PSYCHOLOGICAL EFFECTS OF EXOGENOUS TESTOSTERONE ON FEMALE-TO-MALE TRANSSEXUALS: A LONGITUDINAL STUDY

A Dissertation

Presented to

The Faculty of the Department

of Psychology

University of Houston

In Partial Fulfillment

Of the Requirements for the Degree of

Doctor of Philosophy

By

Stacey L. Colton Meier

May 2012

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ABSTRACT

The aim of the current study is to examine the effects of exogenous testosterone on multiple mental health domains in female-to-male transsexuals (FTMs). While previous US longitudinal studies have examined the physical effects of exogenous testosterone on FTMs, no US study has examined the psychosocial or cognitive effects of testosterone on FTMs longitudinally. In the current study, adult male and female control participants from the University of Houston and surrounding Houston community and FTMs from all over the US were assessed on cognitive functioning (local participants only) psychosocial functioning including depression, anxiety, stress, quality of life, self esteem, emotional reactivity, as well as gender role and psychopathology three times over a one year period. Controls were recruited to match FTMs (n = 79) on age and education level (n = 154). FTM participants completed measures initially before they begin testosterone treatment (T1, n = 79), three months later (T2, n = 54) and ten months to one year later (T3, n = 39). Male (n = 70; 56; 38) and female (n = 84; 61; 51) controls were measured in the same time intervals. Resulted showed that FTMs experienced decreases in gender dysphoria over their first year on testosterone. FTMs were not found to differ from males or females on verbal or spatial intelligence at T1, and by T3 a trend was found for an interaction of time x gender on spatial intelligence with FTMs' spatial performance increasing more than controls by T3. While FTMs initially displayed poorer psychosocial functioning than controls, by T3 they appeared to be similar to controls on all variables except for self-esteem, where they displayed lower scores than males. In terms of gender role, while FTMs were not found to over-confirm their masculinity, they

consistently displayed lower femininity scores than both males and females over all three time points. At the initial assessment, FTMs displayed higher scores on the MMPI-2 Psychopathic deviate scale and the Masculinity/femininity compared to male and female controls and on the Depression, Paranoia, Psychasthenia, Schizophrenia, and the Social Inversion scales compared to males. After a year of testosterone use, FTMs only differed from females on Masculinity/femininity and no longer differed from males on the Psychopathic deviate, Paranoia, or Psychasthenia scales. Contrary to the idea that beginning hormone treatment is a stressful experience, FTMs' levels of stress actually decreased rapidly. No iatrogenic psychological effects of testosterone were found. Overall findings indicate that FTMs become more psychologically healthy after three months of using exogenous testosterone and these effects are maintained for their first year receiving testosterone treatment.

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I am grateful to my family. To my partner Rebecca, thank you for your unconditional love, support, and patience during this project and my doctoral training. To my parents who have encouraged me to pursue graduate training and have given me all that they have, most importantly they have loved me for who I am and have always fostered my growth. You all mean the world to me.

To the God, this project is dedicated to your call and offered for your glory. Thank you for blessing me with this project, may it bless You and those who read it.

TABLE OF CONTENTS

DEDICATION

This work is dedicated to all persons who have ever considered taking testosterone in order to feel more comfortable with their body as well as those who serve them and those who love them.

Psychological Effects of Exogenous Testosterone on Female-to-Male Transsexuals: A Longitudinal Study

Background

Female-to-Male transsexuals (FTMs) have been using exogenous testosterone to aid in their gender transitions since the 1930's (Meyerowitz, 2002). Even though FTMs have been using testosterone in varying dosages, studies assessing the effects of large amounts of testosterone on FTMs' bodies have just begun in the last thirty years (Meyer, Walker, & Suplee, 1981; Gooren, Giltay, & Bunck, 2008). Ideally, prospective studies would examine the effects of testosterone over time. However, because some previous research on FTMs has pathologized this small population, focusing on perceived deviant behaviors (e.g. fetishism or desire for genital modification), FTMs have become suspicious of researchers and reluctant to participate as research subjects (Lev, 2005). Meier and colleagues (2011) as well as Murad and colleagues (2010) have recently called for more vigorous longitudinal research studies examining the quality of life and psychosocial outcomes of hormone replacement therapy on transgender people.

Longitudinal research on trans people is in its infancy. In countries such as the Netherlands and Spain, physical transitions are covered by insurance. Trans people in those countries are required to receive health care at gender identity clinics where researchers can have access to participants for studies. As such, the Netherlands and Spain have produced the most cutting-edge research on trans people in general as well as research using longitudinal designs (Gomez-Gil, Vidal-Hagemeijer, & Salamero, 2008; Rametti, Carrillo, Gomez-Gil, Junque, Segovia, et al., 2011; Slabbekoorn, van Goozen, Megens, Gooren, & Cohen-Kettenis, 1999; van Goozen, Cohen-Kettenis, Gooren, Frijda,

& van de Poll, 1995). Ten years ago the US it was very rare for trans people to have transition related health care covered by insurance and gender clinics were almost non-existent (Meyerowitz, 2002). As of 2012, there are now large health centers who offer transgender specific care, yet insurance coverage for medically necessary hormones is still rare in the US (WPATH, 2011). As a result, domestic longitudinal studies on FTMs have been difficult, if not impossible to complete (Schleifer, 2006).

While gender clinics have generated research on transgender people, mainly on Male-to-Female transsexuals (MTFs), methods they have employed have been challenged as coercive (Lev, 2005). Transgender patients had to "prove" their gender to their doctors in order to obtain the treatments they sought. In this context, it would not be surprising to discover that many patients fabricated narratives to adhere to the doctors' a priori conceptions about transgender people and participated in research studies in order to obtain their treatment (Lev, 2005; Meyerowitz, 2002). Further, many patients in these clinics were asked to pay for the assessments that would later be used in research articles.

In addition, most of the studies conducted in European gender clinics have examined psychological changes due to sexual reassignment surgery and not specifically due to the administration of cross-sex hormones (Cohen-Kettenis & Pfafflin, 2003; Johansson, Sundbom, Hojerback, & Bodlund, 2009; Lindemalm, Korlin, & Uddenberg, 1986). However, in the US, transgender people are more likely to have access to hormonal treatments than surgical treatments, regardless of insurance coverage (Feldman & Bockting, 2003; Feldman & Goldberg, 2007). The World Professional Association for Transgender Health's *Standards of Care* (WPATH, 2011) urge mental and medical health practitioners to be familiar with the effects of hormone treatment.

Sex hormones are known to have both physical and psychological effects (e.g. hair growth, brain structures, anger, and spatial reasoning). Two effects of sex hormones have been established: organizing and activating, where the organizing effects are the influences of hormones on the brain of a developing fetus and the activating effects concern influences of circulating sex steroid hormone blood levels occurring during and after puberty (Slabbekoorn, van Goozen, Megens, Gooren, & Cohen-Kettenis, 1999). In order to study the activational effects of testosterone, investigators have assessed patients who receive medically related hormone treatment. FTMs are thought to provide an ideal population to test activational effects of testosterone in longitudinally designed studies because their treatment consists of weekly or bi-monthly administrations of exogenous testosterone (van Goozen, Slabbekoorn, Gooren, Sanders, & Cohen-Kettenis, 2002). Nonetheless, few researchers have examined psychological changes that accompany testosterone administration longitudinally.

Among research that specifically examines the psychological changes brought about by the administration of exogenous testosterone in FTMs, the majority of studies have focused on cognitive changes specifically including spatial rotation and verbal fluency (van Goozen, Slabbekoorn, Gooren, Sanders, & Cohen-Kettenis, 2002; Gomez-Gil, Canizares, Torres, de la Torre, Halperin, & Salamero, 2008). A meta analysis of the last forty years of research on the quality of life and psychosocial outcome of hormonal and surgical procedures on trans people reported that the evidence reviewed was of 'very low quality' due to observational methods, lack of control groups, and cross-sectional designs (Murad, Elamin, Garcia, Mullan, Murad, et al., 2010).

When FTMs are deciding whether to use testosterone as part of their gender

transition, FTMs, their family members, and partners usually display a strong desire to understand the physical and mental ramifications of testosterone use. A very common fear is that testosterone might make the FTM aggressive (Gorton, Buth, & Spade, 2005). Previous research has found testosterone to be correlated with aggression among men (Pope, Kouri, Hudson, 2000). However, testosterone administration was also found to be related to increased *proneness* to aggression, as measured by a questionnaire that includes assertiveness with aggression proneness, but not with increased aggressive *behavior* among FTMs (Gooren & Giltay, 2007; van Goozen, Cohen-Kettenis, Gooren, Frijda, & van de Poll, 1995). Gorton, Buth & Spade (2005) state "some transgender men report mood swings, increased anger, and increased aggressiveness after starting androgen therapy" (p. 65). However, studies have also provided evidence that suggest transgender people often experience improved psychological health after initiating hormones, in the specific forms of less anxiety, less depression, and greater happiness (Meier et al., 2011; Murad et al., 2010). For some transgender people, this change happens as soon as they begin taking hormones and for others, it happens as physical changes progress.

Given these mixed reports, more large-scale studies with long-term follow-up about the effects of testosterone are needed to make empirically based clinical decisions (Cohen-Kettenis & Gooren, 1999; Meier et al., 2011; Murad et al., 2010). While there are guidelines for medical care providers in treating transgender people (Gorton, Buth, & Spade, 2005; Hembree, Cohen-Kettenis, Delemarre, Gooren, Meyer, et al., 2009), corresponding guidelines for mental health care practitioners are only beginning to emerge (ALGBTIC, 2009; Slabbekoorn, van Goozen, Megens, Gooren, & Cohen-Kettenis, 1999). However, it would seem reasonable for mental health care providers and

FTM clients to be informed about expected changes in the body, mental health, well-being, cognition, emotions, gender role, and psychopathology related to testosterone treatment.

The current study investigated claims of increased psychological well-being among hormone using FTM men through investigating changes in verbal and spatial intelligence, depression, anxiety, quality of life, self esteem, emotional reactivity, gender role, and psychopathology for the first time longitudinally on this population in the US. It was expected that, overall, the FTMs in the current study would shift in a more psychologically healthy direction over the one-year period compared to controls who are expected to remain relatively stable. The proposed research utilized a longitudinal design with non-transgender males and females not undergoing hormone treatment as controls, in order to increase validity by controlling for threats of history, maturation, testing, and instrumentation.

Definitions

First, it is necessary to define terms that are used consistently throughout this paper. The precise definitions of the terms transgender, transsexual, sex, gender identity, and FTM have been contested both within the field of psychology and in the transgender community. For the purposes of this study, *transgender* describes individuals who do not feel like they fit into the gender binary of man or woman. A *transsexual* is a member of the transgender community who lives as a gender to which they were not originally assigned at birth. *Physical sex* is comprised of chromosomes, hormones, and internal and external genitalia (Fausto-Sterling, 1993), whereas *gender identity* is defined as a person's subjective feeling of being a male, female, both, or neither (Brill & Pepper,

2008). Non-transgender persons, or those persons whose assigned physical sex and gender identity are aligned are referred to as *cisgender*. *FTMs* are defined as people who were determined to be females at birth but identify their gender identity as male, but who have not yet been given full rights and recognition as males, (Devor, 1993). Only people whose physical sex was assigned female at birth and whose gender identity is male were eligible to participate in this study as they began hormone treatment. *Sex reassignment surgery* (SRS) includes any surgical procedure that modifies the appearance of primary or secondary sex characteristics to more closely match those of the physical sex with which the person identifies.

Physical Changes

The majority of prior longitudinal research on the effects of testosterone in the FTM population has investigated physical changes (Gooren, Giltay, & Bunck, 2008; Schlatter, Yassouridis, von Werder, Poland, Kemper, & Stalla, 1998). Physical changes brought about by testosterone administration to a typical female body have consistently been found to be: deepening of the voice; noticeable increase in hair growth on the face, pubic region, limbs, chest, back, and stomach; acne, changes in body odor; cessation of menstruation; enlargement of the clitoris; redistribution of fat; more coarse skin texture; increase in muscle mass; and scalp hair loss if it is genetically inherited (Gooren & Giltay, 2007; Gorton, Buth, & Spade, 2005; Meyer, Webb, Stuart, Finkelstein, Lawrence, & Walker, 1986; Papp, 2009). Within three months, FTMs may experience initial physical changes including skin oiliness/acne, facial/body hair growth, body fat redistribution, cessation of menses, clitoral enlargement, and deepened voice (WPATH, 2011). Each of those changes is expected to have its onset by six months of testosterone

treatment at the latest, and increased muscle mass may onset from six to twelve months (WPATH, 2011). Anecdotally, I have found that after about one year of hormone treatment, most FTMs are perceived as men by conventional visual standards.

Psychological Changes

Cognitive Ability

Sex differences in intelligence in the cisgender population have indicated that while men and women have similar overall IQs, men have higher spatial intelligence, while women have higher verbal intelligence (Nowell & Hedges, 1998; Wai, Cacchio, Putallaz, & Makel, 2010). Biological factors, including testosterone, have been indicated to influence these sex differences (Janowsky, Chavez, Zamboni, & Orwoll, 1998; Vermeersch, T'Sjoen, Kaufman, & Vincke 2008). Results have consistently shown that, on average, men have an advantage in spatial ability and women have a slight advantage in verbal ability (Newman, Sellers, & Josephs, 2005), however these differences have become less pronounced over time (Eisenberg, Martin, & Fabes, 1996). Gorski (1998) posited that these gender differences may be due to early effects of hormones on brain development, while Subrahmanyam and Greenfield (1998) propose that spatial abilities may be affected by environmental factors including boys being encouraged to spend more time in activities that require mental rotation of visual images (e.g., carpentry, video games, model-building) than girls. The verbal sex difference has actually been called into question by examining results from meta-analyses and has been said to have been overinflated (Hyde & Linn, 1988; Hyde, 2005).

Longitudinal studies of verbal and performance intelligence (VIQ and PIQ) using full battery Wechsler scales have found practice effects. The effects usually impact

performance IQ scores more than verbal (Wechsler, 1999), for example the WASI manual reports an average increase of 5.1 points for PIQ and 2.12 points for VIQ with repeated measures for adults age 17-54 (Wechsler, 1999). Although all subtests of the WASI demonstrate gains due to practice effects, they are affected differently over repeated measures, with raw scores from Block Design (subtest of PIQ) increasing the most (3.78 points) and Vocabulary (subtest of VIQ) increasing the least (0.91 points) on the second administration (Wechsler, 1999). Usually, the shorter the interval of time in between testing sessions, the greater the practice effects (Wechsler, 1999). These effects are thought to diminish after 1-2 years for performance subtests and after a shorter time interval for verbal subtests (Wechsler, 1999).

Populations used to study the effects of exogenously administered testosterone have included animals, cisgender aging men and women, cisgender hypogonadal males, and FTMs. Increases in spatial ability have been the most robust findings related to testosterone, both endogenous and exogenous (Hampson, 1995; Hausmann, McKeever & Deyo, 1990; Slabbekoorn, van Goozen, Cohen-Kettenis, & Güntürkün, 2000; van Goozen Cohen-Kettenis, Gooren, Frijda, & van de Poll, 1995), although several studies have not found significant improvement in spatial ability (Cherrier, 2009; Haraldsen, Egeland, Haug, Finset,& Opjordsmoen, 2005; Liben, Susman, Finkelstein, Chinchilli, Sunselman, et al., 2002; Lu, Masterman, Mulnard, Cotman, Miller, et al., 2006; van Goozen, Slabbekoorn, Gooren, Sanders, G., & Cohen-Kettenis, 2002).

A recent imaging study of FTMs in Spain examined sexually dimorphic white matter regions in the brains of FTMs and cisgender heterosexual male and female controls (Rametti, Carrillo, Gomez-Gil, Junque, Segovia, et al., 2011). The FTMs in this

study had not begun taking testosterone and the results showed that the white matter microstructure pattern in FTMs was closer to cisgender males than to cisgender females, a finding that the authors suggested, "provides evidence for an inherent brain difference in the brain structure of FTM transsexuals" (p. 1, Rametti et al., 2011).

Dutch studies have provided mixed results on the cognitive effects of testosterone in FTMs. In an uncontrolled study, FTMs were shown to have increased scores on a measure of spatial rotation and decreases in verbal ability after three months on testosterone treatment (van Goozen et al., 1994). A later study, which utilized cisgender males and females as controls, found results in spatial and verbal ability in FTMs similar to the previous study (van Goozen et al., 1995). A long-term follow-up study, which utilized MTFs as controls, was able to again replicate spatial increases, however they did not find verbal ability to diminish in FTMs over one year on testosterone (Slabbekoorn et al., 1999). However, a more recent study by the same researchers that examined spatial ability was not able to replicate spatial gains in FTMs after two-and-a half months on testosterone (van Goozen et al., 2002).

The latest longitudinal research on cognition in FTMs comes from researchers in Spain who tested 14 FTMs before and after 6 months of testosterone administration and used a cross-sectional design to show improved performance on visual memory tasks relative to FTMs who were not on testosterone (Gomez-Gil et al., 2009). From this information, it seems likely that testosterone would be related to increases in spatial skills, however due to variable findings, testosterone's effect on verbal ability is less clear.

Psychosocial Functioning

Depression. Depression is common among the transsexual population. Clements-Nolle, Marx, and Katz (2006) surveyed over 500 transgender persons and classified 60 percent as depressed. Another study of over 400 FTMs found that over 40 percent reported a history of at least one previous suicide attempt (Meier et al., 2011). Indeed transsexuals may experience severe depression and suicidal thoughts when they go through puberty, as their bodies seem to betray them (Brill & Pepper, 2008; Devor, 1997). Although no data was presented, Levy, Crown, and Reid (2003) suggest that withholding hormone treatment from transsexuals may be associated with increased risk for depression and suicide. As a history of a previous suicide attempt is one of the best predictors of eventual death by suicide (Goldstein, Black, Nasralla, & Winokur, 1991), this population is considered to be at a high risk for suicide.

