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Clinical and sociodemographic characteristics as predictors for quality of life in transmasculine and transfeminine individuals receiving gender-affirming hormone therapy

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Abstract

Healthcare systems and providers have increasingly acknowledged the role and impact of social determinants in overall health. However, gender-diverse individuals face persistent health disparities due to their identities. There is limited research on the impact of clinical and sociodemographic characteristics on mood and quality of life (QoL) for transgender (TG) individuals. Our study aims to understand and better elucidate social and clinical characteristics of transmasculine (TM) and transfeminine (TF) individuals and their impact on quality of life and depressive symptoms. In this cross-sectional study, 298 TF and TM individuals on gender-

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CRediT authorship contribution statement

Saloni U. Lad: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Jacob Sinopoli:** Methodology. **Brian Khong:** Methodology. **Britt Conroy:** Writing – review & editing, Conceptualization. **Adam T. Perzynski:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization. **Juan P. del Rincon:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.116734.

affirming hormone therapy (GAHT) were surveyed about their demographic characteristics (age, gender identity, body mass index (BMI), and education), social needs, mood, and quality of life. Multivariable regression modelling was performed to assess the effect of each variable listed above on three domains of QoL (psychological, environmental, and physical) as well as depressive symptoms. We find that QoL scores are similar between TM and TF individuals, with scores in the psychological domain particularly low in both cohorts. TM individuals report higher rates of stress and restroom avoidance than TF individuals. In particular, psychological well-being (measured by the psychological domain of QoL and depressive symptoms) is significantly associated with increased BMI, financial instability, and stress in TM individuals while for TF individuals, psychological well-being is associated with stress and social integration. These data suggest that social circumstances are key drivers of QoL and psychological well-being among gender-diverse individuals receiving GAHT with specific differences between TF and TM individuals. This information may be utilized by healthcare providers and policymakers to address and improve clinical care and social policies to improve health equity for gender-diverse individuals.

Keywords

Transgender medicine; Social determinants of health; Quality of life; Gender-affirming hormone therapy

1. Introduction

Individuals who are transgender (TG) typically have an incongruence between their biologic sex assigned at birth and their gender identity. Gender identities include male and female, as well as other expansive categories including gender-fluid, gender-queer, and non-binary. Some TG individuals may elect medical interventions such as hormone therapy, surgeries, and/or other modifications that align their outward physical appearance to match their gender identity. However, not all TG individuals choose to undergo medical interventions (Cicero et al., 2019).

TG individuals face a number of disparities and disadvantages including higher rates of homelessness, sexual and physical assaults and trauma, unemployment, discrimination, and increased morbidity and mortality (Cicero et al., 2019; Fredriksen Goldsen et al., 2022; Grant et al., 2010). Prior work has reported that only 30–40 percent of TG individuals utilize the healthcare system regularly (Feldman et al., 2021; Grant et al., 2010). Of these individuals, at least one-quarter report suboptimal care due to unsafe public and healthcare spaces, lack of knowledgeable clinicians (Grant et al., 2010), decreased trust in the healthcare system (Baguso et al., 2022), and restricted health insurance benefits that limit access to gender affirming health care services (Andermann, 2018; Hobster and McLuskey, 2020; Safer et al., 2016). Additionally, there is also concern that sexual orientation and gender identity information (SOGI) is not adequately collected from providers or documented in the electronic health record despite recent recommendations from the National Academy of Medicine and the Joint Commission to better document SOGI information (Deutsch et al., 2013; Deutsch and Buchholz, 2015; *The Health of Lesbian, Gay, Bisexual, and Transgender People*, 2011). As a result, LGBTQ + individuals

may not be getting identified and their specific health needs may not be getting appropriately addressed (Cahill and Makadon, 2014; Wolfe et al., 2021).

Although there has been an increased awareness in healthcare of the impact of social needs on overall health status and outcomes, unmet social needs remain a persistent barrier in providing high-quality, evidence-based clinical care (O'Gurek and Henke, 2018). Additionally, mounting evidence across a spectrum of health issues has demonstrated that low income, lower educational attainment, and decreased social status/support are associated with worse health outcomes, notably increased morbidity and premature mortality (Andermann, 2018; Gama e Colombo, 2010).

While screening for social determinants of health in a clinical setting in the general population has been increasing, there is limited research utilizing these screening tools in TG patients. A cross-sectional study assessing food and housing insecurity in TG and cisgender adults in the United States, using the Behavioral Risk Factor Surveillance System Survey (BRFSS), found that TG individuals have higher odds of experiencing food-related stress and underemployment (Henderson et al., 2019). In terms of QoL, a systematic review and meta-analysis suggested that TG individuals have lower QoL than the general population (Nobili et al., 2018), with some evidence supporting that QoL improves within 6–12 months of commencing gender-affirming hormone therapy (GAHT) (Foster Skewis et al., 2021; Manieri et al., 2014).

There are a small number of studies using the World Health Organization Quality of Life Survey (WHO-QoL) in TG individuals. A study used and validated the brief version of this instrument (WHOQOL-BREF) in a cohort of TF individuals (Thompson et al., 2015). Two other cross-sectional studies utilized this survey in TM and TF individuals undergoing GAHT or surgical therapy and concluded that physical characteristics (such as body hair and breast size), family support, and employment are associated with higher QoL scores (Gómez-Gil et al., 2014; Silva et al., 2021).

Our work builds upon the Minority Stress Model which was developed to better understand how diverse minority groups experience stress and its effect on mental and physical health (Meyer, 2003). Specifically, the Transgender Resilience Intervention Model focuses on developing resilience-based interventions that can buffer some of this stress in TG individuals to improve psychological well-being (Matsuno and Israel, 2018). Knowing that these resilience factors mitigate excess stressors creates more of an impetus to focus work on further identifying and measuring these stressors and their impact on QoL and health.

Our study uses a comprehensive survey of TF and TM individuals to evaluate multiple social needs including restroom access, financial stability, social interactions, stress, and transportation availability. The goal of this research is to understand the influence of social needs on multiple QoL domains and symptoms of depression in TM and TF persons receiving GAHT.

