The Relationship Between Tobacco Use and Legal Document Gender-Marker Change, Hormone Use, and Gender-Affirming Surgery in a United States Sample of Trans-Feminine and Trans-Masculine Individuals: Implications for Cardiovascular Health

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Abstract

Purpose: Transgender individuals smoke tobacco at disproportionately higher rates than the general U.S. population, and concurrent use of gender-affirming hormones (estrogen or testosterone) and tobacco confers greater cardiovascular (CV) risk. This study examines the relationship between tobacco use and legal document gender-marker change, and medical/surgical interventions for gender transition.

Methods: Data came from an Internet-based survey of U.S. trans-feminine ($n=631$) and trans-masculine ($n=473$) individuals. We used multivariable logistic regression to investigate the relationship between past 3-month tobacco use and legal document gender-marker change, hormone use, and gender-affirming surgery controlling for demographic covariates and enacted and felt stigma.

Results: Compared to trans-feminine participants, trans-masculine individuals reported significantly higher rates of lifetime (74.4% vs. 63.5%) and past 3-month tobacco use (47.8% vs. 36.1%), and began smoking at an earlier age (14.5 vs. 15.5 years). Trans-feminine smokers reported significantly more frequent and heavier use. Adjusting for demographic covariates and enacted and felt stigma, legal document gender-marker change was associated with lower tobacco-use odds among trans-feminine individuals, whereas gender-affirming surgery predicted lower smoking odds among trans-masculine individuals. There were no significant differences in tobacco use by hormone use status.

Conclusion: In this study, trans-masculine individuals were more likely to smoke and trans-feminine individuals reported heavier use. It is concerning that individuals receiving hormones did not report lower smoking rates, given the elevated CV risk of this combination. This is a missed opportunity to intervene on a major public health issue and highlights the need for smoking cessation interventions in this population.

Keywords: cardiovascular risk, gender transition, smoking, tobacco use, transgender

Introduction

ALTHOUGH SMOKING RATES have decreased in the general population to ~15%,[1] smoking rates among several subgroups remain high. Transgender individuals are one such group. The transgender population is a diverse group of individuals whose gender identity and/or gender expression differ from the sex that they were assigned at birth (i.e., male or female).[2,3] This incongruence can lead to distress known as "gender dysphoria," for which some patients seek psychological, hormonal, and/or surgical treatments.[4]

Estimates of tobacco use among transgender individuals vary widely between 33.2% and 83%.[5–7] Rath et al.[6] found that transgender individuals smoked at higher rates compared to both cisgender (gender identity aligns with sex assigned at birth) heterosexual individuals and cisgender lesbian, gay, and bisexual (LGB) people. Gamarel et al.[5] also found that 51.7% of transgender women reported making at least one

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attempt to quit smoking, offering the possibility for smoking cessation interventions to impact tobacco use in this population. In addition to tobacco use, transgender individuals also experience many other health disparities[2,8] (e.g., depression,[9,10] suicidality,[11] nonsuicidal self-injury,[12] alcohol and drug abuse,[13,14] violence,[15] and sexually transmitted infections[16]), and many encounter insensitive or discriminatory treatment when attempting to access healthcare,[17–19] potentially explaining lower rates of healthcare utilization among transgender individuals.[20] Overall, transgender individuals are more likely than cisgender individuals to rate their health as poor.[9]

Despite higher rates of tobacco use among transgender individuals, little is known about factors that contribute to these disparities. Among LGB individuals, minority stressors (e.g., discrimination, prejudice, and stigma)[21] are associated with increased odds of tobacco use and decreased odds of attempting to quit.[22,23] Similarly, coping with minority stress may provide one explanation for tobacco use among transgender individuals.[24] For example, in a convenience sample of 73 trans-masculine individuals (gender identity on a masculine spectrum but assigned female at birth), Reisner et al.[10] found that 15.6% of participants were "syndemic" with elevated rates of tobacco use, alcohol use, depressive symptomatology, obesity, and asthma. Among syndemic individuals, tobacco use was associated with healthcare discrimination.

