GYNECOLOGY

Testosterone use and sexual function among transgender men and gender diverse people assigned female at birth

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BACKGROUND: Testosterone use among transgender people likely impacts their experience of sexual function and vulvovaginal pain via several complex pathways. Testosterone use is associated with decreased estrogen in the vagina and atrophic vaginal tissue, which may be associated with decreased vaginal lubrication and/or discomfort during sexual activity. At the same time, increased gender affirmation through testosterone use may be associated with improved sexual function. However, data on pelvic and vulvovaginal pain among transgender men and nonbinary people assigned female at birth are scarce.

OBJECTIVE: This study aimed to assess the association between testosterone and sexual function with a focus on symptoms that are commonly associated with vaginal atrophy.

STUDY DESIGN: We conducted a cross-sectional analysis of 1219 participants aged 18 to 72 years using data collected from 2019 to 2021 from an online, prospective, longitudinal cohort study of sexual and/or gender minority people in the United States (The Population Research in Identity and Disparities for Equality Study). Our analysis included adult transgender men and gender diverse participants assigned female at birth who were categorized as never, current, and former testosterone users. Sexual function was measured across 8 Patient-Reported Outcomes Measurement Information System Sexual Function and Satisfaction domains.

RESULTS: Overall, 516 (42.3%) participants had never used testosterone, and 602 (49.4%) currently used testosterone. The median duration of use was 37.7 months (range, 7 days to >27 years). Most participants (64.6%) reported genital pain or discomfort during sexual activity in the past 30 days, most commonly in the vagina or frontal genital opening (52.2%), followed by around the clitoris (29.1%) and labia (24.5%). Current testosterone use was associated with a greater interest in sexual activity (β=6.32; 95% confidence interval, 4.91−7.74), higher ability to orgasm (β=1.50; 95% confidence interval, 0.19-2.81), and more vaginal pain or discomfort during sexual activity (β=1.80; 95% confidence interval, 0.61−3.00). No associations were observed between current testosterone use and satisfaction with sex life, lubrication, labial pain or discomfort, or orgasm pleasure.

CONCLUSION: Testosterone use among transgender men and gender diverse people was associated with an increased interest in sexual activity and the ability to orgasm, as well as with vaginal pain or discomfort during sexual activity. Notably, the available evidence demonstrates that >60% of transgender men experience vulvovaginal pain during sexual activity. The causes of pelvic and vulvovaginal pain are poorly understood but are likely multifactorial and include physiological (eg, testosterone-associated vaginal atrophy) and psychological factors (eg, gender affirmation). Given this high burden, there is an urgent need to identify effective and acceptable interventions for this population.

Key words: dyspareunia, sexual function, testosterone, transgender, vulvovaginal pain

Introduction

At least 1.6 million transgender adults and adolescents live in the United States,[1] among whom an estimated 70% of transgender men have used testosterone as gender-affirming hormone therapy (GAHT).[2] A vaginectomy is rare (<3%) in this population, and the majority of transgender men and gender diverse people retain their vagina.[2] Testosterone GAHT likely impacts sexual function via several complex pathways. Testosterone GAHT is associated with vaginal atrophy, which may be associated with decreased lubrication and/or discomfort during sexual activity.[3−5] At the same time, increased gender affirmation through testosterone use may be associated with improved sexual function.

There is limited research on the sexual function of transgender men and gender diverse people assigned female at birth (AFAB). The evidence that exists suggests that, although testosterone GAHT is associated with increased desire and arousal,[6] a high proportion of transgender men also reported dyspareunia (painful sex), a common symptom of vaginal atrophy. The prevalence of dyspareunia may be as high as 60% to 62% among transgender men,[7,8] markedly higher than the prevalence reported among cisgender women (3%−48%).[9] Several studies also suggest that transgender men who use testosterone may experience chronic genital pain and discomfort with one study reporting that 10% to 16% of transgender men had been diagnosed with vulvodynia (defined as chronic burning, stinging, or irritating vulvovaginal pain for 3 consecutive months or longer).[7,8] Only 1 previous small study directly assessed the impact of testosterone GAHT on genital pain during sexual activity. Although 30% of transgender men reported that testosterone had caused genital dryness and 14% experienced genital tearing since initiating testosterone, they did not observe an association between testosterone use and vulvodynia or dyspareunia symptoms.[10]

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AJOG at a Glance

Why was this study conducted?

The study aimed to improve our understanding of the impact of testosterone on the sexual health of transgender men and gender diverse people assigned female at birth.

Key findings

In our cross-sectional analysis of 1219 adult transgender participants, 65% reported any genital pain or discomfort during sexual activity in the past 30 days. Current testosterone use was associated with a higher interest in sexual activity, ability to orgasm and vulvovaginal pain during sexual activity.

What does this add to what is known?

Although data from the extant literature are scare, the available evidence demonstrates that >60% of transgender men experience vulvovaginal pain during sexual activity. Given this high burden, there is an urgent need to identify effective and acceptable interventions for this population.

The present study aimed to improve our understanding of the impact of testosterone on the sexual health of transgender people with a focus on symptoms that are commonly associated with vaginal atrophy, including decreased lubrication and pain during sexual activity. Using data from a large, national, online sample of sexual and/or gender minority adults in the United States, we examined the association between current testosterone use and self-reported measures of sexual function and satisfaction experienced by transgender men and gender diverse people.

Materials and Methods

This analysis used data from The Population Research in Identity and Disparities for Equality (PRIDE) Study, an online, prospective, longitudinal cohort study of sexual and/or gender minority people in the United States. We conducted a cross-sectional analysis using data collected from 2019 to 2021 using a questionnaire administered annually to study participants who were adult transgender men and gender diverse participants AFAB. We included participants who self-reported that they currently had a vagina or frontal genital opening (FGO) and who completed the Patient-Reported Outcomes Measurement Information System (PROMIS) Sexual Function and Satisfaction (SexFS) items.[11] We excluded participants who self-reported that they did not have a vagina or FGO or who reported that they underwent a phalloplasty or vaginectomy.

Measures

Demographic characteristics

Self-reported participant data on race and ethnicity, current gender identity, current sexual orientation, and sex assigned at birth were collected. Participants could select multiple response options for race, ethnicity, gender, and sexual orientation. Participants self-reported the gender(s) of people they had any sexual activity within the past year.

Testosterone use

We categorized participants as never, current, and former testosterone users. Current testosterone use was assessed in the 2019 to 2021 annual questionnaires and included participants who, at the time, indicated that they were currently taking testosterone (of any type and in any formulation such as gel, injection or patch), testosterone cypionate, testosterone enanthate, or testosterone undecanoate for gender affirmation. To differentiate between participants who had never used testosterone and participants who formerly used testosterone, we also incorporated participants' responses to a baseline survey that assessed participants' lifetime testosterone use. Duration of testosterone use was calculated based on participant's self-reported month and year of initiating testosterone and the date of survey completion. We did not collect information on the dose of testosterone.

Sexual function

The PROMIS SexFS assesses self-reported sexual function and satisfaction over the past 30 days. This instrument was originally developed for cancer populations and was subsequently validated in a broad group of sexually active adults in the United States who were not cancer survivors.[11] Although sexual minority (eg, bisexual, gay, and lesbian) individuals were involved in the development of the PROMIS SexFS, transgender people were not. The PRIDE Study used a modified version of the PROMIS SexFS that allowed participants to select their preferred anatomical language (ie, vagina or FGO).[12,13] In completing the survey, each participant's selection for their preferred terminology was propagated throughout subsequent survey items.