Although cisgender women are routinely found to have greater rates of diagnoses of depression than cisgender men (Nolen-Hoeksema, 2010), estrogen is not associated with depression in cisgender women. Recent neurobiological research posits that the higher incidence of affective disorders in women may be related to the influence of androgens on the interactions between serotonin and the hypothalamic-pituitary-adrenal (HPA) axis (Goel, Plyler, Daniels, & Bale, 2011).

While it might seem logical that MTFs who are transitioning to female would have higher risk for depression compared to cisgender males after hormone treatment, the use of estrogen in MTFs has actually been found to have a direct effect on decreasing depression (Leavitt, Berger, Hoeppner, & Northrop, 1980). It is thought that this change

is due to the alleviation of gender dysphoria by physically aligning the minds and bodies of MTFs.

The effect of testosterone on depression in FTMs has yet to be thoroughly examined. Studies using cross-sectional designs have found that testosterone use is related to fewer symptoms of depression in FTMs (Davis, 2006; Gomez-Gil, Zubiaurre-Elorza, Esteva, Gullamon, Godas, et al., 2011; Meier et al., 2011). Testosterone treatment of hypogonadal males has been found to reduce depressive symptoms, perhaps by more closely aligning their minds and bodies, similar to MTFs (Giltay, Tishova, Mskhalaya, Gooren, Saad, & Kalinchenko, 2010; Khera, Bhattacharya, Blick, Kushner, Nguyen, & Miner, 2011).

Anxiety. Anxiety is another mental health concern associated with FTMs. According to transgender identity development models created by Devor (2004) and Lev (2004), anxiety is one of the first stages that a transsexual person experiences. This anxiety is linked to a mismatch between physical sex and gender identity. This underlying anxiety may lead to stress and physical problems. Devor predicts that, "the more pronounced the mismatch between their gender preferences and society's expectations, the more pervasive will be their feelings of abiding anxiety and the greater their psychological and social difficulties will become." (Devor, 2004, p. 5). Cross-sectional studies have also found testosterone to be related to fewer symptoms anxiety in FTMs compared to FTMs who were not using testosterone (Davis, 2006; Gomez-Gil et al., 2011; Meier et al., 2011). While no studies to date have examined longitudinal change in anxiety symptoms following testosterone administration in FTMs, it was predicted that testosterone treatment would help to alleviate anxiety over time, as the

physical changes that it produces would ameliorate the experience of gender dysphoria.

Stress. One might consider the time during a gender transition to be incredibly stressful, as transgender people commonly report losing their jobs and support from family and/or romantic partners (Schilt & Connell, 2007; Meier, Sharp, Michonski, Babcock, & Fitzgerald, under review). Research on stress in the cisgender population had found high levels of stress to be associated with a host of negative psychological as well as physical problems. Psychological correlates of high levels of stress include depression, anxiety, irritability, drug abuse, trouble sleeping, and tension (O'Leary, 1990), while physical consequences include high blood pressure, decreased immune function, cancer, high levels of cholesterol, and arthritis (O'Leary, 1990). A recent cross-sectional study of FTMs found that FTMs who were using testosterone for three years or more reported less stress than those who were using testosterone for shorter periods of time (DuBois, 2011). A larger proportion of FTMs who were on testosterone for fewer than 6 months reported stress related to not "passing" (being perceived as a cisgender male) than those who had been using testosterone for more than six months (DuBois, 2011).

Quality of Life. The WPATH SOC (WPATH, 2011) express that a main goal of medical treatment of trans persons is to increase quality of life, defined as the "level of functioning and perceived well-being," (p 1448; Newfield, Hart, Dibble, & Kohler, 2006). Preliminary assessment of quality of life in FTMs indicates that testosterone treatment may improve their quality of life (Meier et al., 2011; Newfield, et al., 2006). Internet-based studies using the same measure of quality of life have reported mixed findings regarding levels of quality of life in the FTM population. Studies of testosterone administration on aging hypogonadal males have shown increased quality of life following

treatment (Gruenewald & Matsumoto, 2003).

While Newfield and colleagues (2006) found that FTMs reported diminished quality of life compared to their male and female cisgender counterparts, my colleagues and I (2011) found FTMs' average level of quality of life to be one standard deviation above the national average of cisgender males and females. Even so, both studies concluded that FTMs who had begun hormone therapy reported higher quality of life than FTMs who had not (Meier et al., 2011; Newfield et al., 2006). While no studies to date have examined change in quality of life following testosterone administration on FTMs using longitudinal within-groups designs, it is was expected that, similar to that of to hypogonadal males, FTM's quality of life would increase over time.

Self-Esteem. Studies examining the self-esteem of transgender people have yielded different results depending on surgical status. Skrapec and McKenzie (1981) compared pre-operative MTFs to gay and heterosexual males on level of self-esteem and found that the pre-operative MTFs reported lower self-esteem than either control group. Results from a study of post-operative MTFs reveal an interesting difference. Wolfradt & Neumann (2001) found post-operative MTFs to have higher levels of self-esteem than female controls and equivalent to male controls. In the first study of self-esteem in FTMs, Strassberg, Roback, Cunningham, McKee, and Larson (1979), pre-treatment FTMs had lower self-concept scores than control females, similar to a psychiatric outpatient group. The most recent study of self-esteem in FTMs compared post-operative FTMs who were sexually attracted to men and receiving hormone therapy to gay and bisexual cisgender males (Bockting, Benner, & Coleman, 2009). They did not find significant difference between the groups on self-esteem. Results of these studies suggest that the more a

transgender person's body matches his or her identity, the higher his or her self-esteem.

Emotional Reactivity. Gorton, Buth, and Spade (2005) list "emotional changes: both good and bad" as a reversible effect of testosterone administration. They provide a discussion on mood and psychiatric issues related to testosterone administration in FTMs. This report includes information learned from clinical practice and research-based findings. From clinical practice, the authors report that some FTMs "report mood swings, increased anger, and increased aggressiveness after starting androgen therapy (p. 65)." Indeed, many transgender men report "*improved* mood, decreased emotional lability, and a *lessening* of anger and aggression" (Gorton, Buth, & Spade, 2005, p. 66). However, the prevalence of these changes is not specified, as it remains insufficiently researched. Gorton and colleagues (2005) explain the finding related to increased aggression as what would be expected in cisgender males experiencing 'roid rage' from taking an excessive amount of testosterone.

Aggression readiness, tendencies, and anger proneness have been found to increase in FTMs after starting testosterone treatment (van Goozen, et al., 1995; Slabbekoorn et al. 2001). van Goozen and colleagues (1995) measured aggression proneness by having FTM subjects appraise situations and found an increase in aggressive tendencies and anger readiness and a decrease in indirect angry behavior. This finding may be related to the onset of secondary puberty in FTMs, which may be similar to puberty in cisgender men. The effects of hormones on reported moods were quite small: contrary to what might have been expected, hormonally treated FTMs were not in a very irritated or aggressive mood, in fact both FTMs and MTFs were about equally high in cheerfulness, liveliness, and feelings of satisfaction, and equally low in different

negative moods (van Goozen et al., 1995). Although the researchers cautioned readers to interpret these findings as tentative due to small sample sizes, it is important to note that comparing transgender people who have just begun hormone treatment to cisgender controls on a short-term measure does not control for the onset of a second puberty. Findings may have differed if longer term follow up assessments had been conducted.

Previous studies have been limited to the investigation of aggression. No studies to date have examined changes in emotional reactivity, which has been found to be a predictor of aggression (Calkins, Gill, Johnson, & Smith, 1999; Marsee & Frick, 2007; Schultz, Izard, & Bear, 2004). With aggression being one facet of emotional reactivity, a broader scoped measure may provide a more comprehensive picture of changes in emotion sensitivity, intensity, and persistence (Nock, Wedig, Holmberg, & Hooley, 2008).

A review of neuroimaging research on the effects of hormones on emotional regulation in cisgender females suggests a relationship between exogenous hormones and amygdala and orbitofrontal cortex activity (van Wingen, Ossewaarde, Bäckström, Hermans, & Fernández, 2011). Specifically, the administration of exogenous testosterone in cisgender females increases amygdala reactivity but decreases its connectivity with the orbitofrontal cortex, while exogenous progesterone increases both amygdala reactivity and the amygdala's connectivity with the orbitofrontal cortex (van Wingen et al., 2011). van Wingen and colleagues (2011) suggest that these hormones' differing effects on the amygdala and orbitofrontal cortex may impact emotional regulation and behavioral inhibition so as to make females more vulnerable to affective disorders.

Gender Role

Besides cognitive shifts, changes in masculinity, femininity, and gender role of transgender people have been examined most frequently. Past research on transgender people has used qualitative methodology, measurement of applicants for hormone treatment, and comparisons of pre-hormone-treatment MTFs to post-hormone-treatment MTFs with or without control groups. Although overall findings have been inconclusive due to stage of transition at time of measurement and control group implementation, on the whole, transgender persons report themselves to be more androgynous than male and female controls (Fleming, Jenkins, & Bugarin, 1980; Skrapec & MacKenzie, 1981; Wolfradt & Neumann, 2001; Herman-Jeglinska, Grabowska, & Dulko, 2002).

Qualitative research suggests that transgender people who are beginning their physical transition may over-confirm their gender identity by claiming to have stereotypical masculine or feminine characteristics but later they may employ a more realistic and a more balanced perspective on their gender identity. To illustrate, Skrapec and MacKenzie (1981) measured eight MTFs applying for gender affirmation treatment, and reported "subjects used extremes in their endorsements of masculine and/or feminine characteristics for themselves," (p. 366). Based on data from seven FTMs, Lippa (2001) concluded that FTMs were higher on masculinity and lower in femininity as compared to female controls, but did not point out that FTM's scores were also higher in masculinity than male controls. This may be due to a tendency to 'overmasculizine' and 'underfemininize' in order to receive validation of an FTM's gender identity, which may

occur early in transgender identity formation (Devor, 2004). A large-scale study of around 100 Polish FTM applicants for hormones and surgery found that the FTMs had higher masculinity scores than control males, while another found FTMs' masculinity scores to be similar to control males' scores (Fleming, Jenkins, & Bugarin, 1980; Herman-Jeglinska et al., 2002). A possible reason why transgender people may over-confirm their gender identity and under-report their non-identified gender role is that they may have felt that they needed to prove themselves to be a gender that is not aligned with their sex in order to receive desired treatment (Meyerowitz, 2002).

While no long-term, longitudinal studies of FTMs have been conducted explicitly examining gender role change over time, comparisons of MTFs pre- and post-surgery have typically found evidence of over-confirmation of gender identity at the beginning of transition. For example, pre-transition MTFs are more likely than post-transition MTFs to identify with the personality characteristics that they believe are socially desirable to women. In a study comparing MTFs at different time periods during physical transition (i.e., those being initially assessed, those on the waiting list for surgery, and those who were post-operative), Mate-Kole, Freschi, and Robin (1990), found MTFs the on the waiting list to be lowest on masculine scores and highest on feminine scores. A more recent study comparing MTFs at various points in transition, concluded that, "transgender women change how they define their femininity as they complete the process of transitioning--from holding a socially constructed perspective that embraces idealized feminine characteristics to one that gives great importance to inner strength and self-reliance," (Magalhaes, Magalhaes, Katz, Theodore & Duran, 2009). One short-term

longitudinal study of MTFs and FTMs did not find meaningful changes in self-assessment of masculinity and femininity over three months of hormone treatment (van Goozen**,** Cohen-Kettenis, Gooren, Frijda, & van de Poll, 1995). It remains a question as to whether this shift from socially desirable over-confirmation to a more balanced sense of identity also occurs in the FTM population. I hypothesized that FTMs would initially over emphasize their masculinity and de-emphasize their femininity before hormone treatment and that this pattern would be less pronounced after they are seen as men in society.

Psychopathology

Previous studies have examined personality profiles of transsexuals with the intent of determining if transgender people were experiencing severe psychopathology (Bozkurt, Isikli, Demir, Ozmenler, Gulcat, et al., 2006; Cole, O'Boyle, Emory, & Meyer, 1997; Gomez-Gil, Vidal-Hagemeijer, & Salamero, 2008; Miach, Berah, Butcher, & Rouse, 2000; Roback, McKee, Webb, Abramowitz, & Abramowitz, 1976). The majority of these studies have been cross-sectional; no extant studies have administered psychopathology measures longitudinally on FTMs, although some have examined MTFs. This limited research on MTFs has found that being transgender is not necessarily associated with severe psychopathology (Leavitt, Berger, Hoeppner, & Northrop, 1980; Bozkurt et al., 2006; Miach et al., 2000; Tsushima & Wedding, 1979). For example, Leavitt et al. (1980) compared 19 pre-hormonally treated MTFs to 22 MTFs who had received hormone therapy for at least 12 months in a cross-sectional study. They found that the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1940) personality profiles of pre-hormonally treated MTFs showed more scale elevations

than the group receiving treatment and concluded that MTFs probably become less pathological over time. Moreover, Leavitt and colleagues reported that both groups scored within the normal limits on neuroticism and psychotic disturbance.

Studies using longitudinal designs to measuring psychological changes related to hormone treatment have found positive ameliorative results using single case studies of transgender and hypogonadal patients. In the only study to measure psychopathology of a transsexual with a long-term follow-up measure, Hill (1980) documented three separate psychological evaluations of a single MTF patient before, during, and after her physical transition. Hill reported the success that the patient had in decreasing depression, anxiety, and suicidal ideation, which she contributes to therapy and sexual reassignment surgery. Ehrenreich and colleagues (1999) reported that testosterone treatment was the only intervention able to reduce depression and suicidality in a birth assigned male who had testosterone deficiency. Although these studies were based on one individual each, it was expected that a similar trend of positive changes would arise in the mental health profiles of FTMs during their transition.

No studies have examined FTMs' testosterone-induced changes on the Minnesota Multiphasic Personality Inventory—2nd edition (MMPI-2**;** Butcher, Dahlstrom, Graham, Tellegen, & Kaemmer, 2001) longitudinally with a controlled design. One of the original studies examining FTMs using the MMPI examined three groups with 10 subjects in each: FTMs requesting surgery, female patients requesting gastric bypass surgery, and female psychiatric outpatients (Roback et al., 1976). While no scales were elevated in the obese group, six scales were elevated in the psychiatric outpatient group, and two scales were elevated in the FTM group. The group of FTMs' average T scores were above the

clinical cutoff (*T* score greater than or equal to 65) on Scales 4 (Psychopathic deviate) and 5 (Masculine-feminine), a finding that was a replication of an earlier study (Rosen, 1974). The FTMs' mean raw scores on Scale 4 were not more deviant than the other two control groups. Researchers concluded that severe psychopathology was not associated with gender dysphoria in FTMs. Roback et al. (1976) explained the elevation on Scale 4 (Psychopathic deviate) was likely related to the social difficulties that the FTMs experience due to their variation from expected sex-role conventions. Elevations on Scale 4 may also be related to social isolation. The elevation on Scale 5 (Masculinity-femininity) indicated that FTMs reported more masculine traits than expected of females. A cross-sectional study comparing MMPI profiles of 5 pre-surgical FTMs to 5 post-surgical FTMs found that pre-surgical FTMs displayed mean scale elevations on Scale 5 (Masculinity-femininity) and Scale 9 (Hypomania) and post-surgical FTMs only had a mean scale elevation on Scale 5 (Masculinity-femininity) (Fleming, Cohen, Salt, Jones, & Jenkins, 1981). In addition, post-surgical FTMs had much lower scores on Scales 6 (Paranoia), 8 (Schizophrenia), and 9 (Hypomania) than pre-surgical FTMs. FTMs were expected to show elevations on Scale 4 and Scale 5 at initial assessment and decreases in Scales 6 (Paranoia), 8 (Schizophrenia), and 9 (Hypomania) over their first year on testosterone.

One recent study using the MMPI-2 conducted in Spain assessed personalities of pre-hormonal and pre-surgical MTF and FTMs (Gomez-Gil et al., 2008). They used a between subjects design, comparing results from one group of FTMs requesting hormone therapy to a distinct group of FTMs who had been receiving testosterone treatment for at least one year and were requesting surgery and they did not use a control group. They did

not find any significant differences between FTMs and MTFs in clinical scales. Further, it was reported that MTFs seeking hormones did have higher scores than MTFs seeking surgery on Scale 3 (Hysteria) and Scale 4 (Psychopathic deviate); however mean scores of each FTM group (pre-hormone and pre-surgical treatment) were found to be in the normative range.

Research Aims and Hypotheses

The present study attempted to answer the call for long-term follow up psychological research by examining the possible effects of exogenous testosterone on the FTM population that could aid in the treatment of individuals identified as having gender dysphoria. This investigation attempted to replicate previous research on changes in cognition and generate new knowledge about the effects of testosterone on verbal and spatial intelligence, depression, anxiety, quality of life, self-esteem, emotional reactivity, gender role, and psychopathology of FTMs in the first year of their hormonal transition. Hypothesis for Initial (Pre-Testosterone Treatment) Analyses (T1):

(1a) FTMs have lower spatial ability and higher verbal ability than male controls and FTMs have higher spatial ability and lower verbal fluency than female controls.

(1b) FTMs have more symptoms of depression, anxiety, stress and emotional reactivity than male and female controls.

(1c) FTMs have lower levels of health-related quality of life, and self-esteem than male and female controls.

(1d) FTMs have higher masculinity scores than male controls and lower femininity scores than female controls.

(1e) FTMs have higher levels of psychopathology than male and female controls.

Hypothesis for the First Year on Testosterone Treatment Follow-up Analyses:

(2a) FTMs will demonstrate gains in spatial ability and losses in verbal fluency

(2b) FTMs will show decreases in symptoms of depression, anxiety, stress, and emotional reactivity

(2c) FTMs will show gains in self-esteem, and quality of life

(2d) FTMs will show decreases in masculinity scores and increases in femininity scores

(2e) The psychopathology profiles of FTMs will become more psychologically healthy

All effects are expected to be more pronounced in the long-term comparison measure (T3) than the short-term measure (T2) and to persist when comparing them to controls.