Tobacco use, which itself poses cardiovascular (CV) risks, is a particularly relevant component of transgender healthcare because many transgender individuals take feminizing or masculinizing hormones as part of their gender transition.[25] While the relationship between gender-affirming hormone use (hereafter referred to as "hormone use") and CV risk warrants further study, Streed et al.[26] found that hormone therapy was associated with worsening of CV risk factors. Although exogenous estrogens have been linked to increased risk for venous thromboembolism,[27,28] data obtained from cisgender postmenopausal women receiving hormone replacement therapy are controversial as to the precise relationship between estrogen and CV risk.[29,30] Still, some researchers recommend exercising caution.[29] Preliminary studies of trans-feminine individuals (gender identity on a feminine spectrum but assigned male at birth) receiving estrogen for gender transition have yielded mixed results regarding associated CV risks.[31–33] Nonetheless, at least one recent retrospective cohort study found increased incidence of venous thromboembolism among trans-feminine individuals on estrogen.[33] CV risk may also be related to formulation, dosage, duration of treatment, and route of estrogen administration.[28,31] Testosterone may also carry CV risks. While it is not clear if testosterone for gender transition independently elevates CV risk and most research in this area has focused on testosterone for other indications (e.g., hypogonadism or postprostatectomy), androgen therapy in trans-masculine individuals is associated with increased serum triglycerides and decreased high-density lipoprotein cholesterol, both of which are CV risk factors.[34–36]

The aims of this study were to assess the prevalence of tobacco use in a U.S. sample of transgender adults and to explore associations between past 3-month tobacco use and markers of gender transition (legal document gender-marker change, hormone use, and gender-affirming surgery), controlling for demographic covariates and enacted/felt stigma. Based on the potential risks associated with concurrent tobacco use and hormone use, we hypothesized that individuals currently receiving hormones would be less likely to have used tobacco in the past 3 months. In addition, we hypothesized that having undergone gender-affirming surgery would be related to lower odds of past 3-month tobacco use, after controlling for stigma and demographic covariates.

Methods

Participants and procedures

This is a secondary analysis of data from an Internet-based study of the U.S. transgender population conducted between 2003 and 2006.[37] The primary study and this secondary analysis were approved by the Institutional Review Board (IRB) of the University of Minnesota. Participants were recruited online through banner advertisements on transgender community websites and messages posted to mailing lists and forums. By clicking on a banner or link, participants were directed to the study's website which provided information about the researchers, transgender community advisory board members, frequently asked questions, and contact information for the Principal Investigator and IRB. Before beginning the survey, informed consent was obtained from each participant using a chunked online consent form that explained the purpose of the study, what would be asked in the survey, risks, benefits, and confidentiality procedures.

After providing informed consent electronically, participants were screened for eligibility and included in the study if they self-identified as transgender, were aged 18 or older, and lived in the United States. Gender identity was assessed in several ways. First, participants were asked to describe their gender identity in an open-ended manner. Next, they were asked to classify their gender identity into one of four categories: (1) transsexual, (2) cross dresser, (3) drag queen or king, or (4) other ("My transgender identity doesn't fit any of the above categories").[37,]* Finally, they were asked to report the degree to which they felt like a woman or a man. Participants were also asked their sex assigned at birth (i.e., female or male). Using the information gathered, we classified participants as either trans-feminine (gender identity on a feminine spectrum but assigned male at birth) or trans-masculine (gender identity on a masculine spectrum but assigned female at birth). Eligible participants were asked to complete a 50-minute online survey with a focus on sexual health and HIV prevention. Of 1229 valid surveys submitted, 89.8% ($n = 1104$) completed the section on tobacco use. The final analytic sample included 631 trans-feminine participants and 473 trans-masculine participants.

Measures

Age, race/ethnicity, living environment, legal married status, educational attainment, annual household income ("income"), and employment status were assessed using items from the 2000 U.S. Census.[38] Income was dichotomized based on whether an individual's income was above versus at-or-below two times the 2003 U.S. Department of Health and Human Services (DHHS) Poverty Guideline.[39] Self-reported educational attainment was recoded into a three-

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*These terms do not reflect current terminology and we acknowledge that they may no longer be considered appropriate or acceptable.

level variable as follows: high school or less, some college, and college degree or higher. Because our sample was mostly White (86.4% of trans-feminine participants and 85.8% of trans-masculine participants) with relatively few non-White individuals, race/ethnicity was dichotomized to White and non-White for multivariable analyses. Sex assigned at birth was assessed with the following item: ''The sex that I was assigned at birth (the sex on my original birth certificate) is: (1) Male or (2) Female.''

