their physical health was not good, with yearly means ranging from 3.12 to 4.13 days. Transgender individuals reported higher means, with an overall mean of 5.83 days and yearly means ranging from 4.21 to 6.37 days. A detailed breakdown by transgender subgroups reveals that MTF individuals reported an overall 72.87% good general health, with a mean of 11.57 days of poor mental health and 5.20 days of poor physical health. FTM individuals reported 75.28% good general health, with a mean of 10.32 days of poor mental health and 5.60 days of poor physical health. GNC individuals reported the lowest proportion of good general health at 67.04%, with a mean of 13.91 days of poor mental health and 6.53 days of poor physical health.

Figure 1 displays the ASMD between cisgender and transgender groups on observed characteristics before and after propensity score weighting. All confounding variables had an ASMD below the threshold value of 0.1, indicating that balance was achieved between cisgender and transgender groups following the propensity score weighting adjustment. Similarly, Fig. 2 shows the ASMD between different gender identity groups before and after weighting. Each one-to-one comparison among the gender identity groups also demonstrated that the ASMD for all confounding variables was below the threshold, confirming the group balance after the weighting adjustment.

Tables 3 and 4 present the association between general health and gender identity using broader and detailed classifications. Participants identifying as transgender were significantly less likely to report good general health compared to cisgender participants, with an odds ratio (OR) of 0.60 (95% Confidence Interval [CI] = 0.52–0.69), indicating that transgender participants had 40% lower odds of reporting good general health compared to their cisgender counterparts. Within the transgender group, those identifying as GNC were significantly less likely to report good general health compared to cisgender participants (OR = 0.46, 95% CI = 0.35–0.61). Similarly, MTF and FTM individuals had lower odds of reporting good general health, with ORs of 0.67 (95% CI = 0.53–0.85) and 0.71 (95% CI = 0.57–0.87), respectively, compared to cisgender peers.

Supplement Tables 2 and 3 present the sensitivity analysis results between general health and gender identity using broader and more detailed classifications. The results from the ordinal logistic models were consistent with those from the binary logistic regressions. The odds of reporting better general health for transgender individuals compared to cisgender individuals were significantly lower (OR = 0.71, 95% CI: 0.62, 0.81). Furthermore, we found that those identifying as MTF (OR = 0.81, 95% CI: 0.66–0.99), FTM (OR = 0.73, 95% CI: 0.62–0.86), and GNC (OR = 0.59, 95% CI: 0.44–0.80) had lower odds of reporting better general health compared to cisgender participants.

The associations of poor mental and physical health frequency with gender identity are shown in Tables 5 and 6. Transgender individuals had a significantly higher frequency of poor mental and physical health days compared to cisgender peers, with an incidence rate ratio (IRR) of 1.82 (95% CI = 1.66–1.99) for mental health and 1.38 (95% CI = 1.25–1.53) for physical health. In the detailed transgender classification, those identifying as GNC had an 86% higher frequency of poor mental health days (IRR = 1.86, 95% CI = 1.57–2.21) compared to cisgender peers. Similarly, MTF (IRR = 1.84, 95% CI = 1.58–2.14) and FTM individuals (IRR = 1.72, 95% CI = 1.50–1.96) had a higher frequency of poor mental health days compared to their cisgender counterparts. In terms of physical health, FTM participants experienced a 51% higher frequency of poor physical health days compared to their cisgender counterparts (IRR = 1.51, 95% CI = 1.29–1.77). GNC individuals had a 37% higher frequency of poor physical health days (IRR = 1.37, 95% CI = 1.15–1.63), and MTF individuals had a 23% higher frequency (IRR = 1.23, 95% CI = 1.03–1.45) compared to the cisgender population.

Discussion

Overall, our study highlights that transgender individuals, including those identifying as gender nonconforming, male-to-female, and female-to-male, experience poorer

Table 2 Prevalence of general health and mean of mental and physical health outcomes among different gender identity groups

