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The effect of testosterone therapy on personality traits of trans men: a controlled prospective study in Germany and Switzerland

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ABSTRACT

Gender dysphoria in transgender men is generally treated with exogenous testosterone administration aiming to suppress secondary female sex characteristics and achieve masculinization. However, the effect of testosterone on the personality of transgender men remains largely unknown. Therefore, we conducted a controlled study with 23 trans men ($M = 27.2$ years, $Range = 18–51$ years), recruited from internet-groups, medical and psychiatric services in Switzerland and Germany versus 27 cisgender women matched by age as control group. Data were collected prior to hormone therapy (HT), three and six months after the first treatment. Non-pathological personality traits (Big Five) were measured with the revised NEO-Personality-Inventory (NEO-PI-R). The greatest changes in the Big Five and its subdimensions occurred within the first three months. Interaction effects showed a significant decrease in the dimension *Neuroticism* ($p < 0.01$) - with the most relevant decline in its facet *Depression* - conversely, *Extraversion* ($p < 0.001$) increased, in particular, within its facets of *Assertiveness* ($p < 0.01$) and *Warmth* ($p < 0.01$). Expectedly, personality traits were stable in the control group. An overall decrease in interpersonal stress-related traits and a substantial increase in enhanced social-interaction traits and personal well-being occurred. These results enable medical services to ensure that informed-consent prior to HT is evidence-based with respect to potential changes in personality and may reduce concerns of trans men and their significant others regarding increased aggressiveness.

1. Introduction

People with gender dysphoria experience an incongruence between their felt or self-identifying gender and their physical or assigned gender and therefore, may wish to medically transition: seek hormone treatment or gender affirmation surgery in order to reduce dysphoria. The etiology of gender dysphoria (GD) remains speculative. One of the most accepted theories was proposed by Milton Diamond (2006) assuming that prenatal genetic and endocrine organizational factors determine gender specific behavior, subsequently fueled by interaction with society, culture and family.

An estimation of the prevalence of gender dysphoria is challenging, but survey studies from the US and the Netherlands range from 0.02–0.5% in the general population (Conron et al., 2012; Wiepjes et al., 2018).

1.1. Affirmation process

The gender affirmation process involves several steps with variances between approaches: A psychiatric evaluation to verify the diagnosis of

gender dysphoria, followed by the medical process, which, for transgender men represents testosterone therapy, hysterectomy with oophorectomy, subcutaneous mastectomy, and genital affirmation surgery (metoidioplasty or phalloplasty). About 87% of trans men choose the affirming hormone treatment (Metzger, 2013). The aim of HT is the physical virilization including a deepening of the voice, ceasing of menstruation, changes in fat distribution, increases in muscle mass and libido, growth of facial and body hair. Potential negative effects of HT include mood swings, atrophy of vaginal epithelium, an increase in clitoral size, acne, apnea, edemas of the legs, increases in aggression, impulsivity and, depending on genetic predisposition, loss of scalp hair (Steinle, 2011; Wierckx et al., 2014).

Gender dysphoria may cause serious distress because of social stigmatization and internalized transphobia (Colizzi et al., 2014; Hendricks and Testa, 2012). As a result, the prevalence of mental health issues such as depression and/or anxiety in this population is high and often causes maladaptive strategies like substance abuse, self-harm and suicide attempts (Liu and Mustanski, 2012; Mizock, 2017).

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1.2. Personality

Personality marks the relatively stable individual difference in physical appearance, behavior and experience of humans over time (Asendorpf, 2011) and should not be mistaken for a certain behavior in a specific situation (*state* vs. *trait*; Hermann, 1976). Personality traits though, may be affected by their “biological base”, such as changes in brain structure or in endocrine levels (McCrae, 2011; p 212) and even - to a certain extent - through experiences or social changes across the life span (Specht et al., 2011). The so called “Big Five”, assessed by the NEO-Personality-Inventory (NEO-PI-R), have been identified as the most stable non-pathological traits (McCrae and Costa, 1994; Terracciano et al., 2010).

1.3. Effects of testosterone

Sexual hormones are known to have an organizational and activation effect on the brain which influences behavior and mood. Specifically, there is a direct influence on the hypothalamus and hippocampus and therefore, they affect the psychological functioning of emotions, perception and behavior (Buchanan et al., 1992; Slabbekorn et al., 1999).