Method

Participants

Two hundred seventy-four participants were recruited to participate in a longitudinal study via the University of Houston subject pool, Houston community, personal contacts, transgender-related conferences, advertisements on FTM-specific online groups and blogs, and FTM support groups in the US (refer to Appendix A for recruitment ads). Of those, 233 consented to participate and completed the initial assessment. Participants include self-identified trans men over 16 years of age from the US (n = 78) and Canada (n = 1), as well as cisgender females and cisgender males. FTMs (n = 79) were matched to cisgender controls (males n = 70, females n = 84) by age and education level (see Table 1 for summary demographics). Controls were recruited via the

subject pool at the University of Houston and in the surrounding Houston community. In the short and long-term analyses, some participants were lost to follow up due to attrition (see Figure 1 for a flow chart of attrition). One female control and one male control were dropped from analyses due to reading levels below 8th grade and VIQ scores below 80.

--insert Table 1 here--

--insert Figure 1 here--

Procedures

Participants completed a variety of measures at three time points in order to assess longitudinal changes in psychosocial functioning, gender role, and cognitive functioning. Local participants also completed an intelligence assessment at each time point. Research participants were measured three times over a one-year period, at Time 1, 3 to 4 months later (T2) to determine the short-term effects of testosterone, and 10-12 months later (T3) to determine the long-term effects of testosterone. Refer to Table 2 for design of the study.

--insert Table 2 here--

The principal investigator traveled to recruit FTM participants in transgender conferences. Controls were recruited over the University's online recruitment website and in psychology courses. For local FTMs and controls, testing occurred in the Psychological Research and Services Clinic (PRSC) located at the University of Houston (see Appendix B for undergraduate and graduate research assistant's scripts). Procedures were explained to non-local participants over the phone, and they were mailed the measures with stamped return envelopes. One male and one female control were recruited to match each FTM through the subject pool at the University of Houston and

within in the Houston community. They were matched to FTMs on age and education level and completed measures at the same time intervals as FTMs.

Participants completed 3 hours of measures at each time point. The measures included demographic questions, measures of verbal and spatial intelligence (WASI), depression, anxiety, and stress (DASS-42), general health related quality of life (SF36v2), self-esteem (RSES), Emotional Reactivity (ERS), Bem Sex Role Inventory (BSRI), psychopathology (MMPI-2), and reading level (WRAT-4). None of the non-local participants completed the WASI, as it requires participants to come into the lab for face-to-face interaction with the assessor. Participants received $40 in gift cards for their participation in the study: $10 for completing T1, $10 for completing T2, and $20 for completing T3.

Inclusion Criteria

Controls were required to be age 18 or older and FTMs were age 16 or over and willing to be re-assessed for a total of three sessions, first (Time 1), then three to four months later (Time 2), and ten to twelve months later (Time 3; refer to Table 2 for study design). FTMs must currently identify as FTM or have identified as FTM in the past and now identify as male. FTMs who intended to begin testosterone therapy and maintain hormone treatment for a minimum of one year were recruited. FTMs could not have started testosterone for more than one month prior to their first measurement, as masculinizing effects may take place as soon as one month after initiating testosterone treatment (WPATH, 2011).

Males were expected to have established the production of normal levels of testosterone, as evidenced by: having gone through puberty and report no history of

hypogonadism or hormone imbalance. Female controls were also expected to have established the production of normal levels of estrogen, as evidenced by: having gone through puberty, and the lack to polycystic ovarian syndrome, congenital adrenal hyperplasia, hypogonadism, or hormone imbalance. As the level of testosterone during a woman's menstrual cycle has been found to have a significant effect of spatial cognition, with highest scores found during their menstrual phase (Davis, 2001; Hausmann, Slabbekoorn, van Goozen, Cohen-Kettenis, & Gunturkun, 2000; Liben et al., 2002; Neave, Menaged, & Weightman, 1999), female controls completed the protocol while menstruating in order to control for fluctuating hormone levels.

Exclusion Criteria

Subjects were excluded if they were unable to read at or above an 8th grade reading level, as assessed by the WRAT-4 reading subscale, or communicate in English fluently because they must have been able to complete the written questionnaires and understand the English-speaking examiner who explained the procedure and obtained informed consent (refer to Appendix C). They were also excluded if they scored in or below the borderline range of intellectual functioning on the WASI. Controls who had a medical history of hormone imbalances or hypogonadism were not included in the study. Females with a history of polycystic ovarian syndrome or congenital adrenal hyperplasia were excluded for the same reason. Females who became pregnant during the course of the study were also excluded due to the fluctuations in hormone levels during pregnancy.

Measures

Participants were asked to complete measures of demographic information, verbal and spatial intelligence, depression, anxiety, stress quality of life, self-esteem, emotional

reactivity, gender role, reading level, and psychopathology at each time-point. FTMs completed a more comprehensive demographic questionnaire assessing information specific to transitioning as well as gender dysphoria. Local FTMs and controls also completed a measure of cognitive ability. All measures except the WASI, WRAT-4, and MMPI-2 are included in the Appendix (see Appendix D).

Cognitive Ability

Wechsler Abbreviated Scale of Intelligence. The Wechsler Abbreviated Scale of Intelligence (WASI; The Psychological Corporation, 1999) is a standardized assessment battery designed to estimate verbal, performance, and full-scale IQ. It contains four subtests: 1) *Block Design*: visuo-spatial construction; 2) *Matrix Reasoning*: nonverbal abstract reasoning; 3) *Vocabulary*: word knowledge; and 4) *Similarities*: verbal abstract reasoning.

The WASI was developed to provide a short, reliable measure of intelligence in a variety of settings including the research setting. Raw scores are converted into standard scores relative to age-group norms. The WASI was created to be administered by a trained examiner and is estimated to take 30 minutes to complete.

Psychosocial Functioning

Depression, Anxiety, and Stress Scale. The Depression, Anxiety, and Stress Scale (DASS; Lovibond & Lovibond, 1995) is a 42-item measure of depression, anxiety, and stress experienced over the past week. The DASS has been found to possess concurrent and construct validity in the acceptable to excellent range (Antony, Bieling, Cox, Enns & Swinson, 1998). The scale has been shown to correlate .74 with the Beck Depression Inventory and .81 with the Beck Anxiety Inventory (Lovibond & Lovibond, 1995).

Reliabilities of each scale, as assessed by Cronbach's alpha, have been found to range from .90 to .97 (Crawford & Henry, 2003). A recent study of FTMs found internal consistencies of the DASS subscales to range from .86 to .95 (Meier et al., 2011). In the current study, the Cronbach's reliability coefficient for the total scale was .96 and for the subscales were .93 (depression), .86 (anxiety), and .93 (stress).

Short Form 36-Item Questionnaire version 2. The Short Form 36-Item Questionnaire version 2 (SF-36v2; Ware, Snow, & Kosinski, 2002) is a comprehensive measure of quality of life. It has been used on the FTM population in previous research and has been found to be an appropriate Internet-based measure (Newfield, Hart, Dibble, & Kohler, 2006). It yields eight subscales with internal consistency reliabilities in the .93 to .95 range for all subscales (Ware, Kosinski, & Dewey, 2000). The current analysis utilizes the General Health subscale, which was found to have adequate reliability in a previous study with FTMs (.85) (Meier et al., 2011). In the current study, the Cronbach's reliability coefficient for the General Health subscale was found to be .79.

Rosenberg Self-Esteem Scale. The Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1989) is a 10-item measure of self-esteem. The RSES uses a 4 point Likert-type scale from strongly agree to strongly disagree. It is one of the most widely used measures of self-esteem (Rosenberg, 1989). Previous studies of transgender people have utilized the RSES (Skrapec and McKenzie, 1981; Wolfradt, & Neumann, 2001; Bockting, Benner, & Coleman, 2009). Internal consistencies have been found to be between .74 and .90 (McCarthy & Hoge, 1982; Rosenberg, 1965). Test-retest reliability has been found to be .85 (Silber & Tippett, 1965). The RSES has been identified to

possess strong construct, convergent, and discriminant validity (Dagnan & Sandhu, 1999). Internal consistency for the current study was found to be .92.

Emotional Reactivity Scale. The Emotion Reactivity Scale (ERS; Nock, Wedig, Holmberg, & Hooley, 2008) is a measure of emotional sensitivity, intensity, and persistence. Emotional reactivity has been defined as the degree an individual experiences emotions (Nock, Wedig, Holmberg, & Hooley, 2008). Three components of this concept are emotional sensitivity, intensity, and persistence. Emotional sensitivity is the degree on experiences emotions in response to an assortment of stimuli, intensity refers to how strongly one responds, and persistence describes a prolonged amount of time before one returns to their baseline arousal level (Nock, Wedig, Holmberg, & Hooley, 2008). The ERS contains 21, five-point Likert scale items and has been found to have excellent internal consistency reliability ranging from .81 to .88 and promising convergent and divergent validity (Nock, Wedig, Holmberg, & Hooley, 2008). For the current study, the Cronbach alpha for the total scale was .95 and the internal consistencies for the subscales were found to be .91 (sensitivity), .88 (intensity), and .83 (persistence).

Gender Role

Bem Sex Role Inventory. The Bem Sex Role Inventory (BSRI; Bem, 1974) was developed in 1974 in order to measure gender role self-concept. It contains 60 items and uses a seven-point Likert scale from never or almost true (1) to almost always true (7). Previous research has utilized the BSRI on the transgender population (Herman-Jeglinska, Grabowska, & Dulko. 2002; Mate-Kole, Freschi, & Robin,1990; Skrapec & MacKenzie, 1981; Fleming, Jenkins, & Bugarin, 1980). Internal consistency reliabilities have been found to range from .75 to .90 (Bem, 1978), and high test-retest reliability has

been found (Bem, 1974; Rowland, 1977). Although the interpretation of the BSRI has been criticized, it has found to have adequate validity (Uleman & Weston, 1986; Holt & Ellis, 1998). In the current study, internal consistency reliabilities were .89 (masculinity) and .79 (femininity).

Psychopathology

Minnesota Multiphasic Personality Inventory-2. The Minnesota Multiphasic Personality Inventory—2nd edition (MMPI-2; Butcher et al., 1989) is the most commonly utilized assessment of psychopathology (Gomez-Gil, Vidal-Hagemeijer, & Salamero, 2008). Reliability and validity of this instrument have been well established (Butcher et al., 1989) The MMPI-2 utilizes 567 true/false items in order to assess a range of personality profiles. It is estimated to take one hour to one hour and a half to complete. The MMPI-2 has previously been used in research on the transsexual population because of its ability to assess a range of psychological problems (de Vries et al., 2011; Gomez-Gil, Vidal-Hagemeijer, & Salamero, 2008; Lothstein, 1984; Miach, et al., 2000).

The second version of the MMPI is a re-standardized version of the original MMPI and contains three validity scales: Lie, Infrequency, and Correction in order to ensure that the profile is valid. It also contains ten clinical scales: Hypochondriasis (1), Depression (2), Hysteria (3), Psychopathic-deviate (4), Masculinity-femininity (5), Paranoia (6), Psychasthenia (7), Schizophrenia (8), Hypomania (9), and Social introversion (0). Raw scores were converted to T scores as compared to normative data for assigned sex. Consistent with previous research, the Female template was used for FTMs (Fleming, Cohen, Salt, Jones, & Jenkins, 1981; Gomez-Gil, Vidal-Hagemeijer, & Salamero, 2008; Roback et al., 1976; Rosen, 1974). All subjects were analyzed using

gendered norms for the MMPI-2, yet analyses using non-gendered norms are presented in Appendix E (Ben-Porath & Forbey, 2003).

Gender Dysphoria

Hoffman Gender Scale. Gender dysphoria has been defined as the "distress and unease experienced if gender identity and sex are not completely congruent" (p. 3134, Hembree et al., 2009). As no acceptable measures of gender dysphoria were published at the time of the study's inception, a measure of comfort with gender was used. The Hoffman Gender Scale (HGS; Hoffman, Borders, & Hattie, 2000), including a novel transgender subscale (included with the original scale in Appendix D), was given to FTMs. Gender self-acceptance is defined as one's level of comfort and ease as a member of their self-identified gender (Hoffman, Borders, & Hattie, 2000). Reverse scores of the masculine gender self-acceptance and original transgender self-acceptance subscales were utilized in the present study as measures of gender dysphoria. Both subscales contain seven six-point Likert scale items. Scores are determined by calculating the mean of the seven items and range from one to six, with higher scores indicating a higher level of self-acceptance. Coefficient alphas were reported to be .80 for the gender self-acceptance subscale and test-retest reliability was found to be acceptable (Hoffman, Borders, & Hattie, 2000). Internal consistency reliabilities were found to be .88 for masculine self-acceptance and .78 for transgender self-acceptance.

An open-ended question was included on the demographic questionnaire at each time point: If you have started T, what changes have you or others noticed about you? Qualitative results were analyzed and are included in Table 22.

Reading Level

Wide Range Achievement Test-4. The Wide Range Achievement Test: Fourth Edition (WRAT-4) reading subtest was used to assess reading level (Wilkinson & Robertson, 2006). The reading subtest was administered by a trained graduate student. Participants were instructed to read words from a single page. Their reading grade level equivalent was then calculated based on the number of words they pronounced correctly. The WRAT-4 reading subtest was administered only once during the study.

Data Analysis

Attrition Analyses. Two series of T-tests and chi-square analyses were conducted to compare participants who completed assessments at T1 and T2 to those who dropped after T1 and those who completed assessments at T1, T2, and T3 to those who dropped after T2.

Testosterone. Series of T-tests and chi-square analyses were conducted to compare FTMs who had begun testosterone before completing their initial assessment to those who had not.

Transition Procedures. Demographic information on surgical procedures were presented for each time of assessment in order to reveal how many FTMs were accessing other medical treatments related to gender.

Initial Assessment. Bivariate correlations were run in order to test the appropriateness of the data for use in MANOVAs. MANOVAs were run to compare FTMs, men, and women on all dependent variables at the initial assessment with gender (FTM, M, F) as the independent variable. Separate MANOVAs were run on **cognitive ability** dependent variables, including verbal and performance IQ, **psychosocial functioning** dependent variables, including depression, anxiety, stress, self-esteem,

emotional reactivity, and quality of life; **gender role** (e.g., masculinity and femininity scores) in a third analysis, and the **psychopathology** dependent variables in a final MANOVA. Contrast analyses were run for variables that yielded significant main effects and interactions.

One Year Follow-up. Paired t-tests were run comparing FTMs on gender dysphoria at each time point. Using a similar method as reported in Slabbekorn et al. (1999), mixed-model, repeated-measures MANOVAs were conducted to examine the short-term and long-term effects of testosterone. In all repeated measures MANOVAs, time (T1, T2, and T3) and gender (FTM, M, F) were the independent variables. Separate repeated-measures MANOVAs were run in the same manner as the initial assessment, including data from all three measures. Fewer subjects were included in follow-up analyses due to attrition. Whenever a significant main effect of time or an interaction between time and gender was found, paired comparison analyses were performed in order to determine more information about the time of testing at which gender differences occurred and how the dependent measures of each group changed over time. Three month follow up analyses can be found in Appendix F.

Results

Attrition at T2

At T2, 32% of FTMs (n = 25), 20% of males (n = 14), and 27% of females (n = 23) were lost to attrition. Most participants did not complete T2 due to loss of contact where the investigators were unable to reach the participant (see Figure 1). Results from a chi-square test of maximum likelihood indicated that there was no difference in likelihood of losing participants to attrition between the gender groups at T2, $|^2$ (2)= 1.9, $p > .05$. Among FTMs, those who dropped out at T2 were similar to FTMs who continued in the study on all dependent variables assessed at the initial assessment. Intelligence comparisons were not made due to varying sample sizes in FTMs (dropped n = 5; continued n = 20). In terms of demographics, a trend was found for age, with older FTMs being more likely to continue in the study $t(74) = -1.95$, $p = .06$. Female completers and non-completers were not significantly different on dependent variables assessed at the initial assessment except for intelligence. Specifically, females who dropped had lower verbal intelligence $t(51) = -2.52$, $p < .05$ and a trend was found in the same direction for spatial/performance intelligence $t(51) = -1.99$, $p = .05$. A comparison of males who completed T2 with those who dropped revealed similar results on intelligence variables with completers scoring higher in both verbal $t(44) = -3.55$, $p < .01$ and performance intelligence $t(44) = -2.85$, $p < .01$. Males who did not complete T2 were found to endorse more symptoms of anxiety $t(68) = 3.78$, $p < .001$ and higher levels of stress $t(68) = 2.28$, $p < .05$ than completers. Males who dropped also displayed higher

scores on Scale 1 (Hypochondria) $t(68) = 2.03$, $p < .05$ and Scale 8 (Schizophrenia) $t(68) = 2.74$, $p < .01$ the MMPI, and trends were also found for the Scale 6 (Paranoia) $t(68) = 1.96$, $p = .05$ and Scale 7 (Psychasthenia) $t(68) = 2.0$, $p = .05$ scales in the same direction.