Our analysis included 8 PROMIS SexFS domains, including interest in sexual activity, satisfaction with sex life, vaginal or FGO lubrication, ability to orgasm, orgasm pleasure, and vaginal or FGO, labial, or clitoral pain or discomfort during sexual activity. Interest in sexual activity was assessed for all participants, whereas all other domains were only assessed for participants who reported any sexual activity in the past 30 days (which was broadly defined and included masturbation). For each domain, we calculated each participant's raw score and T-scores. A T-score of 50 represents the mean for the US population and has a standard deviation of 10. Higher T-scores indicate more of the construct measured by the domain; for example, more interest in sexual activity, increased vaginal or FGO lubrication, and more pain or discomfort relative to lower scores.

Covariates

We considered covariates that are associated with sexual function and pelvic

pain based on previous literature. These included standardized clinical assessment tools and self-reported lifetime diagnoses. We broadly considered 5 categories of covariates that have been associated previously with sexual function among cisgender women and transgender men, including structural changes to the pelvis, inflammatory conditions in the pelvis, hormonal influences, mental health, and substance use.[14–27]

Structural changes to the pelvis included previous pregnancies, hysterectomy, and uterine fibroids. Inflammatory conditions in the pelvis included pelvic inflammatory disease, inflammatory bowel disease (including Crohn's disease and ulcerative colitis), irritable bowel syndrome, and bacterial sexually transmitted infections (STIs) (defined as a chlamydia, gonorrhea, or syphilis diagnosis in the past year). Hormonal influences include an oophorectomy, polycystic ovary syndrome, current hormonal contraceptive use (including oral contraceptives, transdermal patch, vaginal rings, medroxyprogesterone acetate injections, and etonogestrel implants), and intrauterine device use.

Mental health measures included lifetime diagnoses of depression and posttraumatic stress disorder (PTSD) and lifetime experiences of sexual abuse, rape, and sexual assault. Depressive symptoms in the past 2 weeks were assessed using the Patient Health Questionnaire-9 (PHQ-9) (score range is 0–27 with higher scores indicating more depressive symptoms)[28] and PTSD symptoms in the last month were assessed using the brief 6-item version of the PTSD Checklist (PCL-6) (score range, 6–30).[29] Substance use variables included current smoking and current alcohol consumption behaviors; the latter was assessed using the Alcohol Use Disorders Identification Test (AUDIT) (score range is 0–40 with higher scores indicating more disordered alcohol use).[30]

Statistical analysis

We assessed cross-sectional associations between current testosterone use and sexual function. For participants who completed more than 1 annual questionnaire, we restricted our analysis to only include their first year of responses. We calculated descriptive statistics stratified by testosterone use using chi-squared tests. We conducted 1-sample *t* tests to evaluate if the SexFS domain T-scores differed from the population mean of 50 and calculated the Pearson correlation coefficient to estimate the strength and direction of the relationship between PROMIS SexFS domains.

We then used multivariable linear regression to estimate the association between current testosterone use (relative to never testosterone use) and the T-scores for each sexual function domain. We used causal diagrams to select covariates to include in our model (Supplemental Figure 1). We evaluated 3 models, namely an unadjusted model, a minimally adjusted model, and a robustly adjusted model. We chose our primary analysis to be a minimally adjusted model that included confounding variables (ie, covariates that were associated with both the exposure [testosterone use] and the outcomes [sexual function] in our sample). The minimally adjusted model included age, current depression symptoms (PHQ-9 scores), current PTSD symptoms (PCL-6 scores), alcohol use (AUDIT score), current smoker, hysterectomy, oophorectomy, and hormonal contraception use. We conducted secondary analyses with a robustly adjusted model that included all covariates that are associated with sexual function and dyspareunia in previous literature but were not associated with testosterone use in our sample, including a history of sexual assault, previous pregnancy, inflammatory bowel disease, irritable bowel syndrome, uterine fibroids, pelvic inflammatory disease, polycystic ovary syndrome, and intrauterine devices.[14–27]

Our primary analysis considered current vs never testosterone users. Results comparing former and current users are provided in the Supplemental Tables 2 and 3. We hypothesized that asexual identity may be a potential effect modifier, because asexual participants may differ from nonasexual participants in terms of interest in sexual activity. Therefore, we conducted sensitivity analyses stratified by self-reported asexual sexual orientation. All analyses were conducted in R, version 4.2.1 (R Core Team, Vienna, Austria). This study received ethical approval from the University of California, San Francisco, Stanford University School of Medicine, and WIRB-Copernicus Group institutional review boards.

Results

Our analysis included 1219 participants aged 18 to 72 years old (median age, 27.1 years) (Table 1). Most participants (61.1%) endorsed more than 1 gender identity, most commonly nonbinary (54.2%), transgender man (46.0%), genderqueer (33.6%), and man (21.5%). Participants were diverse in sexual orientation, although most identified as queer (65.1%). The majority (80.6%) of participants only reported White race and/or ethnicity and 12.0% of participants selected more than 1 race or ethnicity.

There were 516 (42.3%) participants who had never used testosterone, 602 (49.4%) who currently used testosterone, and 76 (6.2%) former testosterone users. A total of 25 participants were missing information about GAHT use. The median duration of GAHT with testosterone use was 37.7 months (range, 7 days to >27 years). Current testosterone users were significantly more likely to identify as a man or transgender man and less likely to identify as agender, genderqueer, nonbinary, or questioning (Supplemental Table 1). There were no differences in testosterone use by age, race, or ethnicity.

Most participants reported having sex with another person in the past year (68.9%), being in a relationship (59.4%), and participating in any sexual activity (including masturbation) in the past 30 days (89.5%) (Table 2). Among participants who reported having sex with another person in the past year, 88.5% reported any receptive oral sex or receptive vaginal or FGO sex. Participants currently using testosterone were more likely to be sexually active in the past year (73.3% vs 63.4%; $P=.001$) and in the past 30 days (93.9% vs 84.7%; $P<.001$).

TABLE 1
Participant characteristics

N	1219
Age (y), median (IQR)	27.1 (22.6–33.0)
Gender identity,[a] n (%)	
Agender	166 (13.6)
Genderqueer	410 (33.6)
Man	262 (21.5)
Nonbinary	661 (54.2)
Transgender man	561 (46.0)
Two-spirit	14 (1.1)
Questioning	39 (3.2)
Another gender identity	166 (13.6)
Sexual orientation,[a] n (%)	
Asexual	262 (21.5)
Bisexual	406 (33.3)
Gay	227 (18.6)
Lesbian	85 (7.0)
Pansexual	245 (20.1)
Queer	793 (65.1)
Same-gender loving	60 (4.9)
Straight or heterosexual	49 (4.0)
Two-spirit	5 (0.4)
Questioning	58 (4.8)
Another sexual orientation	84 (6.9)
Race and ethnicity,[a] n (%)	
American Indian or Alaskan Native	39 (3.2)
Asian	59 (4.8)
Black, African American or African	49 (4.0)
Hispanic, Latinx, or Spanish	82 (6.7)
Middle Eastern or North African	15 (1.2)
Native Hawaiian or Pacific Islander	5 (0.4)
White	1120 (91.9)
Another race or ethnicity	16 (1.3)
Missing	10 (0.8)

IQR, interquartile range.

