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Vocal-Gender Incongruence, wellbeing, and safety: the medical necessity of gender-affirming vocal training

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ABSTRACT

Background: Voice is a gender signifier, and incongruence between a person's gender identity and others' perception of their gender based on their voice can trigger dysphoria in transgender/gender diverse (TGD) individuals. Vocal-gender incongruence (VGI) can also signal one's TGD identity, which may be unsafe given the prevalence of discrimination and victimization experienced by TGD persons.

Methods: To understand the impact of VGI on wellness and safety, a cross-sectional electronic survey was developed. The Quality-of-Life Scale (QOLS), a modified version of the Transgender Self-Evaluation Questionnaire (TSEQ), and questions assessing experiences of violence, discrimination and misgendering were included. Differences in safety and wellness measures between participants with and without VGI were assessed using t-tests and chi-squared tests. Linear and logistic regression analyses were conducted to examine the relationships between VGI and safety, quality of life, and experiences of discrimination or misgendering.

Results: Of 187 TGD participants, 127 (68%) reported VGI. Participants with VGI had significantly lower scores on the QOLS (70 vs 76; p=.02) and were significantly more likely to have been misgendered based on their voice in the past year ($p < .001$; 85% vs. 33%). Higher TSEQ scores (indicating higher impact of VGI on daily life) were associated with lower QOLS scores (β=0.06; 95% CI 0.04, 0.09; $p < .001$) and with greater likelihood of having experienced public discrimination (β=0.03; 95% CI 0.02, 0.05; $p < .001$), medical discrimination (β=0.04; 95% CI 0.02, 0.06; $p < .001$), and verbal harassment (β=0.03; 95% CI 0.01, 0.04; $p < .001$) but not physical harm (β=0.03; 95% CI 0.002, 0.06; p=0.05).

Conclusion: VGI is associated with lower quality of life and experiences of discrimination and verbal harassment for TGD individuals. Therefore, healthcare that alleviates VGI, including gender-affirming vocal training, is medically necessary.

KEYWORDS
Discrimination; safety; speech; transgender; voice

Introduction

Transgender/gender diverse (TGD) individuals have higher rates of chronic disease, disability, and mortality (Brown & Jones, 2016; de Blok et al., 2021; Downing & Przedworski, 2018; Fredriksen Goldsen et al., 2022; Hughes et al., 2022). In addition, literature demonstrates a two- to eight-fold increased prevalence of mental health conditions in the TGD population compared to the cisgender population (Brown & Jones, 2016; Hanna et al., 2019; Pinna et al., 2022; Reisner et al., 2015, 2016). Researchers have demonstrated that minority stress, as well as structural, community, and interpersonal stressors contribute to these health disparities (Flentje et al., 2020; Hendricks & Testa, 2012; Streed et al., 2021; Tebbe & Budge, 2022; Valentine & Shipherd, 2018).

Unfortunately, these stressors are highly prevalent. The 2011 report of the National Transgender Discrimination Survey in the United States (U.S.) demonstrated that "Transgender and gender non-conforming people face injustice at every turn: in childhood homes, in school systems that

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promise to shelter and educate, in harsh and exclusionary workplaces, at the grocery store, the hotel front desk, in doctors' offices and emergency rooms, before judges and at the hands of landlords, police officers, health care workers and other service providers" (Grant et al., 2011). Since then, the 2015 U.S. Transgender Survey of over 27,000 respondents across the U.S. showed that nearly half (47%) had been sexually assaulted at some point in their life (James et al., 2016). Preliminary results from an updated survey of 84,000 TGD adults reported that in the 12 months prior to taking the survey, nearly one third (30%) of respondents had been verbally harassed, 39% had been harassed online, and 3% had been physically assaulted for being TGD (James et al., 2024). In addition to these experiences, there has been a dramatic rise in anti-transgender legislation in the U.S. since 2016, which contributes to distress and increases anticipated safety concerns (Abreu et al., 2022; Bockting et al., 2020; Cunningham et al., 2022; Pham et al., 2020; Tebbe & Budge, 2022).

When a TGD individual can access gender-affirming healthcare, there are decreases in psychological distress, body dissatisfaction and uneasiness, as well as improvements inquality of life (Colizzi et al., 2014; Cornell University, 2018; Van Leerdam et al., 2023; White Hughto & Reisner, 2016). Based on the strong evidence for the benefits to quality of life and well-being, and the balance between risks and benefits, many gender-affirming interventions are considered medically necessary, and described in the World Professional Association of Transgender Health Standards of Care version 8 (WPATH SOCv8) (Coleman et al., 2022).

One of the ways in which humans assign gender to individuals is through voice. When there is vocal incongruence between a person's gender expression and their voice (vocal-gender incongruence; VGI), it can signal that a person may be TGD and could place them at risk of victimization given the high rates of victimization experienced by TGD community members (James et al., 2024). Unfortunately, VGI is a common phenomenon, with 88% of TGD participants in one study reporting current VGI and 96% reporting historical VGI (Kennedy & Thibeault, 2020). VGI can lead to anxiety and depression and decreased quality of life (Cler et al., 2020; Nuyen et al., 2023; Valente Junior & Mesquita de Medeiros, 2022). It can also contribute to overall gender dysphoria (Ziltzer et al., 2023).

Gender-affirming vocal ttraining (GAVT) can include pitch, intonation patterns, resonance, semantics (word choice), pragmatics, and non-verbal communication training (Adler, 2017; Hancock & Siegfriedt, 2020; Oates & Dacakis, 2015). Voice professionals can reliably evaluate how the public will gender a person's voice, and believe it is within their scope of practice to treat TGD clients, and yet many are not specifically trained to provide GAVT (American Speech-Language-Hearing Association, n.d.; Matthews et al., 2020; McNeill et al., 2008). When provided by a trained professional, GAVT can lessen VGI by increasing perception of voice as more aligned with gender identity and improve voice-related quality of life (Carew et al., 2007; Chadwick et al., 2022; Dacakis et al., 2012; Gelfer & Tice, 2013; Rapoport et al., 2023). Referral for GAVT is recommended in the WPATH SOCv8 for TGD people who are dissatisfied with their voice (Coleman et al., 2022). Despite this, many TGD individuals do not seek this care, and many vocal professionals report not having been formally trained to provide GAVT to TGD individuals (Matthews et al., 2020; Ziltzer et al., 2023).

The aim of the current study was to investigate the relationship between VGI, quality of life, discrimination, and safety in a large group of TGD individuals. We hypothesized that patients who self-report VGI would present with lower quality of life and safety and higher discrimination compared to those who did not self-report VGI.