2. Materials and methods

2.1. Participants and recruitment

The participants in this study were recruited as part of a broad project known as “sex Hormones and Lower Urinary Tract Symptoms” (H-LUTS). In the H-LUTS project we are studying a comprehensive set of biologic, behavioral, psychological and socioeconomic variables in cohorts of TM and TF subjects receiving GAHT therapy for at least 12 months. One of the aims of the study is understanding the interplay of these variables with lower urinary tract symptoms (LUTS). Following approval by the MetroHealth System Institutional Review Board (IRB), initial survey participant screening and identification was conducted using the EPIC electronic health record (EHR). Study data were collected and managed using REDCap electronic data capture tools hosted at Case Western Reserve University. All eligible survey participants received care at the MetroHealth System, in Northeast Ohio, and were identified with permission of their respective treating health care provider. Inclusion criteria included the following: at least 18 years old, able to read English, able to complete a survey, individuals assigned male sex at birth or female sex at birth who had been receiving exogenous estrogens or testosterone, respectively, for gender dysphoria for at least 12 months. Individuals with a documented history of chronic kidney disease (CKD) stage 5, congenital urinary tract malformations, and pregnancy at time of survey were excluded from the study, due to the potential role of these conditions on LUTS. Eligible individuals were invited to complete the study survey either on paper, online via REDCap, or via a telephone interview. A total of 310 individuals consented to participate, of whom 298 completed all questionnaires and are included in the analysis.

2.2. Survey instrument

We administered a comprehensive survey that included the following: whether participants considered themselves to be TG/gender nonconforming, sex assigned at birth, gender identity (male, female, other including non-binary or gender-diverse), sex hormone therapy and duration, history of genital surgery (bottom surgery) for gender-affirming care (i.e. surgery on penis/testicle vs. surgery on vagina/uterus/ovaries), QoL, depression, lower urinary tract symptoms (LUTS), race/ethnicity, height, weight, social needs, smoking status, alcohol intake, and substance use. We also included a novel question on whether bathroom facilities were avoided due to safety concerns: ‘Over the last month or so, did you have to hold your urine, and avoid going to the bathroom, because you felt that the bathroom facilities were not adequate, friendly, or safe for transgender persons?. A complete version of survey items is included (Supplemental Materials; Fig. S1). This survey was administered between July 5, 2019, and March 9, 2020.

Study participants were asked their current gender identity and were given three options: ‘male’, ‘female’, and ‘other’, which is referring to individuals who identify as non-binary or gender-diverse. The ‘other’ group only contained twenty participants, thus was not large enough to perform comparable statistical analyses. As a result, we operationally categorized the study sample into individuals using feminizing hormone therapy as TF and masculinizing hormone therapy as TM. For all analyses, we refer to our populations as TM and TF.

The WHO QoL-BREF instrument consists of 26 items: two global items and 24 additional items assessing four domains: psychological, environmental, social, and physical. Domain scores were transformed and scaled from zero to 100 according to instrument guidelines to allow for comparisons between domains (The WHOQOL Group, 1998). Cronbach's alpha was used to analyze internal consistency of the domains. Values close to and greater than 0.70 indicated acceptable internal consistency (Supplemental Data; Table S1). The social domain of the WHO QoL-BREF was omitted from our analysis of outcomes; after review of the individual items, we found considerable overlap between the wording of the QoL measure and the social integration social determinants of health indicators.

The Alcohol Use Disorders Identification Test (AUDIT-C) instrument consists of three items evaluating the frequency of drinking, the amount of alcohol consumed, and the number of binging events. Each question is scored from zero to four and summed for a possible score of zero to 12 (Bush et al., 1998). AUDIT scores greater than eight were re-coded to eight since few participants scored higher than eight.

The Center of Epidemiological Studies Depression Scale-8 (CESD-8) is an instrument for the screening of depression. The CESD-8 consists of eight questions to measure the presence of symptoms such as depressed mood, feelings of guilt and worthlessness, loss of appetite, and sleep disturbance. Responses were summed for a possible score of zero to eight (Van de Velde et al., 2009).

Additional social determinants of health questions were included in this survey to evaluate financial strain (Kahn and Pearlin, 2006; Puterman et al., 2012), stress (Elo et al., 2003), social isolation (Berkman and Syme, 1979; Ford et al., 2006; Pantell et al., 2013), and transportation accessibility (De Marchis et al., 2020). These questions have been utilized, scored, and validated in prior studies in the general population (Chagin et al., 2021).

Individual social isolation questions are demonstrated in the univariable analysis. However, for use in the bivariable and multivariable analyses, they were summed and used as a continuous variable. The scoring for these questions has been described elsewhere (Pantell et al., 2013).

Survey participants were asked whether they had been on GAHT for at least 12 months and their hormone therapy start date. The difference between self-reported hormonal therapy start date and survey completion date was calculated, with the assumption that therapy had been continuous throughout this period.

2.3. Statistical analysis

Patient characteristics were described using median with interquartile range (IQR) for continuous variables, and percentages for categorical data. Wilcoxon rank sum, chi-squared, and ANOVA tests were used where appropriate. Four models were created to understand the effect of multiple predictors on overall well-being (measured by three QoL domains: physical, environmental, and psychological, and CESD-8 scores).

While we presented each Likert scaled variable as categorical variables in the univariable analysis, due to their relatively normal distribution and large sample size, we treated these

variables as continuous in the bivariable and multivariable analyses. Spearman ranked correlation coefficients were further used for bivariable analyses to account for interval responses of the Likert variables.

To assess the importance of social and clinical demographic information on the different domains of QoL and depressive symptoms, multiple linear regression models were created for TM and TF groups. Other covariates in the models included BMI, education attainment level, whether bathroom facilities were avoided due to safety or other concerns, financial insecurity, stress levels, social integration, transportation accessibility, exercise frequency, current/past smoking status, AUDIT score, time on hormone therapy, and age.