[a] Participants were able to select more than 1 response, therefore, proportions may sum to mire than 100%. Of the participants, 61.1% selected more than 1 gender identity, 53.2% selected more than 1 sexual orientation, and 12.0% selected more than 1 race and/or ethnicity.

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Table 2 reports participants' pelvic health histories. Current testosterone users were more likely to have undergone a hysterectomy (17.9% vs 5.4%; $P<.001$) and oophorectomy (14.5% vs 3.3%; $P<.001$) and less likely to currently use hormonal contraceptives (5.8% vs 17.8%; $P<.001$) than participants who never used testosterone. Current testosterone users were also more likely to have had a bacterial STI diagnosis in the past year (3.0% vs 1.6%; $P=.001$). Testosterone use was not associated with pelvic inflammatory disease, polycystic ovary syndrome, uterine fibroids, inflammatory bowel disease, irritable bowel syndrome, pregnancy history, or intrauterine device use.

Participants reported very high levels of lifetime experiences of sexual abuse, sexual assault, and ever having received depression or PTSD diagnoses (Table 2). Testosterone use was associated with lower scores (ie, better mental health) for current depressive and PTSD symptoms. Testosterone use was also associated was substance use, including current smoking (7.5% vs 4.3%; $P=.033$) and higher AUDIT scores.

Among the 1091 sexually active participants, most (n=693; 64.6%) reported genital pain or discomfort during sexual activity in the past 30 days, most commonly in the vagina or FGO (52.2%), followed by around the clitoris (29.1%) and the labia (24.5%) (Table 3). There were 103 (9.6%) participants who reported pain at all 3 genital sites. T-scores for pain or discomfort were higher than the population mean ($P<.001$), whereas T-scores for orgasm pleasure (mean T-score, 45.0; $P<.001$) and satisfaction with sex life (mean T-score, 45.6; $P<.001$) were lower than the population mean. The Figure shows the correlation between each sexual function T-score among participants. Interest in sexual activity, satisfaction, lubrication, orgasm ability, and pleasure were positively correlated. Measures of pain or discomfort were negatively correlated with all other domains.

When compared with participants who never used testosterone, current testosterone users were less likely to report difficulty with lubrication (58.5% vs 66.7%; $P=.01$), more like to report any vaginal pain or discomfort (56.0% vs 49.2%; $P=.04$), and more likely to achieve orgasm ($P=.003$) (Table 3). In the minimally adjusted regression models (Table 4), current testosterone use was associated with higher interest in sexual activity ($\beta=6.32$; 95% confidence interval [CI], 4.91–7.74), higher ability to orgasm ($\beta=1.50$; 95% CI, 0.19–2.81), as well as

TABLE 2
Sexual behavior and medical history of participants, stratified by never or current testosterone use

Sexual behavior and medical history	Overall	Never testosterone use	Current testosterone use	*P* value
Number	1219	516	602	
Sex in the past year, n (%)	750 (68.9)	291 (63.4)	400 (73.3)	.001[a]
Receptive oral sex[b]	598 (79.8)	218 (74.9)	333 (83.5)	.008[a]
Receptive vaginal or FGO sex[b]	400 (53.9)	174 (59.8)	193 (49.1)	.007[a]
Interest in sexual activity past 30 d[c], mean (SD)	46.6 (11.1)	44.2 (11.3)	49.0 (10.5)	<.001[a]
Any sexual activity past 30 d[d], n (%)	1091 (89.5)	437 (84.7)	565 (93.9)	<.001[a]
In a relationship, n (%)	701 (59.4)	291 (58.3)	355 (60.5)	.509
Gender(s) of past year sex partners, n (%)				
Cisgender men	354 (29.0)	147 (28.5)	182 (30.2)	.567
Cisgender women	286 (23.5)	107 (20.7)	160 (26.6)	.027[a]
Genderqueer, nonbinary, or gender nonconforming people AFAB	183 (15.0)	75 (14.5)	92 (15.3)	.791
Genderqueer, nonbinary, or gender nonconforming people AMAB	125 (10.3)	52 (10.1)	60 (10.0)	>.999
Transgender men	112 (9.2)	25 (4.8)	81 (13.5)	<.001[a]
Transgender women	103 (8.4)	37 (7.2)	57 (9.5)	.203
Pelvic health history, n (%)				
Pelvic inflammatory disease	27 (2.2)	13 (2.5)	11 (1.8)	.556
Polycystic ovary syndrome	120 (9.8)	51 (9.9)	55 (9.1)	.747
Uterine fibroids	50 (4.1)	24 (4.7)	22 (3.7)	.493
Inflammatory bowel disease[e]	24 (2.0)	11 (2.1)	12 (2.0)	>.999
Irritable bowel syndrome	218 (17.9)	86 (16.7)	112 (18.6)	.443
Bacterial STI diagnosis[f]	19 (1.6)	1 (0.2)	18 (3.0)	.001[a]
Ever pregnant	130 (10.7)	60 (11.6)	56 (9.3)	.241
Hysterectomy	142 (11.6)	28 (5.4)	108 (17.9)	<.001[a]
Oophorectomy	108 (8.9)	17 (3.3)	87 (14.5)	<.001[a]
Current hormonal contraceptive use[g]	138 (11.3)	92 (17.8)	35 (5.8)	<.001[a]
Current hormonal intrauterine device use[h]	91 (8.4)	49 (10.0)	32 (6.5)	.056
Current non-hormonal intrauterine device use[h]	29 (2.7)	11 (2.3)	16 (3.2)	.454
Mental health and substance use, n (%)				
History of sexual abuse	686 (78.0)	289 (76.3)	340 (78.3)	.532
Ever experienced rape or sexual assault	437 (49.9)	196 (51.9)	206 (47.7)	.266
Ever diagnosed with depression	988 (81.1)	399 (77.3)	503 (83.6)	.011[a]

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TABLE 2
Sexual behavior and medical history of participants, stratified by never or current testosterone use *(continued)*

Sexual behavior and medical history	Overall	Never testosterone use	Current testosterone use	*P* value
PHQ-9 score for depression[i], mean (SD)	10.2 (6.4)	10.7 (6.4)	9.6 (6.2)	.005[a]
Ever diagnosed with PTSD	484 (39.7)	198 (38.4)	238 (39.5)	.737
PCL-6 score for PTSD[j], mean (SD)	15.6 (5.3)	16.1 (5.2)	15.0 (5.2)	.001[a]
Current smoker	74 (6.1)	22 (4.3)	45 (7.5)	.033[a]
AUDIT score for alcohol use[k], mean (SD)	3.6 (4.3)	3.2 (3.8)	3.9 (4.6)	.005[a]
Language preferences, n (%)				
Vagina	891 (73.1)	428 (82.9)	386 (64.1)	<.001[a]
FGO	315 (25.8)	86 (16.7)	207 (34.4)	

AFAB, assigned female at birth; *AMAB*, assigned male at birth; *AUDIT*, Alcohol Use Identification Test; *FGO*, frontal genital opening; *PHQ-9*, 9-Item Patient Health Questionnaire; *PTSD*, posttraumatic stress disorder; *SD*, standard deviation; *STI*, sexually transmitted infection.