Felt stigma (perceived rejection and expectations of being stereotyped/discriminated against) was measured with a 10-item adaptation of Pinel's Stigma Consciousness Questionnaire.[40] Using a seven-point Likert-type scale (ranging from strongly agree to strongly disagree), participants indicated the degree to which they agreed with statements, such as ''Most people have a lot more transphobic thoughts than they actually express'' and ''Most people have a problem viewing transgender people as equals.'' For each participant, scores for each item were summed and divided by the total number of items to arrive at a mean felt stigma score (ranging from 1 to 7). Higher scores indicated higher levels of felt stigma. The internal consistency of this scale was 0.77; test-retest reliability was 0.70.

Enacted stigma (actual experiences of rejection/discrimination) was measured with a 10-item scale inquiring whether participants had ever experienced discrimination (employment, housing, healthcare, law enforcement), violence, harassment, or sexual abuse because of their gender identity or expression (adapted from the Everyday Discrimination Scale[41]). Participants replied ''yes'' or ''no'' to each of the 10 questions (e.g., ''Have you ever been verbally abused or harassed and thought it was because of your gender identity or gender presentation?''). The number of affirmative responses represented a participant's enacted stigma score (ranging from 0 to 10). Internal consistency of this scale was 0.74; test-retest reliability was 0.79.

Tobacco use was measured using the National Institute on Drug Abuse (NIDA) Risk Behavior Assessment.[42] We first assessed lifetime use (''Have you ever used tobacco [e.g., smoked cigarettes, pipes, cigars, or chewed tobacco]?'') and age of first tobacco use (''How old were you when you first used tobacco [e.g., smoked cigarettes, pipes, cigars, or chewed tobacco]?''). Next, for both past 3-month and past 30-day time periods, participants were asked, ''How many days did you use tobacco (e.g., smoked cigarettes, pipes, cigars, or chewed tobacco)?'' Finally, amount of use each day was assessed by asking, ''On the days that you use tobacco, how many cigarettes, pipes, or cigars do you usually smoke and/or how many times do you usually chew tobacco?'' For statistical analyses, participants were classified as either ''smokers'' (any tobacco use in the past 3 months) or ''nonsmokers'' (no tobacco use in the past 3 months). For the purposes of this article, ''smoking'' operationally refers to all forms of tobacco use. The past 3-month time period was chosen for statistical analyses because it matches the time period over which hormone use was assessed.

Legal document gender-marker change was determined by comparing a participant's sex assigned at birth (measured as described previously) and their response to the following question: ''According to your current birth certificate, what is your legal sex?'' Those who indicated a different response to these two items (e.g., ''male'' for sex assigned at birth and ''female'' for current birth certificate legal sex) were classified as having changed their legal document gender marker. Three dichotomous (yes/no) questions inquired about lifetime hormone use (''Have you ever used hormones to feminize/masculinize your body?''), past 3-month hormone use (''In the last 3 months, have you used hormones?''), and lifetime gender-affirming surgery (''Have you ever had any type of sex reassignment surgery?''). For this last item, participants were also asked about specific genital and nongenital surgical procedures.

Analysis

Data were analyzed with SPSS Version 24.[43] First, we examined bivariate differences in demographic and tobacco use variables (i.e., lifetime and past 3-month use, age at first use, frequency of past 3-month smoking, and amount used each day) between trans-feminine and trans-masculine individuals using chi-square and independent sample t-tests for categorical and continuous variables, respectively. Next, using chi-square analyses, we examined differences in the rates of past 3-month tobacco use by each of the four markers of gender transition: (1) legal document gender-marker change, (2) lifetime hormone use, (3) past 3-month hormone use, and (4) lifetime gender-affirming surgery. We conducted these comparisons separately for trans-feminine and trans-masculine participants. Finally, we used hypothesis-driven, hierarchical multivariable logistic regression to examine the relationship between past 3-month tobacco use and markers of gender transition. Because the distribution and patterns of tobacco use were different for trans-feminine and trans-masculine participants, separate multivariable analyses were conducted for each group. First, we included age, race/ethnicity, income, and educational attainment as demographic covariates. Next, we controlled for enacted stigma and felt stigma as indicators of minority stress. Finally, after checking for multicollinearity, we added legal document gender-marker change, past 3-month hormone use, and lifetime gender-affirming surgery to the model.