Attrition at T3

At T3, 28% of FTMs ($n = 15$), 16% of females ($n = 10$), and 32% of males ($n = 18$) were lost to attrition. Eight of the 15 FTMs, three of the ten females, and seven of the 16 males not included in the present analyses did not complete T3 at the time of the analyses. It is thought that most of those participants will eventually complete T3. Similar to attrition at T2, most participants did not complete T3 due to loss of contact where the investigators were unable to reach the participant (see Figure 1). Results from a chi-square test of maximum likelihood indicated that there was a trend in difference in likelihood of losing participants to attrition between the gender groups at T2, $|^2 (2)= 5.9$, $p = .05$, where females were less likely to be lost as participants due to attrition than FTMs or males. Among FTMs, those who dropped out at T3 were similar to FTMs who completed all three time points on all dependent variables assessed except Depression $t(46) = 3.2$, $p < .01$, where those who dropped out endorsed more symptoms than those who completed the study, Stress $t(46) = 2.7$, $p < .05$ where those who dropped out displayed higher levels of stress than those who completed the study, Scale 4 (Psychopathic deviate) $t(50) = 2.7$, $p < .01$, and where non-completers displayed higher T scores. A trend was found where non-completers scored differently than completers on Scale 6 (Paranoia) $t(50) = 1.9$, $p = .06$, with non-completers displaying higher T scores. Female completers and non-completers only displayed different scores on femininity $t(56) = 2.04$, $p < .05$, with non-completers scoring higher. A comparison of males who

completed T3 with those who dropped after T2 revealed that they differed on quality of life $t(50) = -2.25$, $p < .05$, with non-completers scoring lower. Trends were found on Scale 5 (Masculinity/femininity) $t(52) = 2.00$, $p = .05$ and Scale 8 (Schizophrenia), with non-completers displaying higher T scores on both scales.

Univariate Analyses

Testosterone. Of those who indicated what method of testosterone administration they were using ($n = 21$), FTMs who were already on testosterone at the initial assessment, most reported using intramuscular injections ($n = 17$), followed by cream ($n = 2$), patches ($n = 1$) and gel ($n = 1$).

At T2 ($n = 49$), most participants were using intramuscular injections ($n = 45$) and had been on the same dose constantly since initiating treatment ($n = 36$). Over their first 3-4 months of testosterone some participants' doses were increased ($n = 6$) and some decreased ($n = 3$). A few participants changed method of administration including using injections then patch ($n = 1$) and injections then patch then back to injections ($n = 1$). Patches and gels were each used by one participant.

At T3 ($n = 29$), all were using intramuscular injections, except one who was using gel. Of those using injections, eleven participants had been on the same dose since beginning (range 50 to 200 mg/weekly, with most on 100 mg/weekly). Over their first 10-12 months of testosterone some participants' doses were increased ($n = 7$), some decreased ($n = 4$), and some initially increased then were decreased to their original dose or lower ($n = 5$). Two participants changed method of administration including using injections then cream ($n = 1$) and injections then patch then back to injections ($n = 1$).

Twenty-four of the 79 (30%) FTMs had begun using testosterone before completing their initial assessment (M = 17 days, SD = 12 days, Range = 1 to 44 days). Analyses comparing those who had started testosterone before initial assessment to those who had not found that those already on testosterone endorsed fewer anxiety symptoms $t(67) = 2.15$, $p < .05$ and displayed lower emotional intensity scores $t(73) = 2.01$, $p < .05$, but were not found to be different in age or any other dependent variable measured including psychosocial functioning, gender role, or psychopathology. Intelligence comparisons could not be made due to very different sample sizes (on testosterone at T1 n = 3; not on testosterone at T1 n = 24).

Transition Procedures. At the initial assessment most FTMs had not received any gender affirming medical interventions (n = 55). Before T1, a few participants had had chest reconstructive surgery (CRS) with the double-incision technique (n = 6) or the peri-areloar technique (n = 1), had undergone a hysterectomy (n = 4), or used estrogen blockers (n = 1). Between the initial assessment and T2 (n = 52), 6% of FTMs (n = 3) underwent medical interventions in addition to testosterone. Two FTMs had CRS with the double-incision technique, and one had CRS with the peri-areolar technique. Between T2 and T3 (n = 38), 28% of FTMs (n = 11) underwent medical interventions in addition to testosterone. Eight FTMs had CRS with the double-incision technique, one had CRS with the peri-areolar technique, and two had a hysterectomy.

Bivariate Correlations

All correlations were tested using Pearson's product-moment correlation. Verbal and spatial performance scores were moderately correlated (r = .54, $p < .001$). All correlations between psychosocial functioning variables were the in the anticipated

direction and significant at the $p < .001$ level (refer to Table 3). More specifically, depression, anxiety, stress, emotional sensitivity, intensity, and persistence were positively correlated; quality of life and self-esteem were also positively correlated; depression, anxiety, stress, emotional sensitivity, intensity, and persistence were each negatively correlated with quality of life and self-esteem. The significant correlations provide evidence for good discriminant validity, and the small to moderate correlations indicate that the scales measure related, yet distinct constructs. Thus the dependent variables are appropriate for use in multivariate analyses of variance (MANOVAs). Masculinity and Femininity scores were not found to be related ($r = -.02$, ns).

--insert Table 3 here--

Correlations between the MMPI-2 clinical scales were conducted. Scales 1, 2, 3, 4, 6, and 8 were all positively correlated with each other at the $p < .001$ level (see Table 4). Scale 5 was not correlated with any other scale except for a small correlation with Scale 8. Scale 9 was positively correlated with Scales 2, 4, and 8. Scale 0 was positively correlated with Scales 1, 2, 7, and 8 and negatively correlated with Scale 9.

--insert Table 4 here--

Multivariate Analyses

Hypothesis Testing: Differences Between Groups at Initial Assessment

Reading Level. Reading level was assessed in order to ensure that participants would be able to comprehend the MMPI-2 and other questionnaires. All participants were reading at least at an eighth grade level. The majority of participants were found to be reading at a twelfth grade or above (81.8%; see Table 5).

--insert Table 5 here--

Hypothesis 1a. Cognitive Ability. All mean scores for the gender groups were found to be in the normative range for verbal and performance IQ (refer to Table 5). To test whether FTMs, males, and females differed on VIQ or PIQ at initial assessment, a between-subjects MANOVA of gender (3 levels: FTM, M, or F) was conducted on the dependent variables VIQ and PIQ. As predicted, there emerged an overall significant effect of gender $F(4, 242) = 2.56$, $p < .05$. A main effect of PIQ was found $F(2, 121) = 5.30$, $p < .01$, with males scoring higher than females $t(95) = 8.72$, $p < .01$. No significant differences between groups were found on VIQ. FTMs were not found to differ from males or females in VIQ or PIQ at the initial assessment.

Hypothesis 1b and 1c. Psychosocial Functioning. To test whether FTMs, males, and females differed on psychosocial functioning, a between-subjects MANOVA was performed (3 levels: FTM, M, or F) on the dependent variables of depression, anxiety, stress, emotional sensitivity, emotional intensity, emotional persistence, quality of life and self-esteem was conducted (See Table 5). As predicted, there emerged an overall significant effect of gender $F(16, 406) = 2.34$, $p < .001$. Main effects were found for all dependent variables, depression $F(2, 209) = 8.04$, $p < .001$; anxiety $F(2, 209) = 3.99$, $p < .05$; stress $F(2, 209) = 10.51$, $p < .001$; emotional sensitivity $F(2, 209) = 4.25$, $p < .05$; emotional intensity $F(2, 209) = 5.55$, $p < .01$; emotional persistence $F(2, 209) = 3.66$, $p < .05$; quality of life $F(2, 209) = 3.43$, $p < .05$; self-esteem $F(2, 209) = 12.62$, $p < .001$. Specifically, compared to males, FTMs endorsed more symptoms of depression $t(136) = 4.41$, $p < .001$, and anxiety $t(136) = 2.59$, $p < .01$, had higher levels of stress $t(136)= 5.76$, $p < .001$, emotional sensitivity $t(136) = 4.10$, $p < .01$, emotional intensity $t(136) = 3.40$, $p < .01$, emotional persistence $t(136) = 1.61$, $p < .05$, and lower quality of life $t(136)$

= -7.83, $p < .05$, and lower self-esteem $t(136) = -4.64$, $p < .001$. FTMs differed from females on emotional intensity and self-esteem, with FTMs reporting higher levels of emotional intensity $t(142) = 2.08$, $p < .05$ and lower self-esteem $t(142) = -2.01$, $p < .05$ than females. Compared to males, females reported more symptoms of depression $t(140) = 3.03$, $p < .01$, higher levels of stress $t(140) = 4.78$, $p < .001$, emotional persistence $t(140) = 1.44$, $p < .05$, and lower self-esteem $t(140) = 2.63$, $p < .01$.

Hypothesis 1d. Gender Role. To test whether FTMs, males, and females differed on gender roles at T1, a between-subjects MANOVA of gender (3 levels: FTM, M, or F) on the dependent variables of masculinity and femininity was conducted (See Table 5). As predicted, an overall significant effect of gender $F(4, 448) = 12.78$, $p < .001$ emerged. Main effects of masculinity $F(2, 224) = 9.52$, $p < .001$ and femininity $F(2, 224) = 16.54$, $p < .001$, were found. Specifically, FTMs scored higher in masculinity $t(156) = 5.73$, $p < .05$ and lower in femininity $t(156) = -10.86$, $p < .001$ than females as well as lower in femininity than males $t(143) = 3.94$, $p = .05$. FTMs scored lower in masculinity than males $t(143) = 5.38$, $p < .05$. As expected, females scored higher in femininity $t(149) = -6.92$, $p < .01$ and lower in masculinity than males $t(149) = 11.11$, $p < .001$.

Hypothesis 1e. Psychopathology. Five subjects were excluded from this analysis due to elevations on the validity scales: L scale T scores above 80 (n = 1 FTM) or F scale T scores above 100 (n = 1 FTM and n = 3 Females), no subjects' T score was above 80 on the K scale (de Vries, Kreukels, Steensma, Doreleijers, & Cohen-Kettenis, 2011). First, all mean scores were found to be in the non-clinical range for all groups. To test whether FTMs, males, and females differed on psychopathology, a between-subjects MANOVA of gender (3 levels: FTM, M, or F) on the dependent variables of the 10

scales of the MMPI-2 was conducted (See Table 5). As predicted, a significant effect of gender $F(20, 414) = 5.85$, $p < .001$ was found. Main effects were found for Scale 2 (Depression) $F(2, 215) = 5.19$, $p < .01$, Scale 4 (Psychopathic deviate) $F(2, 215) = 6.69$, $p < .01$, Scale 5 (Masculinity/femininity) $F(2, 215) = 37.21$, $p < .001$, Scale 6 (Paranoia) $F(2, 215) = 4.66$, $p < .05$, Scale 7 (Psychasthenia) $F(2, 215) = 4.34$, $p < .05$, Scale 8 (Schizophrenia), $F(2, 215) = 7.10$, $p < .05$, and Scale 0 (Social introversion) $F(2, 215) = 4.20$, $p < .05$. In regard to gender differences on these scales, females displayed significantly higher scores than males on Scale 2 (Depression) $t(145) = -5.77$, $p < .01$, Scale 5 (Masculinity/femininity) $t(145)$ -9.99, $p < .001$, Scale 7 (Psychasthenia) $t(145) = -5.47$, $p < .01$, and Scale 8 (Schizophrenia) $t(145) = -5.28$, $p < .01$. FTMs displayed higher scores than males on the Scale 2 (Depression) $t(138) = -5.27$, $p < .01$, Scale 4 (Psychopathic deviate) $t(138) = -7.31$, $p < .001$, Scale 5 (Masculinity/femininity) $t(138) = -15.68$, $p < .001$, Scale 6 (Paranoia) $t(138) = -5.76$, $p < .01$, Scale 7 (Psychasthenia) $t(138) = -4.94$, $p < .05$, Scale 8 (Schizophrenia) $t(138) = -7.39$, $p < .001$, and Scale 0 (Social Inversion) $t(138) = -5.31$, $p < .01$. As anticipated, FTMs scored higher than females on Scale 4 (Psychopathic deviate) $t(147) = -4.64$, $p < .05$) and Scale 5 (Masculinity/femininity) $t(147) = -5.58$, $p < .01$.

One Year Follow Up Analyses

Hypothesis Testing: Differences Between Groups Over One Year

Gender Dysphoria. A series of paired t-tests were conducted to examine the effects of testosterone on gender dysphoria as measured by the HGS over one year. Fourteen FTM participants completed the HGS at all three time points (see Table 6). Overall, gender dysphoria related to masculinity significantly decreased between T2 and

T3 $t(13) = -2.18$, $p < .05$ and between T1 and T3 $t(13) = -2.54$, $p < .05$. Gender dysphoria related to transgender identity also decreased between T1 and T3 $t(13) = -2.62$, $p < .05$.

--insert Table 6 here--

Hypothesis 2a. Cognitive Ability. A repeated measures MANOVA was performed to examine the effects of testosterone on intelligence over one year. VIQ and PIQ were entered as the dependent variables with time (T1, T2, and T3) as the within-subjects factor and gender (F, FTM, and M) as the between-subjects factor. An overall trend was found for a main effect of gender $F(4, 132) = 2.3$, $p = .06$. Results showed an overall significant main effect of time on intelligence was found $F(4, 63) = 23.2$, $p < .001$, however the time x gender interaction was not found to be significant $F(8, 128) = 1.4$, ns (see Figure 2). Follow up analyses on the effect of gender found females to score lower on PIQ than males $t(53)= 8.0$, $p < .05$. A significant main effect of time was present for both VIQ and PIQ, where scores increased over time in all groups (See Table 7). The effect of time can be attributed to practice effects, which have been found to be stronger for PIQ than VIQ.

--insert Table 7 here--

Hypothesis 2b and 2c. Psychosocial Functioning. The data revealed an overall significant main effect of gender over one year on psychosocial functioning $F(16, 194) = 2.0$, $p < .05$. Although there was no overall effect of time $F(16, 88) = 1.5$, ns, there was an overall significant time x gender interaction on psychosocial functioning $F(32, 178) = 1.6$, $p < .05$ (See Table 8). Follow up contrast analyses on the overall main effect of gender found FTMs scored lower on emotional persistence than females $t(68)= 1.5$, $p < .05$ and FTMs scored lower than males on self esteem $t(65)= 3.6$, $p < .01$. Females scored

higher on depression $t(73) = -3.9$, $p < .01$, anxiety $t(73) = -2.2$, $p < .05$, and stress $t(73) = -5.3$, $p < .01$, emotional sensitivity $t(73) = -4.8$, $p < .01$, emotional persistence $t(73) = -2.1$, $p < .01$ than males and lower than males on self esteem $t(73) = 3.1$, $p < .01$. A significant main effect of time was present for stress, emotional persistence, and quality of life. Stress scores decreased for FTMs and females, emotional persistence decreased in all groups, and quality of life increased in all groups over time (see Table 8). The overall interaction effect of time x gender could mainly be attributed to the only significant interaction effect, which was found for stress $F(4, 206) = 4.3$, $p < .01$, where FTMs stress levels were found to decrease relative to controls over one year (refer to Figure 3).

--insert Table 8 here--

Hypothesis 2d. Gender Role. An overall significant main effect of gender over one year emerged for gender role $F(4, 234) = 8.8$, $p < .001$. The effect of time $F(4, 114) = 1.3$ and the interaction of time x gender $F(8, 230) = 0.9$ were not found to be significant (see Table 9). Follow up contrast analyses revealed that while FTMs displayed lower femininity scores than females $t(81) = 11.9$, $p < .001$, they did not differ from males on masculinity or femininity nor females on masculinity. Males scored higher on masculinity than females $t(82) = 10.5$, $p < .01$ and females scored higher than males on femininity $t(82) = -7.8$, $p < .01$).

--insert Table 9 here--

Hypothesis 2e. Psychopathology. An overall significant main effect of gender over one year emerged for psychopathology $F(20, 210) = 3.5$, $p < .001$ (see Table 10). There was also an overall significant overall effect of time $F(20, 94) = 1.9$, $p < .05$. However, the overall interaction of time x gender $F(40, 190) = 1.2$ was not found to be

significant (refer to Figure 4). Follow up analyses on the overall main effect of gender revealed that females scored higher on Scale 2 (Depression) $t(81)= -6.3$, $p < .05$, Scale 5 (Masculinity/femininity) $t(81) = -9.6$, $p < .001$, Scale 7 (Psychasthenia) $t(81)= -6.8$, $p < .01$, and Scale 8 (Schizophrenia) $t(81) = -6.0$, $p < .01$ than males. FTMs scored higher than males on Scale 5 (Masculinity/femininity) $t(67) = -17.7$, $p < .001$, Scale 8 (Schizophrenia) $t(67) = -6.0$, $p < .05$, and Scale 0 (Social introversion) $t(67) = -6.8$, $p < .05$. Compared to females, FTMs displayed higher scores on Scale 5 (Masculinity/femininity) $t(78) = 8.1$, $p < .01$. A significant main effect of time was present for Scale 1 (Hypochondria), Scale 2 (Depression), Scale 3 (Hysteria), Scale 4 (Psychopathic deviate), Scale 6 (Paranoia), Scale 8 (Schizophrenia), and Scale 9 (Hypomania). More specifically, Scale 1 (Hypochondria), Scale 3 (Hysteria), Scale 4 (Psychopathic deviate), and Scale 9 (Hypomania) scores decreased for FTMs and females. Scale 8 (Schizophrenia) scores decreased for all groups, in females and FTMs more so than males. Scale 2 (Depression) scores decreased for all groups, yet there seemed to be an effect from T1 to T2 where FTM's scores decreased more rapidly than controls (see Appendix F, Table 20, for analysis of T1 to T2). Refer to Table 11 for a display of participants who displayed clinical elevations for each scale at each time point.

--insert Table 10 here--

--insert Figure 4 here--

--insert Table 11 here--

Discussion

Female-to-male transsexuals (FTMs) have been using exogenous testosterone for

over 80 years in order to masculinize their bodies (Meyerowitz, 2002). Testosterone treatment of FTMs has been determined to be a medically necessary treatment (American Medical Association, 2008; WPATH, 2011). As outlined in the recent brief from the Institute of Medicine, research is needed on transgender persons in order to understand their experiences and increase their health (IOM, 2011). Internationally, only a few studies have examined the impact of hormone treatment on FTMs and those have been mostly cross-sectional, retrospective, or based on clinician observation and have usually been conducted on those who have undergone sexual reassignment surgery (WPATH, 2011). Because of this, little is known about the psychological effects of testosterone on FTMs.