Methods

Study design

To address our study aim we used an anonymous cross-sectional electronic survey which included questions about demographic information, vocal congruence, experiences of discrimination, personal safety, and quality of life. Study data were collected and managed using REDCap (Research Electronic Data Capture) electronic data capture

tools hosted at the University of Cincinnati, a secure, web-based software platform designed to support data capture for research studies (Harris et al., 2019). Survey completion took approximately 20 minutes.

Participants were recruited from June-November 2022 through social media (Facebook, Instagram) and professional listservs of clinicians serving TGD patients, flyers posted at local community venues and events in a Midwestern city in the U.S., and TGD-serving medical offices. To be included in this study, participants had to affirm that they were 18 years of age or older and that they identified as transgender, non-binary, or gender diverse. Individuals who responded "No" to either of these statements were excluded from participation. This study was approved by the Institutional Review Board of the University of Cincinnati (#2022-0358). Other data from this survey, which explored relationships between access to primary care and vocal incongruence as well as perceived barriers to accessing GAVT (i.e. health insurance), have previously been published (Madzia et al., 2024).

Variables

Vocal-gender incongruence

We measured VGI in three ways. First, we asked about the presence of VGI, with the statement "I think my voice aligns with my gender" with response options "yes," "no," or "unsure." To ascertain the degree of VGI, participants were also provided with a numerical sliding scale to rate their current and ideal voices ranging from very masculine (0) to very feminine (100), with 50 being gender neutral. The degree of VGI was calculated by subtracting participants' current voice rating from their ideal voice rating and using the absolute value. This absolute value was used to operationalize VGI as a continuous variable for all statistical analyses and regression models.

Lastly, the survey assessed the impact of VGI by including the Transgender Self-Evaluation Questionnaire (TSEQ), a 30-item scale developed in 2006 to assess TGD individuals' perceptions of their voice and the impact of their voice on their everyday lives, including questions related to fatigue and vocal quality (Davies & Goldberg, 2006). For each item, participants report their frequency of the experience on a 5-point Likert scale from Never (0) to Always (4). Questions are summed to a total score in which higher scores indicate a greater impact of voice on daily life.

The TSEQ was developed for immediate clinical use and has not had robust psychometric evaluation. Despite this, we elected to use the TSEQ for this study because other existing tools have been developed specifically for transfeminine and non-binary people (e.g. TSVQ and VENI, respectively) but none have been developed for transmasculine people. Our goal was to use a single scale to query across multiple gender identities, so we employed a modified version of the scale to include more gender expansive language, as the original scale only referred to masculine/feminine voices and genders of men and women (Appendix A). For example, the statement "I feel my voice gets in the way of me living as a woman (MtF)/man (FtM)" was adjusted to "I feel my voice gets in the way of living my gender identity."

We also asked several survey questions related to prior experiences with gender-affirming vocal care, including history of vocal surgery and prior familiarity and experience with GAVT.

Experiences of misgendering

Misgendering was assessed by two questions that the research team devised: "In the past year, how frequently were you misgendered based on your physical appearance?" and "In the past year, how frequently were you misgendered based on your voice?". Participants chose a single response for each on a 5-item Likert scale from 1 (never) to 5 (always) or "I don't know".

Experiences of discrimination

The team developed two novel questions to determine the presence of discrimination in public places and in medical settings. These questions were based on those used in the 2015 U.S. Transgender Survey (James et al., 2016). The two questions included were: "In the past year, have you experienced denial of equal treatment or service at a place of business or public place due to your trans status, gender identity, or gender expression?" and "In the past year, have you

experienced medical discrimination (e.g. reduced access to care) due to your trans status, gender identity, or gender expression?" Participants answered "yes" or "no" to each.

Experiences of safety

Safety was assessed using two questions developed by the research team to assess victimization by verbal harassment and physical violence. Once again, these questions were based on those used in the 2015 U.S. Transgender Survey (James et al., 2016). The questions included were "In the past year, were you verbally harassed in a place of business or public place due to your trans status, gender identity, or gender expression?" and "In the past year, were you physically attacked in a place of business or public place due to your trans status, gender identity, or gender expression?", with response options for each being "yes" or "no".

Quality of life

Quality of life was measured using the 15-item Quality of Life Scale (QOLS), which asks people to rate their satisfaction with 15 aspects of their life, ranging from material comfort and relationships, social and community connectedness, health, work, and leisure. Responses were collected on a seven-item Likert scale for each ranging from "delighted" (score 7) to "terrible" (score 1). Question scores are summed to reflect an overall quality of life rating, with higher scores indicating higher quality of life. The QOLS was originally developed in the U.S. in the 1970s and was validated by Burckhardt et al. in 1989, demonstrating high reliability (Cronbach's alpha of .87) and convergent and discriminant construct validity (Burckhardt et al., 1989; Burckhardt & Anderson, 2003).

Covariates

Given that experiences of discrimination were an important variable for this survey, we asked participants to report their age, race (Asian, Black, Native American/Alaska Native, Native Hawaiian/Pacific Islander, White, two or more races, or other), ethnicity (Hispanic/non-Hispanic), gender identity (man/transgender man/masc, woman/transgender woman/femme, or nonbinary/genderqueer/other), and previous use of gender-affirming hormone therapy (GAHT) for at least 3 months (yes/no). Use of GAHT was included in this analysis since testosterone can impact one's voice, while estrogen does not result in voice changes. Participants were also asked additional demographic questions regarding sex assigned at birth, insurance status, access to primary care, previous GAVT, and prior vocal surgeries; these variables were examined but not included in regression models.

Statistical analysis

Normality was assessed visually and with Shapiro-Wilk tests. The sample was dichotomized into those who reported the presence of VGI and those who denied it or were unsure. Differences in safety and wellness measures between participants with and without self-reported VGI (were assessed using Wilcoxon rank sum tests for continuous variables and chi-squared tests for categorical variables, as distributions were non-normal for the variables of age ($W = 0.82$, $p < 0.01$), VGI ($W = 0.94$, $p < 0.01$), QOLS scores ($W = 0.37$, $p < 0.01$), and TSEQ scores ($W = 0.98$, $p < 0.01$). Linear and logistic regression analyses were conducted to examine the relationships between the impact of VGI (as measured by the TSEQ) and safety and wellness measures. All regression models were adjusted for age, race, gender identity, and history of gender-affirming hormonesg. Significance was set a priori to $p < .05$ and Bonferroni correction was used to correct for multiple comparisons. Statistical analysis was carried out in RStudio Version 2022.01.2 using the dplyr and ggplot2 packages.

Positionality statement

The authors of this manuscript include a speech-language pathologist, otolaryngologist, family medicine and psychiatry physicians, a sociologist, and medical trainees. Multiple authors identify as part of the LGBTQIA+ community. The majority of the authors are White and all are American. These lived experiences shape our perspectives on VGI in the TGD community and our approaches to studying this topic.