Results

Demographics

Demographic information for trans-feminine and trans-masculine participants is detailed in Table 1. The sample was predominantly White/non-Hispanic (trans-feminine individuals 86.4% and trans-masculine individuals 85.8%), but there were no significant racial/ethnic differences between trans-feminine and trans-masculine participants. On average, trans-masculine individuals were younger than trans-feminine individuals (26.2 vs. 38.0 years, $p < 0.001$) and less likely to be legally married or in a civil union (7.8% vs. 28.2%, $p < 0.001$). Trans-masculine participants were also more likely to have an income at-or-below twice the U.S. DHHS Poverty Guideline (41.4% vs. 23.6%, $p < 0.001$) but less likely to be unemployed (13.7% vs. 19.5%, $p = 0.01$). On average, trans-masculine individuals also scored slightly higher than trans-feminine individuals on measures of enacted stigma (2.48 vs. 1.95, $p < 0.001$) and felt stigma (4.65 vs. 4.51, $p = 0.02$).

Tobacco use: comparison of trans-feminine and trans-masculine participants

We observed significant differences between trans-feminine and trans-masculine participants in several domains of tobacco

TABLE 1. DEMOGRAPHIC COMPARISONS BETWEEN TRANS-FEMININE ($N=631$)
AND TRANS-MASCULINE INDIVIDUALS ($N=473$)

Demographic variables	Trans-feminine individuals n (Column %)	Trans-masculine individuals n (Column %)	χ^2 (df) or t(df)	p
Mean age (years)	38.0 (SD 12.2)	26.2 (SD 7.5)	18.6 (1101)	<0.001
Past 3-month smokers	228 (36.1%)	226 (47.8%)	15.5 (1)	<0.001
Race/ethnicity			0.96 (4)	NS
White/non-Hispanic	545 (86.4%)	406 (85.8%)	—	—
Black/African American	16 (2.5%)	12 (2.5)	—	—
Latino/Hispanic	29 (4.6%)	27 (5.7%)	—	—
Asian/Pacific Islander	12 (1.9%)	7 (1.5%)	—	—
Other	29 (4.6%)	21 (4.5%)	—	—
Living environment			9.46 (3)	0.02
Rural area or small town	233 (36.9%)	204 (43.1%)	0.49 (1)	NS
Medium-sized city	192 (30.4%)	109 (23.0%)	3.76 (1)	NS
Metropolitan/large city	188 (29.8%)	140 (29.6%)	1.36 (1)	NS
Other	18 (2.9%)	20 (4.2%)	0.10 (1)	NS
Legal married status			159.91 (2)	<0.001
Marriage or civil union	178 (28.2%)	37 (7.8%)	92.97 (1)	<0.001
Widowed/divorced/separated	156 (24.7%)	26 (5.5%)	87.99 (1)	<0.001
Single (never married)	297 (47.1%)	409 (86.7%)	17.62 (1)	<0.001
Educational attainment			9.53 (2)	0.009
High school or less	81 (12.8%)	60 (12.7%)	1.23 (1)	NS
Some college	286 (45.3%)	256 (54.1%)	9.52 (1)	0.002
College degree or higher	264 (41.8%)	157 (33.2%)	26.59 (1)	<0.001
Income at-or-below twice the 2003 U.S. DHHS Poverty Guideline	149 (23.6%)	196 (41.4%)	41.59 (1)	<0.001
Unemployed	123 (19.5%)	65 (13.7%)	6.33 (1)	0.01
Mean enacted stigma score (SD)	1.95 (1.98)	2.48 (1.88)	−4.51 (1099)	<0.001
Mean felt stigma score (SD)	4.51 (0.91)	4.65 (0.945)	−2.37 (1095)	0.02

DHHS, Department of Health and Human Services; NS, not statistically significant at the $p < 0.05$ level; SD, standard deviation.

use. Trans-masculine participants were more likely to report lifetime tobacco use compared with trans-feminine participants ($n=352$ [74.4%] vs. $n=401$ [63.5%], $\chi^2[1]=14.73$, $p<0.001$) and on average began smoking at an earlier age (14.5 years vs. 15.5 years, $t(748)=2.80$, $p<0.01$). Trans-masculine participants were also more likely to report past 3-month tobacco use compared with trans-feminine individuals ($n=226$ [47.8%] vs. $n=228$ [36.1%], $\chi^2=15.47$, $p<0.001$). However, compared to trans-masculine smokers, trans-feminine smokers reported significantly more frequent past 3-month smoking (mean 68.1 days vs. 55.5 days, $t(452)=3.64$, $p<0.001$) and smoking more cigarettes per day (mean 17.5 cigarettes vs. 11.7 cigarettes, $t(350)=5.76$, $p<0.001$).