In the literature, the exogenous testosterone therapy has been mostly studied in cisgender men, characterized by male gender assignment at birth and male gender identification. Relatively few studies were conducted on testosterone treatment in trans men, characterized by female gender assignment at birth and male gender identification, and mainly focused on changes in aggression, sexual behavior or cognitive abilities (Haraldsen et al., 2005; Slabbekorn et al., 1999; Sommer et al., 2008; van Honk et al., 2011). Only more recent studies have explored the effects of testosterone treatment in trans men on mental health, personality-related psychopathology, perceived and social stress and quality of life in trans men (Colizzi et al., 2014; Davis and Meier, 2013; DuBois, 2012; Gómez-Gil et al., 2012; Gorin-Lazard et al., 2012; Keo-Meier et al., 2014). Most studies have implemented cross-sectional designs, however, in the few longitudinal studies measuring hormonal effects in the transgender population substantial differences in outcome were noted (Costa and Colizzi, 2016).

Based on the aforementioned literature on hormone treatment effects, we hypothesized that neurotic and depressive dimensions would decrease and dimensions related to psychological well-being would increase after three months of HT. Although affirming hormone therapy is commonly administered to trans men (Metzger, 2013), its effects on stable non-pathological personality traits in trans men have not been studied in a prospective longitudinal design to date. Thus, in the following, this controlled prospective study aims to assess the impact of testosterone treatment on the stable non-pathological personality traits as measured with the NEO-PI-R.

2. Methods

2.1. Participants

Subjects were recruited through German female-to-male internet-groups and from psychological and medical services in Switzerland and Germany between August 2013 and October 2014. For the trans men, inclusion criteria were the indication for HT and a diagnosis of transsexualism (F64.0), as specified in the International Statistical Classification of Diseases and Related Health Problems (ICD-10) by the World Health Organization (World Health Organization, Dilling et al., 2010), made by a licensed psychiatrist. Further inclusion criteria were the wish to initiate HT, an age of more than 18 and less than 55 years, and sufficient mastery of the German language. Exclusion criteria were current treatment of substance use and/or affective disorders, as well as any prior and ongoing medical gender affirmation interventions.

For the control group, inclusion criteria were being a cis woman

(non-gender-dysphoric assigned female at birth) and age between 18 and 55 years. Exclusion criteria were being pregnant or breast-feeding, having a polycystic ovarian syndrome (PCOS) or adrenogenital syndrome (AGS) due to altered sexual hormone levels. Controls were recruited through personal contacts of the research team and were matched by age to the trans men group (Pospeschill, 2006).

All patients consented to the use of their de-identified data for the purpose of this study, and the study and subsequent publication were approved by the University of Applied Sciences Zurich, Switzerland.

2.2. Procedures

At baseline - T1, sociodemographic, psychiatric and medical variables were collected and the NEO-PI-R and BDI-II were administered. Trans men were asked to send in their testosterone and estradiol plasma levels tested regularly after every 3 months of HT by their endocrinologists. After the inclusion of the eligible trans men, a cis women sample serving as control group was matched by age and included.

The NEO-PI-R and BDI-II were administered at menstruation of the controls to exclude variances in hormone levels. After three and six months of hormone treatment (T2 and T3), the NEO-PI-R and BDI-II were completed again with all subjects. As part of the routine testosterone and estradiol levels were tested by various laboratories in Switzerland and Germany. All data were collected between August 1st 2013 and March 31st 2015.

2.3. Measurements

2.3.1. Beck depression inventory (BDI-II)

The German revised version of the Beck Depression Inventory (BDI-II) was used to measure depressive symptoms. This self-report instrument assesses levels of depression by 21 multiple choice questions representing 21 symptom clusters on a 4-point scale (0–3) and records depressive symptomatology in the prior two weeks. Higher scores indicate more severe depressive symptomatology, the internal consistency and test-re-test-reliability are high (Beck et al., 1996).

2.3.2. NEO-personality-inventory-revised (NEO-PI-R)

The German version of the NEO-PI-R is a non-pathological personality inventory based on the five factor model of personality including *neuroticism*, *extraversion*, *openness to experience*, *agreeableness*, and *conscientiousness*. The individual traits are subdivided into six facets each, totaling 30 facets. The internal consistency of this test is very high and the test-re-test-reliability satisfactory, indicating stability of the measured personality traits over time.

Norm values for the NEO-PI-R are available from the validation study ($N = 11,724$) carried out in Germany, Austria and Switzerland (Ostendorf and Angleitner, 2004, p 178).

2.3.3 Testosterone and estradiol

The reference levels for serum sexual hormone levels were based on the biological male levels at 9.3–34.6 nmol/l testosterone and <195 pmol/l estradiol.

2.3.4. Statistical methods

All statistical procedures were conducted using the Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics were implemented for the characterization of the study sample such as sociodemographic and personality variables. The nature of the data was tested with Kolmogorov Smirnov, determined to be parametric and described as means and standard deviations. For categorical variables Pearson's chi-square was computed.