[a] *P*-value <.05; [b] Among participants who reported having sex in the past year; [c] T-scores of 50 represents the population average for the United States population, and 10 points represents 1 standard deviation from the population average; [d] Includes masturbation and sexual activity with a partner; [e] Includes Crohn's disease, ulcerative colitis, etc; [f] Diagnosis with chlamydia, gonorrhea, or syphilis in the past year; [g] Including oral contraceptives, transdermal patch, vaginal rings, medroxyprogesterone acetate injections, and etonogestrel implants; [h] Excluding participants who had a hysterectomy; [i] The PHQ-9 measures depressive symptoms in the past 2 weeks with scores of ≥10 being suggestive of moderate to severe depression; [j] The PCL-6 measures PTSD symptoms in the past month with scores of ≥17 being associated with probable PTSD; [k] The AUDIT measures current alcohol consumptions behaviors with scores of ≥15 being suggestive of alcohol use disorder.

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pain or discomfort during sexual activity in the vagina or FGO (β=1.80; 95% CI, 0.61−3.00) and around the clitoris (β=1.20; 95% CI, 0.10−2.30). The association between testosterone use, ability to orgasm, and clitoral pain or discomfort was not statistically significant in the robustly adjusted model. No associations were observed between current testosterone use and satisfaction with sex life, lubrication, labial pain or discomfort, or orgasm pleasure.

Duration of testosterone use was associated with increased interested in sexual activity, but not with any other outcomes (Supplemental Table 4). In sensitivity analyses, we did not observe any evidence of effect modification by asexual sexual orientation (Supplemental Figure 2), although asexual identity was independently associated with most sexual function domains.

Discussion

In our study, testosterone use among transgender men and gender diverse people AFAB was associated with some domains of positive sexual function (such as a higher interest in sexual activity and ability to orgasm) and pain or discomfort during sexual activity. Specifically, we observed a strong, consistent association between current testosterone use and higher interest in sex, as well as vaginal or FGO pain during sexual activity.

Our findings are consistent with previous studies that found that testosterone use is associated with increased desire and interest in sex.[6] GAHT is associated with significant improvements in overall mental health, quality of life, and body image,[31−33] which in turn likely have positive impacts on other areas of wellbeing, including sexual function. For example, other studies have found that access to gender-affirming chest reconstruction surgery is associated with higher sexual function scores, whereas experiencing barriers to accessing gender-affirming care is associated with lower sexual function scores.[22] Although previous studies have not observed an association between testosterone use and orgasm,[6] testosterone use was associated with a higher ability to orgasm in our study.

Notably, we observed that the majority of transgender and gender diverse people AFAB who used testosterone (67%) experienced vulvovaginal pain during sexual activity. This prevalence is consistent with previous studies that have reported that 60% to 62% of transgender men experience dyspareunia.[7,8] Although testosterone was associated with vaginal or FGO pain in all regression analyses, the prevalence of any genital pain among individuals who were testosterone naïve was also quite high (63%). The causes of genital pain during sex (including dyspareunia, vulvodynia, and vaginismus) are multifactorial.[21] Although physiological factors (such as vaginal atrophy, endometriosis, and pelvic floor injury) are associated with genital pain during sex,[5] there are complex associations with psychological and social factors, including co-occurrence with other pain disorders, mental health, substance use, and sexual trauma.[19,20] Our sample reported an alarmingly high level of sexual abuse (78%), sexual assault (50%), depression (81%), and PTSD diagnoses (40%)—factors that are correlated with chronic pelvic pain among presumably cisgender women.[14−18] This may partially account for the high prevalence of pain in our study.

Genital pain, including dyspareunia and chronic vulvodynia, can have a significant impact on people's well-being

TABLE 3
Sexual function stratified by never and current testosterone use

Sexual function	Overall	Never testosterone use	Current testosterone use	*P* value
Participants who were not sexually active in the past 30 d, n	128	79	37	
Reasons for no sexual activity, n (%)				
Not interested	93 (72.7)	67 (84.8)	17 (45.9)	<.001[a]
No partners	43 (33.6)	26 (32.9)	14 (37.8)	.756
Do not enjoy sexual activity	32 (25.0)	23 (29.1)	4 (10.8)	.053
Partner(s) away, not interested in sex, or health condition	20 (15.6)	10 (12.7)	7 (18.9)	.544
Difficulties with orgasm or climax	15 (11.7)	10 (12.7)	5 (13.5)	>.999
Dryness or pain in or around my vagina or FGO	11 (8.6)	4 (5.1)	5 (13.5)	.225
Health condition	9 (7.0)	5 (6.3)	2 (5.4)	>.999
Another reason	18 (14.1)	12 (15.2)	6 (16.2)	>.999
Participants who were sexually active in the past 30 d, n	1091	437	565	
Lubrication				
Any difficulty achieving or maintaining lubrication, n (%)	670 (62.2)	289 (66.7)	326 (58.5)	.010[a]
T-score,[b] mean (SD)	50.7 (8.5)	50.2 (8.4)	51.2 (8.4)	.045[a]
Any genital pain or discomfort, n (%)	693 (64.6)	274 (63.3)	368 (66.5)	.317
Pain or discomfort inside vagina or FGO				
Any pain or discomfort, n (%)	561 (52.2)	213 (49.2)	310 (56.0)	.040[a]
T-score[c], mean (SD)	51.6 (9.1)	50.9 (8.9)	52.3 (9.2)	.013[a]
Pain or discomfort in the labia				
Any pain or discomfort, n (%)	263 (24.5)	118 (27.3)	126 (22.8)	.124
T-score[c], mean (SD)	51.2 (7.5)	51.6 (7.7)	51.0 (7.4)	.168
Pain or discomfort in the clitoris				
Any pain or discomfort, n (%)	312 (29.1)	117 (27.1)	167 (30.2)	.317
T-score[c], mean (SD)	53.1 (8.3)	52.6 (7.7)	53.4 (8.5)	.136
Orgasm				
Did not have an orgasm, n (%)	61 (5.6)	34 (7.8)	19 (3.4)	.003[a]
Any difficulty achieving orgasm, n (%)	559 (52.8)	216 (51.2)	289 (52.2)	.811
T-score for achieving orgasm[b], mean (SD)	49.2 (9.8)	48.4 (10.8)	50.1 (9.0)	.010[a]
T-score for orgasm pleasure[b], mean (SD)	45.0 (8.4)	45.1 (8.3)	45.2 (8.3)	.918
Satisfaction with sex life				
T-score[b], mean (SD)	45.6 (7.7)	45.7 (7.9)	45.9 (7.6)	.670

T-scores of 50 represents the population average for the United States population, and 10 points represents 1 standard deviation from the population average.

FGO, frontal genital opening; *SD*, standard deviation.

[a] *P*-value <.05; [b] High scores indicate more lubrication, ability to achieve orgasm, pleasure from orgasms, and satisfaction with sex life; [c] Higher scores indicate more pain or discomfort.