Tobacco use: relationship to markers of gender transition

Table 2 presents bivariate, unadjusted past 3-month smoking rates for trans-feminine and trans-masculine individuals by each of the four markers of gender transition (legal document gender-marker change, lifetime hormone use, past 3-month hormone use, and lifetime gender-affirming surgery). While few participants had changed the gender marker on their birth certificate, doing so was associated with lower smoking rates among both trans-feminine (21.3% vs. 37.4%, $p=0.02$) and trans-masculine individuals (24.0% vs. 49.3%, $p=0.01$), compared to those who had not made this change. There were no significant differences in smoking status based on lifetime or past 3-month hormone use for either trans-

feminine or trans-masculine individuals. For trans-masculine individuals, those who had undergone gender-affirming surgery reported a lower rate of past 3-month tobacco use (34.0% vs. 52.2%, $p=0.001$). There were no significant differences in smoking rates among trans-feminine individuals based on gender-affirming surgery.

Tables 3 and 4 present multivariable logistic regression results for trans-feminine and trans-masculine individuals, respectively, with past 3-month tobacco use as the dependent variable. Model A contains only demographic covariates. For trans-feminine individuals, having only some college education (compared to college graduates) was significantly associated with past 3-month tobacco use (odds ratio [OR] 1.60; 95% confidence interval [CI] 1.11–2.32). None of the demographic covariates was significantly associated with past 3-month tobacco use among trans-masculine individuals. Model B added measures of enacted stigma and felt stigma. For both trans-feminine and trans-masculine individuals, higher enacted stigma (discrimination) scores were associated with increased odds of past 3-month tobacco use (trans-feminine individuals OR 1.10; 95% CI 1.01–1.21; trans-masculine individuals OR 1.15; 95% CI 1.03–1.29).

Model C presents findings for markers of gender transition after adjusting for enacted and felt stigma and demographic covariates. In this adjusted model, higher enacted stigma scores were associated with greater odds of past 3-month tobacco use among both trans-feminine (OR 1.14; 95% CI 1.03–1.25) and trans-masculine individuals (OR 1.18; 95% CI

TABLE 2. COMPARISON OF PAST 3-MONTH TOBACCO USE WITHIN SUBGROUPS OF TRANS-FEMININE AND TRANS-MASCULINE INDIVIDUALS BASED ON MARKERS OF GENDER TRANSITION (N=1104)

Trans-feminine individuals (N=631)

	Legal document gender-marker change			Lifetime hormone use			Past 3-month hormone use			Gender-affirming surgery		
	n (Column %)			n (Column %)			n (Column %)			n (Column %)		
	Yes	*No*	*p*	*Yes*	*No*	*p*	*Yes*	*No*	*p*	*Yes*	*No*	*p*
Nonsmokers	37 (78.7)	365 (62.6)	0.02	238 (65.2)	163 (61.7)	NS	206 (65.0)	196 (62.6)	NS	54 (71.1)	348 (63.0)	NS
Smokers	10 (21.3)	218 (37.4)		127 (34.8)	101 (38.3)		111 (35.0)	117 (37.4)		22 (28.9)	204 (37.0)	

Trans-masculine individuals (N=473)

	Legal document gender-marker change			Lifetime hormone use			Past 3-month hormone use			Gender-affirming surgery		
	n (Column %)			n (Column %)			n (Column %)			n (Column %)		
	Yes	*No*	*p*	*Yes*	*No*	*p*	*Yes*	*No*	*p*	*Yes*	*No*	*p*
Nonsmokers	19 (76.0)	226 (50.7)	0.01	103 (52.6)	141 (51.5)	NS	98 (53.8)	147 (50.9)	NS	70 (66.0)	173 (47.8)	0.001
Smokers	6 (24.0)	220 (49.3)		93 (47.4)	133 (48.5)		84 (46.2)	142 (49.1)		36 (34.0)	189 (52.2)	

NS, not statistically significant at the *p*<0.05 level.