Results

Demographics

There were 224 survey responses in total. Thirty-seven of these responses were incomplete, resulting in 187 TGD participants who responded to all questions relevant to this analysis. Participants were aged 18–79 ($M = 31.3$, SD = 11.2), 35.4% were men, 33.3% women, and 26.2% nonbinary/genderqueer adults (see Table 1). Of the 103 endosex participants (those without intersex variations) who were assigned female at birth (i.e. transgender men and some of the nonbinary/genderqueer people), 74 (67.9%) had been on testosterone for at least 3 months. Of the 75 endosex participants who were assigned male at birth (i.e. transgender women and some of the nonbinary/genderqueer people), 72 (92.3%) had been on estradiol for at least 3 months. Of the 9 intersex participants, 2 (22.2%) had been on testosterone and 4 had been on estradiol for at least 3 months. Of the 67 trans men, 57 (85.1%) had been on testosterone, while 61 (93.8%) of 65 trans women had been on estradiol for at least 3 months. Of the 55 nonbinary/genderqueer participants, 15 (27.3%) had been on testosterone and 12 (21.8%) had been on estradiol for at least 3 months.

Table 1. Demographic information.

Factor		Number (%)
Race/Ethnicity	White Non-Hispanic	145 (77.5)
	White Hispanic	8 (4.3)
	Black Non-Hispanic	11 (5.9)
	Asian Non-Hispanic	4 (2.1)
	Native American Hispanic	1 (0.5)
	Unlisted Race Non-Hispanic	2 (1.2)
	Multiracial Non-Hispanic	14 (7.5)
	Multiracial Hispanic	1 (0.5)
Gender Identity	Woman / Transgender Woman / Femme	65 (34.8)
	Man / Transgender Man / Masc	67 (35.8)
	Nonbinary/Genderqueer	55 (29.4)
	Write-in	9 (4.8)
Intersex	Yes	9 (4.8)
	No	178 (95.2)
Access to Primary Care	Yes	167 (89.3)
	No	16 (8.6)
	Unsure	4 (2.1)
Employment	Full time	105 (56.1)
	Part time	33 (17.6)
	Unemployed	41 (21.9)
	Retired	8 (4.3)
Insurance	Medicaid/State Insurance	43 (23.0)
	Medicare	12 (6.4)
	Private Insurance (self/partner)	82 (43.9)
	Private Insurance (parents)	35 (18.7)
	Other	12 (6.4)
	Uninsured	14 (7.5)
History of Hormone Use for 3+ months	Yes	146 (78.1)
	No	41 (21.9)
Length of Hormone Use	<1 year	23 (12.3)
	1 year	15 (8.0)
	1–3 years	49 (26.2)
	3–5 years	24 (12.8)
	5–10 years	27(14.4)
	>10 years	8 (4.2)
Ever Hormone Use For 3+ months	Testosterone	83 (44.4)
	Estradiol	102 (54.5)
	Spironolactone	52 (27.8)
	Bicalutamide	4 (2.1)
	Finasteride/Dutasteride	23 (12.3)
	Progesterone	47(25.1)
	GnRH analogue	1 (0.5)
Current Hormone Use	Testosterone	68 (36.4)
	Estradiol	73 (39.0)
	Spironolactone	40 (21.4)
	Bicalutamide	1 (0.5)
	Finasteride/Dutasteride	20 (10.7)
	Progesterone	44 (23.5)
	GnRH analogue	2 (1.1)

Vocal incongruence

Sixty participants (32%) agreed with the statement "I think my voice aligns with my gender." When asked about degree of VGI using a 0–100 mm scale with higher numbers indicating a larger difference between current and ideal voice, 95% ($n = 177$) of the whole sample reported a non-zero mismatch between current voice and ideal voice, calculated by subtracting ideal voice from current voice and using the absolute value to represent VGI (Mean = 30.7 mm, SD = 21.3 mm, Median = 28 mm, Range = 0–100 mm, Interquartile Range = 26.75 mm). Participants on GAHT reported mean VGI of 29.4 mm compared with participants not on GAHT who had mean VGI of 35.3 mm ($p = 0.05$). For trans men, there was a significant difference in mean VGI between participants on testosterone (19.4 mm) and not on testosterone (47.6 mm; $p < 0.001$). Mean VGI was similar between trans women who were on estradiol (40.6 mm) or were not on estradiol (45.0 mm; $p = 0.54$); VGI was also similar for nonbinary/genderqueer respondents who were on GAHT (25.7 mm) or were not on GAHT (29.3 mm; $p = 0.66$).

TSEQ summative scores that evaluated the impact of VGI on quality of life showed an average score of 50.4 (SD = 26.9), indicating an average response of 1.6/4 on each question and mild-moderate impact or that VGI "sometimes" impacts quality of life. Participants on GAHT reported mean TSEQ of 51.7 compared with participants not on GAHT who had mean TSEQ of 45.6 ($p = 0.17$). For trans men, there was a significant difference in TSEQ between participants on testosterone (mean = 41.6) and not on testosterone (mean 64.5, $p = 0.02$). There was no difference in TSEQ between trans women on estradiol (mean = 62.9) and not on estradiol (mean = 56.3, $p = 0.93$). TSEQ scores also did not differ by hormone usage for nonbinary/genderqueer respondents (mean = 48.0 vs. 37.1, $p = 0.14$).

Misgendering

As seen in Table 2, misgendering was a common phenomenon among participants, with 45% of all participants reporting always or often having been misgendered in the last year due to their physical appearance, and 52% due to their voice. Nonbinary/genderqueer participants were most likely to be misgendered due to physical appearance in the past year (67.3%) compared with trans men (31.1%) and trans women (34.5%). Trans women were most likely to be misgendered due to voice in the past year (60.3%) compared with trans men (39.3%) and nonbinary/genderqueer participants (54.5%). Participants with reported VGI in the top quartile (greater than 41.75 mm) were significantly more likely to report often or always being misgendered due to their

Table 2. Participant experiences with misgendering, discrimination, and threats to safety.

		Number (%)*
Misgendering		
In the past year, how frequently were you misgendered based on your physical appearance?	Always	30 (17.5)
	Often	46 (26.9)
	Sometimes	34 (19.9)
	Rarely	30 (17.5)
	Never	29 (17.0)
In the past year, how frequently were you misgendered based on your voice?	Always	43 (25.1)
	Often	46 (26.9)
	Sometimes	28 (16.4)
	Rarely	14 (8.2)
	Never	29 (17.0)
Discrimination		
In the past year, have you experienced denial of equal treatment or service at a place of business or public place due to your trans status, gender identity, or gender expression?	Yes	45 (26.3)
	No	126 (73.7)
In the past year, have you experienced medical discrimination (e.g. reduced access to care) due to your trans status, gender identity, or gender expression?	Yes	33 (19.3)
	No	138 (80.7)
SAFETY		
In the past year, were you verbally harassed in a place of business or public place due to your trans status, gender identity, or gender expression?	Yes	71 (41.5)
	No	100 (58.5)
In the past year, were you physically attacked in a place of business or public place due to your trans status, gender identity, or gender expression?	Yes	10 (5.8)
	No	161 (94.2)

*Percentages calculated out of 171 participants who responded to these measures.

voice than participants with VGI below the top quartile (72.3% vs. 39.6%; $p<0.001$).