This research deficit is especially concerning due to the debate about the mental health difficulties in this marginalized at-risk population (Hepp, Kraemer, Schnyder, Miller, & Delsignore, 2005). While some studies have found mental health discrepancies between FTMs and cisgender persons, others have found FTMs to be psychologically healthy (de Vries et al., 2011). Rigorous empirically sound investigations determining the psychological outcomes of testosterone use are critically important due to the deficit of research on FTMs.

This controlled longitudinal study examined the effects of exogenous testosterone administration on FTMs in the US for the first time in the domains of cognitive functioning, psychosocial functioning, gender role, and psychopathology. These areas were examined to shed light onto the role of exogenous testosterone on the mental health and well being of those undergoing a hormonal gender transition from female to male during their first year of testosterone administration.

This study is set apart from the few previous longitudinal studies on transsexuals for seven reasons: a) it is the first to use an American sample b) the number of participants in this study at least doubles those presented in previous research c) it has the widest age range of FTMs beginning testosterone ever reported d) it is the first to use both cisgender male and female controls e) it uses the same reliable and valid questionnaires at each time point f) it is the first to utilize a community sample instead of a clinical sample. Finally, it is more comprehensive than previous studies, examining multiple domains of psychological functioning relevant to the lives of the participants.

Hypothesis 1a) FTMs have lower spatial ability and higher verbal ability than male controls and FTMs have higher spatial ability and lower verbal fluency than female controls. Hypothesis 1a was not supported, as FTMs were not found to differ from controls on verbal or spatial intelligence. However, FTMs' mean scores for both verbal and spatial intelligence were in between those of males and females. While males and females did not significantly differ on verbal intelligence, males outperformed females on spatial intelligence. The lack of difference between untreated FTMs and cisgender males and females on spatial ability suggests that prenatal and perinatal influences of androgens may have organized FTMs' brain structure and adds further support to the theory of organizational effects of sex hormones in transsexuals (Cohen-Kettenis et al., 1998; Rametti et al., 2011). Females were not found to outperform males on verbal ability, supporting the idea that gender differences in verbal ability no longer exist (Hyde & Linn, 1988).

Hypothesis 1b) FTMs have more symptoms of depression, anxiety, stress and emotional reactivity than male and female controls. Although FTMs' mean scores were

all within the normative range, hypothesis 1b received full support for comparisons to male controls, in that FTMs endorsed more symptoms of depression and anxiety, higher levels stress, emotional sensitivity, emotional intensity, and emotional persistence. FTMs were only significantly different from female controls on emotional intensity, with FTMs scoring higher. Compared to males, females reported more symptoms of depression, higher levels of stress, and emotional persistence. This finding is consistent with previous research (Nolen-Hoeksema, 2010) and may be related to anticipating their imminent transition.

Hypothesis 1c) FTMs have lower levels of health-related quality of life, and self-esteem than male and female controls. Hypothesis 1c was mostly supported in that FTMs had lower levels of self-esteem than male and female controls and FTMs displayed lower levels of quality of life than male controls. Compared to males, females reported lower self-esteem. FTMs differed from both males and females on emotional intensity and self-esteem and from males on all other variables examined. Overall FTMs demonstrated statistically significant lower psychosocial functioning than controls at initial assessment. It is possible that FTMs' psychosocial functioning pre-treatment could be impaired due to combined distress related to gender dysphoria, internalized transphobia, and being an ostracized member of society (Meier et al., 2011; Meyer, 1995; WPATH, 2011). Their pre-treatment psychological functioning may also be affected as they are beginning the process of transition, where there are many unknowns that may include family, spiritual, job and relationship security.

Hypothesis 1d) FTMs have higher masculinity scores than male controls and lower femininity scores than female controls. Hypothesis 1d was partially supported with

FTMs scoring lower in femininity than females. However FTMs actually scored lower in masculinity than males, which is in contrast to the idea of over-confirmation. FTMs scored higher in masculinity than females and lower in femininity than males. In essence, they scored between males and females on masculinity and lower than both controls on femininity. The lower femininity score supports the idea of under-reporting and may reflect attempts to compensate for not presenting as masculine as they desire. FTMs may have been less likely to over-confirm their masculinity than those in previous studies due to the different nature of the present study. In prior studies, FTMs may have over-confirmed their masculinity in order to answer in a socially desirable manner in order to convince psychologists at gender clinics that they were really male (Meyerowitz, 2002). FTMs in the present study may have been less likely to respond in a socially desirable manner, as their responses did not impact whether or not they received testosterone treatment. As expected, females scored higher in femininity and lower in masculinity than males.

Hypothesis 1e) FTMs have higher levels of psychopathology than male and female controls. Hypothesis 1e received strong empirical support when using cisgender males as the comparison group, as FTMs displayed higher scores than cisgender males on the Depression, Psychopathic deviate, Masculinity/femininity, Paranoia, Psychasthenia, Schizophrenia, and the Social Inversion scales (7 of 10 scales). As previous research typically used cisgender females as controls, this is the first known comparison of cisgender male and FTM MMPI-2 scores and supports prior research that suggest transsexuals have higher rates of psychiatric comorbidity than cisgender persons (Hepp et al., 2005). However, FTMs only displayed higher scores than females on only the Scale 4

(Psychopathic deviate) and Scale 5 (Masculinity/femininity) (2 of 10 scales). This finding is in line with previous research that found FTMs tend to score higher on these two scales (de Vries et al., 2011; Roback et al., 1976; Rosen, 1974). The Psychopathic deviate scale was thought to be elevated in transsexuals due to interpersonal difficulties related to the lack of acceptance of transsexuals in society (de Vries et al., 2011; Nuttbrock et al., 2010), while the Masculinity/femininity scale was expected to be elevated due to gender dysphoria (Miach, Berah, Butcher, & Rouse, 2000). It is thought that social isolation of FTMs may explain their higher scores on Scales 4, 8, and 0. Females displayed significantly higher scores than males on Scale 2 (Depression), Scale 5 (Masculinity/femininity), Scale 7 (Psychasthenia), and Scale 8 (Schizophrenia) (4 of 10 scales). It is important to note that all mean T-scores for FTMs were within the normal range, which actually supports the other body of prior research that suggests transsexuals have normative levels of psychological functioning (Cole et al., 1997; de Vries et al., 2011 Gomez-Gil et al., 2008).

Hypotheses for the initial assessment were generally supported, although FTMs' mean scores on the initial measures were all found to be within the normative range. This suggests that while FTMs from community samples may demonstrate psychological profiles that are statistically different from controls before hormone treatment, these differences may not be clinically significant. The hypotheses related to psychosocial functioning and psychopathology received the most support when using male controls as the comparison group, as males generally displayed healthier mean scores, yet some support was found comparing FTMs to females.

Hypothesis 2a) FTMs will demonstrate gains in spatial ability and losses in verbal fluency. Hypothesis 2a was not supported. FTMs' cognitive ability did not change relative to controls over one year of testosterone treatment. This finding may indicate that the activating effects of testosterone do not impact cognitive ability, yet the small sample size at T3 is likely the reason no significant differences were found. A trend was found for FTMs' spatial performance increasing more than controls by T3. The study is ongoing with five more FTMs expected to complete T3. With a larger sample size, FTMs are likely to exhibit a significant change in the anticipated direction. This would support the activating effect of testosterone on spatial ability (Cohen-Kettenis et al., 1998; Slabbekorn et al., 1999). In line with previous research, practice effects were found for all gender groups at T2 at T3 for both spatial and verbal ability, with a larger effect for spatial scores (Wechsler, 1999). Contrary to the hypothesis, FTMs did not show declines in verbal ability. Worsening of verbal ability has only been found in one study (van Goozen, 1995), which has not been replicated (Slabbekorn et al., 1999).

Hypothesis 2b) FTMs will show decreases in symptoms of depression, anxiety, stress, and emotional reactivity. Hypothesis 2b was supported. FTMs showed significant improvements in psychosocial functioning relative to controls at both T2 and T3, with significant decreases in stress. Notions that beginning hormone treatment increases stress are not supported by this finding. By T2, FTMs no longer differed from females on emotional intensity, which was the only Hypothesis 2b variable they differed on at T1. At T2, while FTMs still differed from males on depression, anxiety, stress, emotional sensitivity, and emotional intensity in the same direction, they no longer differed from males on emotional persistence. Compared to males, females still reported more

symptoms of depression, higher levels of stress, and emotional persistence at T2. By T3, FTMs differed from females on emotional persistence, where they displayed lower scores. They no longer differed from males on any variable examined by Hypothesis 2b. At T3, similar to T2, females still differed from males on depression, anxiety, and stress, emotional sensitivity, and emotional persistence, all in the same direction.

Hypothesis 2c) FTMs will show gains in self-esteem, and quality of life. Hypothesis 2c also received support. By T2 and at T3 FTMs no longer differed from males on quality of life nor did they differ from females on self-esteem. At T3, both FTMs and females still demonstrated lower levels of self-esteem than males.

In sum, FTMs initially displayed higher scores than male controls on depression and anxiety, higher levels stress, emotional sensitivity, emotional intensity, and emotional persistence and lower scores on quality of life and self-esteem. By T3, FTMs only differed from males on self-esteem, demonstrating lower levels than males only. FTMs initially displayed higher scores than female controls on emotional intensity and lower levels of self-esteem. By T3, FTMs only differed from females on emotional persistence, displaying lower scores. These findings provide clear empirical evidence of positive effects of testosterone treatment on the psychosocial functioning of FTMs. This provides a case for the use of exogenous testosterone in FTMs not only to confirm their male gender identities and masculinize their bodies, but to also to improve psychosocial functioning.

Hypothesis 2d) FTMs will show decreases in masculinity scores and increases in femininity scores. Hypothesis 2d was not supported. FTMs did not demonstrate significant changes in gender role relative to controls. Both FTMs' mean scores of

masculinity and femininity remained relatively constant over one year, with masculinity scores in between those of control males and females and lower femininity scores than controls. Because FTMs were not found to over-confirm their masculinity at the initial assessment, it follows that the expected decreases in masculinity were not found. Perhaps FTMs' femininity scores remained low over the first year of testosterone use because of discomfort with acknowledging feminine qualities. This could be related to a desire to reinforce their decision to transition to male and reject anything that may challenge their masculine gender identity. As expected, females scored higher in femininity and lower in masculinity than males at all time points.

Hypothesis 2e) The psychopathology profiles of FTMs will become more psychologically healthy. Hypothesis 2e received strong empirical support: by T2, FTMs scores were found to significantly decrease more rapidly than those of female or male controls on the Depression, Hysteria, Paranoia, Psychasthenia, and Schizophrenia scales (a total of 5 scales). At T2, FTMs did not differ from females on any scale. While FTMs still displayed higher scores on the Psychopathic deviate, Masculinity/femininity, Paranoia, Schizophrenia, and Social introversion scales than males (a total of 5 scales), they no longer displayed higher scores on the Psychasthenia scale at T2. Similarly, females still displayed higher scores than males on the Depression, Masculinity/femininity, Psychasthenia, and Schizophrenia scales (a total of 4 scales), however they also displayed higher scores on the Hypochondria, Psychopathic deviate, and Paranoia scales at T2. At T3, FTMs only scored higher than females on Scale 5 (Masculinity/femininity), as would be expected. Compared to males, FTMs still scored higher on the Masculinity/femininity, Schizophrenia, and Social introversion scales (a

total of 3 scales), yet they no longer differed from males on the Psychopathic deviate or Paranoia scales. The decrease in Psychopathic deviate scores suggests that FTMs experience fewer interpersonal difficulties after testosterone treatment and that previous research findings of elevations on this scale may be related to gender dysphoria. It is thought that the reduction in Paranoia scores is related to "passing" as male due to the masculinizing physical changes related to testosterone treatment. Transsexuals are one of the most at risk group for hate crimes, we speculate that they are one thousand times more likely to be victims of hate crimes than cisgender people (Meier & Labuski, in press). Their Paranoia scores at initial assessment may be related to a realistic concern that they are at risk and may be alleviated once they begin "passing" and functioning in the male role. Testosterone use was clearly associated with decreased psychopathology in FTMs.

Positive psychological changes in FTMs were generally found by the second assessment at three to four months after initiating testosterone treatment and maintained or further improved by the third assessment at ten to twelve months post-treatment initiation. Most hypotheses received moderate support, in that testosterone treatment was associated with healthy psychological changes and no iatrogenic effects were found. Because FTMs were found to be clinically similar to controls at the initial assessment, there was not much room for improvement. Therefore, it is noteworthy that significant gains in mental health were found.

Gender dysphoria was assessed in a subsample of the FTMs FTMs experienced reductions in gender dysphoria and increased feelings of acceptance of being transgender. At this point, it remains speculative if the reduction in gender dysphoria and increased

acceptance of being transgender accounts for the increases in psychological functioning of FTMs.

Clinical Implications

This study has clinical and research implications with the potential to impact disciplines concerned with transgender health and well-being. The fields of medicine, public health, mental health, and education have been criticized for neglecting transgender issues in their training programs (Corliss, Shankle, & Moyer, 2007; DePaul, Walsh, & Dam, 2009; Gonzalez & McNulty, 2010; Obedin-Maliver, et al., 2011). Some medical professionals express hesitancy to prescribe medications, especially controlled substances like testosterone, due to lack of training and research. The results of this study may help to educate providers trying to meet the needs of their FTM patients who wish to transition, including mental health professionals conducting hormone readiness assessments and medical practitioners prescribing testosterone. Further, insurance companies may be more willing to provide coverage for this medically necessary treatment as the body of evidence continues to build. The present study provides solid empirical evidence for the psychological ameliorative effects and lack of iatrogenic effects of testosterone treatment of FTMs across age groups.

Recently WPATH has issued their 7th edition of the Standards of Care, which provide less stringent requirements for allowing transgender adults to access hormone treatment than previous editions (WPATH, 2011). The results from this study support the less restrictive recommendations set forth by WPATH. The former restrictions required mental health providers to see all transgender patients for three months of psychotherapy before writing a letter to a physician "approving" them for hormone treatment. The

current standards no longer require therapy for all transgender people. Also, as this study included many teenagers and adolescents who showed improvements and no iatrogenic effects, professionals may be more comfortable prescribing testosterone at a younger age (de Vries et al., 2011).

The decision of FTMs to start testosterone is not a solitary decision (Lev, 2004). They are family members, may be in romantic relationships, and may have children when they decide to begin taking testosterone. Because of the lack of research on the psychological effects of testosterone, not only have some professionals been hesitant to prescribe testosterone, but family members and partners of FTMs have also expressed concerns with their decision to start testosterone treatment (Meier et al., under review). Some fear that an FTM will become a different person or become more aggressive (Gorton, Buth, & Spade, 2005). If anything, results from the present study indicate that, in general, FTMs become more psychologically healthy.

Limitations

There are multiple limitations to this study that may have impacted the results. The primary limitation of this study was that the amount of testosterone in all participants was not directly measured. The majority of FTMs in this study did not have regular bloodwork tests. Preliminary evidence shows that pre-testosterone treated FTMs have higher levels of testosterone than cisgender females (Baba et al., 2007), which could account for their lack of difference from male controls on spatial ability at Time 1. Also, there were multiple methods of administration of testosterone including patches, gel, creams, and injections, all of which are administered at varying time intervals. Each method has a different rate of absorption and dosages are not directly comparable

between methods. As such, it is impossible to determine the exact amount of testosterone participants were receiving during the study.

The use of internet recruitment limits the generalizability of the results. Relying on the internet restricts the sample to FTMs who have access to the internet and participants in FTM specific groups. These people tend to be predominately White and highly educated. On the other hand, the use of Internet recruiting has been recommended for recruiting difficult to recruit populations such as transgender persons (Rosser, Oakes, Bockting, & Miner, 2007). Attrition is a reality of longitudinally designed studies and limits the interpretation of the findings. Although all gender groups lost participants, FTM participants were less likely to drop out due to loss of interest than cisgender males and females. The most common reason for participant drop out was loss of contact. Finally, the questionnaire measures used may also be a limitation of the study. Although questionnaires administered revealed adequate reliability, most were not designed to measure change over time.

Future Directions

Past cross-sectional research studies that have lumped many different transgender people together (e.g. FTMs with MTFs or those who have began gender related medical treatment with those who have not) may have generated faulty conclusions on transgender people's mental health. The studies that have found high rates of comorbidity may have found differential findings if they had separated FTMs and MTFs as well as those who had received gender-affirming hormones and/or surgeries from those who desired those treatments (Meier et al., 2011). Future research designs should separate transgender people into relevant groups in order to generate more valid conclusions.

Future studies should follow FTMs on testosterone for longer periods of time. The current study is ongoing and the principal investigator has received permission from the IRB and participants to follow up with participants at 5 to 7 years after their initial assessment. Although it is important for clinical research studies to continue, more community-based research is needed in order to represent a broader sample of the transgender population. A sister study on MTFs is needed to compare the psychological effects of estrogen and anti-androgens on MTFs to the results found here.

Future longitudinal studies may benefit from including additional variables, such as neuropsychological assessments, brain imaging, and testing sex hormone levels in participants over time. Experimental paradigms could also shed light on behavioral changes associated with testosterone. For example, studies could investigate the behavioral effects of testosterone on emotional reactivity and aggression using standardized, laboratory-based tasks. Future studies could also attempt to recruit more people of diverse socio-economic class, age, ethnic and racial backgrounds in order to be better able to generalize their findings.

Recommendations

The data demonstrate clear and conclusive empirical support for the positive psychological effects of testosterone use on a community sample of FTMs across age groups over their first year of hormone treatment. That being said, testosterone should not be thought of as a panacea for FTMs. Overall the results suggest that most FTMs report subclinical levels of psychological distress before initiating testosterone treatment. Initiating testosterone treatment is associated with improved mental health in FTMs.