To estimate the variability of each coefficient, a bootstrapping procedure was employed. Ten thousand resamples were generated from the original sample population, and each model was run through the resampled populations to create a mean of the standardized regression coefficients. The distribution of these bootstrapped means was used to construct a 95% confidence interval. The sample standardized regression coefficients, the bootstrapped 95% confidence intervals, and the bootstrapped coefficient of determination are reported to determine model fit.

This study was approved by the MetroHealth Institutional Review Board (IRB). All analyses were conducted using R version 4.2.1, Vienna, Austria.

3. Results

3.1. Demographics and descriptive characteristics

The demographic characteristics of our study sample are displayed in Table 1. A total of 298 participants completed the survey. Screened participants had a median age of 28 years. The majority of participants were white (78%), unmarried (54%), 36% attended some college, and 42% reported some degree of higher education (i.e. Associate's, Bachelor's, graduate degree). Our study sample was almost equally distributed between TM (51%) and TF (49%) individuals. The TM group was younger (median, IQR; 26 years; (20–31)) than the TF cohort (31 years (25–44), $p < 0.001$; Table 1A). A minimal percentage of our sample population had a BMI <18.5 (1.7%). The rest of the population distributed approximately evenly between a BMI of 18.5–24.9 (33%), 25–29.9 (30%), and >30 (34.7%).

Median time on hormone therapy was 2.9 years (IQR 1.7–5.1), and 16.1% of participants reported having undergone gender-affirming genital surgeries, with no significant differences between TF and TM individuals (Table 1B).

A large percentage (61%) of surveyed participants reported having three or more depressive symptoms, as measured by the CESD-8. 35% of participants reported previously smoking cigarettes, while 13% of individuals reported currently smoking. Most of our sample population reported never having used recreational drugs (64%) or misused prescription drugs (90%). These numbers were similar between TM and TF groups.

The Center for Disease Control (CDC) recommendations for physical activity include a mix of moderate and high intensity aerobic activity on two or more days a week. 73% of the TM and 64% of the TF individuals reportedly met these recommendations (Table 1C).

3.2. Transmasculine individuals delay urination at higher rates due to decreased availability of adequate facilities and report higher levels of stress

When asked about stress levels, 46.8% of TM individuals reported high levels of stress (often or very often) compared to 36.3% of our TF individuals (Fig. 1A, $p = 0.005$). A minority of our cohort reported getting together with friends and family often or very often (20.8%) and talking on the phone throughout the week often or very often (39%; Fig. 1B). A striking and significantly higher percentage of the TM individuals (67.8%) reported avoiding restroom facilities, as compared to TF individuals (38.4%; Fig. 1C; $p < 0.001$). TM and TF cohorts had similar percentages for all other social needs.

3.3. Psychological domain QoL scores were lower compared to other domains in both transmasculine and transfeminine cohorts

QoL scores were broken into four main domains: physical, psychological, social, and environmental (Table 2). Overall, psychological satisfaction scores (median, IQR; 54.2, 37.5–66.7) were lower than that of physical (median, IQR; 67.9, 53.6–78.6), social (median, IQR; 66.7, 50.0–75.0), and environmental (median, IQR; 65.6, 53.1–78.1) in both TM and TF cohorts.

Variables that showed an association with other independent variables in the bivariate analyses are presented in Supplemental Materials (Fig. S2). Of note, there appears to be a positive correlation between an inability to afford the basics with stress and depressive symptoms. Other social needs correlate with different QoL domains and were included in the multivariable models.

In order to assess the effects of multiple factors such as demographic data, GAHT data, health behaviors, and social needs on QoL and depressive symptoms, multiple linear regressions were performed (Table 3). A separate multivariable model was created with each of the following as a separate outcome measure: psychological domain, physical domain, environmental domain, and CESD-8 scores for the TM (Table 3A) and TF (Table 3B) cohorts.

For the psychological domain in our TM cohort, BMI (β: −0.16; −0.29, −0.03), difficulty to afford the basics (β: −0.21; −0.34, −0.08), stress levels (β: −0.44; −0.58, −0.30), social integration score (β: 0.15; 0.02, 0.27), exercise frequency (β: 0.16; 0.04, 0.28), and current smoking status (β: −0.44; −0.87, −0.02) were significantly associated with psychological QoL. For our TF cohort, stress levels (β: −0.56, −0.70, −0.42), social integration score (β: 0.25, 0.12, 0.39), and AUDIT-C scores (β: 0.19; 0.06, 0.32) were significantly associated with psychological QoL.

For the physical domain in our TM cohort, BMI (β: −0.13; −0.25, −0.02), education (β: 0.13; 0.01, 0.26), difficulty to afford the basics (β: −0.40; −0.52, −0.28), stress levels (β: −0.31; −0.44, −0.19), lack of transportation (β: −0.37; −0.65, −0.09), exercise (β: 0.21;

0.09, 0.32), past smoking status (β: 0.35; 0.06, 0.64), and age (β: −0.37; −0.54, −0.19) were significantly associated with physical QoL. For our TF cohort, BMI (β: −0.14; −0.28, −0.01), difficulty affording the basics (β: −0.23; −0.38, −0.09), and stress levels (β: −0.39; −0.54, −0.24) were significantly associated with physical QoL.

For the environmental domain in our TM cohort, an inability to afford the basics (β: −0.52; −0.64, −0.39), stress (β: −0.13; −0.27, 0.00), and lack of transportation (β: −0.59; −0.89, −0.29) were significantly associated with QoL while avoiding bathroom facilities (β: −0.25; −0.50, 0.00; p = 0.052) trended towards significance. In our TF cohort, difficulty affording the basics (β: −0.37; −0.52, −0.23), stress levels (β: −0.26; −0.41, −0.12), and social integration scores (β: 0.23; 0.09, 0.37) were significantly associated with environmental QoL.