The impact of HT on the personality traits and depressive symptomatology were determined with Student's *t*-test. and a two-factor Analysis of Variance (ANOVA) repeated measures. Gender identity

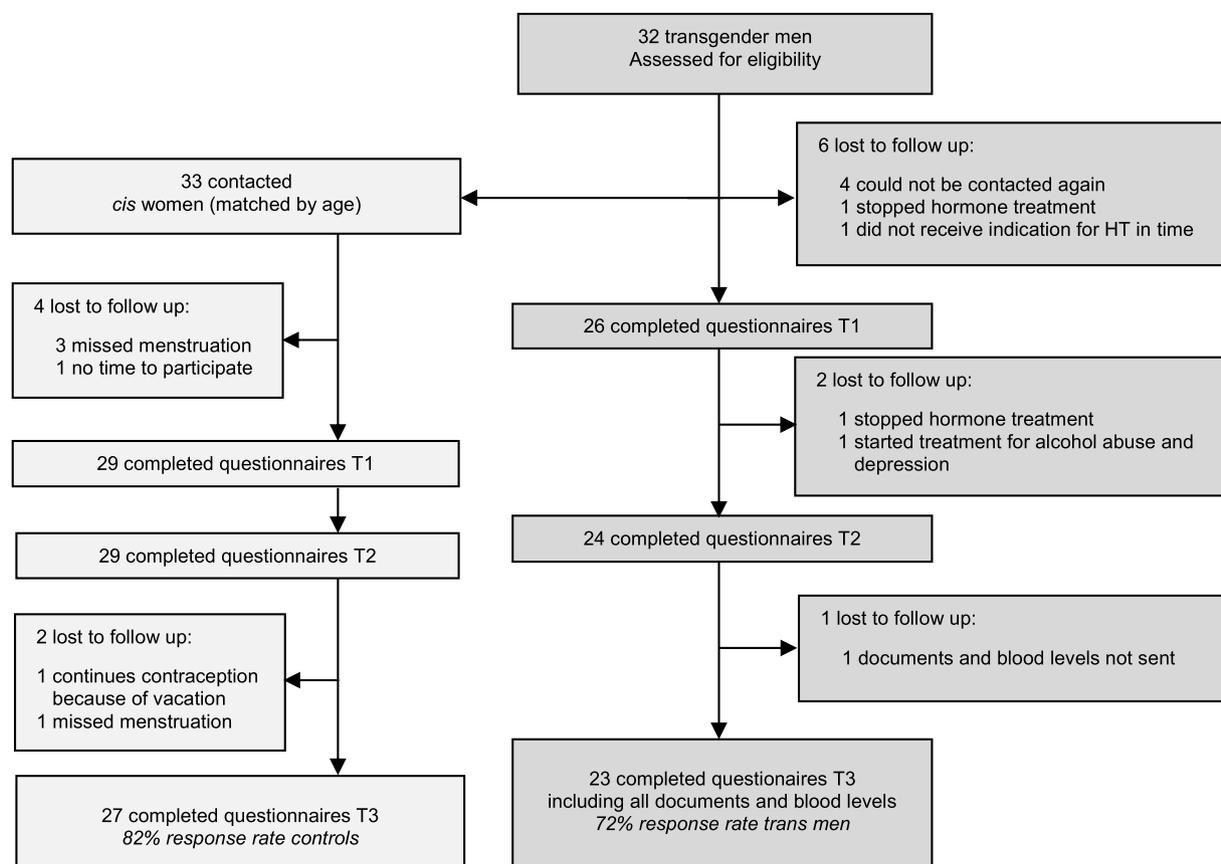


Fig. 1. Response rate of recruitment until end of data collection over three points of measurement T1 to T3. Adapted from the CONSORT-standard for the reporting of trials. Copyright 2010, consort-statement.org.

(trans men vs. cis women) was set as *between-subjects* factor and measuring-intervals (T1, T2 and T3) as *within-subjects* factor. A mixed-model was used to determine main- and interaction-effects. For all implemented tests, two-tailed tests were used, and the significance level alpha was set at $p < 0.05$.

3. Results

3.1. Attrition of the sample

As depicted in the flowchart (Fig. 1), of the recruited 32 trans men eligible for this study, six were lost before T1 (four lost to follow-up, one stopped before HT, another did not receive the indication for HT in time), thus, 26 trans men completed the baseline assessment. After three months (T2), 24 trans men completed the assessment, one was excluded after ceasing HT, another one for substance use and depressive disorders. At six months, 23 trans men completed the assessment, one was not able to return all documents in time (response rate 72%).

Of the matched control group of cis women, initially, 33 cis women were included and four lost prior to T1 due to missed menstruation and lack of time. At T1 and T2, 29 cis women, and at T3, 27 controls completed the assessments, two were lost due to missed menses (response rate 82%).

3.2. Sociodemographic characteristics of the study sample

Table 1 shows that neither age, marital status, nor relationship status were different between trans men and controls. There were differences in the education level and housing arrangements, trans men were less educated and lived more commonly on their own.