	General Health					Mental Health					Physical Health				
	2020*	**2021***	**2022***	**2023***	**Overall***	**2020****	**2021****	**2022****	**2023****	**Overall****	**2020****	**2021****	**2022****	**2023****	**Overall****
Broad Classification															
Cisgender	85.78 (85.41, 86.15)	84.32 (84.01, 84.63)	83.07 (82.74, 83.40)	81.39 (81.04, 81.75)	83.62 (83.45, 83.79)	4.15 (0.0403)	4.49 (0.0358)	4.78 (0.0374)	4.73 (0.0398)	4.53 (0.0194)	3.12 (0.0384)	3.58 (0.0329)	4.08 (0.0369)	4.13 (0.0352)	3.72 (0.0181)
Transgender	80.96 (75.46, 86.46)	74.76 (69.73, 79.78)	70.81 (66.71, 74.91)	63.89 (58.81, 68.98)	71.43 (68.74, 74.12)	10.41 (1.2003)	10.93 (0.6367)	12.85 (0.5641)	13.19 (0.6208)	12.05 (0.3961)	4.21 (0.5599)	6.02 (0.5817)	6.36 (0.3944)	6.37 (0.4273)	5.83 (0.2523)
Detailed Classification															
Cisgender	85.78 (85.41, 86.15)	84.32 (84.01, 84.63)	83.07 (82.74, 83.40)	81.39 (81.04, 81.75)	83.62 (83.45, 83.79)	4.15 (0.0403)	4.49 (0.0358)	4.78 (0.0374)	4.73 (0.0398)	4.53 (0.0194)	3.12 (0.0384)	3.58 (0.0329)	4.08 (0.0369)	4.13 (0.0352)	3.72 (0.0181)
Male-to-Female	84.54 (78.40, 90.67)	72.42 (64.30, 80.55)	70.63 (63.84, 77.42)	66.43 (57.18, 75.69)	72.87 (68.66, 77.07)	8.88 (1.1075)	9.59 (1.1266)	12.41 (0.9347)	14.03 (1.2841)	11.57 (0.6326)	4.10 (0.8102)	5.52 (0.8851)	5.81 (0.6923)	5.37 (0.7084)	5.20 (0.3878)
Female-to-Male	82.32 (71.48, 93.16)	79.92 (71.84, 88.01)	75.02 (67.78, 82.26)	66.13 (56.63, 75.63)	75.28 (70.20, 80.37)	8.98 (2.4279)	10.99 (1.2924)	11.44 (1.0137)	10.09 (0.9993)	10.32 (0.8156)	3.99 (1.0512)	5.05 (0.8850)	5.77 (0.6795)	7.24 (0.8227)	5.60 (0.4885)
Gender Nonconforming	74.94 (65.53, 84.34)	72.17 (63.31, 81.03)	67.44 (60.44, 74.44)	60.73 (52.90, 68.55)	67.04 (62.75, 71.33)	14.14 (1.5695)	11.86 (0.8971)	14.35 (0.9242)	14.63 (0.8472)	13.91 (0.5097)	4.63 (0.9046)	7.19 (1.0714)	7.28 (0.6632)	6.48 (0.6715)	6.53 (0.4095)

* Indicates the weighted percentage (95% confidence interval). **Indicates the mean (standard error)

General Health: Assessed by the question, 'Would you say that in general, your health is:' with responses 'Excellent,' 'Very good,' 'Good,' 'Fair,' and 'Poor.' For analysis, 'Excellent,' Very good,' and 'Good' were grouped as 'Good,' and 'Fair' and 'Poor' as 'Poor'

Mental Health: Measured by 'For how many days during the past 30 days was your mental health not good?' including stress, depression, and emotional problems. Responses were 'none' or the number of days

Physical Health: Measured by 'For how many days during the past 30 days was your physical health not good?' including illness and injury. Responses were 'none' or the number of days

For analysis, none was recorded as zero days. Both mental and physical health were treated as count variables, indicating the number of days health was not good in the past 30 days