On CESD-8 scores, in our TM cohort difficulty affording the basics (β: 0.27; 0.12, 0.43) and stress levels (β: 0.33; 0.17, 0.49) were significantly associated with depressive symptoms, while exercise (β: −0.14; −0.28, 0.00; p = 0.051) trended towards significance. In our TF cohort, stress levels (β: 0.57; 0.43, 0.72) and social integration (β: −0.17; −0.31, −0.02) were significantly associated with depressive symptoms, while education (β: −0.13, −0.27, 0.00; p = 0.053) trended towards significance.

4. Discussion

This study investigates social needs and QoL in TG individuals on GAHT within the MetroHealth system. In this study, QoL scores were similar in TF and TM cohorts receiving GAHT with highest physical satisfaction scores followed by social and environmental satisfaction, and lowest psychological satisfaction scores. This differs from previous reports which have shown social satisfaction to be highest in a cohort of TG patients taking GAHT (Silva et al., 2021) and psychological satisfaction to be highest in a cohort of TF individuals (Thompson et al., 2015). A cross-sectional study of healthy adults in the United States showed scores of the WHOQoL-100 to range from 71.7 to 77.1 for each of the four domains (Bonomi et al., 2000). Median scores in both our TM and TF cohorts were substantially lower than these reported values. In order to understand what factors may be associated with each domain of QoL, we created multivariable regression models with clinical and sociodemographic characteristics.

BMI was a significant predictor for two models (psychological, physical) in our TM cohort compared to one model (physical) in our TF cohort. A prior study reported that 26% of the TG population meet the clinical cut-point for classification with obesity compared to 18% of the cisgender population, comparable to our data (Martinson et al., 2020). The impact of BMI on different domains of QoL in our TG population can be due to several reasons. One is that previous studies have demonstrated a link between decreased psychological QoL and obesity in the general population (Pétré et al., 2016), which can be attributed to reduced daily functioning, increased comorbidities, and increased stigma (Luppino et al., 2010; Papadopoulos and Brennan, 2015; Puhl and Heuer, 2010; Stephenson et al., 2021). TG individuals are also more likely to be obese compared to cisgender individuals due to disparities in access to healthy lifestyle behaviors, consistent medical care, and

increased gender minority stress, all of which can contribute to weight gain. In addition, weight stigma, may reinforce high body weight or promote weight gain. Thus, there may be a combination of factors overlapping and contributing to a higher BMI (Brewis, 2014; Hemmingsson et al., 2023; Herbozo et al., 2023; Taormina and Iwamoto, 2023). Finally, GAHT can also impact BMI, however, there is mixed data on its effect. Studies show that BMI in TF individuals typically increases due to a loss of lean muscle and an increase in overall fat mass (Ford et al., 2022) while BMI in TM individuals on GAHT also seems to increase to a higher extent likely due to increased muscle mass due to anabolic effects of testosterone (Bartolucci et al., 2015; Velho et al., 2017).

Social integration was a significant negative predictor for one model (psychological) in TM individuals and three models (psychological, environmental, CESD-8) in TF individuals. Although this questionnaire has been validated previously, to our knowledge, it has not been used in a gender-diverse population. In a previous study performed at MetroHealth, 45% of the surveyed individuals were considered to be socially isolated (Chagin et al., 2021). In our cohort, surveyed before the declaration of the COVID-19 pandemic, this number was even higher at 65%. No prior study has examined social isolation in a clinical sample of gender-diverse persons, but it is well-known that social stigma has a clearly negative impact on overall health, highlighting the importance of social support (Hendricks and Testa, 2012; Meyer, 2003). Prior work has postulated that this association exists because social support influences an individual's thinking and acting and may enhance their motivation to engage in health promotion (Maida, 1985; Weiss, 1969).

Lack of transportation access was a significant predictor of two QoL domains (physical and environmental) in our TM cohort. In our study, 19% of TF individuals and 21.6% of TM individuals had unmet medical/daily needs due to lack of transportation. There is currently no other published finding on how prevalent transportation inaccessibility is in the gender-diverse population. However, there is inadequate protection against discrimination in public spaces such as public transportation (Reisner et al., 2015) and one known barrier to healthcare is the lack of available transportation (Safer et al., 2016).

Current smoking was a significant negative predictor for psychological QoL in our TM cohort. Additionally, our univariable analysis showed differing results from the literature. 11% of TF individuals and 14% of TM individuals reported smoking currently. These numbers are lower than what has been reported in previous literature, which have been around 32.6% and 39.7% (Buchting et al., 2017; Wheldon and Wiseman, 2019), similar to past cigarette use in our population. Thirty-five percent of TM and 35% of TF individuals reported having smoked at least 100 cigarettes in their lifetime. We hypothesize this discrepancy is due to two reasons. One, TG patients who are receiving GAHT are more likely to follow-up with a health care provider, giving providers additional opportunities to address other comorbidities such as smoking habits. Second, while there is a paucity of data understanding the effects of smoking on GAHT, there is a large amount of literature evaluating the negative effects of smoking for cisgender post-menopausal women utilizing estrogen as hormone-replacement therapy. Some of these effects include decreasing the efficacy of estrogen (Mueck and Seeger, 2005), and higher risks of breast cancer, and stroke, and venous thromboembolism (VTE) (Henderson and Lobo, 2012; Mueck and Seeger,

2005). Of note, an increased risk for VTE in TF individuals in general has been found in some, but not all studies (Arrington-Sanders et al., 2022). Similar data is found in cisgender males, in whom testosterone therapy is associated with an increase in short-term risk for VTE (Walker et al., 2020). Still, it should be considered that testosterone use in TM individuals appears to have a very low risk for serious side effects (Wierckx et al., 2012). According to the published guidelines for primary and gender-affirming care for TG individuals developed by the Center of Excellence for Transgender Health, all TF individuals should be counseled on tobacco risks and cessation options at every visit given the established risks of estrogen use (Sun et al., 2023; UCSF Gender Affirming Health Program, 2016). Therefore, health care providers may be more emphatic in motivating patients to stop smoking before initiation or continuation of GAHT.