Participants who denied presence of VGI were significantly less likely to also report having been misgendered based on their voice in the past year (33.3% vs. 84.6%; $p<0.001$) than participants with VGI, but not less likely to report having been misgendered based on physical appearance (42.5% vs. 74.0%; $p=0.11$). Higher TSEQ scores (indicating greater impact of VGI) were associated with increased odds of being misgendered based on voice in a logistic regression model including the covariates age, race, gender identity, and history of gender-affirming hormones (OR = *1*.06; 95% CI 1.05–1.08; $p<0.001$) (Table 3). Compared to non-binary/genderqueer participants, trans men (OR = 0.37, 95% CI 0.18–0.76, $p<0.001$) and trans women (OR = 0.38, 95% CI 0.16–0.85, $p=0.02$) had decreased odds of being misgendered based on voice in the past year.

Higher TSEQ scores were also associated with increased odds of being misgendered based on physical appearance in the past year an adjusted logistic regression model (OR = 1.03; 95% CI 1.01–1.04; $p<0.001$). Younger age (OR = 0.96; 95% CI 0.93–0.99; $p<0.01$) and non-White race (OR-0.28; 95% CI 0.13–0.59; $p<0.01$) were associated with decreased odds of being misgendered based on physical appearance. Compared with non-binary/genderqueer participants, trans men (OR = 0.17; 95% CI 0.09–0.32; $p<0.001$) and trans women (OR = 0.18; 95% CI 0.08–0.37; $p<0.001$) had decreased odds of being misgendered based on physical appearance.

Discrimination

About 1 in 4 (26.3%) of participants described having experienced denial of equal treatment/service in a public place or place of business due to their gender identity in the last year, and nearly 1 in 5 (19.3%) reported discrimination or reduced access to care in medical settings in the last year, as seen in Table 2. Trans men were most likely to report denial of equal treatment in a public place (29.9%), compared with 23.1% of trans women and 18.2% of nonbinary/genderqueer participants. Nonbinary participants were most likely to report discrimination in medical settings (23.6%)

Table 3. Logistic regression results for past year misgendering, discrimination, and QOLS scores.

	Past year misgendering based on voice			Past year misgendering based on physical appearance			Past year public discrimination			Past year medical discrimination			QOLS		
	OR	(95% CI)	*p*-value	OR	(95% CI)	*p*-value	OR	(95% CI)	*p*-value	OR	(95% CI)	*p*-value	*β*	(95% CI)	*p*-value
TSEQ	1.06	1.05–1.08	<0.001***	1.03	1.01–1.04	<0.001***	1.03	1.02–1.04	<0.001***	1.04	1.03–1.06	<0.001***	−0.18	−0.26–(−0.10)	<0.001***
Age	0.99	0.97–1.03	0.82	0.96	0.93–0.99	<0.01**	0.99	0.96–1.02	0.70	1.00	0.97–1.04	0.80	0.04	−0.15–0.23	0.67
Gender															
Non-binary	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–	–	–	–
Trans man	0.37	0.18–0.76	<0.001***	0.17	0.09–0.32	<0.001***	1.93	0.97–3.98	0.70	0.41	0.19–0.87	0.02*	2.09	−3.23–7.42	0.44
Trans woman	0.38	0.16–0.85	0.02*	0.18	0.08–0.37	<0.001***	0.99	0.43–2.31	0.99	0.15	0.06–0.39	<0.001***	2.38	−3.72–8.48	0.44
Race															
White	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–	–	–	–
Non-white	0.55	0.26–1.13	0.11	0.28	0.13–0.59	<0.01**	2.28	1.12–4.57	0.02*	0.24	0.06–0.68	0.01*	−1.05	−3.17–1.07	0.33
GAHT															
Yes	1.00	–	–	1.00	–	–	1.00	–	–	1.00	–	–	–	–	–
No	3.91	1.92–8.25	<0.001***	3.77	1.98–7.36	<0.001***	0.94	0.45–1.91	0.86	0.67	0.30–1.42	0.31	0.87	−4.57–6.31	0.75

*indicates *p*-value <0.05 **indicates *p*-value <0.01 ***indicates *p*-value <0.001

compared with 16.4% of trans men and 13.8% of trans women. There was no significant difference based on whether participants reported VGI in the top quartile in either experience of denial of equal treatment in a public place (27.7% vs. 23.0%; $p = 0.49$) or discrimination in medical settings (23.4% vs. 15.8%; $p = 0.23$).

Higher TSEQ scores (indicating greater impact of VGI) were associated with increased odds of having experienced public discrimination in an adjusted logistic regression model (OR = 1.03; 95% CI 1.02–1.04; $p < 0.001$). Higher TSEQ scores were also associated with increased odds of having experienced medical discrimination in the past year (OR = 1.04; 95% CI 1.03–1.06; $p < 0.001$). Compared with non-binary/genderqueer participants, trans men (OR = 0.41; 95% CI 0.19–0.87; $p = 0.02$) and trans women (OR = 0.15; 95% CI 0.06–0.39; $p < 0.001$) had decreased odds of having experienced medical discrimination in the past year.

Safety

Nearly half of participants (41.5%) experienced verbal harassment in the last year, but recent experiences of physical assault were rare (5.9%). Participants who reported VGI in the top quartile experienced verbal harassment at a higher rate than participants in the lower three quartiles (48.9% vs. 34.5%) but this difference was not statistically significant ($p = 0.07$). There was also no difference in likelihood of experiencing verbal harassment based on gender identity. Experience of physical attacks did not differ by gender identity or having a higher reported VGI (all $p > 0.05$).

There were no significant differences between those who reported or denied presence of VGI on history of verbal harassment ($p = 0.39$) or physical harm ($p = 0.19$). In adjusted logistic regression models, higher TSEQ scores (indicating greater impact of VGI) were associated with increased odds of having experienced verbal harassment (OR = 1.03; 95% CI 1.02–1.04; $p < 0.001$) and physical harm (OR = 1.02; 95% CI 1.01–1.05; $p = 0.01$) in the past year (Table 4).

Being misgendered because of one's voice in the past year was significantly associated with increased odds of verbal harassment in an

Table 4. Logistic regression results for past year verbal harassment and physical harm by TSEQ and misgendering in past year.