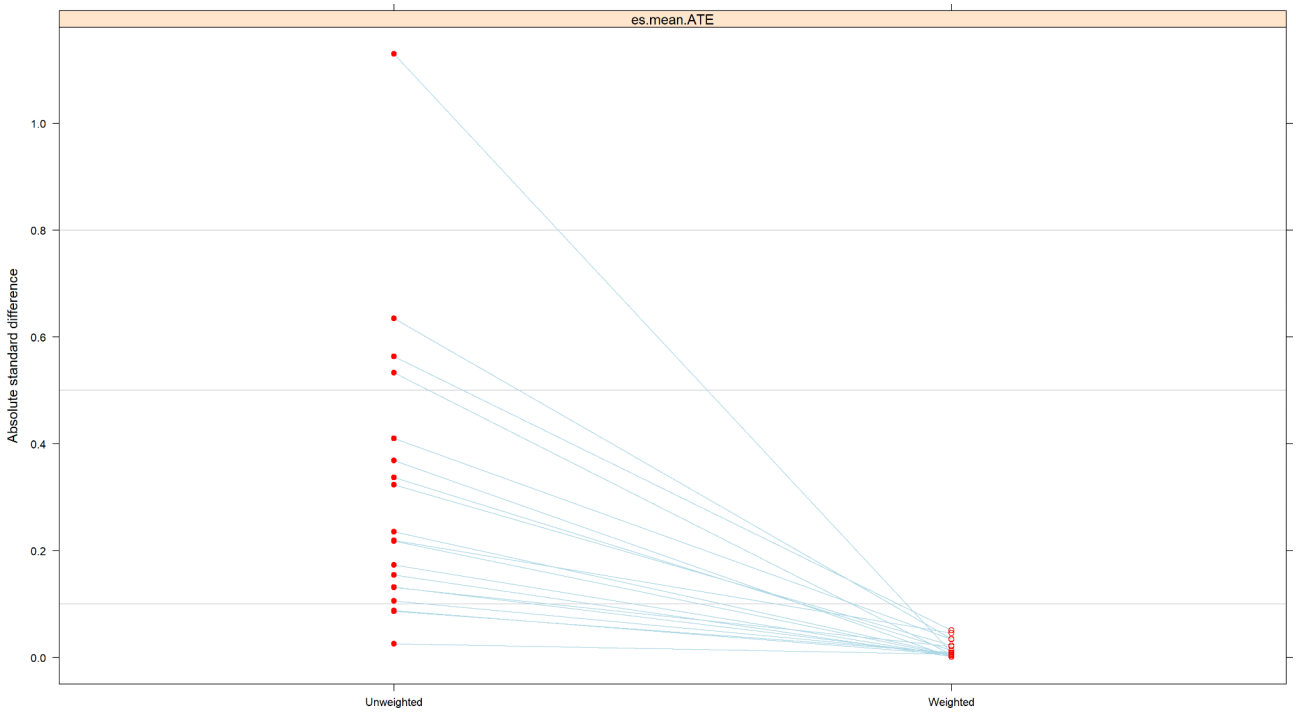

Fig. 1 Absolute standardized mean differences between the cisgender and transgender groups on observed characteristics before and after weighting