4.1. Application of the AUDIT-C questionnaire in gender-diverse individuals

Alcohol use was a significant positive predictor of psychological QoL in TF individuals. Although prior literature indicates that heavy drinking is correlated with higher rates of clinical depression, low/moderate alcohol consumption may be associated with positive mood, which may be captured by our data (Baum-Baicker, 1985). Alcohol use disorder is highly prevalent in TG individuals (James et al., 2016). The United States Preventative Task Force recommends that clinicians screen all adults for alcohol misuse and provide counseling to those who engage in risky/hazardous behavior. One such screening tool is the AUDIT-C questionnaire, which currently screens positive for men scoring four or above and women scoring three or above (Bradley et al., 2003, 2007; Bush et al., 1998). While this tool has several limitations, we present below an additional concern when utilizing these gender/sex-related differences in our gender-diverse population.

Traditionally, substance use disorders have been diagnosed more frequently in cisgender men, despite cisgender women having increasing rates of alcohol consumption and binge drinking (Wilsnack et al., 2000). In response, screening tools were modified to increase sensitivity for cisgender women (Tan et al., 2018). Sex-related differences in neurocircuitry (Logrip et al., 2018), hormone profiles (Sutker et al., 1983), fat and muscle composition (Kwo et al., 1998), body water content (Sutker et al., 1983), and gastric absorption (Thomasson, 1995) affect alcohol metabolism. Additionally, gender-related differences in drinking habits affect alcohol consumption (Gilbert et al., 2018). Little is known about the validity of this screening tool in a gender-diverse population, which is at higher risk of alcohol use disorder. To our knowledge, there are few studies that have assessed the validity and reliability of common alcohol use screening tools such as the AUDIT-C (Flentje et al., 2020), the CAGE questionnaire, and the Michigan Alcoholism Screening Test (MAST) in gender-diverse individuals (Gilbert et al., 2018; Smalley et al., 2016). Additionally, for our study, we utilize the AUDIT-C screening tool separately based on sex assigned at birth and gender (Supplemental Materials; Table S2). Depending on which characteristic was used for the AUDIT-C screening tool, a differing number of individuals screen positive (Table S2). Our data demonstrates and emphasizes the need for improved, more gender-diverse and inclusive definitions of sex and gender's relationship to alcohol use, as well as further research validating established screening protocols and/or developing new screening protocols for gender-diverse groups.

Time on hormone therapy was not a significant predictor for any of the QoL domains in these cohorts. Prior literature demonstrates that GAHT reduces gender dysphoria, body dissatisfaction, and uneasiness, resulting in an overall improvement in psychological QoL (van Leerdam et al., 2021). Our current study is cross-sectional; further longitudinal data would allow us to examine QoL over time.

Finally, our data showed that 68% of TM individuals, and 39% of TF individuals have reportedly avoided using restrooms because they felt these facilities were inadequate, unsafe, or unfriendly. This is consistent with other studies that reported 49–61.9% of TG individuals made travel decisions based on safe restroom availability (Herman, 2013; Lerner, 2021; Seelman, 2016). We find that TM individuals also report higher rates of stress than their TF counterparts. Stress is a significant predictor for nearly all models in both TM and TF groups. Prior studies have found an association between increased suicidal ideation/attempt and anxiety as well as decreased resilience and QoL, with the ability to safely use public restrooms (Seelman, 2016; Weinhardt et al., 2017). Thus, safe bathroom access may be a likely contributor to overall stress. The minority stress model was established to understand the specific types of unique stressors that minority groups may face. These can be categorized as distal stressors, interactive proximal stressors, and internalized stressors (Hoy-Ellis, 2023). Our work has utilized survey data to identify specific stressors in each category. Distal stressors include financial insecurity, proximal stressors include physical appearance in the form of BMI and social integration, and internalized stressors include drinking behaviors in the form of AUDIT-C scores, exercise, and smoking behaviors. Given these elucidated stressors, the TG resilience intervention model provides critical context for advocating for community, group, and individual interventions at the state and national levels in order to buffer some of these stressors (Matsuno and Israel, 2018).

To date, and to the best of our knowledge, this is one of the largest studies examining a wide range of clinical and sociodemographic characteristics in TM and TF individuals on GAHT. Our analysis of these two separate groups allows us to understand the nuances in differences of how each predictor affects some aspect of well-being based on gender and hormone use. Our sample population is a group of individuals regularly engaging with the MetroHealth care system and receiving GAHT, limiting the generalizability of our results to the wider gender-diverse population. More large-scale prospective studies are needed to better understand the individual relationships uncovered in our regional sample population.

One limitation of this study is that there are several key pieces of data that are known to affect an individual's well-being that were not captured in this study such as income, insurance status, and employment. Thus, our regression model did not adjust for these variables. Our survey also does not capture significant nuances in individual questions. For instance, we evaluate access to restroom facilities by asking about restroom adequacy, friendliness, and safety. There are multiple ways an individual may interpret this question such as access to gender-neutral bathrooms, the presence of legislation protecting restroom use related to gender identity, or overall public safety for gender-diverse individuals. Thus, there is a limitation on what conclusions we can extrapolate from these data. While we assessed cigarette smoking and marijuana use, we did not account for other methods of smoking such as vaping. Additionally, we did not evaluate individual satisfaction with their

embodiment goals of gender transition. There is data that has demonstrated personal and social gender congruence to be associated with improved mental health. Specifically, visual conformity with affirmed gender, also known as 'passing', is associated with improved depression and anxiety, less distress, and less public violence, all of which may impact our results (Flynn and Smith, 2021; Peixoto et al., 2022; To et al., 2020). Future studies need to be done to understand these nuanced relationships. Finally, there is a limitation to how much we can generalize the results of this study to the entire TG population. Our inclusion criteria consisted of individuals on GAHT, which implies consistent healthcare and a certain level of access and financial security. Our population is also not widely representative of all racial and ethnic minority groups.