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Figures and Tables

Figure 1. Flowchart of the sampling, sample sizes and reasons for attrition

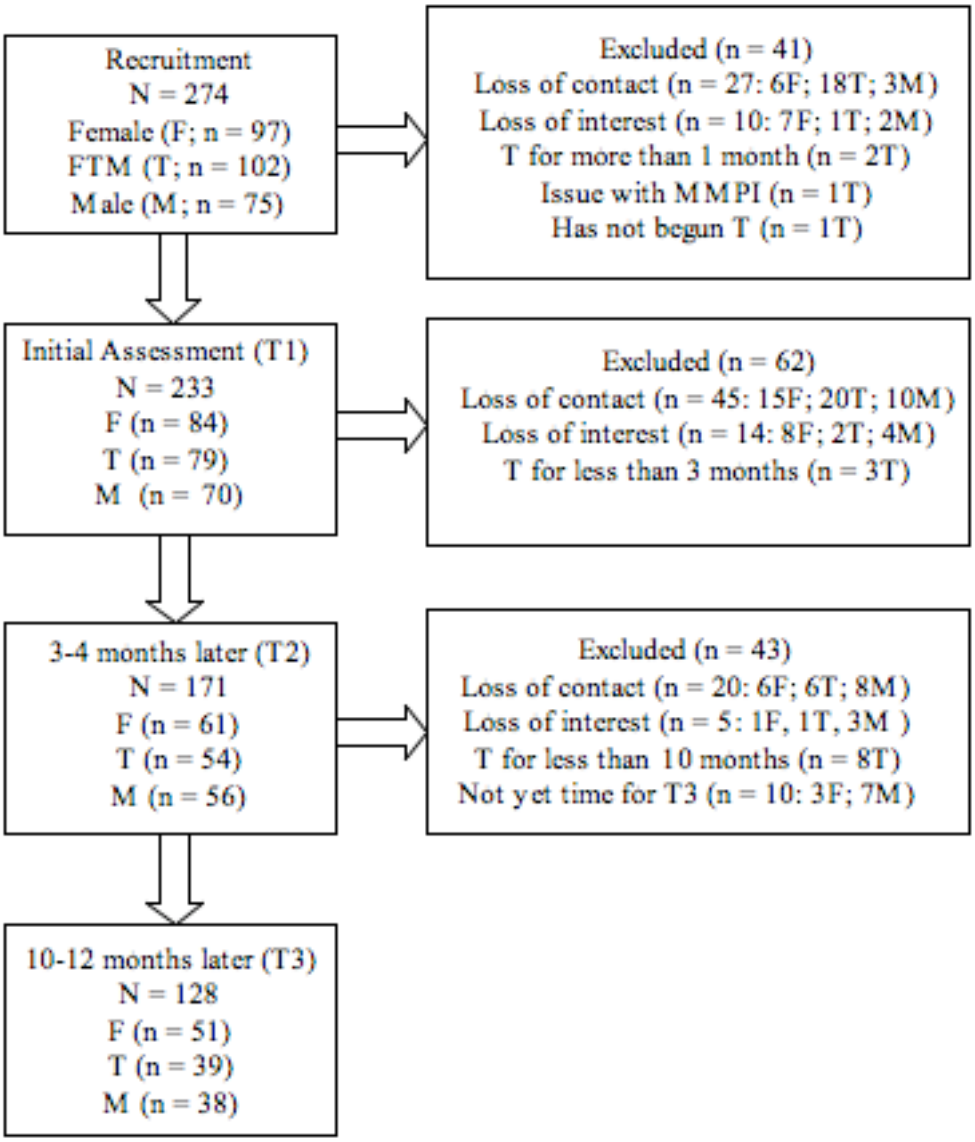

Figure 2. Time x Gender Interaction on Spatial Intelligence Over 12 Months (Trend)

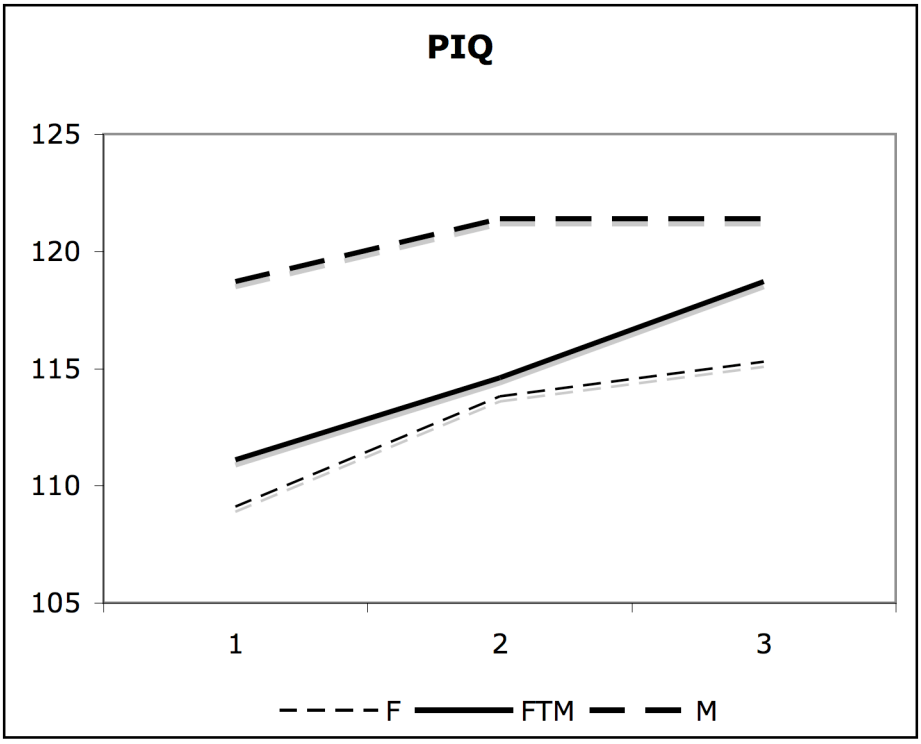

Figure 3. Time x Gender Interaction on Stress over 12 Months

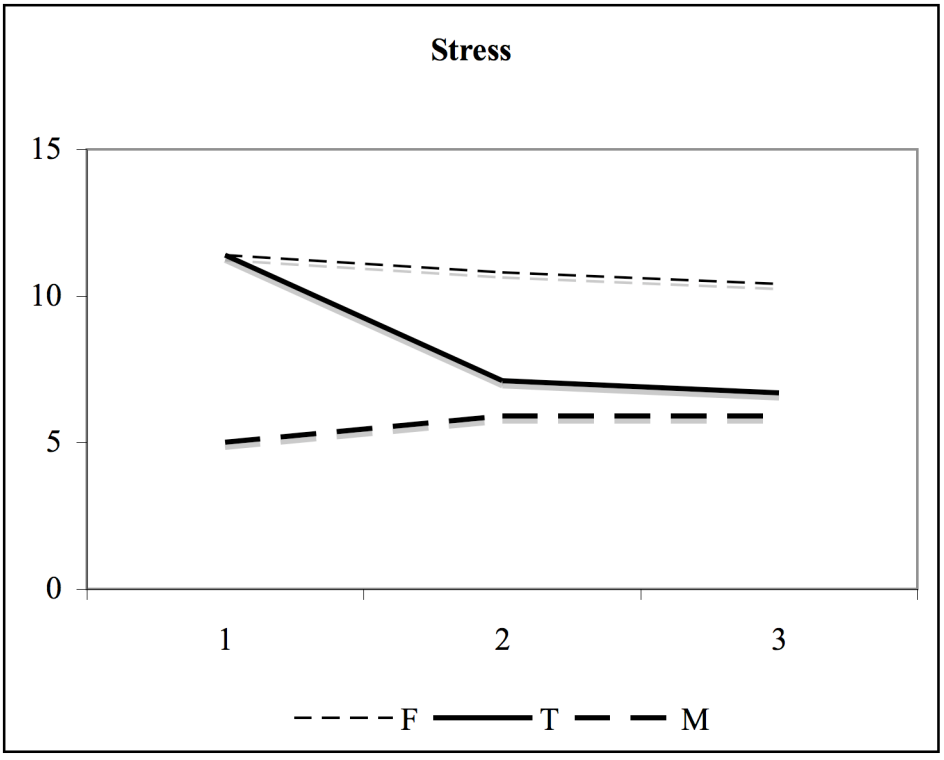

Figure 4. Time x Gender Interaction on Paranoia over 12 Months

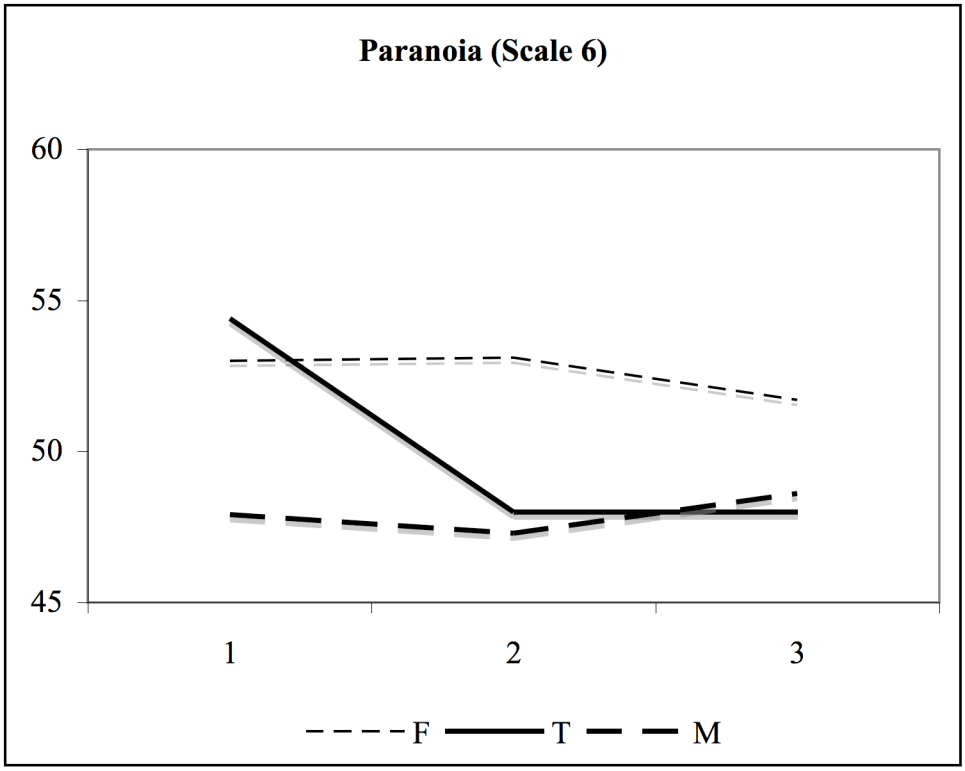

Figure 5. Time x Gender Interaction on Depression Over 3 Months (Non-gendered)

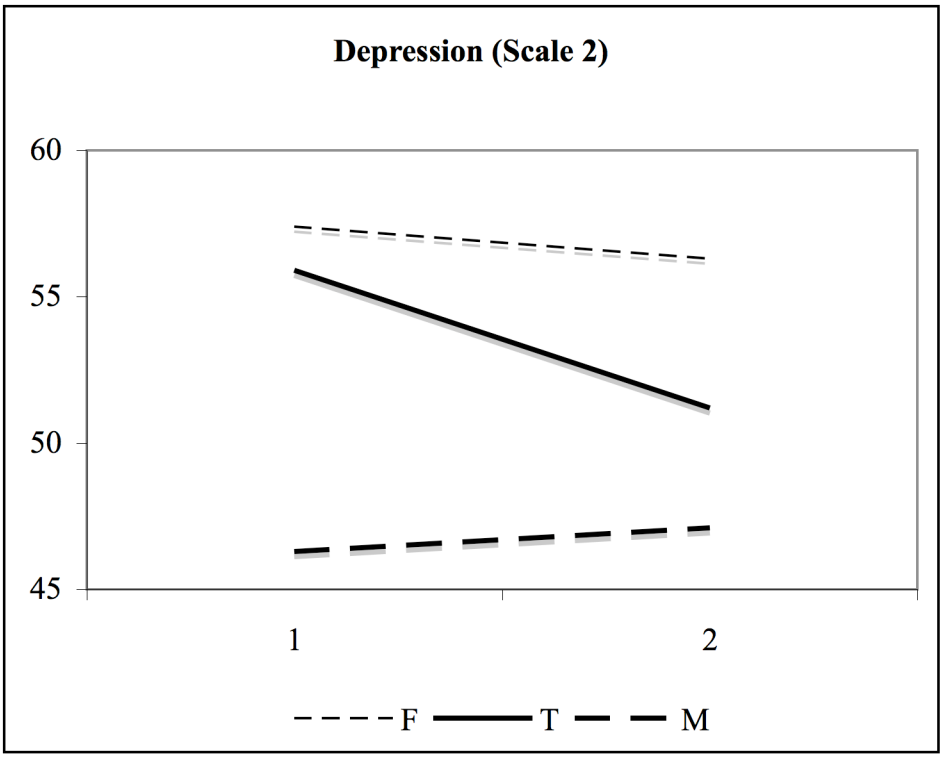

Figure 6. Time x Gender Interaction on Psychopathic deviate Over 3 Months (Non-gendered)

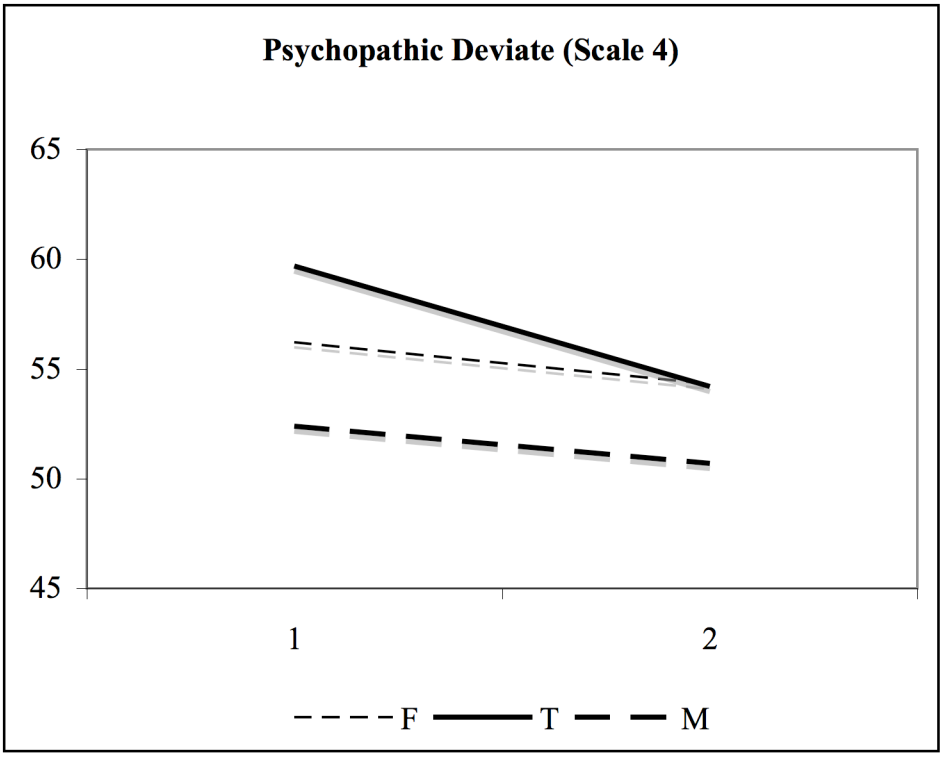

Figure 7. Time x Gender Interaction on Paranoia Over 3 Months (Non-gendered)

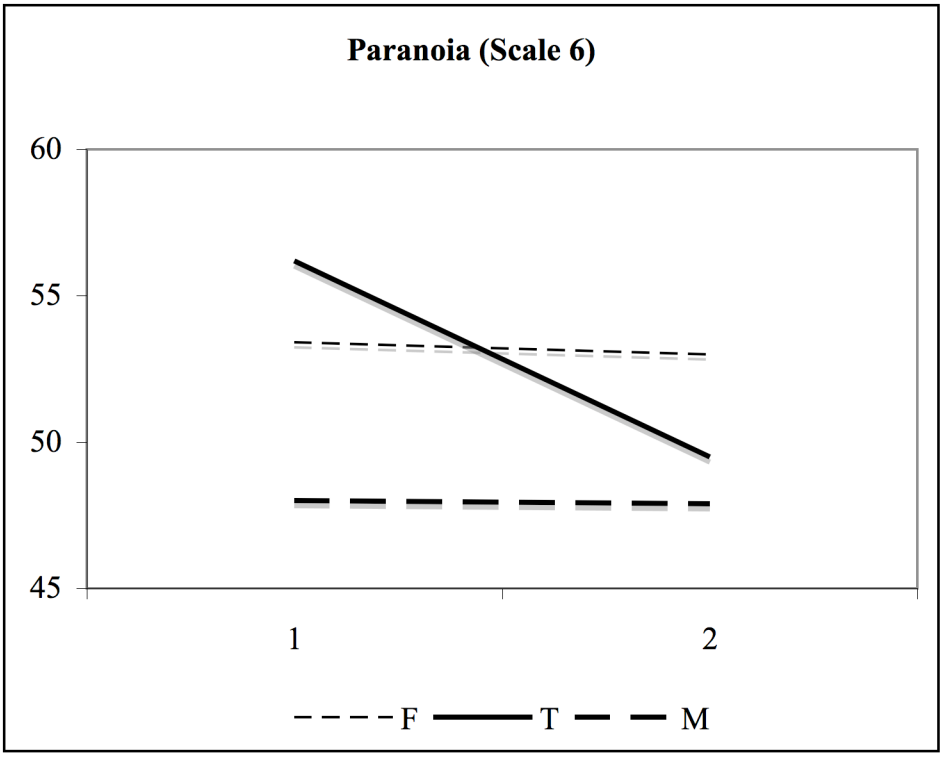

Figure 8. Time x Gender Interaction on Psychasthenia Over 3 Months (Non-gendered)