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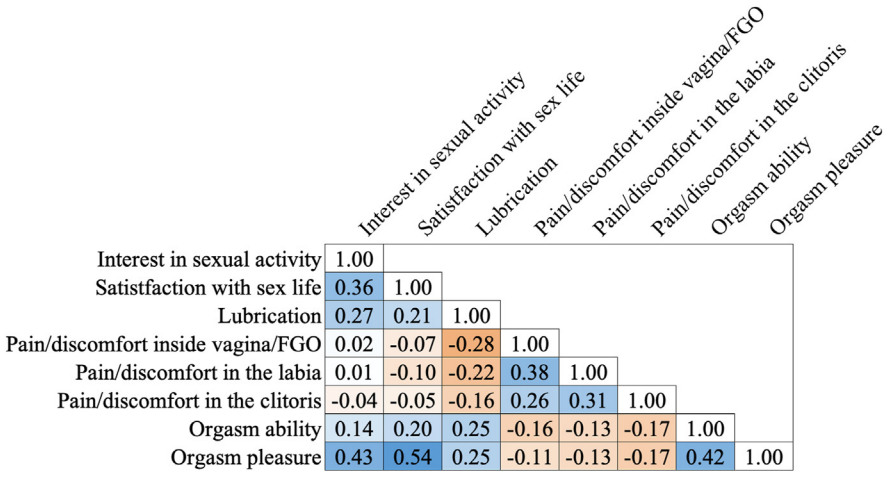
FIGURE
Correlation between sexual function T-scores



The correlation coefficient measures the strength and directional of the linear association between 2 variables. It ranges from −1 to 1 with zero indicating no correlation. Blue indicates that variables are positively correlated with one another, and orange indicates that variables are negatively correlated.

FGO, frontal genital opening.

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and quality of life.[34,35] Although one previous study reported that 1 in 5 transgender men reported that pain during sexual activity was causing significant problems in their life or relationships,[7] there has been limited investigation into how this may impact the well-being and quality of life of transgender people.

Intravaginal estrogen (delivered via cream, tablets, or a ring) is recommended for transgender men who experience testosterone-associated dyspareunia, vaginitis, and cervicitis.[36] Locally administered estrogen therapy has been demonstrated to be a safe and effective therapy for postmenopausal cisgender women who also experience vaginal atrophy associated with estrogen deficiency.[37–39] However, few existing reports likewise suggest that a minority of transgender men (<5%) have ever used intravaginal estrogen.[8] Therefore, there may be barriers to the uptake of this intervention among transgender populations, including acceptability, provider awareness, participant or patient knowledge, insurance coverage, and other structural barriers, in addition to the limited evidence base to inform clinical use.

Strengths and limitations

This study has several strengths, including a large, national sample of transgender participants who were diverse in terms of their age, gender identity, and sexual orientations.

Our results should be interpreted with several limitations. The PRIDE Study is a convenience sample of mostly White participants that relies on self-reported health outcomes and diagnoses and therefore may be subject to sampling, recall, and social desirability biases. Although our study demonstrates the feasibility of using the PROMIS SexFS with transgender men, the PROMIS SexFS has not been validated in transgender populations. This is notable given that the item calibration and scoring is stratified by sex assigned at birth. Although scoring for interest in sexual activity, orgasm ability, and orgasm pleasure are identical for male and female populations, the items specific to vaginal or FGO anatomy were calibrated using a sample primarily composed of (presumably) cisgender women.[11] Therefore, there remain opportunities to develop and validate sexual function measures for transgender and gender diverse people.

In addition, our survey did not collect data on several important variables. Although most participants reported any receptive oral or receptive vaginal or FGO sex, we did not assess other types of vaginal or FGO sexual activity (eg, penetration with fingers or sex toys) and acknowledge that some transmasculine people do not use their vagina or FGO at all during sex. We also lacked detailed information of hormone doses and were unable to distinguish between low- and high-dose testosterone. We did not collect data on several factors that also influence genital pain, including intravaginal estrogen use or the use of other medications for management of symptoms of vaginal atrophy and painful sex (eg, topical lidocaine).

Lastly, although the duration of testosterone use was associated with a few outcomes in the study, this may in part be a limitation of our cross-sectional design. Future prospective, longitudinal research is important for identifying changes in sexual function over time, taking into account the cyclical variability in vaginal symptoms and variation in testosterone access and dosing, and for understanding how long-term testosterone use may impact sexual function and vulvovaginal pain.

Conclusion

Using data from a large, national sample of transgender men and gender diverse people AFAB, we observed that testosterone use was both associated with positive sexual function and dyspareunia. The relationship between receipt of testosterone GAHT and sexual function is complex and likely includes both physiological (eg, vaginal atrophy) and psychological factors (eg, affirmation). However, given the high burden (>60%) of dyspareunia observed among transgender people AFAB, there is a need to assess its impact on the overall quality of life, identify effective and acceptable interventions, and reduce barriers to accessing treatment for transgender people experiencing dyspareunia. ■

TABLE 4
Association between current testosterone use and sexual function

	Current testosterone use vs never testosterone use					
	Unadjusted		Minimally adjusted[b]		Fully adjusted[c]	
Outcomes[a]	β (95% CI)	*P* value	β (95% CI)	*P* value	β (95% CI)	*P* value
Interest in sexual activity	6.44 (5.10–7.78)[d]	<.001[d]	6.32 (4.91–7.74)[d]	<.001[d]	6.02 (4.35–7.69)[d]	<.001[d]
Satisfaction with sex life	0.21 (−0.75 to 1.17)	.669	0.16 (−0.85 to 1.16)	.762	0.42 (−0.75 to 1.58)	.486
Lubrication	1.08 (0.01–2.15)[d]	.048[d]	0.61 (−0.52 to 1.75)	.289	1.15 (−0.14 to 2.44)	.081
Pain or discomfort inside vagina or FGO	1.45 (0.31–2.59)[d]	.013[d]	1.80 (0.61–3.00)[d]	.003[d]	1.95 (0.53–3.36)[d]	.007[d]
Pain or discomfort in the labia	−0.67 (−1.61 to 0.28)	.168	−0.38 (−1.38 to 0.62)	.455	−0.75 (−1.93 to 0.44)	.218
Pain or discomfort around the clitoris	0.78 (−0.25 to 1.82)	.139	1.20 (0.10–2.30)[d]	.033[d]	1.21 (−0.09 to 2.51)	.068
Orgasm ability	1.62 (0.39–2.86)[d]	.010[d]	1.50 (0.19–2.81)[d]	.025[d]	0.36 (−1.14 to 1.86)	.636
Orgasm pleasure	0.06 (−1.02 to 1.13)	.919	−0.04 (−1.15 to 1.08)	.951	0.46 (−0.81 to 1.73)	.475

AUDIT, Alcohol Use Identification Test; *CI*, confidence interval; *FGO*, frontal genital opening; *PCL-6*, 6-item version of the PTSD Checklist; *PHQ-9*, 9-Item Patient Health Questionnaire; *PTSD*, posttraumatic stress disorder.

[a] T-scores of 50 represents the population average for the United States population, and 10 points represents 1 standard deviation from the population average; [b] Adjusted for age, current depression symptoms (PHQ-9 scores), current posttraumatic stress symptoms (PCL-6 scores), alcohol use (AUDIT score), current smoker, hysterectomy, oophorectomy, and hormonal contraception use; [c] Adjusted for age, current depression symptoms (PHQ-9 scores), current posttraumatic stress symptoms (PCL-6 scores), alcohol use (AUDIT score), current smoker, hysterectomy, oophorectomy, intrauterine devices use, hormonal contraception use history of sexual assault, inflammatory bowel disease, irritable bowel syndrome, uterine fibroids, pelvic inflammatory disease, polycystic ovary syndrome, prior pregnancy, and intrauterine devices use; [d] *P*-value <.05.