5. Conclusion

This study examines a variety of clinical and sociodemographic characteristics/factors as predictors for QoL in TM and TF groups. For both groups, we find that difficulty affording the basics, stress levels, and social integration are significant social need predictors in at least one model. These data suggest that social circumstances are powerfully associated with QoL and psychological well-being among gender-diverse individuals receiving gender-affirming hormone therapy, with relevant differences between TM and TF individuals.

These data are very relevant in the current political ecology and landscape where state and national legislation is being proposed and/or enacted that perpetuates discrimination against gender-diverse individuals, including increased barriers for adequate healthcare, sport participation, restroom access, and acquiring identification documents with preferred name and gender (Barbee et al., 2022). Previous data has also shown that legislation, such as employment protection for gender minority patients, positively impacts the type of health care TG patients seek out. For example, in states with legal protection, individuals were less likely to present with mood disorders compared to individuals who live in states without such policies (Blosnich et al., 2016). Data from this study may be utilized and leveraged by healthcare providers and policy makers to develop more tailored, acceptable, sensitive, and gender-diverse healthcare services and programming to enhance the overall well-being of TG persons.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Data availability

The data that has been used is confidential.

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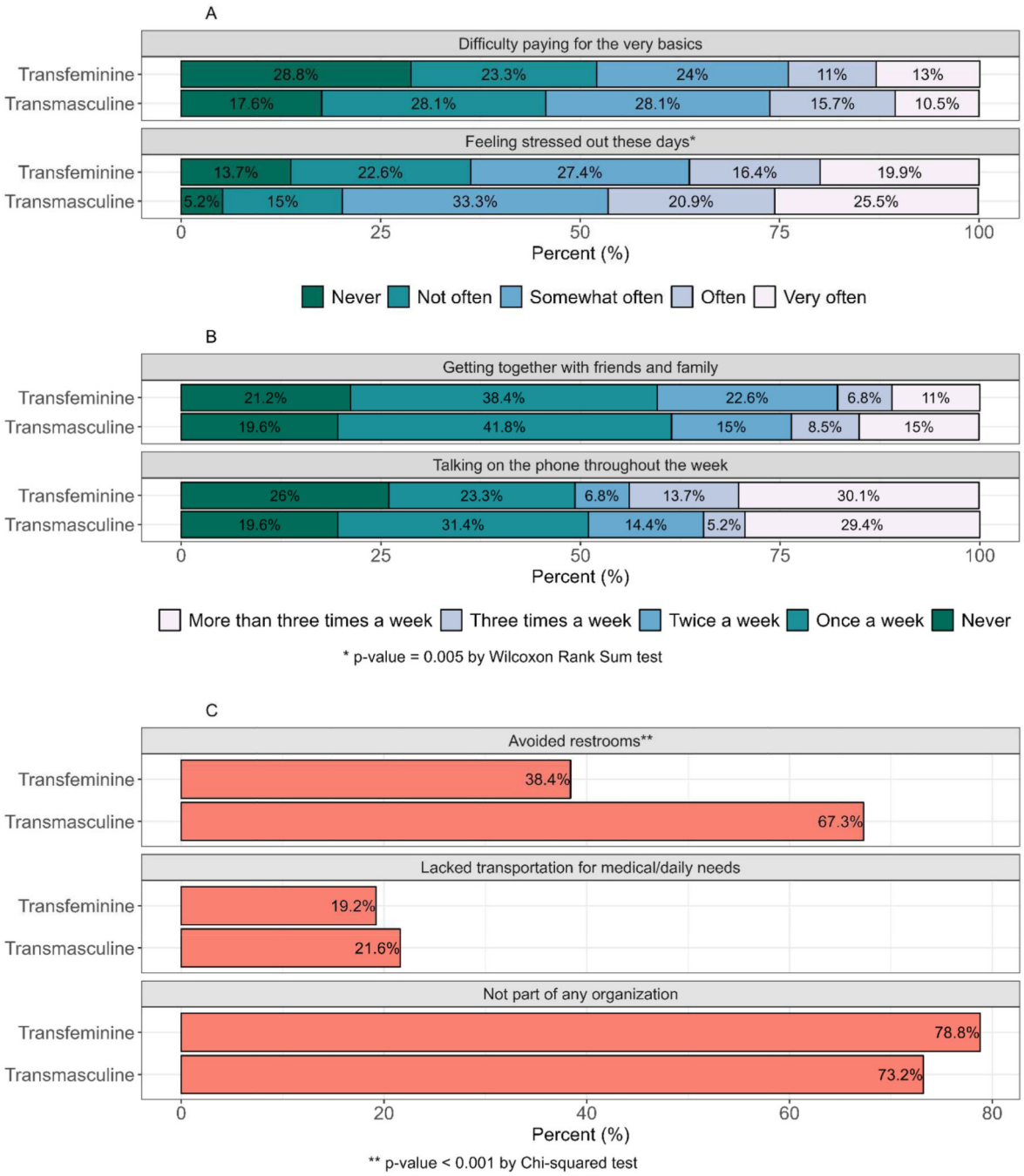

Fig. 1. Social needs in transmasculine and transfeminine individuals.

Stacked bar graphs demonstrating social needs assessed on a five-point scale. From top to bottom the following were assessed: A) difficulty affording the basics, stress levels; B) getting together with friends and family, talking on the phone throughout the week; C) avoidance of restroom facilities, transportation inaccessibility, and not part of any organization. Lowest values were shown on the left and highest values were shown on the right.

Table 1

A Subject characteristics and demographics.