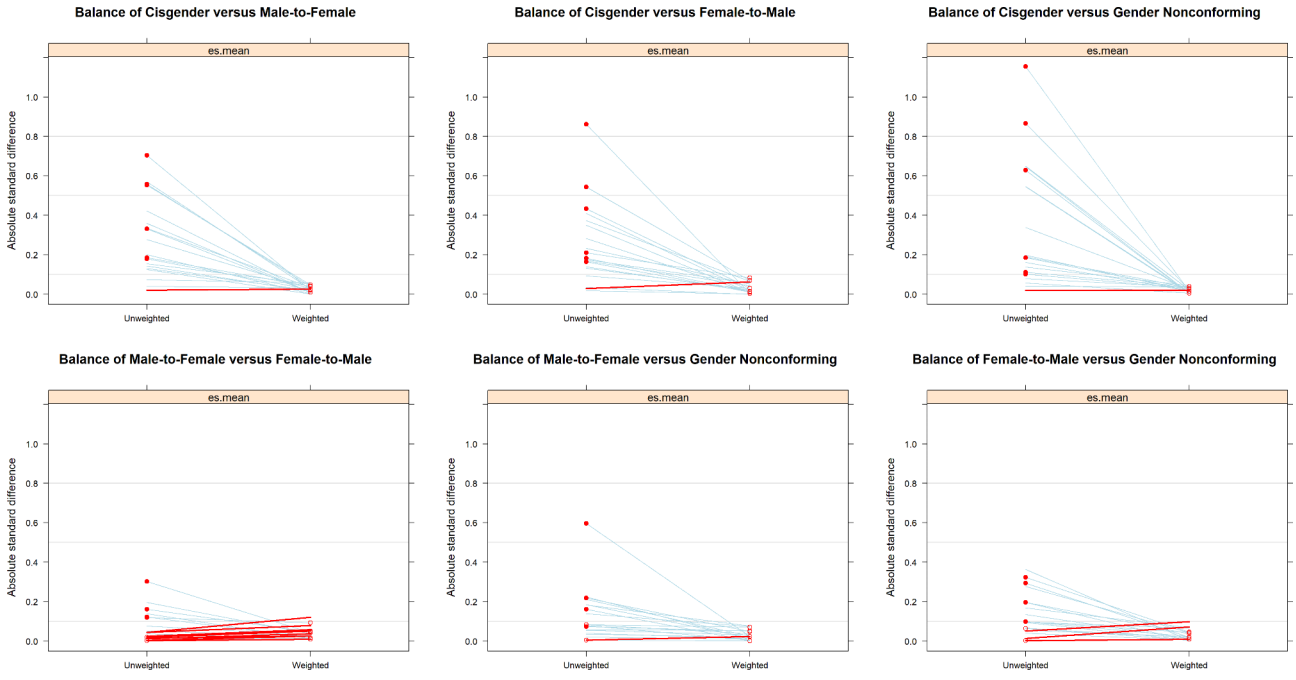

Fig. 2 Absolute standardized mean differences between the gender identity groups on observed characteristics before and after weighing

general, mental, and physical health compared to cisgender individuals, with gender nonconforming individuals facing the most significant health challenges. Our results confirmed our hypothesis that transgender individuals report poorer general, physical, and mental health compared to cisgender individuals. The recent proliferation of anti-transgender policies in some US jurisdictions may exacerbate existing health inequities and introduce new challenges for gender minorities [30]. This restrictive policy landscape can increase minority stress and further worsen health outcomes for this subpopulation [30]. These findings are consistent with previous research

Table 3 Association between general health and gender identity with broader classification

	General Health OR (95% CI)
Gender Identity	
Cisgender	Reference
Transgender	0.60 (0.52, 0.69)
Year	
2020	Reference
2021	0.82 (0.65, 1.03)
2022	0.71 (0.55, 0.90)
2023	0.64 (0.51, 0.81)

OR refers to the Odds Ratio, and 95% CI denotes the 95% Confidence Interval. The propensity score model included participants' age, race/ethnicity, marital status, education level, health insurance status, and housing situation

Table 4 Association between general health and gender identity with detailed classification

	General Health OR (95% CI)
Gender Identity	
Cisgender	Reference
Male-to-Female	0.67 (0.53, 0.85)
Female-to-Male	0.71 (0.57, 0.87)
Gender Nonconforming	0.46 (0.35, 0.61)
Year	
2020	Reference
2021	0.87 (0.64, 1.19)
2022	0.72 (0.52, 1.02)
2023	0.65 (0.48, 0.89)

OR refers to the Odds Ratio, and 95% CI denotes the 95% Confidence Interval. The propensity score model included participants' age, race/ethnicity, marital status, education level, health insurance status, and housing situation

Table 5 Association between mental and physical health with gender identity using a broader classification

	Mental Health IRR (95% CI)	Physical Health IRR (95% CI)
Gender Identity		
Cisgender	Reference	Reference
Transgender	1.82 (1.66, 1.99)	1.38 (1.25, 1.53)
Year		
2020	Reference	Reference
2021	1.07 (0.89, 1.28)	1.24 (1.05, 1.48)
2022	1.27 (1.05, 1.54)	1.34 (1.15, 1.57)
2023	1.20 (1.00, 1.45)	1.38 (1.16, 1.63)

IRR refers to the Incidence Rate Ratio, and 95% CI denotes the 95% Confidence Interval. The propensity score model included participants' age, race/ethnicity, marital status, education level, health insurance status, and housing situation

Table 6 Association between mental and physical health with gender identity using a detailed classification

	Mental Health IRR (95% CI)	Physical Health IRR (95% CI)
Gender Identity		
Cisgender	Reference	Reference
Male-to-Female	1.84 (1.58, 2.14)	1.23 (1.03, 1.45)
Female-to-Male	1.72 (1.50, 1.96)	1.51 (1.29, 1.77)
Gender Nonconforming	1.86 (1.57, 2.21)	1.37 (1.15, 1.63)
Year		
2020	Reference	Reference
2021	1.07 (0.85, 1.34)	1.21 (0.96, 1.52)
2022	1.30 (1.02, 1.66)	1.31 (1.06, 1.64)
2023	1.23 (0.99, 1.52)	1.40 (1.12, 1.76)

IRR refers to the Incidence Rate Ratio, and 95% CI denotes the 95% Confidence Interval. The propensity score model included participants' age, race/ethnicity, marital status, education level, health insurance status, and housing situation

indicating that transgender individuals often experience poorer general health outcomes. For instance, a previous study found that transgender groups were more likely to report worse general health and disabilities compared to cisgender individuals [19]. Additionally, studies have shown that transgender individuals face numerous barriers to healthcare, including discrimination and lack of culturally competent care, which can contribute to poorer health outcomes [24, 43]. These barriers often result in delayed or avoided medical care, leading to the worsening of health [44].