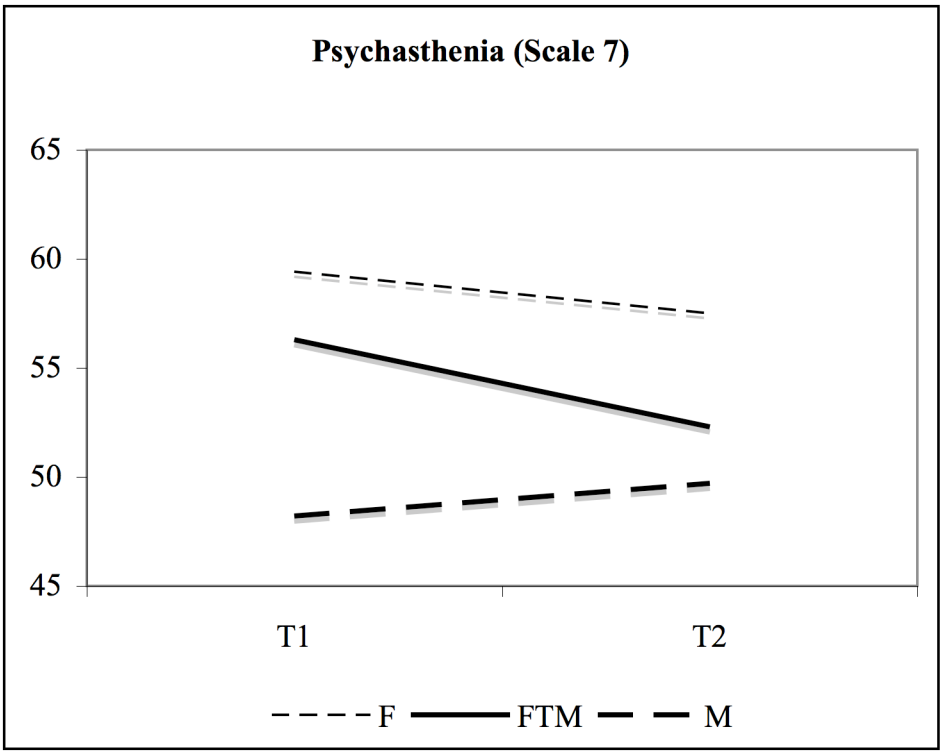

Figure 9. Time x Gender Interaction on Schizophrenia Over 3 Months (Non-gendered)

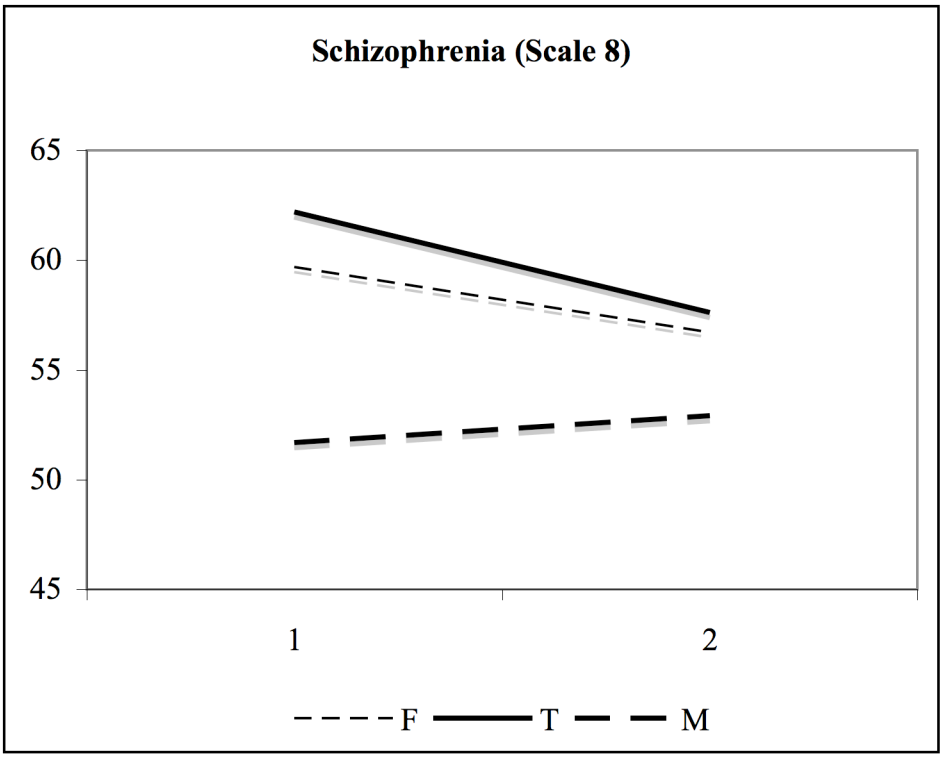

Figure 10. Time x Gender Interaction on Paranoia Over 12 Months (Non-gendered Norms)

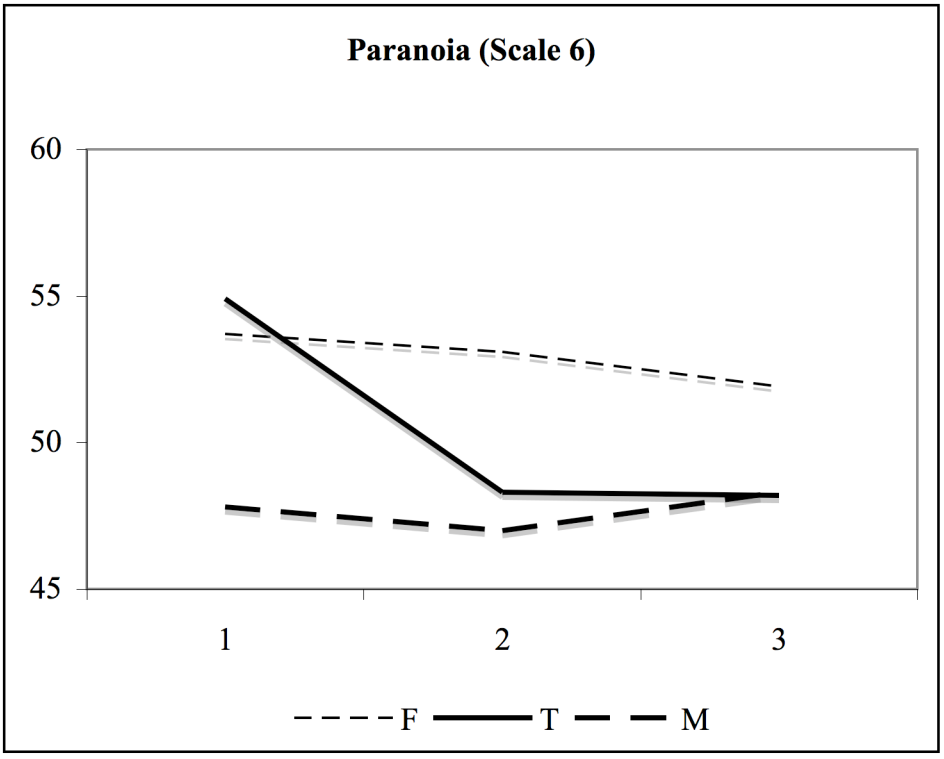

Figure 11. Time x Gender Interaction of VIQ over 3 Months (Trend)

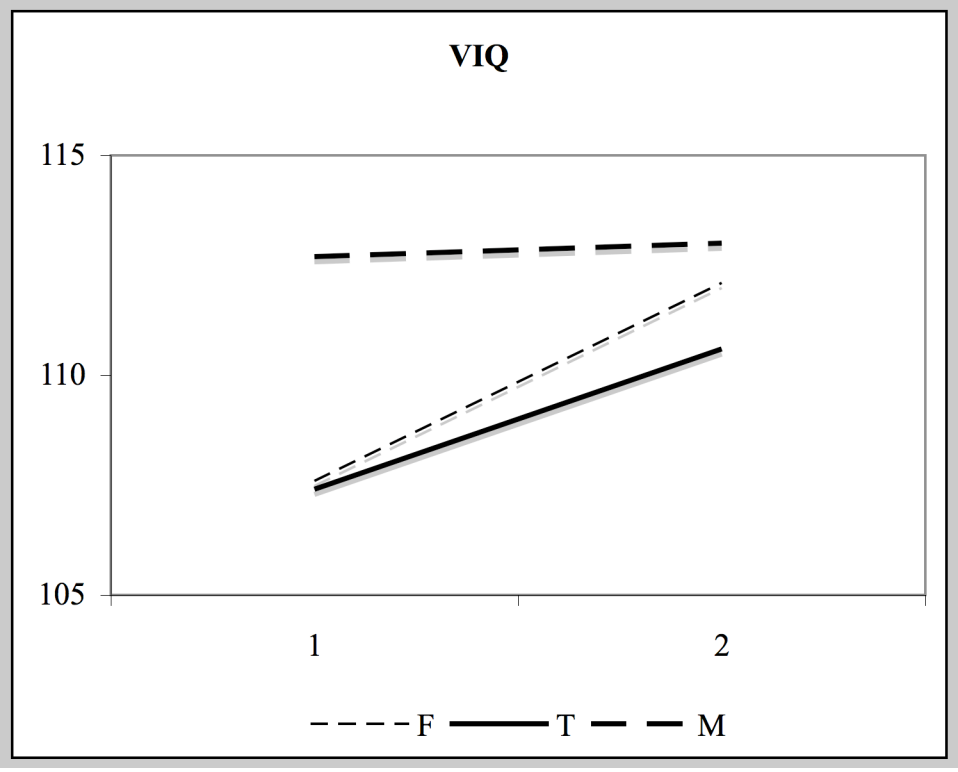

Figure 12. Time x Gender Interaction on Stress over 3 Months

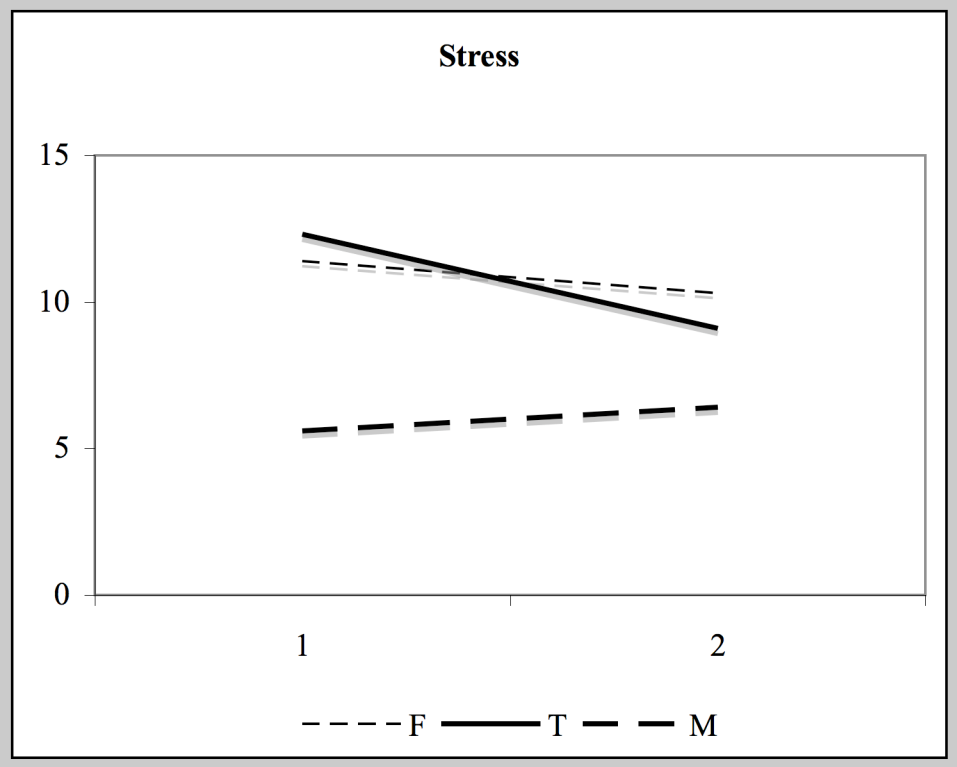

Figure 13. Time x Gender Interaction on Emotional Sensitivity over 3 Months (Trend)