Characteristic	Overall, N = 298[1]	Transmasculine, N = 152[1]	Transfeminine, N = 146[1]
Race/Ethnicity			
White	231 (78%)	116 (76%)	115 (79%)
Black	33 (11%)	17 (11%)	16 (11%)
Other/Mixed	23 (7.7%)	13 (8.6%)	10 (6.8%)
Unknown	11 (3.7%)	6 (3.9%)	5 (3.4%)
Highest Level of Education			
Some Grade School	20 (6.7%)	12 (7.9%)	8 (5.5%)
High School Graduate/GED	46 (15%)	18 (12%)	28 (19%)
Some College, No Degree	107 (36%)	56 (37%)	51 (35%)
Associate's/Bachelor's	95 (32%)	50 (33%)	45 (31%)
Graduate Degree (i.e. MA, MD, PhD)	30 (10%)	16 (11%)	14 (9.6%)
Marital Status			
Never Married	161 (54%)	87 (57%)	74 (51%)
Married	39 (13%)	20 (13%)	19 (13%)
Living with a partner	71 (24%)	35 (23%)	36 (25%)
Widowed	2 (0.7%)	1 (0.7%)	1 (0.7%)
Separated	25 (8.4%)	9 (5.9%)	16 (11%)
BMI (kg/m^2)			
< 18.5	5 (1.7%)	1 (0.7%)	4 (2.7%)
18.5–24.9	98 (33%)	51 (34%)	47 (32%)
25–29.9	90 (30%)	40 (26%)	50 (34%)
> 30	105 (35%)	60 (39%)	45 (31%)
Age (Years) [2]	28 (22, 36)	26 (20, 31)	31 (25, 44)

[1] n (%); Median (IQR).

[2] $p < 0.001$ by *t*-test.

Table 1B

Gender-affirming therapy characteristics.

Characteristic	Overall, N = 298[1]	Transmasculine, N = 152[1]	Transfeminine, N = 146[1]
Gender-Affirming Genital Surgery			
Feminizing Surgery	26 (8.7%)	0 (0%)	26 (18%)
Masculinizing Surgery	22 (7.4%)	22 (14%)	0 (0%)
None	250 (84%)	130 (86%)	120 (82%)
Time on Gender-Affirming Hormone Therapy (Years)	2.9 (1.7, 5.1)	2.9 (1.8, 4.9)	3.1 (1.7, 5.7)

[1] n (%); Median (IQR).

Table 1C

Clinical characteristics and health behaviors.

Characteristic	Overall, N = 298[1]	Transmasculine, N = 152[1]	Transfeminine, N = 146[1]
AUDIT-C			
Scored 0–2	193 (65%)	95 (62%)	98 (67%)
Scored 3	33 (11%)	16 (11%)	17 (12%)
Scored 4 or more	72 (24%)	41 (27%)	31 (21%)
Screening AUDIT			
Positive	105 (35%)	57 (38%)	48 (33%)
Negative	193 (65%)	95 (62%)	98 (67%)
Moderate to Strenuous Exercise (Days per week)			
0–1 day(s) per week	94 (32%)	41 (27%)	53 (36%)
2–4 days per week	133 (45%)	72 (47%)	61 (42%)
5 or more days per week	71 (24%)	39 (26%)	32 (22%)
Social Isolation			
Most socially isolated (Scored 0–1)	194 (65%)	99 (65%)	95 (65%)
Less socially isolated (Scored 2–3)	102 (34%)	53 (35%)	49 (34%)
Least socially isolated (Scored 4)	2 (0.7%)	0 (0%)	2 (1.4%)
CESD-8 Score			
0–2 depressive symptoms	115 (39%)	52 (34%)	63 (43%)
3–5 depressive symptoms	84 (28%)	41 (27%)	43 (29%)
6–8 depressive symptoms	99 (33%)	59 (39%)	40 (27%)
Has Smoked at least 100 Cigarettes within Lifetime	105 (35%)	53 (35%)	52 (36%)
Currently Smokes	38 (13%)	22 (14%)	16 (11%)
Recreational Drugs			
Never	190 (64%)	91 (60%)	99 (68%)
Less than monthly	37 (12%)	15 (9.9%)	22 (15%)
Monthly	24 (8.1%)	13 (8.6%)	11 (7.5%)
Weekly	18 (6.0%)	13 (8.6%)	5 (3.4%)
Daily or almost daily	29 (9.7%)	20 (13%)	9 (6.2%)
MisusedPrescription Drugs			
Never	268 (90%)	135 (89%)	133 (91%)
Less than monthly	16 (5.4%)	12 (7.9%)	4 (2.7%)
Monthly	4 (1.3%)	2 (1.3%)	2 (1.4%)
Weekly	5 (1.7%)	3 (2.0%)	2 (1.4%)
Daily or almost daily	5 (1.7%)	0 (0%)	5 (3.4%)

[1] n (%).

Table 2

Quality of life domain scores by gender.

Characteristic	Overall, N = 298[a]	Transmasculine, N = 152[a]	Transfeminine, N = 146[a]
Physical Satisfaction	67.9 (53.6, 78.6)	67.9 (53.6, 78.6)	67.9 (50.0, 82.1)
Psychological Satisfaction [b]	54.2 (37.5, 66.7)	50.0 (37.5, 63.5)	54.2 (41.7, 70.8)
Social Satisfaction	66.7 (50.0, 75.0)	66.7 (50.0, 75.0)	66.7 (41.7, 75.0)
Environmental Satisfaction	65.6 (53.1, 78.1)	67.2 (53.1, 78.1)	65.6 (53.9, 78.1)

[a] Median (IQR).

[b] $p < 0.001$ by ANOVA for all groups.

Table 3A

Clinical and sociodemographic predictors in transmasculine individuals.