	Past year verbal harassment			Past year physical harm		
Variable	OR	(95% CI)	*p*-value	OR	(95% CI)	*p*-value
TSEQ	1.03	1.02–1.04	<0.001***	1.02	1.01–1.05	0.01*
Age	0.99	0.96–1.01	0.37	1.01	0.95–1.06	0.76
Gender						
Non-binary	1.00	–	–	1.00	–	–
Trans man	0.79	0.43–1.45	0.44	1.91	0.50–9.3	0.37
Trans woman	0.52	0.24–1.08	0.08	1.17	0.27–6.30	0.84
Race						
White	1.00	–	–	1.00	–	–
Non-white	1.30	0.66–2.55	0.44	1.19	0.26–3.98	0.80
GAHT						
Yes	1.00	–	–	1.00	–	–
No	1.05	0.56–1.95	0.89	0.45	0.07–1.81	0.32

	Past year verbal harassment			Past year physical harm		
Variable	OR	(95% CI)	*p*-value	OR	(95% CI)	*p*-value
Misgendered in past year	2.82	1.72–4.7	<0.001***	2.39	0.84–7.55	0.11
Age	0.99	0.96–1.01	0.28	1.00	0.95–1.05	0.87
Gender						
Non-binary	1.00	–	–	1.00	–	–
Trans man	0.95	0.52–1.74	0.87	2.15	0.56–10.58	0.29
Trans woman	0.81	0.40–1.62	0.55	1.80	0.42–9.59	0.45
Race						
White	1.00	–	–	1.00	–	–
Non–white	1.40	0.72–2.68	0.32	1.26	0.28–4.17	0.72
GAHT						
Yes	1.00	–	–	1.00	–	–
No	0.83	0.44–1.55	0.55	0.39	0.06–1.67	0.25

adjusted logistic regression model (OR = 2.82; 95% CI 1.72–4.70; $p < 0.001$). There was no association between being misgendered because of one's voice and physical harm. Gender identity was not associated with greater likelihood of verbal harassment or physical harm.

Quality of life

Of the 169 participants who answered 13–15 questions on the QOLS, the average score per item was 4.8 (which falls closest to "mostly satisfied", a score of 5) with a standard deviation of 0.9. There was nosignificant difference in QOLS scores based on gender identity ($p = 0.40$). Participants who denied presence of VGI had significantly higher composite scores on the QOLS ($p = 0.02$) compared to those who self-reported VGI. Higher TSEQ scores (indicating greater impact of VGI) were associated with lower QOLS scores in an adjusted linear regression model ($\beta = -0.18$; 95% CI −0.26, −0.10; $p < 0.001$).

Discussion

This study investigated how the presence and impact of VGI on daily life influenced wellness and safety measures among 187 TGD adults. Across participants, there was a high burden of experiences of misgendering due to voice, discrimination in public and medical settings, and verbal harassment. Our hypothesis was supported when we found markedly high incidence of VGI in our sample, significant differences between those with and without VGI on quality-of-life measures, and relationships between the impact of VGI on daily life and measures of personal well-being and safety.

Our survey found that more than two-thirds (68%) of those surveyed disagreed that their voice aligned with their gender, and nearly all (95%) experienced some degree of mismatch between ideal and current voice related to gender. These numbers are consistent with previous research that reported >90% of TGD people experience VGI (Kennedy & Thibeault, 2020). Importantly, there is an assumption that VGI is only present in trans women who underwent a testosterone-driven puberty, due to persistent effects of testosterone on the larynx; however, our study provides evidence that VGI is a phenomenon experienced across all genders, when 36% of trans men/masc and 51% of non-binary individuals also reported VGI. The finding that VGI is experienced among many transgender men and non-binary people is congruent with previous research (Kennedy & Thibeault, 2020; Ziegler et al., 2018). This information is critically important for the expansion, justification, and reimbursement for GAVT services across gender identities.

Consistent with our hypothesis, we found that responders who denied presence of VGI were significantly less likely to be misgendered based on voice and had significantly higher QOLS scores than those who reported VGI. Conversely, there were no apparent differences between those with and without VGI on factors of misgendering based on physical appearance, nor experiences with public discrimination or verbal harassment. This is perhaps because other sex characteristics that can be observed without direct interaction may be the first indication of trans identity, whereas voice may signal gender identity only when communicating with someone. The TSEQ questions related to vocal fatigue and vocal quality demonstrated consistent impact of VGI on daily life, with mean scores indicating that on average each item "sometimes" impacted quality of life.

Further supporting our hypothesis, we found significant associations between TSEQ scores and questions related to each domain assessed in the present study: misgendering, quality of life, discrimination, and safety. First, higher TSEQ scores (indicating greater impact of VGI on daily life) were associated with a greater frequency of being misgendered based both on physical appearance and voice. Second, higher TSEQ scores were associated with lower QOLS scores. Finally, higher TSEQ scores were associated with a higher likelihood of experiencing public and medical discrimination and verbal harassment. Given that misgendering and experiences of discrimination and harassment lead to worse health, intervening on VGI by making GAVT more accessible is critical to improving the health of TGD individuals who experience VGI (Barr et al., 2022; Colson et al., 2024; Jacobsen et al., 2024).

The World Professional Association of Transgender Health Standards of Care version 8 endorses expanded access to GAVT to improve VGI (Coleman et al., 2022). To date, several barriers have been identified to accessing voice-related medical services in the U.S., including provider training, knowledge of services, and lack of insurance coverage (Dubey et al., 2024; Hancock, 2015; Jakomin et al., 2020; Madzia et al., 2024). More specifically, there are wide disparities in GAVT insurance coverage in the U.S. that reduces access to needed care (Dubey et al., 2024). A recent survey identified service affordability concerns in 68% of adults aged 18–24 in the U.S., with added barriers of approachability (transparency of the health system's services) and acceptability (e.g. social and cultural norms that influence access to care) (Wind, 2023). Therefore, research elucidating the relationships between VGI and safety, quality of life, discrimination, and wellness is still needed to further support medical necessity of services and increase support for patients needing services. Importantly, this study was conducted in the U.S. and we have framed the discussion of our findings based on the specific economic and social barriers to GAVT relevant to the U.S. context. Given that health care systems around the world differ, the barriers discussed here may not be generalizable to other geographic contexts.

Limitations and future directions

A major limitation to the present study is the use of the TSEQ, which has not been robustly validated as a questionnaire, particularly with the adaptations that our team made to make it more relevant across gender identities. Using unvalidated scales can lead to potential for biased results, difficulty comparing findings across studies, and reduced confidence in the overall validity of the research findings. With these limitations in mind, we selected the TSEQ for this study since there is currently no tool that has been validated for use in transgender women, transgender men, and non-binary people to capture the impact of VGI on daily experiences. While we did consider more recent questionnaires such as the TWVQ, this tool has only been validated among binary transgender women and as such would only have been applicable to a portion of our participants (Dacakis et al., 2013). Future investigations and validation of questionnaires are warranted to fully characterize the impact of VGI on TGD people, and major progress is underway in this area through efforts like the GENDER-Q comprehensive patient-reported outcome measure which will include a means to evaluate outcomes of GAVT (Kaur et al., 2024).