3.3. Hormone preparations

Hormone therapy consisted of subcutaneous or intramuscular injections of testosterone undecanoate and testosterone enanthate or transdermal application with testosterone gel. At T2 and T3 14 trans men used intramuscular injections (61%) such as Testoviron® or Nebido®. Transdermal applications such as Testogel®, Andropot® or Axiron® were used by 9 trans men (39%) (Table 3).

3.4. Mean comparison of depressive symptoms between trans men and controls

Before HT the group of trans men showed significantly higher levels of depressive symptomatology than controls (Table 2). At T1, the levels of depression of nine participants equaled a moderate to severe depression (Hautzinger et al. (2006).

3.5. NEO-PI-R mean response profile differences for trans men versus controls

A total of 23 trans men and 27 controls completed the personality inventory (NEO-PI-R) at all three assessments (T1, T2 and T3). Generally, controls reached higher levels in all main dimensions – *Extraversion*, *Openness*, *Agreeableness*, *Conscientiousness*, with the exception of *Neuroticism*. Between trans men and controls, main differences were found in the personality traits of *Extraversion* and *Neuroticism*, whereas, in the dimensions of *Openness*, *Agreeableness* and *Conscientiousness*, differences were smaller.

A group (gender identity) and time interaction term was fit in longitudinal linear models to compare effects on mean response profiles on each dimension of the NEO-PI-R between transgender men and controls (Table 4). Statistically significant interactions were found for

Table 1
Sociodemographic characteristics at T1 (baseline).

	Trans men (n = 23)		Cis women (n = 27)		Bivariate comparison		Total (n = 50)	
	M (SD)	%	n	M (SD)	%	n	M (SD)	%
<i>Age in years</i>								
- Up to 20 years		30.4	7		18.5	5		24.0
- Between 20 and 30 years		43.5	10		51.9	14		48.0
- More than 30 years		26.1	6		29.6	8		28.0
Age span	18–51			18–52			18–52	
Mean age (SD)	27.22(9.56)			28.11(9.28)			27.7(9.32)	
<i>Marital status</i>								
- Married/same sex union		2.0	1		6.0	3		8.0
- Single/divorced/separated	44.0	22		48.0	24		92.0	46
<i>Stable relationship^a</i>								
Yes		43.5	10		63.0	17		54.0
No		56.5	13		37.0	10		46.0
<i>Form of housing</i>								
- With family/other people		30.0	15		50.0	25		80.0
- Alone		16.0	8		4.0	2		20.0
<i>Education level</i>								
- University/higher edu. ^b		10.0	5		28.0	14		38.0
- Other		36.0	18		26.0	13		62.0
<i>Employment</i>								
- Student		18.0	9		34.0	17		52.0
- Other		28.0	14		20.0	10		48.0

Note. M = mean; SD = standard deviation; T1 = baseline; T2 = after 3 months; T3 = after 6 months. Only subjects were included with all three assessments completed.

*p < 0.05. **p < 0.01. (exact significance, two-tailed).

^a Subjects with stable relationship at T1 (n = 27), subjects with stable relationship at T3 (n = 23).

^b University/higher edu.: such as universities, colleges or academies.

Table 2
ANOVA with repeated measures: HT (6 months) and depression levels, Time as within-subjects and Group as between-subjects factors.

	T	Trans men (n = 23)		Controls (n = 27)		Time F(2,47)	Group F(1,48)	Time* group F(2,47)
		M	(SD)	M	(SD)			
BDI-II						10.59***	8.18**	11.83**
	1	15.7	(12.3)	5.8	(4.5)			
	2	7.7	(5.1)	5.7	(4.4)			
	3	8.1	(6.2)	6.3	(6.0)			

Note. M = mean; SD = standard deviation; T1 = baseline; T2 = after 3 months; T3 = after 6 months of hormone therapy; HT = hormone therapy; BDI-II = revised Beck Depression Inventory.

* p < 0.05.

** p < 0.01.

*** p < 0.001. (exact significance, two-tailed).

Table 3
ANOVA with repeated measures: HT (6 months) and testosterone levels, Time as within-subjects factors.

	T	Trans men (n = 23)		F(2,22)
		M	(SD)	
Testosterone				4.86*
	1	1.1	(0.6)	
	2	17.7	(9.5)	
	3	19.4	(11.2)	
Estradiol				67.89***
	1	267.5	(241.4)	
	2	202.5	(180.6)	
	3	152.6	(94.3)	

Note. M = mean; SD = standard deviation; T1 = baseline; T2 = after 3 months; T3 = after 6 months of hormone therapy; HT = hormone therapy.