1.05–1.32). Trans-feminine participants whose birth certificate reflected their gender identity had significantly lower odds of tobacco use (OR 0.39; 95% CI 0.15–0.96) compared to those with incongruent documents. This association did not hold true for trans-masculine individuals. Among trans-masculine individuals, lifetime gender-affirming surgery was significantly associated with lower odds of tobacco use (OR=0.38; 95% CI 0.20–0.69).

Discussion

This study examined tobacco use in a diverse online sample of U.S. trans-feminine and trans-masculine adults. To our knowledge, this is the first study to examine the relationship between tobacco use and markers of gender transition, and surrogate markers for gender affirmation. The prevalence of tobacco use in our sample was much higher than general population estimates.[1] We also found important differences in tobacco use between trans-feminine and trans-masculine participants. In the general U.S. adult population, cisgender men are more likely than cisgender women to be current smokers,[1] whereas cisgender women may be more likely to internalize antismoking stigma.[44] In our sample, trans-masculine individuals (assigned female at birth) were more likely to report lifetime and past 3-month tobacco use beginning at an earlier age, whereas trans-feminine smokers (assigned male at birth) reported heavier tobacco use. This finding that trans-masculine individuals' smoking behavior reflects both the smoking norms associated with their sex assigned at birth (less heavy smoking) and their gender identity (higher rates of tobacco use) highlights the complex ways in which transgender people may be affected by gendered smoking norms. Studying tobacco use among transgender individuals provides an opportunity to better understand the impact of gendered norms on tobacco use with applicability to both transgender and cisgender individuals. Future research is also needed to determine the efficacy of prevention and treatment interventions targeting such norms.

It is especially concerning that hormone use was not associated with lower levels of tobacco use among either trans-feminine or trans-masculine individuals. Both tobacco use and feminizing/masculinizing hormones potentially increase venous thromboembolism and CV risk.[27,31,34,35,45–48] Clinicians prescribing hormones to transgender individuals have an opportunity to intervene on an important public health issue for this population. Educational efforts regarding the health risks of concurrent smoking and hormone use should be a priority for healthcare providers working with transgender individuals.[49,50] This includes placing an emphasis on smoking cessation counseling and, when appropriate, co-prescribing evidence-based smoking cessation pharmacotherapy to transgender individuals starting or continuing hormones. Furthermore, given the common use of nonprescribed hormones among some transgender people,[51,52] all providers working with this population should receive education on the importance of smoking cessation counseling.

We also found that trans-feminine individuals whose birth certificates reflected their gender identity and trans-masculine individuals who had undergone gender-affirming surgery were less likely to smoke, compared to individuals who had not taken these steps. The association of gender transition with lower smoking rates may be explained by enhanced ability to cope with minority stress, including enacted stigma (i.e.,

TABLE 3. MULTIVARIABLE LOGISTIC REGRESSION ANALYSES AMONG TRANS-FEMININE INDIVIDUALS OF THE RELATIONSHIP BETWEEN PAST 3-MONTH TOBACCO USE (DEPENDENT VARIABLE) AND MARKERS OF GENDER TRANSITION ($N=631$)

	Model A $R^2=0.025$				Model B $R^2=0.35$				Model C $R^2=0.062$			
	β	SE	Odds	95% CI	β	SE	Odds	95% CI	β	SE	Odds	95% CI
Age	−0.01	0.007	0.98	0.97–1.00	−0.02	0.01	0.98	0.97–1.00	−0.01	0.01	0.99	0.87–1.00
Race (ref White)	−0.11	0.22	0.89	0.58–1.38	−0.05	0.22	0.94	0.61–1.47	−0.05	0.23	0.95	0.60–1.48
Income (ref >2×2003 U.S. DHHS Poverty Guideline)	−0.09	0.21	0.92	0.61–1.37	0.03	0.21	1.00	0.65–1.51	0.001	0.22	1.00	0.65–1.53
Educational attainment												
High school or less	0.27	0.28	1.31	0.75–2.29	0.24	0.29	1.27	0.73–2.23	0.19	0.29	1.21	0.69–2.12
Some college	0.47	0.19	1.60*	1.11–2.32	0.44	0.19	1.55	1.07–2.26	0.41	0.19	1.51	1.03–2.21
College degree or higher (ref)	—	—	—	—	—	—	—	—	—	—	—	—
Enacted stigma					0.096	0.05	1.10*	1.01–1.21	0.13	0.05	1.14*	1.03–1.25
Felt stigma					0.70	0.10	1.07	0.88–1.30	0.02	0.10	1.02	0.83–1.24
Legal document gender-marker change									−0.95	0.47	0.39*	0.15–0.96
Past 3-month hormone use									−0.19	0.19	0.83	0.57–1.21
Gender-affirming surgery									0.20	0.35	0.68	0.62–2.41