Our study provides recent, population-based data showing mental health disparities among transgender individuals, which aligns with studies reporting high rates of depression and anxiety in this population [45, 46]. The higher incidence of poor mental health days among transgender individuals may support the minority stress model [21]. This model suggests that marginalized groups face unique stressors, such as internalized stigma and discrimination, which can lead to adverse mental health outcomes [22, 23]. Prior studies have linked minority stressors to adverse mental health outcomes, including depression and suicidal ideation, among transgender individuals [21, 28]. The chronic stress associated with minority status may lead to heightened anxiety, which, over time, can contribute to the development of more severe mental health conditions [21]. Additionally, the lack of social support and the experience of social rejection can exacerbate feelings of isolation and depression [47].

The higher frequency of poor physical health days among transgender individuals, particularly FTM and GNC individuals shown in the current study, is consistent with research indicating that gender minorities are at greater risk for various adverse health outcomes [8–10, 17]. Previous studies have documented that transgender individuals are more likely to experience chronic conditions [6, 29]. Partly, this is due to the stress associated with minority status, which can lead to behaviors that increase the likelihood of chronic diseases. Internalized stigma and healthcare avoidance, as documented in earlier studies, likely contribute to these physical health inequities [24, 48]. Avoiding healthcare due to fear of discrimination can result in conditions being identified

late, which could have been treated more effectively if detected earlier [44, 48].

Transgender men, transgender women, and gender nonconforming individuals each face unique health challenges and stressors. Our study reveals significant variation within the transgender population, particularly for those individuals who identify as GNC. By employing a detailed classification of gender identity, this research provides subgroup differences, which has implications for identifying those with specific needs as well as for intervention targeting [4, 6]. Previous research has highlighted the diverse experiences and health needs within the transgender community, underscoring the importance of subgroup analysis. A homogeneous classification of 'transgender' can mask differences, making it challenging to recognize and address the unique needs of each subgroup [4, 6].

Recommendations for improving transgender health

The findings of our study have significant public health implications. The documented health inequities between transgender and cisgender individuals underscore the need for targeted public health initiatives. Efforts should focus on raising awareness about the unique health challenges faced by transgender individuals and promoting inclusive programs [3]. Additionally, public health policies need to reduce barriers to healthcare access for transgender individuals by addressing discrimination and enhancing the cultural competence of healthcare providers [3, 44, 48]. Public health surveillance systems need to include measures of gender identity to better monitor and address health inequities in transgender populations, as most surveys do not capture various gender identities [3].

Healthcare providers can improve their standards of practice by being more inclusive and sensitive to transgender identities and needs. Engaging in transgender-specific cultural competence training and consulting with transgender-led community agencies can enhance the quality of care and encourage gender minorities to utilize healthcare services. Providers should also ensure that staff members are knowledgeable about transgender language and culture, as culturally competent care can improve the likelihood of transgender individuals seeking medical attention [48].

This study has several notable strengths. First, we used a large and representative sample size that is generalizable at the population level. Second, we utilized recent data to reflect current trends and patterns. Third, to ensure that differences were not masked by comparing general populations, we used gender-diverse subgroups. Additionally, the use of propensity scores helped address imbalances in observed characteristics between transgender and cisgender participants. Future studies could build on these findings by exploring the causal mechanisms behind the observed group differences and comparing health outcomes among transgender groups. Several limitations of this study should be noted. The data were obtained from a survey that relies on self-reported information, which may be influenced by social desirability bias. It is unclear to what extent respondents may have concealed their transgender identity due to stigma. Additionally, the general, physical, and mental health measures were self-reported, so no clinical diagnoses can be inferred. The study employed a propensity score approach to address potential imbalances in observed characteristics; however, the balance of unobserved characteristics remains untestable. Another limitation is that data is not collected for individuals living in the Northern Mariana Islands and American Samoa. Additionally, it does not represent states, the District of Columbia, and Puerto Rico that did not include the optional sexual orientation and gender identity module in their survey, which may limit the generalizability of the findings to these regions and states. Finally, the survey may not have captured all relevant variables that influence health outcomes for this population, such as access to gender-affirming care.