*p < 0.05, **p < 0.01, ***p < 0.001. (exact significance, two-tailed).

three of the five main dimensions (*Neuroticism*, *Extraversion* and *Agreeableness*) and for seven of the subdimensions (*Hostility*, *Depression*, *Vulnerability*, *Warmth*, *Assertiveness*, *Positive Emotions* and *Trust*).

As depicted in Fig. 2, trans men showed a steeper decrease in *Neuroticism* and steeper increases in *Extraversion* and *Agreeableness* as

controls during the first three months of HT, with significant differences between the two groups remaining after six months of treatment. In all models the F test showed group-effects on the three main-dimension (N, E and A), but only in *Extraversion* the interaction of group * time showed an effect (p < 0.001).

Fig. 3 shows significant group-effects of the N-subdimensions such as *Hostility* (p < 0.01), *Depression* (p < 0.001) and *Vulnerability* (p < 0.01). Each graph depicts a steep drop at follow-up after three months of HT in the trans men group.

Fig. 4 depicts the E-subdimensions *Warmth* (p < 0.01), *Assertiveness* (p < 0.01) and *Positive Emotions* (p < 0.01) with their significant group * time interaction effects and steep increase in the trans men group after three months of hormone treatment.

All significant A-Dimensions (*Agreeableness* and *Trust*) show above mean values in controls, whereas trans men remain within the general mean, with values increasing evenly throughout six months of HT (Fig. 5).

4. Discussion

To the best of our knowledge, this is the first study assessing the effects of HT in trans men on non-pathological personality traits over

Table 4
ANOVA with repeated measures: time (T1, T2, T3) as within-subject and group (GI) as between-subject factors.

T	Trans men (n = 23)		Cis women (n = 27)		Time	Group	Time* group
	M	(SD)	M	(SD)	F(2,47)	F(1,48)	F(2,47)
N: Neuroticism							
1	110.2	(24.4)	89.8	(17.2)	6.71**	7.89**	3.00
2	98.8	(21.7)	87.3	(18.2)			
3	100.0	(22.5)	88.2	(17.1)			
N2: Angry hostility							
1	18.0	(5.7)	12.9	(4.6)	4.49*	11.40**	2.62
2	16.0	(4.7)	13.0	(4.0)			
3	15.9	(4.2)	12.2	(4.1)			
N3: Depression							
1	19.2	(5.8)	12.7	(4.5)	7.75**	16.54***	2.48
2	15.7	(4.8)	11.6	(4.2)			
3	16.3	(5.4)	12.0	(5.2)			
N6: Vulnerability							
1	16.0	(5.8)	12.2	(3.2)	4.74*	4.88*	3.01
2	13.4	(4.7)	11.8	(4.0)			
3	14.3	(5.3)	12.3	(3.7)			
E: Extraversion							
1	88.2	(24.8)	117.0	(16.3)	2.57	16.78***	10.09***
2	96.8	(20.3)	114.0	(19.2)			
3	95.0	(20.9)	115.5	(17.1)			
E1: Warmth							
1	17.7	(5.5)	23.9	(3.0)	2.35	19.90***	6.07**
2	19.6	(3.9)	23.3	(3.6)			
3	19.6	(4.3)	23.6	(3.5)			
E3: Assertiveness							
1	12.1	(6.1)	16.5	(4.6)	3.19*	3.35	7.23**
2	14.4	(6.1)	16.1	(5.6)			
3	13.9	(6.3)	16.1	(4.7)			
E6: Positive emotions							
1	16.7	(5.6)	23.7	(3.5)	1.03	17.37***	7.96**
2	19.0	(4.9)	22.7	(4.2)			
3	18.0	(5.5)	22.9	(4.3)			
A: Agreeableness							
1	110.8	(20.7)	123.7	(12.0)	1.29	6.44*	1.26
2	113.2	(16.5)	124.3	(15.3)			
3	114.6	(18.7)	123.7	(13.1)			
A1: Trust							
1	15.7	(5.2)	22.2	(3.8)	4.31*	20.63***	4.54*
2	17.0	(4.3)	21.9	(4.0)			
3	18.0	(4.2)	22.2	(4.2)			

Note. M = mean; SD = standard deviation; T1 = baseline; T2 = after 3 months; T3 = after 6 months of hormone therapy. GI = gender identity as identifier between the two groups (trans men vs. cis women).

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$. (exact significance, two-tailed).

time. This study provides evidence of the important role of HT in the psychological and social functioning of trans men after a relatively short time of administration and shows significant differences in personality traits before HT compared with a matched sample of cis female healthy controls. Especially Neuroticism dimensions decreased significantly after three months of treatment compared with baseline. Conversely Extraversion traits of the transgender men's group showed a significant increase three and six months after initiating testosterone.