Additionally, a larger sample of TGD people is necessary to fully explore nuances in the constructs investigated in this study. For instance, it is well established that TGD people of color experience a disproportional amount and degree of discrimination, with higher rates of unemployment, poverty, and homelessness, which can be relevant to quality of life and safety (James et al., 2024). Our sample was 78% White, non-Hispanic, indicating that we did not have a large sample of people who may be impacted adversely due to additional factors of race/ethnicity. This area of research and how it pertains to VGI is critically needed to assist in identifying ways we can increase safety for minoritized and marginalized TGD populations.

Another limitation is that the findings presented in this manuscript are all based on participants' subjective reports. This is especially important to consider when interpreting the survey items related to misgendering based on physical appearance and voice, experience of public and medical discrimination, and having experienced verbal harassment, as these are all experiences that could differ widely based on individual interpretation and may lead to under- or over-reporting of these experiences. Given that 224 individuals started the survey and only 187 completed all questions relevant to this analysis, there was likely a component of survey fatigue or participants selectively responding to questions that could have also introduced bias into the sample used for this analysis.

Conclusion

This study has provided insights into the impact of VGI in TGD individuals on experiences of misgendering and discrimination, threats to safety, and quality of life. In this study, 95% of participants described a mismatch between the

gendering of their current voice and their ideal voice, including transmasculine, transfeminine, and non-binary/genderqueer participants. VGI was associated with lower quality of life and increased experiences of discrimination and verbal harassment for TGD individuals. Healthcare that alleviates VGI, including gender-affirming vocal training, is medically necessary. Our findings support the WPATH SOCv8 recommendations that healthcare providers should refer TGD patients with VGI to voice clinicians such as speech-language pathologists with documented competence in GAVT. Improved access to GAVT for TGD individuals with VGI is critical to improve TGD health, wellbeing, and safety.

Disclosure statement

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Data availability statement

Data to support the findings of this study are available from the corresponding author, on reasonable request.

References

Abreu, R. L., Sostre, J. P., Gonzalez, K. A., Lockett, G. M., Matsuno, E., & Mosley, D. V. (2022). Impact of gender-affirming care bans on transgender and gender diverse youth: Parental figures' perspective. *Journal of Family Psychology*, *36*(5), 643–652. https://doi.org/10.1037/fam0000987

Adler, R. K. (2017). The SLP as counselor for the transgender client. *Perspectives of the ASHA Special Interest Groups*, *2*(10), 92–101. https://doi.org/10.1044/persp2.SIG10.92

American Speech-Language-Hearing Association. (n.d.). Gender Affirming Voice and Communication. *ASHA Practice Portal*. Retrieved November 22, 2024, from https://www.asha.org/practice-portal/professional-issues/gender-affirming-voice-and-communication/#collapse_1

Barr, P. B., Bigdeli, T. B., & Meyers, J. L. (2022). Prevalence, comorbidity, and sociodemographic correlates of psychiatric diagnoses reported in the all of us research program. *JAMA Psychiatry*, *79*(6), 622–628. https://doi.org/10.1001/jamapsychiatry.2022.0685

Bockting, W., Barucco, R., LeBlanc, A., Singh, A., Mellman, W., Dolezal, C., & Ehrhardt, A. (2020). Sociopolitical change and transgender people's perceptions of vulnerability and resilience. *Sexuality Research & Social Policy*, *17*(1), 162–174. https://doi.org/10.1007/s13178-019-00381-5

Brown, G. R., & Jones, K. T. (2016). Mental health and medical health disparities in 5135 transgender veterans receiving healthcare in the veterans health administration: A case–control study. *LGBT Health*, *3*(2), 122–131. https://doi.org/10.1089/lgbt.2015.0058

Burckhardt, C. S., Woods, S. L., Schultz, A. A., & Ziebarth, D. M. (1989). Quality of life of adults with chronic illness: A psychometric study. *Research in Nursing & Health, 12*(6), 347–354. https://doi.org/10.1002/nur.4770120604

Burckhardt, C. S., & Anderson, K. L. (2003). The Quality of Life Scale (QOLS): Reliability, validity, and utilization. *Health and Quality of Life Outcomes*, *1*(1), 60. https://doi.org/10.1186/1477-7525-1-60

Carew, L., Dacakis, G., & Oates, J. (2007). The effectiveness of oral resonance therapy on the perception of femininity of voice in male-to-female transsexuals. *Journal of Voice*, *21*(5), 591–603. https://doi.org/10.1016/j.jvoice.2006.05.005

Chadwick, K. A., Coleman, R., Andreadis, K., Pitti, M., & Rameau, A. (2022). Outcomes of gender-affirming voice and communication modification for transgender individuals. *The Laryngoscope*, *132*(8), 1615–1621. https://doi.org/10.1002/lary.29946

Cler, G. J., McKenna, V. S., Dahl, K. L., & Stepp, C. E. (2020). Longitudinal case study of transgender voice changes under testosterone hormone therapy. *Journal of Voice*, *34*(5), 748–762. https://doi.org/10.1016/j.jvoice.2019.03.006

Coleman, E., Radix, A. E., Bouman, W. P., Brown, G. R., de Vries, A. L. C., Deutsch, M. B., Ettner, R., Fraser, L., Goodman, M., Green, J., Hancock, A. B., Johnson, T. W., Karasic, D. H., Knudson, G. A., Leibowitz, S. F., Meyer-Bahlburg, H. F. L., Monstrey, S. J., Motmans, J., Nahata, L., … Arcelus, J. (2022). Standards of care for the health of transgender and gender diverse people, Version 8. *International Journal of Transgender Health*, *23*(Suppl 1), S1–S259. https://doi.org/10.1080/26895269.2022.2100644

Colizzi, M., Costa, R., & Todarello, O. (2014). Transsexual patients' psychiatric comorbidity and positive effect of cross-sex hormonal treatment on mental health: Results from a longitudinal study. *Psychoneuroendocrinology*, *39*, 65–73. https://doi.org/10.1016/j.psyneuen.2013.09.029

Colson, A. E., Matsuno, E., Barr, S. M., & Randall, A. K. (2024). Associations between misgendering, invalidation, pride, community connectedness, and trauma among nonbinary adults. *Journal of Counseling Psychology*, *71*(6), 558–568. https://doi.org/10.1037/cou0000759

Cornell University. (2018). *What does the scholarly research say about the effect of gender transition on transgender well-being?* (What We Know Project). Cornell University. https://whatweknow.inequality.cornell.edu/