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Acknowledgments

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J.O.-M. reports receiving consultation fees from Ibis Reproductive Health, Hims Inc., Folx Health Inc., and Sage Therapeutics for topics unrelated to this work. M.R.L. reports receiving consultation fees from Hims Inc., Folx Health Inc., and Otsuka Pharmaceutical Development and Commercialization, Inc. for topics unrelated to this work. All other authors report no conflict of interest.

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The findings from this study were presented at the National Transgender Health Summit, San Francisco, CA, May 6—7, 2023.

We welcome the opportunity to facilitate high-quality, community-engaged research collaborations that aim to improve the health and well-being of LGBTQ+ communities. Through The PRIDE Study's ancillary studies, a wide variety of investigators working on academic or community-based projects related to LGBTQ+ health can apply to work collaboratively with The PRIDE Study team and access data. For more information, please visit: https://pridestudy.org/collaborate

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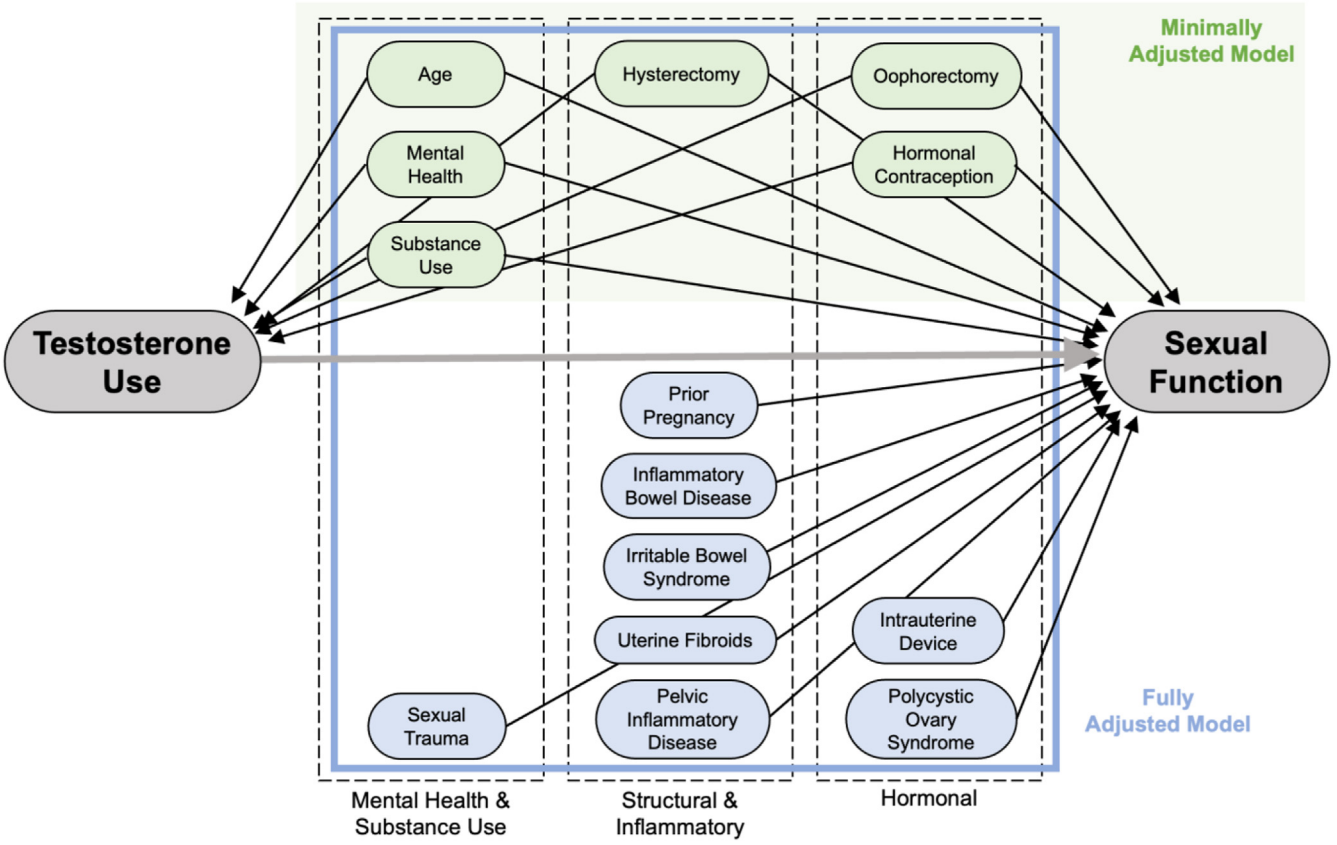
Supplemental Materials

SUPPLEMENTAL FIGURE 1
Directed acyclic graph illustrating covariates included in regression models



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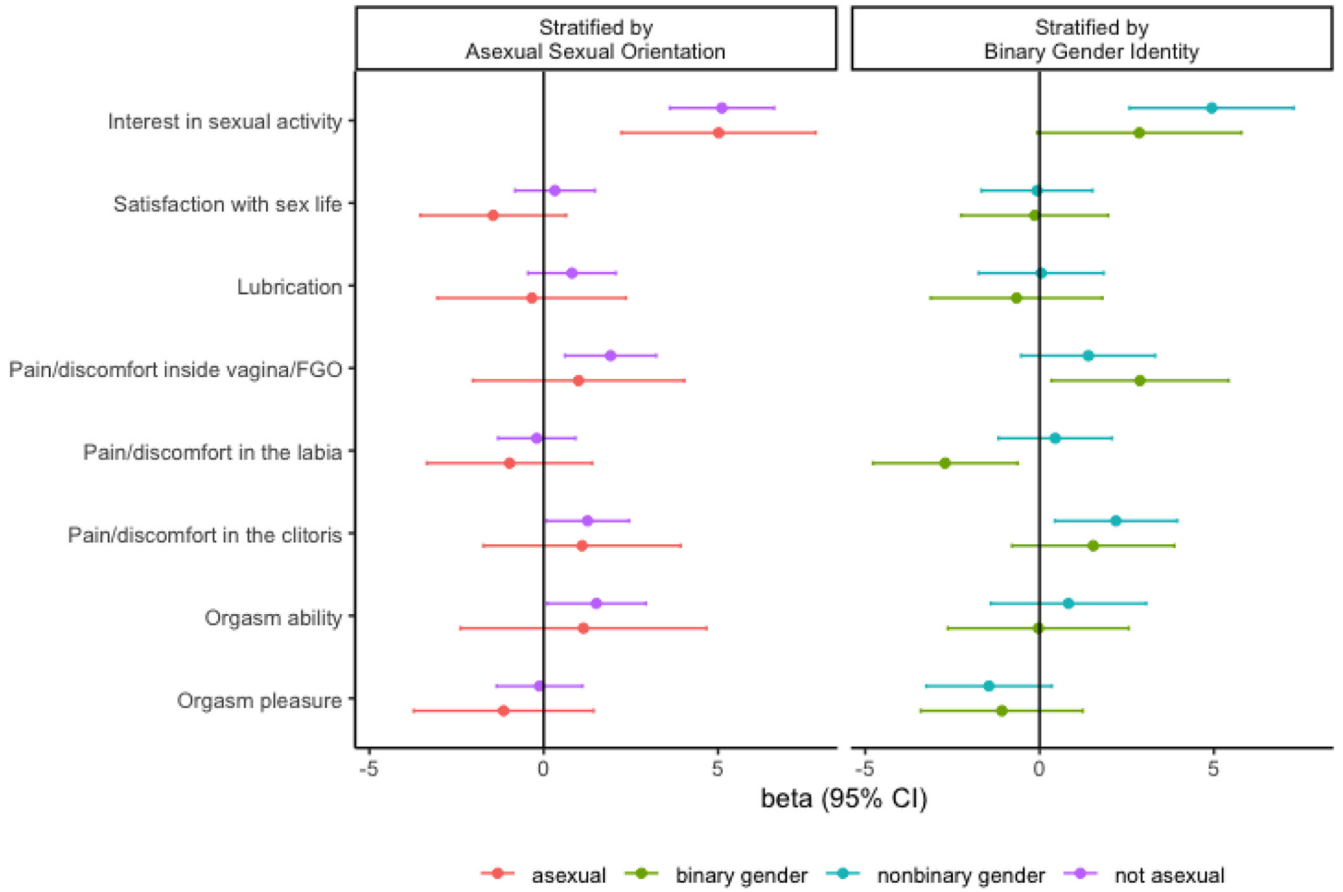
SUPPLEMENTAL FIGURE 2