Conclusion

Our study significantly contributes to the growing body of literature on gender minority health by providing recent, population-based data that reveal substantial health disparities between transgender and cisgender individuals. The findings underscore the unique challenges faced by gender minorities, including those identifying as gender nonconforming, male-to-female, and female-to-male. These groups experience worse general, mental, and physical health outcomes compared to their cisgender counterparts. Such disparities are likely exacerbated by minority stressors, such as stigma and discrimination, which negatively impact health outcomes. The recent increase in anti-transgender policies in some US jurisdictions may further intensify these health challenges, highlighting the importance of ongoing monitoring and targeted public health interventions. The findings of this study suggest the need for research involving transgender individuals to consider subgroups within this community. Collapsing transgender subcategories into one group may mask significant differences within the transgender population. Understanding the diverse experiences within the transgender community is crucial for identifying specific needs and creating effective interventions aimed at promoting health equity.

Abbreviations

ASMD	Absolute Standardized Mean Difference
BRFSS	Behavioral Risk Factor Surveillance System
CI	Confidence Interval
DSS	Disproportionate Stratified Sample

FTM	Female-to-Male
GNC	Gender Nonconforming
IRR	Incidence Rate Ratio
MTF	Male-to-Female
OR	Odds Ratio
PS	Propensity Score
U.S.	United States

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12939-024-02364-4.

Supplementary Material 1

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Author contributions
S.A: Conceptualization, Project administration, Methodology, Supervision, Writing – original draft, Writing – review and editing.G.D: Data Curation, Methodology, Formal analysis. Writing – review and editing.T.E: Writing – original draft, Writing – review and editing. All authors reviewed the manuscript.

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Data availability
Data is publicly available at https://www.cdc.gov/brfss/index.html.

Declarations

Ethics approval and consent to participate
This study followed all relevant guidelines and regulations. As the study utilized publicly accessible, de-identified data, no ethical review or approval was needed. The survey administrators obtained informed consent from all participants.

Consent for publication
Not applicable.

Conflict of interest
The authors declare no conflict of interest.