In personality psychology some studies indicate that certain personality traits may influence aggressive or non-aggressive behavior. Neuroticism has been found to be positively correlated with aggression and aggressive behavior, whereas Extraversion, Openness and Conscientiousness were negatively correlated. Agreeableness showed mixed results in different studies (Bartlett and Anderson, 2012; Komasi et al., 2016).

Sexual hormones have an organizational and activational effect on the brain influencing behavior and mood. Specifically, a direct influence on the hypothalamus and hippocampus occurs and therefore, affects the psychological functioning of emotions, perception and behavior (Buchanan et al., 1992; Slabbekorn et al., 1999). In several studies examining sexual hormones and aggression, testosterone positively correlated with an increase in dominance in cis men (Alvergne et al.,

2010; Boksem et al., 2013; Eisenegger et al., 2007; Guinn Sellers et al., 2007; Kuepper et al., 2010; Mazur and Booth, 1998; Wacker et al., 2013) highly situationally and contextually dependent (Guinn Sellers et al., 2007; Boksem et al., 2013). Conversely, a recent study with transgender men showed no positive correlation between HT and increased aggression, with the exception of high levels of anxiety predicting aggressive behavior (Defreyne et al., 2018).

In a cross-cultural study of the NEO-PI-R, the facets *warmth*, *positive emotions* and *trust* were linked to the female gender (Costa et al., 2001). Interestingly, in this study, all these facets, were less expressed in trans men at baseline and increased with testosterone treatment over time. Several studies documented substantially higher levels of neuroticism in women than men in general (Costa et al., 2001; Lynn and Martin, 1997). In the present study, after only three months of HT, testosterone reduced neuroticism in trans men but levels of depression and irritability remained greater after six months versus controls.

Testosterone biologically impacts personality traits. From these findings, known binary gender differences only sustained in the facets of *neuroticism*, but not in the facets of *extraversion* or *agreeableness* and therefore, these findings cannot be completely explained by the biological model. An alternative model merits discussion: as described by Piedmont (2001), the reduction of psychological distress causes an

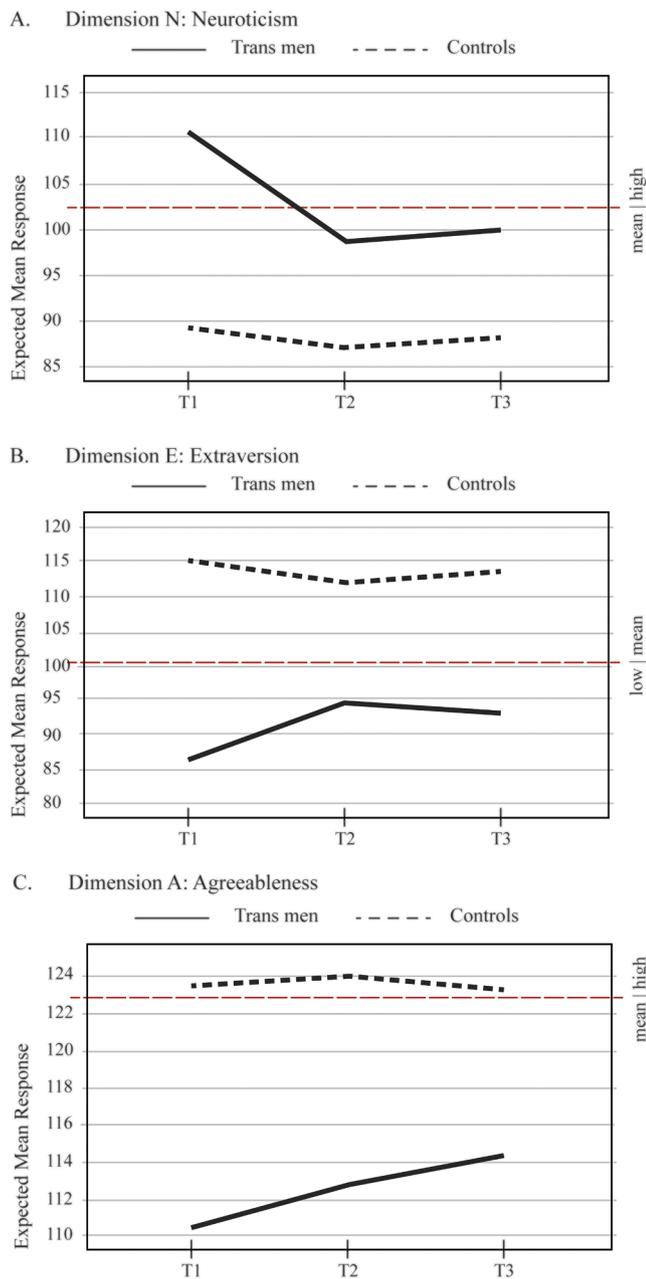


Fig. 2. Graphical depiction of significant group*time interaction effects shown in Table 4. Panel A. Dimension N: Neuroticism. Panel B. Dimension E: Extraversion. Panel C. Dimension A: Agreeableness.