Minimally adjusted regression results stratified by binary vs nonbinary gender identity



Adjusted for age, current depression symptoms (PHQ-9 scores), current posttraumatic stress symptoms (PCL-6 scores), alcohol use (AUDIT score), current smoker, hysterectomy, oophorectomy, and hormonal contraception use.

CI, confidence interval; *FGO*, frontal genital opening.

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SUPPLEMENTAL TABLE 1

Participant characteristics stratified by never, current, and former testosterone use

Characteristics	Never testosterone use	Current testosterone use	*P* value (never vs current)	Former testosterone use	*P* value (current vs former)
n	516	602		76	
Age (y), mean (range)	28.3 (8.7)	29.9 (9.6)	.003[a]	30.7 (9.9)	.505
Gender identity[b], n (%)					
Agender	99 (19.2)	50 (8.3)	<.001[a]	15 (19.7)	.003[a]
Genderqueer	234 (45.3)	135 (22.4)	<.001[a]	30 (39.5)	.002[a]
Man	21 (4.1)	231 (38.4)	<.001[a]	8 (10.5)	<.001[a]
Nonbinary	379 (73.4)	209 (34.7)	<.001[a]	54 (71.1)	<.001[a]
Transgender man	67 (13.0)	458 (76.1)	<.001[a]	31 (40.8)	<.001[a]
Two-spirit	8 (1.6)	5 (0.8)	.401	1 (1.3)	1.000
Questioning	27 (5.2)	10 (1.7)	.002[a]	1 (1.3)	1.000
Another gender identity	86 (16.7)	59 (9.8)	.001[a]	16 (21.1)	.006[a]
Sexual orientation[b], n (%)					
Asexual	145 (28.1)	95 (15.8)	<.001[a]	17 (22.4)	.196
Bisexual	173 (33.5)	203 (33.7)	.996	21 (27.6)	.350
Gay	56 (10.9)	154 (25.6)	<.001[a]	16 (21.1)	.473
Lesbian	59 (11.4)	14 (2.3)	<.001[a]	7 (9.2)	.004[a]
Pansexual	115 (22.3)	108 (17.9)	.082[a]	14 (18.4)	1.000
Queer	336 (65.1)	384 (63.8)	.689	58 (76.3)	.042[a]
Same-gender loving	17 (3.3)	39 (6.5)	.022[a]	3 (3.9)	.542
Straight/heterosexual	6 (1.2)	42 (7.0)	<.001[a]	1 (1.3)	.097
Two-spirit	2 (0.4)	2 (0.3)	1.000	1 (1.3)	.764
Questioning	18 (3.5)	34 (5.6)	.117	4 (5.3)	1.000
Another sexual orientation	39 (7.6)	34 (5.6)	.243	9 (11.8)	.066
Race and ethnicity[b], n (%)					
American Indian or Alaskan Native	23 (4.5)	15 (2.5)	.100	1 (1.3)	.814
Asian	25 (4.8)	28 (4.7)	.991	6 (7.9)	.346
Black, African American, or African	19 (3.7)	29 (4.8)	.432	1 (1.3)	.270
Hispanic, Latinx, or Spanish	36 (7.0)	39 (6.5)	.832	6 (7.9)	.824
Middle Eastern or North African	6 (1.2)	7 (1.2)	1.000	2 (2.6)	.601
Native Hawaiian or Pacific Islander	1 (0.2)	3 (0.5)	.728	0 (0.0)	1.000
White	480 (93.0)	551 (91.5)	.413	72 (94.7)	.458
Another race or ethnicity	8 (1.6)	7 (1.2)	.764	1 (1.3)	1.000
Missing	0 (0.0)	2 (0.3)	.548	0 (0.0)	1.000

[a] *P*-value <.05; [b] Participants were able to select more than 1 response, therefore, proportions may sum to greater than 1.

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SUPPLEMENTAL TABLE 2

Sexual behavior and medical history of participants stratified by current and former testosterone use

Sexual behavior and medical history	Current testosterone use	Former testosterone u	*P* value
n	602	76	
Sex in the past y, n (%)	400 (73.3)	50 (75.8)	.774
Interest in sexual activity past 30 d,[a] mean (SD)	48.96 (10.54)	41.99 (9.93)	<.001[b]
Any sexual activity past 30 d,[c] n (%)	565 (93.9)	64 (84.2)	.005[b]
In a relationship, n (%)	355 (60.5)	45 (61.6)	.948
Gender(s) of past year sex partners, n (%)			
Cisgender men	182 (30.2)	18 (23.7)	.296
Cisgender women	160 (26.6)	16 (21.1)	.370
Genderqueer, nonbinary, or gender nonconforming people AFAB	92 (15.3)	14 (18.4)	.588
Genderqueer, nonbinary, or gender nonconforming people AMAB	60 (10.0)	13 (17.1)	.090
Transgender men	81 (13.5)	6 (7.9)	.237
Transgender women	57 (9.5)	8 (10.5)	.930
Pelvic health history, n (%)			
Pelvic inflammatory disease	11 (1.8)	3 (3.9)	.426
Polycystic ovary syndrome	55 (9.1)	9 (11.8)	.581
Uterine fibroids	22 (3.7)	4 (5.3)	.711
Inflammatory bowel disease[d]	12 (2.0)	1 (1.3)	1.000
Irritable bowel syndrome	112 (18.6)	15 (19.7)	.934
Bacterial STI diagnosis[e]	18 (3.0)	0 (0.0)	.250
Ever pregnant	56 (100.0)	12 (100.0)	.116
Hysterectomy	108 (100.0)	6 (100.0)	.041[b]
Oophorectomy	87 (14.5)	4 (5.3)	.042[b]
Current hormonal contraceptive use[f]	35 (5.8)	8 (10.5)	.181
Current hormonal intrauterine device use[g]	32 (6.5)	8 (11.4)	.207
Current non-hormonal intrauterine device use[g]	16 (3.2)	2 (2.9)	1.000
Mental health and substance use, n (%)			
History of sexual abuse	340 (78.3)	46 (88.5)	.127
Ever experienced rape or sexual assault	206 (47.7)	29 (55.8)	.340
Ever diagnosed with depression	503 (83.6)	70 (92.1)	.076
PHQ-9 score for depression,[h] mean (SD)	9.6 (6.2)	11.08 (7.12)	.053
Ever diagnosed with PTSD	238 (39.5)	42 (55.3)	.012[b]
PCL-6 score for PTSD,[i] mean (SD)	15.1 (5.2)	16.8 (5.8)	.007[b]
Current smoker	45 (7.5)	6 (7.9)	1.000
AUDIT score for alcohol use,[j] mean (SD)	3.9 (4.6)	4.0 (4.7)	.886