Model A contains only demographic covariates. Model B added enacted stigma and felt stigma. Model C added markers of gender transition.
*Statistically significant at $p<0.05$.
CI, confidence interval; SE, standard error.

TABLE 4. MULTIVARIABLE LOGISTIC REGRESSION ANALYSES AMONG TRANS-MASCULINE INDIVIDUALS OF THE RELATIONSHIP BETWEEN PAST 3-MONTH TOBACCO USE (DEPENDENT VARIABLE) AND MARKERS OF GENDER TRANSITION ($N=473$)

	Model A $R^2=0.016$				Model B $R^2=0.031$				Model C $R^2=0.083$			
	β	SE	Odds	95% CI	β	SE	Odds	95% CI	β	SE	Odds	95% CI
Age	−0.01	0.13	0.99	0.96–1.01	0.01	0.01	0.98	0.96–1.01	−0.01	0.01	0.99	0.97–1.02
Race (ref White)	0.10	0.23	1.10	0.70–1.74	0.18	0.24	1.19	0.75–1.90	0.11	0.24	1.11	0.69–1.79
Income (ref >2×2003 U.S. DHHS Poverty Guideline)	−0.17	0.20	0.84	0.57–1.23	−0.12	0.20	0.89	0.60–1.31	−0.05	0.20	0.95	0.64–1.42
Educational attainment												
High school or less	0.20	0.32	1.22	0.64–2.30	0.22	0.33	1.25	0.65–2.38	0.14	0.33	1.15	0.60–2.21
Some college	0.40	0.22	1.49	0.97–2.28	0.45	0.22	1.57	1.02–2.41	0.43	0.22	1.54	0.99–2.39
College degree or higher (ref)	—	—	—	—	—	—	—	—	—	—	—	—
Enacted stigma					0.14	0.06	1.15*	1.03–1.29	0.16	0.06	1.18*	1.05–1.32
Felt stigma					−0.50	0.11	0.95	0.76–1.18	−0.10	0.11	0.90	0.72–1.13
Legal document gender-marker change									−0.75	0.52	0.47	0.17–1.31
Past 3-month hormone use									0.46	0.25	1.58	0.96–2.61
Gender-affirming surgery									−0.97	0.31	0.38*	0.20–0.69

Model A contains only demographic covariates. Model B added enacted stigma and felt stigma. Model C added markers of gender transition.
*Statistically significant at $p<0.05$.

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discrimination). In our sample, enacted stigma was associated with higher odds of past 3-month tobacco use in both trans-feminine and trans-masculine individuals, which is consistent with other research.[5,53]

The process of gender transition is intended to alleviate gender dysphoria and increase gender affirmation,[54] which may promote resilience and buffer the negative effects of minority stress.[55,56] Therefore, if tobacco use is in fact a coping mechanism for minority stress,[24] then the enhanced coping capacity derived from gender transition may explain the association between transition and lower rates of tobacco use. However, the relationship between gender transition and tobacco use is complex as evidenced by the fact that only some processes (e.g., legal document gender-marker change and gender-affirming surgery) were associated with reduced tobacco use, and these associations differed between trans-feminine and trans-masculine individuals. Additional research is needed to explicate the relationship between gender transition and tobacco use, taking into account differences based on sex assigned at birth and gender identity.

Hormone therapy, like gender-affirming surgery, is intended to reduce gender dysphoria and increase gender affirmation.[25] Therefore, it is noteworthy that gender-affirming surgery was associated with reduced odds of tobacco use, whereas hormone use was not. There are several potential explanations for this finding that warrant further study. First, it is possible that surgeons more readily offer preoperative smoking cessation counseling to avoid surgical complications.[57] In addition, current clinical guidelines[25] recommend the following before patients undergo vaginoplasty or phalloplasty/metoidioplasty: consultation with a mental health professional to confirm persistent gender dysphoria, 12 months of hormone therapy (in most cases), and at least 12 continuous months living in the gender congruent with one's gender identity. These measures, which are not required before starting hormones, increase the likelihood of interactions with healthcare providers.