Cunningham, G. B., Watanabe, N. M., & Buzuvis, E. (2022). Anti-transgender rights legislation and internet searches pertaining to depression and suicide. *PLoS One*, *17*(12), e0279420. https://doi.org/10.1371/journal.pone.0279420

Dacakis, G., Davies, S., Oates, J. M., Douglas, J. M., & Johnston, J. R. (2013). Development and preliminary evaluation of the transsexual voice questionnaire for male-to-female transsexuals. *Journal of Voice*, *27*(3), 312–320. https://doi.org/10.1016/j.jvoice.2012.11.005

Dacakis, G., Oates, J., & Douglas, J. (2012). Beyond voice: Perceptions of gender in male-to-female transsexuals. *Current Opinion in Otolaryngology & Head and Neck Surgery*, *20*(3), 165–170. https://doi.org/10.1097/MOO.0b013e3283530f85

Davies, S., & Goldberg, J. (2006). In R. Adler, S. Hirsch, & M. Mordaunt (Eds.), *Voice and communication therapy for the transgender/transsexual client*. Plural Publishing Inc.

de Blok, C. J., Wiepjes, C. M., van Velzen, D. M., Staphorsius, A. S., Nota, N. M., Gooren, L. J., Kreukels, B. P., & den Heijer, M. (2021). Mortality trends over five decades in adult transgender people receiving hormone treatment: A report from the Amsterdam cohort of gender dysphoria. *The Lancet. Diabetes & Endocrinology*, *9*(10), 663–670. https://doi.org/10.1016/S2213-8587(21)00185-6

Downing, J. M., & Przedworski, J. M. (2018). Health of transgender adults in the U.S., 2014–2016. *American Journal of Preventive Medicine*, *55*(3), 336–344. https://doi.org/10.1016/j.amepre.2018.04.045

Dubey, I., Stryker, S. D., Madzia, J. L., Pickle, S., Dion, G. R., & McKenna, V. S. (2024). Insurance coverage for gender-affirming voice and communication services: An in-depth analysis in a midwestern U.S. State. *Perspectives of the ASHA Special Interest Groups*, *9*(3), 490–511. https://doi.org/10.1044/2024_PERSP-23-00240

Flentje, A., Heck, N. C., Brennan, J. M., & Meyer, I. H. (2020). The relationship between minority stress and biological outcomes: A systematic review. *Journal of Behavioral Medicine*, *43*(5), 673–694. https://doi.org/10.1007/s10865-019-00120-6

Fredriksen Goldsen, K. I., Romanelli, M., Hoy-Ellis, C. P., & Jung, H. (2022). Health, economic and social disparities among transgender women, transgender men and transgender nonbinary adults: Results from a population-based study. *Preventive Medicine*, *156*, 106988. https://doi.org/10.1016/j.ypmed.2022.106988

Gelfer, M. P., & Tice, R. M. (2013). Perceptual and acoustic outcomes of voice therapy for male-to-female transgender individuals immediately after therapy and 15 months later. *Journal of Voice*, *27*(3), 335–347. https://doi.org/10.1016/j.jvoice.2012.07.009

Grant, J. M., Mottet, L. A., Tanis, J., Harrison, J., Herman, J. L., & Keisling, M. (2011). *Injustice at every turn: A report of the national transgender discrimination survey*. National Center for Transgender Equality and National Gay and Lesbian Task Force.

Hancock, A. B. (2015). The role of cultural competence in serving transgender populations. *Perspectives on Voice and Voice Disorders*, *25*(1), 37–42. https://doi.org/10.1044/vvd25.1.37

Hancock, A. B., & Siegfriedt, L. L. (2020). *Transforming voice and communication with transgender and gender-diverse people: An evidence-based process*. Plural Publishing, Inc.

Hanna, B., Desai, R., Parekh, T., Guirguis, E., Kumar, G., & Sachdeva, R. (2019). Psychiatric disorders in the U.S. transgender population. *Annals of Epidemiology*, *39*, 1–7. e1. https://doi.org/10.1016/j.annepidem.2019.09.009

Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., & Duda, S. N. (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, *95*, 103208. https://doi.org/10.1016/j.jbi.2019.103208

Hendricks, M. L., & Testa, R. J. (2012). A conceptual framework for clinical work with transgender and gender nonconforming clients: An adaptation of the Minority Stress Model. *Professional Psychology*, *43*(5), 460–467. https://doi.org/10.1037/a0029597

Hughes, L. D., King, W. M., Gamarel, K. E., Geronimus, A. T., Panagiotou, O. A., & Hughto, J. M. W. (2022). Differences in all-cause mortality among transgender and non-transgender people enrolled in private insurance. *Demography*, *59*(3), 1023–1043. https://doi.org/10.1215/00703370-9942002

Jacobsen, K., Davis, C. E., Burchell, D., Rutherford, L., Lachowsky, N., Bauer, G., & Scheim, A. (2024). Misgendering and the health and wellbeing of nonbinary people in Canada. *International Journal of Transgender Health*, *25*(4), 816–830. https://doi.org/10.1080/26895269.2023.2278064

Jakomin, J. R., Ziegler, A., Rio, C., & Suddarth, R. (2020). Opportunities to learn transgender voice and communication therapy in graduate speech-language pathology education: Preliminary E-Survey Findings. *Perspectives of the ASHA Special Interest Groups*, *5*(4), 876–883. https://doi.org/10.1044/2020_PERSP-20-00047

James, S. E., Herman, J. L., Durso, L. E., & Heng-Lehtinen, R. (2024). *Early insights: A Report of the 2022 U.S. Transgender Survey*. National Center for Transgender Equality.

James, S. E., Herman, J. L., Rankin, S., Keisling, M., Mottet, L., & Anafi, M. (2016). *The Report of the 2015 U.S. Transgender Survey*. National Center for Transgender Equality.