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References

1. Institute of Medicine. The Health of Lesbian, Gay, Bisexual, and Transgender people: building a Foundation for Better understanding. National Academies; 2011. https://doi.org/10.17226/13128
2. Winter S, Diamond M, Green J, et al. Transgender people: health at the margins of society. Lancet. 2016;388(10042):390–400. https://doi.org/10.1016/S0140-6736(16)00683-8
3. Reisner SL, Poteat T, Keatley J, et al. Global health burden and needs of transgender populations: a review. Lancet. 2016;388(10042):412–36. https://doi.org/10.1016/S0140-6736(16)00684-X
4. Scheim AI, Baker KE, Restar AJ, Sell RL. Health and Health Care among Transgender adults in the United States. Annu Rev Public Health. 2022;43(43, 2022):503–23. https://doi.org/10.1146/annurev-publhealth-052620-100313
5. American Psychological Association. Guidelines for psychological practice with transgender and gender nonconforming people. Am Psychol. 2015;70:832–64. https://doi.org/10.1037/a0039906
6. Alzahrani T, Nguyen T, Ryan A, et al. Cardiovascular Disease Risk factors and myocardial infarction in the Transgender Population. Circulation: Cardiovasc Qual Outcomes. 2019;12(4):e005597. https://doi.org/10.1161/CIRCOUTCOMES.119.005597
7. Braun H, Nash R, Tangpricha V, Brockman J, Ward K, Goodman M. Cancer in Transgender people: evidence and methodological considerations. Epidemiol Rev. 2017;39(1):93–107. https://doi.org/10.1093/epirev/mxw003
8. Nuttbrock L, Hwahng S, Bockting W, et al. Lifetime risk factors for HIV/Sexually transmitted infections among male-to-female Transgender persons. JAIDS J Acquir Immune Defic Syndr. 2009;52(3):417. https://doi.org/10.1097/QAI.0b013e3181ab6ed8
9. MacCarthy S, Poteat T, Xia Z, et al. Current research gaps: a global systematic review of HIV and sexually transmissible infections among transgender populations. Sex Health. 2017;14(5):456–68. https://doi.org/10.1071/SH17096
10. Van Gerwen OT, Jani A, Long DM, Austin EL, Musgrove K, Muzny CA. Prevalence of sexually transmitted infections and human immunodeficiency virus in Transgender persons: a systematic review. Transgender Health. 2020;5(2):90–103. https://doi.org/10.1089/trgh.2019.0053
11. Azagba S, Latham K, Shan L. Cigarette, smokeless tobacco, and alcohol use among transgender adults in the United States. Int J Drug Policy. 2019;73:163–9. https://doi.org/10.1016/j.drugpo.2019.07.024
12. Buchting FO, Emory KT, Scout, et al. Transgender Use of cigarettes, cigars, and E-Cigarettes in a National Study. Am J Prev Med. 2017;53(1):e1–7. https://doi.org/10.1016/j.amepre.2016.11.022
13. Hughto JMW, Quinn EK, Dunbar MS, Rose AJ, Shireman TI, Jasuja GK. Prevalence and co-occurrence of Alcohol, Nicotine, and other Substance Use Disorder diagnoses among US Transgender and Cisgender adults. JAMA Netw Open. 2021;4(2):e2036512. https://doi.org/10.1001/jamanetworkopen.2020.36512
14. Sawyer AN, Bono RS, Kaplan B, Breland AB. Nicotine/tobacco use disparities among transgender and gender diverse adults: findings from wave 4 PATH data. Drug Alcohol Depend. 2022;232:109268. https://doi.org/10.1016/j.drugalcdep.2022.109268
15. Hanna B, Desai R, Parekh T, Guirguis E, Kumar G, Sachdeva R. Psychiatric disorders in the U.S. transgender population. Ann Epidemiol. 2019;39:1–e71. https://doi.org/10.1016/j.annepidem.2019.09.009
16. Pinna F, Paribello P, Somaini G, et al. Mental health in transgender individuals: a systematic review. Int Rev Psychiatry. 2022;34(3/4):292–359. https://doi.org/10.1080/09540261.2022.2093629
17. Meyer IH, Brown TNT, Herman JL, Reisner SL, Bockting WO. Demographic characteristics and Health Status of Transgender adults in select US regions: behavioral risk factor Surveillance System, 2014. Am J Public Health. 2017;107(4):582–9. https://doi.org/10.2105/AJPH.2016.303648
18. Streed CG Jr, McCarthy EP, Haas JS. Association between gender minority status and self-reported physical and Mental Health in the United States. JAMA Intern Med. 2017;177(8):1210–2. https://doi.org/10.1001/jamainternmed.2017.1460
19. Downing JM, Przedworski JM. Health of Transgender adults in the U.S., 2014–2016. Am J Prev Med. 2018;55(3):336–44. https://doi.org/10.1016/j.amepre.2018.04.045
20. Brooks VR. Minority stress and lesbian women. Lexington Books; 1981.
21. Meyer IH. Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. Psychol Bull. 2003;129(5):674–97. https://doi.org/10.1037/0033-2909.129.5.674
22. Hatzenbuehler ML, Pachankis JE. Stigma and Minority Stress as Social Determinants of Health among Lesbian, Gay, Bisexual, and Transgender Youth: Research evidence and clinical implications. Pediatr Clin. 2016;63(6):985–97. https://doi.org/10.1016/j.pcl.2016.07.003
23. Hatzenbuehler ML, Phelan JC, Link BG. Stigma as a Fundamental cause of Population Health inequalities. Am J Public Health. 2013;103(5):813–21. https://doi.org/10.2105/AJPH.2012.301069
24. White Hughto JM, Reisner SL, Pachankis JE. Transgender stigma and health: a critical review of stigma determinants, mechanisms, and interventions. Soc Sci Med. 2015;147:222–31. https://doi.org/10.1016/j.socscimed.2015.11.010
25. Pellicane MJ, Ciesla JA. Associations between minority stress, depression, and suicidal ideation and attempts in transgender and gender diverse (TGD) individuals: systematic review and meta-analysis. Clin Psychol Rev. 2022;91:102113. https://doi.org/10.1016/j.cpr.2021.102113
26. Valentine SE, Shipherd JC. A systematic review of social stress and mental health among transgender and gender non-conforming people in the United States. Clin Psychol Rev. 2018;66:24–38. https://doi.org/10.1016/j.cpr.2018.03.003
27. Drabish K, Theeke LA. Health Impact of Stigma, discrimination, prejudice, and Bias experienced by Transgender people: a systematic review of quantitative studies. Issues Ment Health Nurs. 2022;43(2):111–8. https://doi.org/10.1080/01612840.2021.1961330