increase in coping abilities (*Neuroticism* and *Extraversion*) and social skills (*Extraversion* and *Agreeableness*). Evidence suggests an increase in mental health and quality of life after only three months of hormone therapy (Meier et al., 2011, 2013). Exogenous testosterone reduces levels of depression, anxiety and stress (Defreyne et al., 2018; Meier et al., 2011), thus, hormone therapy potentially alleviates psychological distress, reduces vulnerability and improves personality facets related to superior social functioning. Therefore, in transgender individuals even those with possible comorbid psychological conditions, e.g. depression, anxiety, the consideration of HT as an early medical step is noteworthy. So far, the common practice of health care providers has been to treat conditions like depression or anxiety before considering medical gender affirmation hormone treatment (Hale, 2007).

This study provides evidence of the important role of HT in the psychological and social functioning of trans men and thus may ensure evidence-based decision-making for health care providers, trans men

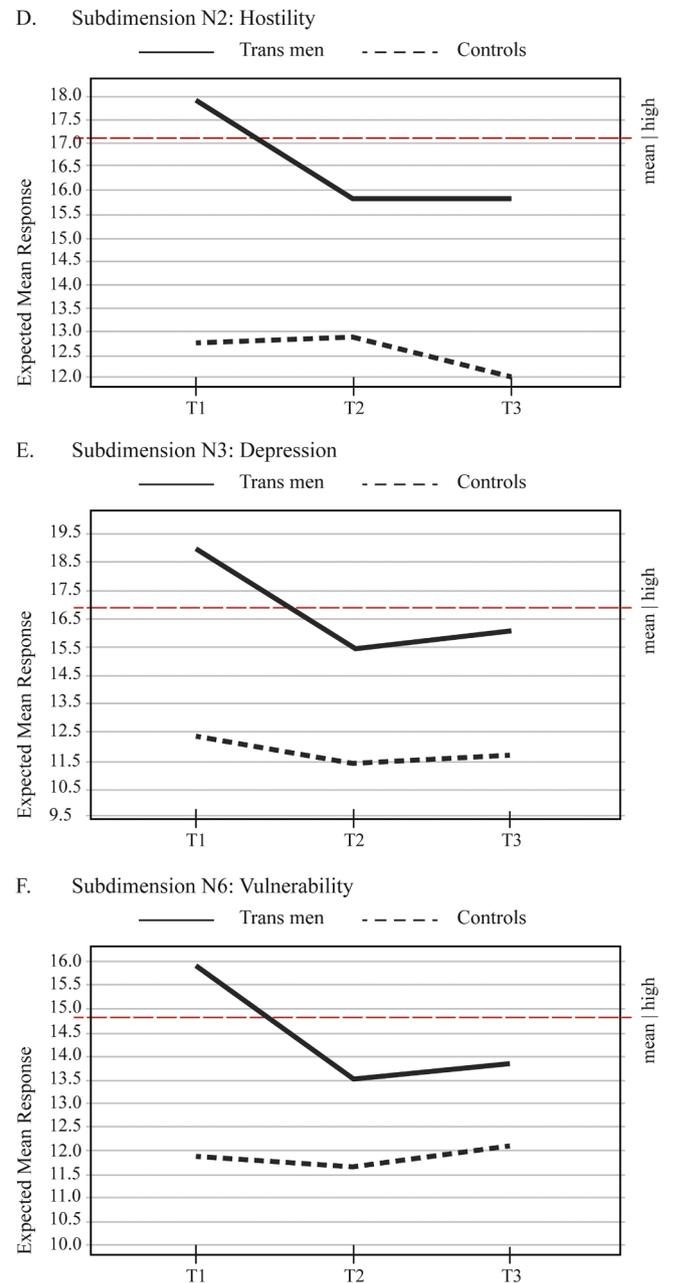


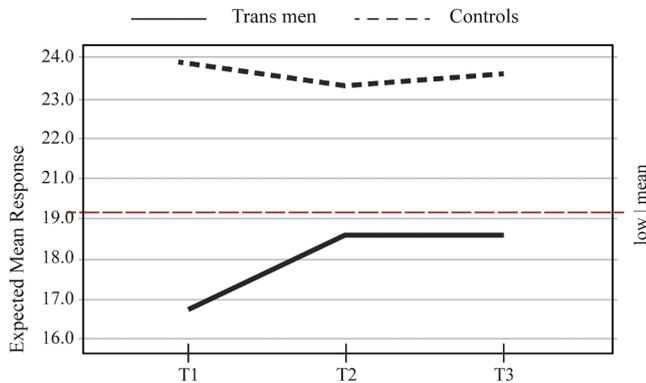
Fig. 3. Graphical depiction of significant group*time shown in Table 4. Panel D. Subdimension N2: Hostility. Panel E. Subdimension N3: Depression. Panel F: Subdimension N6: Vulnerability.

and their significant others, as well as increase the understanding of the positive effects of testosterone therapy and its effect on personality over time.