Kaur, M. N., Morrison, S. D., Kennedy, S. L., Van De Grift, T. C., Højgaard, A., Jacobsen, A. L., Johnson, N., Mullender, M. G., Poulsen, L., Satterwhite, T., Santucci, R., Semple, J., Rae, C., Savard, K., Sørensen, J. A., Young-Afat, D., Pusic, A. L., & Klassen, A. F. (2024). International study to develop a patient-reported outcome measure to evaluate outcomes of gender-affirming care—The GENDER-Q. *Journal of Patient-Reported Outcomes*, *8*(1), 134. https://doi.org/10.1186/s41687-024-00785-x

Kennedy, E., & Thibeault, S. L. (2020). Voice-gender incongruence and voice health information-seeking behaviors

in the transgender community. *American Journal of Speech-Language Pathology*, *29*(3), 1563–1573. https://doi.org/10.1044/2020_AJSLP-19-00188

Madzia, J. L., Stryker, S. D., Bamford, L. M., Pickle, S., & McKenna, V. S. (2024). Gender-diverse patients' awareness and utilization of gender-affirming laryngological services. *The Annals of Otology, Rhinology, and Laryngology*, *133*(5), 503–511. https://doi.org/10.1177/00034894241232488

Matthews, J.-J., Olszewski, A., & Petereit, J. (2020). Knowledge, training, and attitudes of students and speech-language pathologists about providing communication services to individuals who are transgender. *American Journal of Speech-Language Pathology*, *29*(2), 597–610. https://doi.org/10.1044/2020_AJSLP-19-00148

McNeill, E. J. M., Wilson, J. A., Clark, S., & Deakin, J. (2008). Perception of voice in the transgender client. *Journal of Voice*, *22*(6), 727–733. https://doi.org/10.1016/j.jvoice.2006.12.010

Nuyen, B., Kandathil, C., McDonald, D., Thomas, J., & Most, S. P. (2023). The impact of living with transfeminine vocal gender dysphoria: Health utility outcomes assessment. *International Journal of Transgender Health*, *24*(1), 99–107. https://doi.org/10.1080/26895269.2021.1919277

Oates, J., & Dacakis, G. (2015). Transgender voice and communication: Research evidence underpinning voice intervention for male-to-female transsexual women. *Perspectives on Voice and Voice Disorders*, *25*(2), 48–58. https://doi.org/10.1044/vvd25.2.48

Pham, A., Morgan, A. R., Kerman, H., Albertson, K., Crouch, J. M., Inwards-Breland, D. J., Ahrens, K. R., & Salehi, P. (2020). How are transgender and gender nonconforming youth affected by the news? A qualitative study. *The Journal of Adolescent Health*, *66*(4), 478–483. https://doi.org/10.1016/j.jadohealth.2019.11.304

Pinna, F., Paribello, P., Somaini, G., Corona, A., Ventriglio, A., Corrias, C., Frau, I., Murgia, R., El Kacemi, S., Galeazzi, G. M., Mirandola, M., Amaddeo, F., Crapanzano, A., Converti, M., Piras, P., Suprani, F., Manchia, M., Fiorillo, A., & Carpiniello, B. (2022). Mental health in transgender individuals: A systematic review. *International Review of Psychiatry*, *34*(3-4), 292–359. https://doi.org/10.1080/09540261.2022.2093629

Rapoport, S. K., Varelas, E. A., Park, C., Brown, S. K., Goldberg, L., & Courey, M. S. (2023). Patient satisfaction and acoustic changes in trans women after gender affirming voice training. *The Laryngoscope*, *133*(9), 2340–2345. https://doi.org/10.1002/lary.30543

Reisner, S. L., Poteat, T., Keatley, J., Cabral, M., Mothopeng, T., Dunham, E., Holland, C. E., Max, R., & Baral, S. D. (2016). Global health burden and needs of transgender populations: A review. *Lancet*, *388*(10042), 412–436. https://doi.org/10.1016/S0140-6736(16)00684-X

Reisner, S. L., Vetters, R., Leclerc, M., Zaslow, S., Wolfrum, S., Shumer, D., & Mimiaga, M. J. (2015). Mental health of transgender youth in care at an adolescent urban community health center: A matched retrospective cohort study. *The Journal of Adolescent Health*, *56*(3), 274–279. https://doi.org/10.1016/j.jadohealth.2014.10.264

Streed, C. G., Beach, L. B., Caceres, B. A., Dowshen, N. L., Moreau, K. L., Mukherjee, M., Poteat, T., Radix, A., Reisner, S. L., & Singh, V. (2021). Assessing and addressing cardiovascular health in people who are transgender and gender diverse: A scientific statement from the american heart association. *Circulation*, *144*(6), e136–e148. https://doi.org/10.1161/CIR.0000000000001003

Tebbe, E. A., & Budge, S. L. (2022). Factors that drive mental health disparities and promote well-being in transgender and nonbinary people. *Nature Reviews Psychology*, *1*(12), 694–707. https://doi.org/10.1038/s44159-022-00109-0

Valente Junior, C. N., & Mesquita de Medeiros, A. (2022). Voice and gender incongruence: Relationship between vocal self-perception and mental health of trans women. *Journal of Voice*, *36*(6), 808–813. https://doi.org/10.1016/j.jvoice.2020.10.002

Valentine, S. E., & Shipherd, J. C. (2018). A systematic review of social stress and mental health among transgender and gender non-conforming people in the United States. *Clinical Psychology Review*, *66*, 24–38. https://doi.org/10.1016/j.cpr.2018.03.003

Van Leerdam, T. R., Zajac, J. D., & Cheung, A. S. (2023). The effect of gender-affirming hormones on gender dysphoria, quality of life, and psychological functioning in transgender individuals: A systematic review. *Transgender Health*, *8*(1), 6–21. https://doi.org/10.1089/trgh.2020.0094

White Hughto, J. M., & Reisner, S. L. (2016). A systematic review of the effects of hormone therapy on psychological functioning and quality of life in transgender individuals. *Transgender Health*, *1*(1), 21–31. https://doi.org/10.1089/trgh.2015.0008

Wind, E. O. (2023). *Access to gender-affirming voice services among emerging adults in the gender-expansive community*. Longwood University.

Ziegler, A., Henke, T., Wiedrick, J., & Helou, L. B. (2018). Effectiveness of testosterone therapy for masculinizing voice in transgender patients: A meta-analytic review. *International Journal of Transgenderism*, *19*(1), 25–45. https://doi.org/10.1080/15532739.2017.1411857

Ziltzer, R. S., Lett, E., Su-Genyk, P., Chambers, T., & Moayer, R. (2023). Needs assessment of gender-affirming face, neck, and voice procedures and the role of gender dysphoria. *Otolaryngology-Head and Neck Surgery*, *169*(4), 906–916. https://doi.org/10.1002/ohn.329

Appendix A.

Table A1. Original TSEQ statement and the new TSEQ statement for this study.

Question number	Original statement	New statement
3	My voice makes me feel less feminine (MTF) / masculine (FTM).	My voice makes me feel less like my gender.
6	I feel my voice gets in the way of me living as a woman (MTF) / man (FTM).	I feel my voice gets in the way of living my gender identity.
19	When I laugh, cough, or sneeze, I sound like a man (MTF) / woman (FTM).	When I laugh, cough, or sneeze, I do NOT sound like my identified gender.
28	I find it upsetting when I'm perceived as a man (MTF) / woman (FTM) on the phone.	I find it upsetting when I'm perceived as a different gender on the phone.
29	I am envious of other women (MTF) / men (FTM) who have more feminine (MTF) / masculine (FTM) voices than mine.	I am envious of other transgender and gender-diverse people who have more feminine/masculine/androgynous voices.