Characteristic	Psychological			Physical			Environmental			CESD-8		
	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value
Intercept	0.12	−0.12, 0.36	<**0.001**	0.03	−0.19, 0.24	<**0.001**	0.33	0.10, 0.56	<**0.001**	0.02	−0.25, 0.30	0.2
BMI	−0.16	−0.29, −0.03	**0.013**	−0.13	−0.25, −0.02	**0.024**	−0.08	−0.21, 0.04	0.2	0.14	−0.01, 0.28	0.063
Education	0.10	−0.04, 0.23	0.2	0.13	0.01, 0.26	**0.040**	−0.07	−0.20, 0.06	0.3	−0.03	−0.19, 0.12	0.7
Avoided Bathroom Facilities			0.2			>0.9			0.052			0.8
No	–	–		–	–		–	–		–	–	
Yes	−0.16	−0.43, 0.11		0.00	−0.24, 0.25		−0.25	−0.50, 0.00		−0.03	−0.33, 0.27	
Difficulty Affording the Basics	−0.21	−0.34, −0.08	**0.002**	−0.40	−0.52, −0.28	<**0.001**	−0.52	−0.64, −0.39	<**0.001**	0.27	0.12, 0.43	<**0.001**
Stress	−0.44	−0.58, −0.30	<**0.001**	−0.31	−0.44, −0.19	<**0.001**	−0.13	−0.27, 0.00	**0.047**	0.33	0.17, 0.49	<**0.001**
Social Integration	0.15	0.02, 0.27	**0.022**	−0.02	−0.13, 0.10	0.8	0.07	−0.05, 0.19	0.2	−0.01	−0.15, 0.13	0.9
Lack of Transportation			>0.9			**0.011**			<**0.001**			>0.9
No	–	–		–	–		–	–		–	–	
Yes	0.01	−0.30, 0.32		−0.37	−0.65, −0.09		−0.59	−0.89, −0.29		0.02	−0.34, 0.37	
Exercise	0.16	0.04, 0.28	**0.011**	0.21	0.09, 0.32	<**0.001**	−0.01	−0.13, 0.10	0.8	−0.14	−0.28, 0.00	0.051
Current Smoker			**0.043**			**0.015**			0.053			0.8
No	–	–		–	–		–	–		–	–	
Yes	−0.44	−0.87, −0.02		−0.49	−0.88, −0.09		−0.40	−0.81, 0.00		0.06	−0.43, 0.55	
Past Smoker			0.4			**0.019**			0.6			0.8
No	–	–		–	–		–	–		–	–	
Yes	0.14	−0.17, 0.46		0.35	0.06, 0.64		0.07	−0.23, 0.38		−0.05	−0.41, 0.31	
Alcohol Screening Score	0.02	−0.12, 0.15	0.8	0.08	−0.04, 0.20	0.2	0.11	−0.02, 0.24	0.083	0.13	−0.03, 0.28	0.11
Time on Hormone Therapy	−0.01	−0.19, 0.17	>0.9	0.08	−0.09, −0.24	0.4	0.07	−0.10, 0.25	0.4	−0.08	−0.29, 0.12	0.4
Age	0.07	−0.12, 0.27	0.5	−0.37	−0.54, −0.19	<**0.001**	−0.08 0.625	−0.26, 0.11	0.4	0.09	−0.13, 0.31	0.4
R^2	0.545			0.625						0.625		

[1] CI = Confidence Interval (Bootstrapped).

Table 3B

Clinical and sociodemographic predictors in transfeminine individuals.

Characteristic	Psychological			Physical			Environmental			CESD-8		
	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value	Beta	95% CI[1]	p-value
Intercept	−0.02	−0.22, 0.17	<**0.001**	0.04	−0.17, 0.25	<**0.001**	0.19	−0.02, 0.39	<**0.001**	−0.03	−0.24, 0.17	>0.9
BMI	−0.05	−0.18, 0.08	0.5	−0.14	−0.28, −0.01	**0.042**	−0.05	−0.18, 0.09	0.5	0.03	−0.10, 0.17	0.6
Education	0.04	−0.09, 0.17	0.6	0.06	−0.08, 0.20	0.4	0.04	−0.10, 0.18	0.6	−0.13	−0.27, 0.00	0.053
Avoided Bathroom Facilities			0.7			0.7			0.4			0.14
No	–	–		–	–		–	–		–	–	
Yes	0.05	−0.22, 0.32		0.06	−0.23, 0.34		−0.13	−0.41, 0.15		0.21	−0.07, 0.50	
Difficulty Affording the Basics	−0.07	−0.20, 0.07	0.3	−0.23	−0.38, −0.09	**0.002**	−0.37	−0.52, −0.23	<**0.001**	0.09	−0.05, 0.24	0.2
Stress	−0.56	−0.70, −0.42	<**0.001**	−0.39	−0.54, −0.24	<**0.001**	−0.26	−0.41, −0.12	<**0.001**	0.57	0.43, 0.72	<**0.001**
Social Integration Score	0.25	0.12, 0.39	<**0.001**	0.07	−0.08, 0.21	0.3	0.23	0.09, 0.37	**0.002**	−0.17	−0.31, −0.02	**0.024**
Lack of Transportation			0.4			0.11			0.090			0.7
No	–	–		–	–		–	–		–	–	
Yes	0.15	−0.20, 0.49		−0.30	−0.66, 0.07		−0.31	−0.67, 0.05		−0.07	−0.43, 0.30	
Exercise	0.02	−0.11, 0.16	0.7	0.13	−0.02, 0.27	0.086	−0.06	−0.20, 0.08	0.4	−0.01	−0.15, 0.13	0.9
Current Smoker			0.4			0.6			>0.9			0.6
No	–	–		–	–		–	–		–	–	
Yes	0.18	−0.27, 0.63		−0.14	−0.62, 0.33		−0.02	−0.48, 0.45		0.13	−0.34, 0.60	
Past Smoker			0.4			0.8			0.2			0.4
No	–	–		–	–		–	–		–	–	
Yes	−0.13	−0.43, 0.16		0.04	−0.28, 0.35		−0.21	−0.51, 0.10		−0.14	−0.44, 0.17	
Alcohol Screening Score	0.19	0.06, 0.32	**0.005**	0.09	−0.05, 0.23	0.2	0.06	−0.08, 0.20	0.4	0.02	−0.12, 0.16	0.8
Time on Hormone Therapy	0.07	−0.08, 0.22	0.4	−0.04	−0.20, 0.12	0.6	−0.05	−0.21, 0.10	0.5	−0.06	−0.22, 0.09	0.4
Age	0.07	−0.10, 0.23	0.4	0.04	−0.13, 0.21	0.7	0.04	−0.13, 0.21	0.6	0.10	−0.07, 0.27	0.2
R^2	0.570			0.516			0.516			0.515		

[1] CI = Confidence Interval (Bootstrapped).