28. Hendricks ML, Testa RJ. A conceptual framework for clinical work with transgender and gender nonconforming clients: an adaptation of the minority stress model. Prof Psychology: Res Pract. 2012;43(5):460–7. https://doi.org/10.1037/a0029597
29. Streed CG, Beach LB, Caceres BA, et al. Assessing and addressing Cardiovascular Health in people who are transgender and gender Diverse: A Scientific Statement from the American Heart Association. Circulation. 2021;144(6):e136–48. https://doi.org/10.1161/CIR.0000000000001003
30. Barbee H, Deal C, Gonzales G. Anti-transgender Legislation—A Public Health Concern for Transgender Youth. JAMA Pediatr. 2022;176(2):125–6. https://doi.org/10.1001/jamapediatrics.2021.4483
31. Henderson ER. A comparison of Health-Related Quality of Life among Transgender adults in the United States. J Homosex. 2022;69(5):857–74. https://doi.org/10.1080/00918369.2021.1892406
32. Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. Biometrika. 1983;70(1):41–55. https://doi.org/10.1093/biomet/70.1.41
33. D'Agostino RB. Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. Statist Med. 1998;17(19):2265–81. https://doi.org/10.1002/(SICI)1097-0258(19981015)17:19%3C2265::AID-SIM918%3E3.0.CO;2-B
34. McCaffrey DF, Griffin BA, Almirall D, Slaughter ME, Ramchand R, Burgette LF. A tutorial on propensity score estimation for multiple treatments using generalized boosted models. Stat Med. 2013;32(19):3388–414. https://doi.org/10.1002/sim.5753
35. Lee BK, Lessler J, Stuart EA. Improving propensity score weighting using machine learning. Stat Med. 2010;29(3):337–46. https://doi.org/10.1002/sim.3782
36. Cefalu M, Ridgeway G, McCaffrey D, Morral A. Beth Ann Griffin, and Lane Burgette. Twang: Toolkit for Weighting and Analysis of Nonequivalent groups. Published Online Febr. 2006;9:2. https://doi.org/10.32614/CRAN.package.twang
37. DuGoff EH, Schuler M, Stuart EA. Generalizing observational study results: applying propensity score methods to complex surveys. Health Serv Res. 2014;49(1):284–303. https://doi.org/10.1111/1475-6773.12090
38. Ridgeway G, Kovalchik SA, Griffin BA, Kabeto MU. Propensity Score Analysis with Survey Weighted Data. J Causal Inference. 2015;3(2):237–49. https://doi.org/10.1515/jci-2014-0039
39. Austin PC, Jembere N, Chiu M. Propensity score matching and complex surveys. Stat Methods Med Res. 2018;27(4):1240–57. https://doi.org/10.1177/0962280216658920
40. Austin PC. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. Stat Med. 2009;28(25):3083–107. https://doi.org/10.1002/sim.3697
41. Ver Hoef JM, Boveng PL, QUASI-POISSON VS. NEGATIVE BINOMIAL, REGRESSION: HOW SHOULD WE MODEL OVERDISPERSED COUNT DATA?. Ecology. 2007;88(11):2766–72. https://doi.org/10.1890/07-0043.1
42. R Core Team. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. Published online 2024. https://www.R-project.org/
43. Grant JM, Mottet LA, Tanis J, Min D. Transgender discrimination survey. *National Center for Transgender Equality and National Gay and Lesbian Task Force: Washington*. DC USA. 2011;1(1):2–7.
44. Seelman KL, Colón-Diaz MJP, LeCroix RH, Xavier-Brier M, Kattari L. Transgender Noninclusive Healthcare and Delaying Care because of fear: connections to General Health and Mental Health among Transgender adults. Transgender Health. 2017;2(1):17–28. https://doi.org/10.1089/trgh.2016.0024
45. Bockting WO, Miner MH, Swinburne Romine RE, Hamilton A, Coleman E, Stigma. Mental Health, and Resilience in an online sample of the US Transgender Population. Am J Public Health. 2013;103(5):943–51. https://doi.org/10.2105/AJPH.2013.301241
46. Reisner SL, White Hughto JM, Gamarel KE, Keuroghlian AS, Mizock L, Pachankis JE. Discriminatory experiences associated with posttraumatic stress disorder symptoms among transgender adults. J Couns Psychol. 2016;63(5):509–19. https://doi.org/10.1037/cou0000143
47. Budge SL, Adelson JL, Howard KAS. Anxiety and depression in transgender individuals: the roles of transition status, loss, social support, and coping. J Consult Clin Psychol. 2013;81(3):545–57. https://doi.org/10.1037/a0031774
48. Poteat T, German D, Kerrigan D. Managing uncertainty: a grounded theory of stigma in transgender health care encounters. Soc Sci Med. 2013;84:22–9. https://doi.org/10.1016/j.socscimed.2013.02.019

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