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SUPPLEMENTAL TABLE 2

Sexual behavior and medical history of participants stratified by current and former testosterone use *(continued)*

Sexual behavior and medical history	Current testosterone use	Former testosterone u	*P* value
Language preferences, n (%)			
Vagina	386 (64.1)	54 (71.1)	.309
Front genital opening	207 (34.4)	20 (26.3)	

AFAB, assigned female at birth; *AMAB*, assigned male at birth; *AUDIT*, Alcohol Use Identification Test; *PCL-6*, 6-item version of the PTSD Checklist; *PHQ-9*, 9-Item Patient Health Questionnaire; *PTSD*, posttraumatic stress disorder; *SD*, standard deviation; *STI*, sexually transmitted infection.

[a] T-scores of 50 represents the population average for the United States population, and 10 points represents 1 standard deviation from the population average; [b] *P*-value $<.05$; [c] Including masturbation and sexual activity with a partner; [d] Including Crohn's disease, ulcerative colitis, etc.; [e] Diagnosis with chlamydia, gonorrhea, or syphilis in the past year; [f] Including oral contraceptives, transdermal patch, vaginal rings, medroxyprogesterone acetate injections, and etonogestrel implants; [g] Excluding participants who had a hysterectomy; [h] The PHQ-9 measures depressive symptoms in the past 2 weeks with scores of $\geq$10 being suggestive of moderate to severe depression; [i] The PCL-6 measures PTSD symptoms in the past month with scores of $\geq$17 being associated with probable PTSD; [j] The AUDIT measures current alcohol consumptions behaviors with scores of $\geq$15 being suggestive of alcohol use disorder.

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SUPPLEMENTAL TABLE 3

Sexual function stratified by current and former testosterone use

Sexual function	Current testosterone use	Former testosterone use	*P* value
Participants who were not sexually active in the past 30 d, n	37	12	
Reasons for no sexual activity, n (%)			
Not interested	17 (45.9)	9 (75.0)	.156
Dryness or pain in or around my vaginal or FGO	5 (13.5)	2 (16.7)	1.000
Difficulties with orgasm or climax	5 (13.5)	0 (0.0)	.427
Do not enjoy sexual activity	4 (10.8)	5 (41.7)	.049[a]
Health condition	2 (5.4)	2 (16.7)	.528
No partners	14 (37.8)	3 (25.0)	.643
Partner(s) away, not interested, or health condition	7 (18.9)	3 (25.0)	.966
Another reason	6 (16.2)	0 (0.0)	.326
Participants who were sexually active in the past 30 d, n	565	64	
Lubrication			
Any difficulty achieving or maintaining lubrication, n (%)	326 (58.5)	41 (66.1)	.308
T-score[b], mean (SD)	51.2 (8.4)	48.6 (10.2)	.020[a]
Pain or discomfort inside vagina or FGO			
Any pain or discomfort, n (%)	310 (56.0)	27 (43.5)	.084
T-score[c], mean (SD)	52.3 (9.2)	50.7 (9.6)	.182
Pain or discomfort in the labia			
Any pain or discomfort, n (%)	126 (22.8)	15 (24.2)	.928
T-score[c], mean (SD)	51.0 (7.4)	51.4 (7.9)	.664
Pain or discomfort in the clitoris			
Any pain or discomfort, n (%)	167 (30.2)	21 (34.4)	.594
T-score[c], mean (SD)	53.4 (8.5)	54.3 (9.3)	.419
Orgasm			
Did not have an orgasm, n (%)	19 (3.4)	6 (9.4)	.047[a]
Any difficulty achieving orgasm, n (%)	289 (52.2)	41 (67.2)	.036[a]
T-score for achieving orgasm[b], mean (SD)	50.1 (9.0)	46.1 (10.7)	.001[a]
T-score for orgasm pleasure[b], mean (SD)	45.2 (8.3)	42.3 (9.0)	.013[a]
Satisfaction with sex life			
T-score[b], mean (SD)	45.9 (7.6)	42.9 (7.0)	.003[a]

T-scores of 50 represents the population average for the US population, and 10 point represents one standard deviation from the population average.

FGO, frontal genital opening; *SD*, standard deviation.

[a] *P*-value <.05; [b] High scores indicate more lubrication, ability to achieve orgasm, pleasure from orgasms, and satisfaction with sex life; [c] Higher scores indicate more pain or discomfort.

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SUPPLEMENTAL TABLE 4

Association between duration of testosterone use (years) and sexual function

	Unadjusted		Minimally adjusted[b]		Fully adjusted[c]	
Outcomes[a]	Beta (95% CI)	*P* value	Beta (95% CI)	*P* value	Beta (95% CI)	*P* value
Interest in sexual activity	0.38 (0.20−0.56)[d]	<.001[d]	0.39 (0.18−0.59)[d]	<.001[d]	0.35 (0.11−0.60)[d]	.005[d]
Satisfaction with sex life	−0.01 (−0.13 to 0.12)	.917	0.00 (−0.14 to 0.14)	.969	0.01 (-0.16−0.17)	.949
Lubrication	0.10 (−0.04 to 0.23)	.165	0.11 (−0.04 to 0.27)	.161	0.17 (−0.01 to 0.35)	.062
Pain or discomfort inside vagina or FGO	0.01 (−0.14 to 0.15)	.945	0.06 (−0.11 to 0.23)	.500	0.05 (−0.14 to 0.25)	.599
Pain or discomfort in the labia	−0.10 (−0.22 to 0.02)	.099	−0.07 (−0.21 to 0.07)	.325	−0.08 (−0.24 to 0.09)	.367
Pain or discomfort around the clitoris	−0.17 (−0.3 to −0.04)	.012	−0.05 (−0.2 to 0.11)	.557	−0.06 (−0.24 to 0.12)	.521
Orgasm ability	0.20 (0.04−0.35)	.012	0.16 (−0.02 to 0.34)	.078	0.03 (−0.17 to 0.24)	.753
Orgasm pleasure	0.06 (−0.07 to 0.2)	.335	0.03 (−0.12 to 0.18)	.655	0.08 (−0.09 to 0.25)	.358

CI, confidence interval; *FGO*, frontal genital opening.

[a] T-scores of 50 represents the population average for the United States population, and 10 points represents 1 standard deviation from the population average; [b] Adjusted for age, current depression symptoms (PHQ-9 scores), current posttraumatic stress symptoms (PCL-6 scores), alcohol use (AUDIT score), current smoker, hysterectomy, oophorectomy, and hormonal contraception use; [c] Adjusted for age, current depression symptoms (PHQ-9 scores), current posttraumatic stress symptoms (PCL-6 scores), alcohol use (AUDIT score), current smoker, hysterectomy, oophorectomy, intrauterine devices use, hormonal contraception use, history of sexual assault, inflammatory bowel disease, irritable bowel syndrome, uterine fibroids, pelvic inflammatory disease, polycystic ovary syndrome, previous pregnancy, and intrauterine devices use; [d] *P*-value <.05.

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