Each of these interactions is an opportunity for smoking cessation counseling and may explain why gender-affirming surgery was a significant predictor of reduced tobacco use among trans-masculine individuals, whereas hormone use was not. However, this would not explain why surgery was not associated with reduced tobacco use among trans-feminine individuals, as the preoperative recommendations are the same. Alternatively, it is also possible that transgender individuals who smoke may be less likely to receive gender-affirming surgery because of concerns about smoking-related complications. In this scenario, smoking would then serve as a barrier to accessing gender-affirming healthcare, and offering culturally-tailored smoking cessation interventions could help to improve access. Regarding legal document gender-marker change, its association with lower rates of tobacco use could be explained by greater gender identity affirmation. Among LGB individuals, sexual orientation identity affirmation has been associated with lower nicotine dependence scores.[58] Further research is needed to more precisely elucidate and explicate the relationships between different steps in gender transition and tobacco use, including how clinical guidelines for gender transition might be used to promote tobacco cessation among transgender individuals.

Our finding that enacted stigma was associated with greater odds of tobacco use also supports legislative efforts to reduce such victimization. Although some states have passed legislation barring discrimination based on gender identity and expression, several states are considering legislation that would limit transgender individuals' access to public accommodations.[59,60] Furthermore, there are no federal nondiscrimination protections for transgender individuals.[61] In states that have enacted LGBT-affirming laws, such measures have been associated with better mental health and substance use outcomes.[53,59,62,63] By reducing antitransgender discrimination and providing transgender victims with legal recourse, such measures might also be associated with reduced tobacco use in this vulnerable population.

Limitations

There are limitations to this study. First, the parent study was not specifically designed to assess tobacco use. For example, the survey used focused only on nicotine delivery through tobacco and did not individually specify the modality of tobacco use (e.g., cigarettes, cigars, and smokeless tobacco). The use of self-report measures to assess tobacco use also introduces the possibility of reporting bias, and the cross-sectional study design precludes causal inferences. Although this is a large diverse community sample of transgender adults, convenience sampling limits generalizability. Generalizability may be further limited because our sample was majority White. Trans-feminine participants were also significantly older than trans-masculine participants, limiting our ability to generalize to younger and potentially more marginalized trans-feminine individuals. Our findings differ in several respects from recently published representative data comparing transgender and cisgender individuals,[9,20] as these studies found no differences in smoking. However, these studies drew their samples from only a subset of states that collect gender identity data. To further clarify tobacco use disparities among transgender individuals, it is important that gender identity measures be included in nationally representative surveys (a recommendation that lost some support in recent U.S. DHHS proposals to remove such items[64,65]). Finally, interpretation of our findings regarding the relationship between legal document gender-marker change and tobacco use is limited by the time period in which the original study was conducted. The legal landscape in the United States as it pertains to legal document gender-marker change has evolved substantially. Therefore, further research is needed to examine this relationship in the current legal and sociopolitical context.

Conclusion

The present study makes a significant contribution to the literature because it represents the first attempt to investigate the relationship between tobacco use and gender transition. Our findings support previous research demonstrating higher rates of tobacco use among transgender individuals compared to the general population. Of concern, these rates persist even among individuals treated with exogenous estrogen and testosterone, placing them at potentially higher risk for CV complications. Our findings underscore the need to develop and evaluate tobacco education and cessation interventions targeting transgender people. For example, Matthews et al.[66] evaluated a culturally-tailored smoking cessation intervention for LGBT individuals and found

improved satisfaction rates compared to treatment-as-usual. However, this study did not look specifically at outcomes among transgender participants. In addition, implementation research is needed to determine how best to coordinate smoking cessation treatment with other transition-related healthcare, particularly when hormones are being prescribed. Such tailored targeted interventions could have a dramatic impact on the health of this at-risk population by affecting both proximal gender dysphoria and distal health outcomes such as CV disease.

Disclaimer

Data for this study come from the TGStudy (PI Dr. Walter Bockting). The analyses presented in this article have not been presented or published elsewhere. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Author Disclosure Statement

No competing financial interests exist.

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