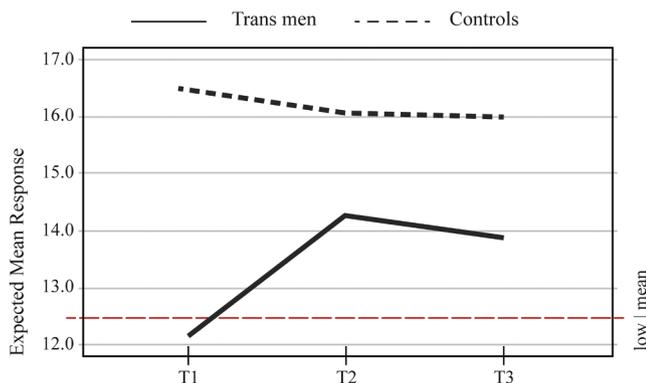
This study had several strengths, nonetheless, few limitations have to be noted. This study had a prospective design and the control group of cis women was matched by age. Due to time and capacity limitations for this study no trans women were included as controls. Overall, the attrition in the sample was marginal, still the number of participating trans men was rather low - indebted to challenges in recruitment. The immunoassays for hormones were not standardized causing potential bias.

Though transgender research and its management are evolving, the effects of hormone therapy on personality traits and character remain relatively unknown. Therefore, future research is definitely warranted. It will be interesting to compare results of transgender men with those of cisgender men, to find out if an alignment in personality traits occurs.

G. Subdimension E1: Warmth



H. Subdimension E3: Assertiveness



I. Subdimension E6: Positive Emotions

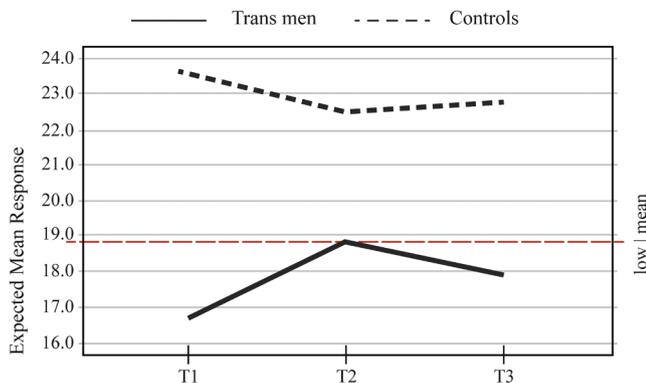


Fig. 4. Graphical depiction of significant group*time effects shown in Table 4. Panel G. Subdimension E1: Warmth. Panel H. Subdimension E3: Assertiveness. Panel I: Subdimension E6: Positive Emotions.

HT may be considered a second puberty, which can take up from five to ten years, so a longer follow-up would be desirable as this study only provided short term data. This is the first study to comprehensively assess the effects of hormone therapy on non-pathological personality traits (as measured with the NEO-PI-R) in trans men over time. Further studies with longitudinal design are needed to better understand the long term effects of HT on personality and its implications on social interaction and personal well-being.

In conclusion, the results of this study indicate that trans men versus female controls have significantly higher scores in *neuroticism* and lower levels of *extraversion* prior to initiation of hormone therapy. Testosterone administration reduces these differences over time and thus, lessens socially inhibiting traits, decreases traits related to

J. Subdimension A1: Trust

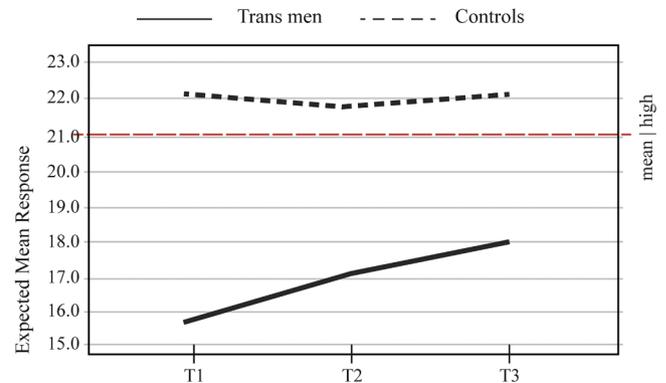


Fig. 5. Graphical depiction of significant group*time interaction effects shown in Table 4. Panel J. Subdimension A1: Trust.

aggression and aggressive behavior, and strengthens traits enabling better interpersonal relations.

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Conflict of interest

The authors have no conflict of interest to declare.

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