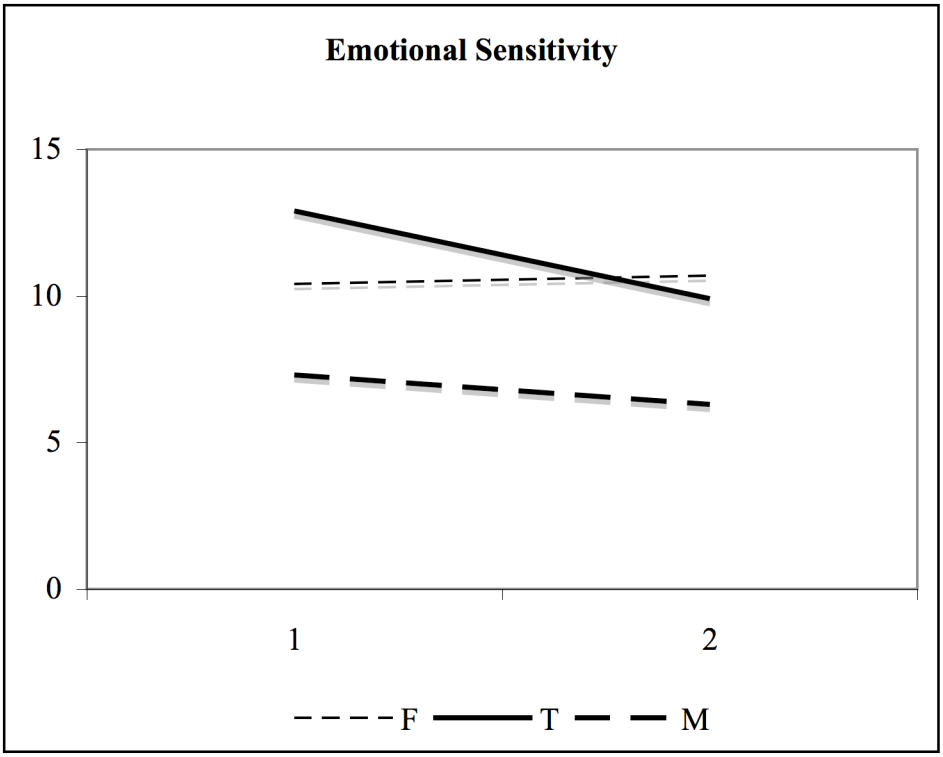

Figure 14. Time x Gender Interaction on Depression Over 3 Months

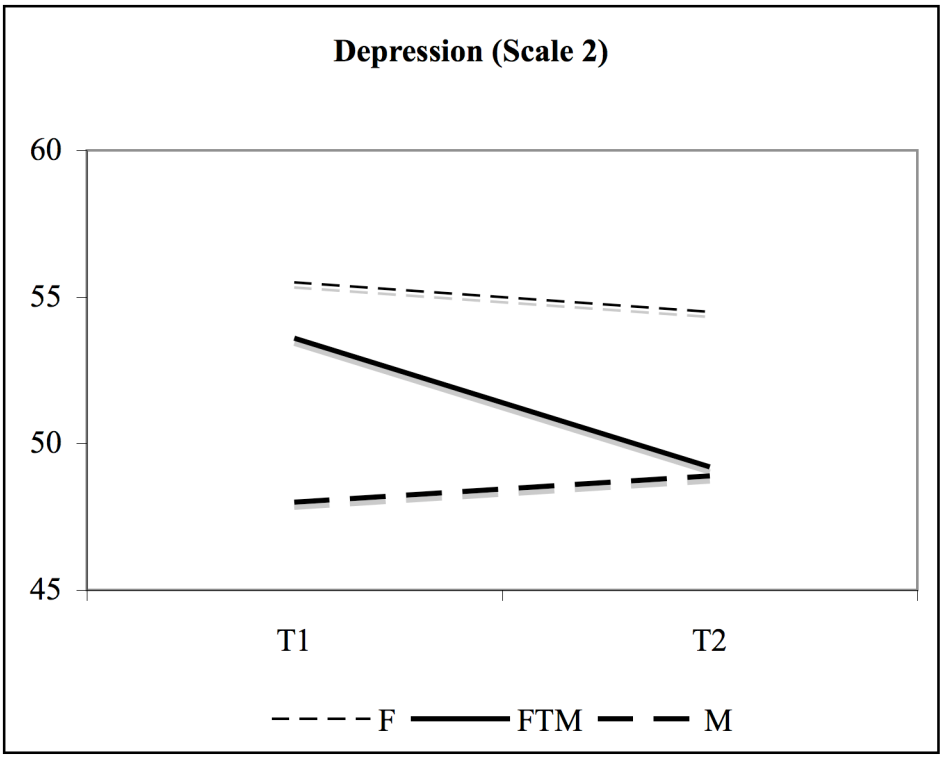

Figure 15. Time x Gender Interaction on Hysteria Over 3 Months

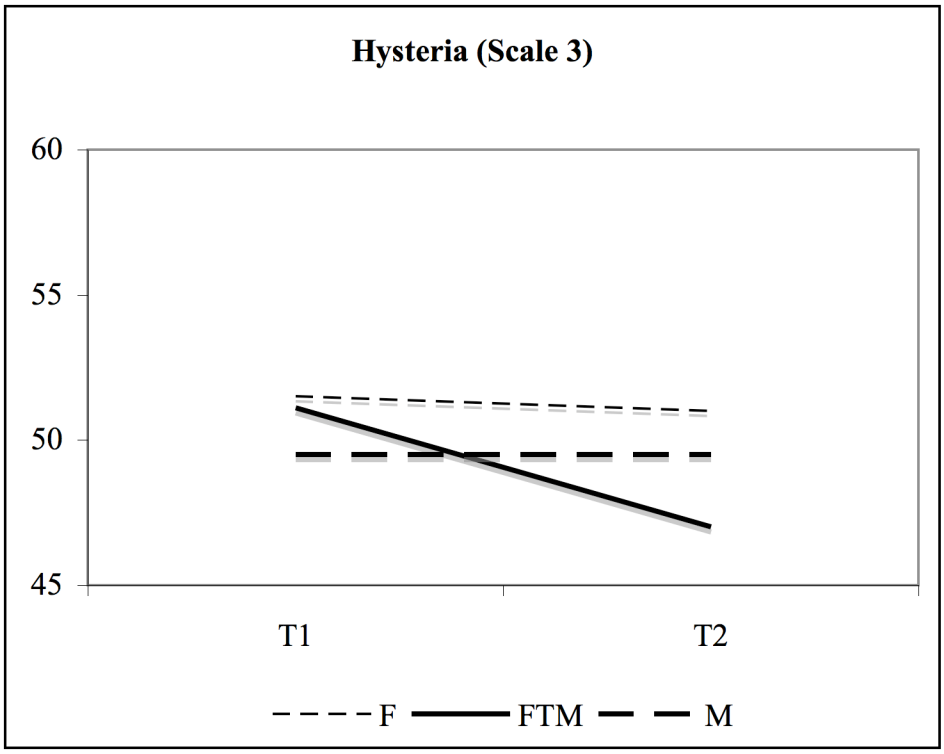

Figure 16. Time x Gender Interaction on Paranoia Over 3 Months

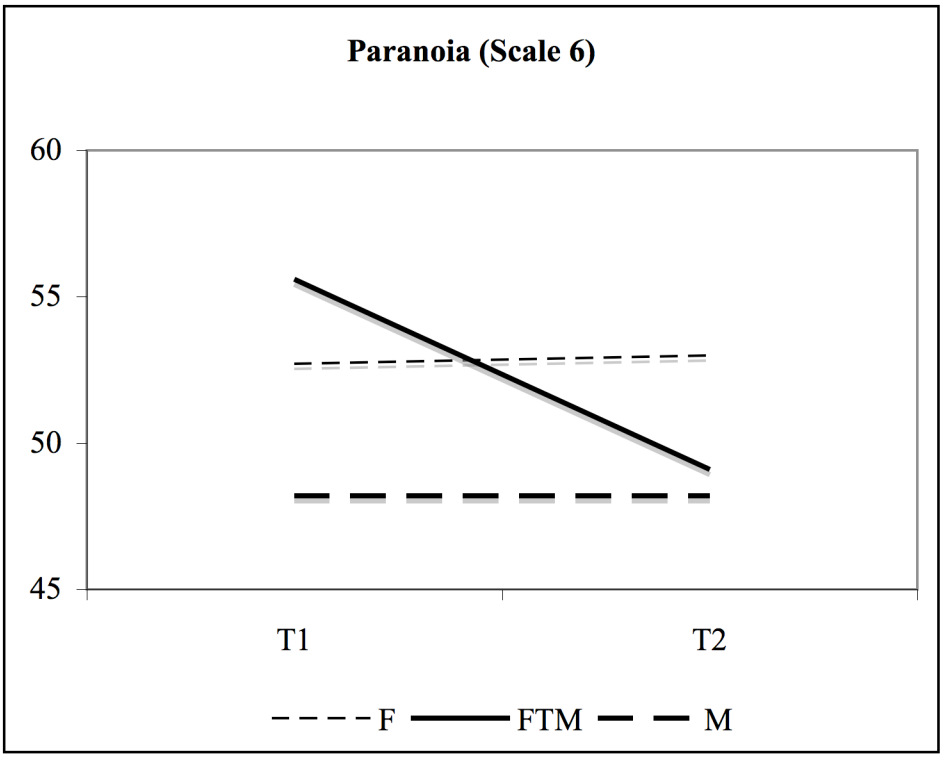

Figure 17. Time x Gender Interaction on Psychasthenia Over 3 Months

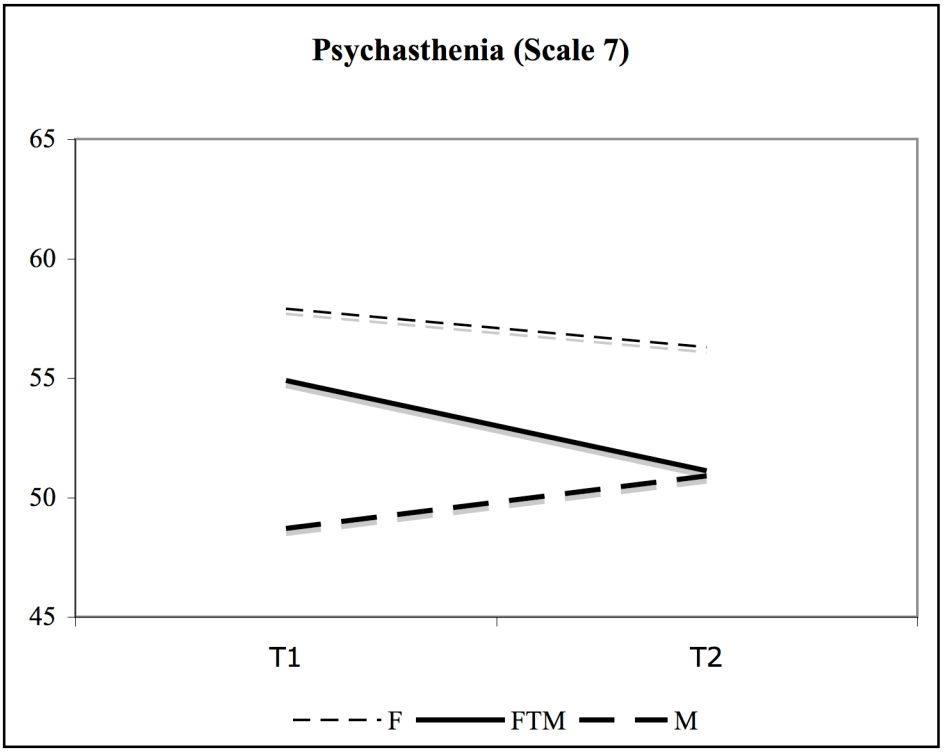

Figure 18. Time x Gender Interaction on Schizophrenia Over 3 Months

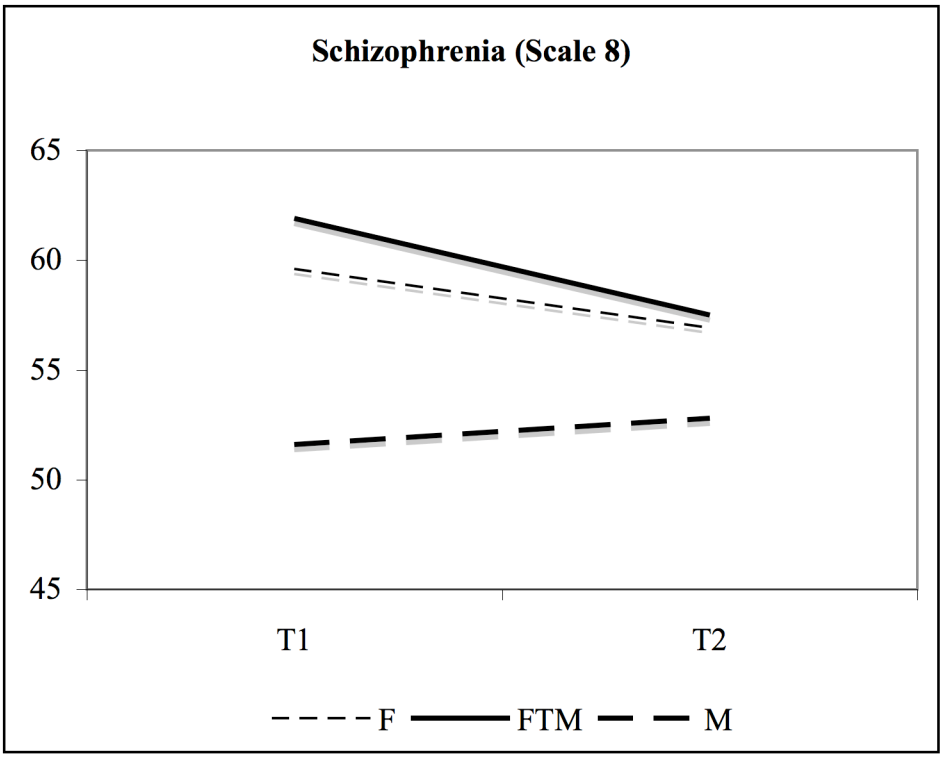

Table 1. Summary of Demographic Information by Group

Level of Variable	FTM	Female	Male	Total
Total	79	84	70	233
		Age		
Mean (SD)	26.58 (8.34)	25.36 (7.19)	26.79 (8.54)	26.2 (8.0)
Range	16-52	18-50	18-54	16-54
Median	24	23	25	24
		Ethnicity		
Hispanic	8 (10.3%)	15 (17.9%)	14 (20%)	37 (15.9%)
		Race		
API[a]	1 (1.3%)	14 (16.7%)	9 (12.9%)	24 (10.3%)
Black	4 (5.1%)	9 (10.7%)	3 (4.3%)	16 (6.9%)
Caucasian	65 (82.1%)	55 (65.5%)	55 (78.6%)	175 (75%)
Multi-racial	4 (5.1%)	3 (3.6%)	0	7 (3.0%)
Other	4 (5.1%)	3 (3.6%)	1 (1.4%)	8 (3.4%)
		Education		
HS/GED or less	14 (17.9%)	13 (15.5%)	8 (11.4%)	35 (15.1%)
Some College	37 (47.4%)	45 (53.6%)	34 (48.6%)	116 (50.0%)
Bachelor's	21 (26.9%)	17 (20.2%)	18 (25.7%)	56 (24.1%)
Post-Grad	7 (7.7%)	9 (10.7%)	8 (11.4%)	24 (9.9%)
		Work Status		
Full Time	25 (32.1%)	20 (23.8%)	28 (40%)	73 (31.5%)
Part Time	9 (11.5%)	27 (32.1%)	13 (18.6%)	49 (21.1%)

Unemployed	10 (11.5%)	3 (3.6%)	6 (8.6%)	19 (7.8%)
Disability	3 (3.8%)	0	0	3 (1.3%)
Student	14 (17.9%)	20 (23.8%)	18 (25.7%)	52 (22.4%)
Working Student	14 (17.9%)	14 (16.7%)	3 (4.3%)	31 (13.4%)

Note: Values represent number of participants who completed the initial assessment (N = 233).

[a] Asian Pacific Islander

Table 2. Study Design

	T1 Initial Assessment	T2 Short-Term	T3 Long-Term
FTM	0-1 month on T	3-4 months on T	10-12 months on T
Male Control		3-4 months after T1	10-12 months after T1
Female Control	menstruating	menstruating 3-4 months after T1	menstruating 10-12 months after T1

Note. Non-local participants did completed the same protocol as local participants except they were unable to complete the WASI, as was administered in person.

Table 3. Correlation Matrix for Psychosocial Functioning

	1	2	3	4	5	6	7
1-Depression	-						
2-Anxiety	.63***	-					
3-Stress	.73***	.77***	-				
4-Sensitivity	.46***	.52***	.56***	-			
5-Intensity	.44***	.47***	.50***	.86***	-		
6-Persistence	.54***	.47***	.53***	.75***	.69***	-	
7-Quality of Life	-.40***	-.42***	-.41***	-.30***	-.26***	-.30***	-
8- Self-Esteem	-.63***	-.42***	-.52***	-.47***	-.40***	-.51***	.52***

*** $p < .001$

Table 4. Correlation Matrix for MMPI-2 Clinical Scales

	1	2	3	4	5	6	7	8	9
1- Hy	-								
2- Dep	.54***	-							
3- Hs	.76***	.47***	-						
4- Pd	.42***	.54***	.43***	-					
5- Mf	-.01	-.03	-.04	0.14	-				
6- Pa	.40***	.40***	.47***	.54***	.02	-			
7- Pt	.52***	.71***	.47***	.59***	.02	.49***	-		
8- Sz	.53***	.50***	.42***	.65***	.19**	.56***	.73***	-	
9- Ma	.01	-.30***	-.06	.20**	.13	.13	-.01	.26***	-
0- Si	.20**	.60***	.03	.11	.05	.10	.43***	.36***	-.33***

** $p < .01$; *** $p < .001$

Table 5. Means, Standard Deviations, and Frequencies from Initial Assessment

Variable		F	FTM	M	Gender Effect
Reading Level		n = 41	n = 53	n = 38	
	8-9.9	1 (2.4%)	1 (1.9)		
	10-10.9	1 (2.4)	1 (1.9)	1 (2.6)	
	11-11.9	8 (19.5)	3 (5.7)	8 (21.1)	
	12-12.9	16 (39.0)	20 (37.7)	12 (31.6)	
	12.9+	15 (36.6)	28 (52.8)	17 (44.7)	
Intelligence		n = 52	n = 27	n = 45	F(2, 121)
	VIQ	105.02 (11.19)	107.00 (10.60)	109.89 (14.26)	1.9
	PIQ	105.94 (13.85)	109.93 (11.43)	114.67 (13.31)	5.30**
Psychosocial Functioning		n = 74	n = 70	n = 68	*F*(2, 209)

Depression	6.12 (7.23)	7.50 (7.51)	3.09 (4.60)	8.04***
Anxiety	4.49 (5.11)	5.87 (6.42)	3.28 (4.48)	3.99*
Stress	11.18 (8.7)	12.16 (8.44)	6.40 (6.23)	10.51***
Emotional Sensitivity	10.34 (8.43)	12.30 (7.98)	8.21 (8.34)	4.25*
Emotional Intensity	8.90 (5.97)	10.97 (6.23)	7.57 (5.95)	5.55**
Emotional Persistence	5.57 (3.98)	5.74 (3.74)	4.13 (3.78)	3.66*
Quality of Life	70.61 (18.09)	68.64 (19.65)	76.47 (16.86)	3.43*
Self-Esteem	32.62 (6.27)	30.61 (5.59)	35.25 (4.13)	12.62***
Gender Role	n = 82	n = 76	n = 69	*F*(2, 224)
Masculinity	93.74 (15.38)	99.47 (15.51)	104.86 (16.03)	9.52***
Femininity	99.99 (12.60)	89.13 (11.25)	93.07 (12.16)	16.54***
*Psychopathology**	n = 78	n = 71	n = 69	*F*(2, 215)
Scale 1 Hypochondria	53.33 (10.89) 12.8	52.35 (10.81) 11.3	50.61 (8.90) 4.3	1.31
Scale 2 Depression	54.78 (13.59) 21.8	54.28 (11.42) 15.5	49.01 (9.92) 4.3	5.19**
Scale 3 Hysteria	51.17 (11.14) 7.7	51.24 (10.22) 7	49.74 (9.88) 4.3	0.46
Scale 4 Psychopathic deviate	56.46 (11.66) 28.2	61.10 (12.08) 39.4	53.80 (12.22) 15.9	6.69**
Scale 5 Masculinity/ femininity	58.33 (9.58) 25.6	63.92 (12.85) 45.1	48.35 (9.78) 4.3	37.21***
Scale 6 Paranoia	51.89 (11.53) 12.8	55.41 (10.62) 19.7	49.65 (11.62) 8.7	4.66*
Scale 7	56.60 (12.49)	56.07 (11.67)	51.13 (12.43)	4.34*

Psychasthenia	24.4	21.1	11.6	
Scale 8 Schizophrenia	59.33 (12.97) 33.3	61.45 (11.31) 33.8	54.06 (11.39) 14.5	7.10*
Scale 9 Hypomania	54.15 (10.34) 11.5	54.89 (12.77) 16.9	55.30 (11.77) 15.9	0.19
Scale 0 Social introversion	49.46 (11.02) 7.7	52.73 (10.64) 11.3	47.42 (11.22) 10.1	4.20*

Note. Standard deviations are in parentheses
*MMPI-2: Percentages in clinical range (T > 65) listed under means and standard deviations

Table 6. Long-term effects (12 months) of cross-sex hormones on gender dysphoria in FTMs

Variable	Time	Mean (n = 14)	SD
Masculine Gender Dysphoria	1*	3.6	0.8
	2*	3.4	0.9
	3~	2.0	0.8
Transgender Gender Dysphoria	1*	3.3	0.7
	2	2.1	0.7
	3~	2.0	0.8

Note. Time points with distinct symbols differ from each other at the $p < .05$ level.

Table 7. Long-term effects (12 months) of cross-sex hormones on intelligence in FTMs using a MANOVA with time (T1 vs. T2 vs. T3) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 28)	(SD)	FTM (n = 14)	(SD)	Male (n = 27)	(SD)	Time F(2, 132)	Gender F(4,132)	Time x Gender F(4, 132)
VIQ	1	107.6	(10.8)	105.1	(10.0)	110.6	(14.9)	15.1***	1.1	1.2
	2	112.2	(9.8)	107.4	(10.9)	112.0	(13.4)			
	3	112.3	(10.6)	109.1	(12.1)	115.4	(13.4)			
PIQ	1	109.1	(13.9)	111.1	(12.0)	118.7	(12.8)	30.9***	3.3*	2.0~
	2	113.8	(12.3)	114.6	(9.9)	121.4	(11.5)			

3	115.3	(13.0)	118.7	(8.6)	121.4	(12.3)	

~ $p = .1$; * $p < .05$; *** $p < .001$

Table 8. Long-term effects (12 months) of cross-sex hormones on psychosocial functioning in FTMs using a MANOVA with time (T1 vs. T2 vs. T3) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 39)	(SD)	FTM (n = 31)	(SD)	Male (n = 36)	(SD)	Time F(2, 206)	Gender F(2,103)	Time x Gender F(4, 206)
Depression	1	7.1	(8.0)	5.2	(5.7)	2.6	(4.2)	1.0	5.2**	0.5
	2	6.4	(9.6)	3.4	(3.6)	2.7	(5.0)			
	3	6.3	(8.3)	4.1	(4.4)	2.8	(4.3)			
Anxiety	1	4.4	(5.0)	3.9	(5.2)	1.9	(2.3)	0.9	3.7*	0.1
	2	4.2	(6.3)	3.7	(3.9)	2.0	(3.6)			
	3	3.6	(4.4)	3.3	(5.8)	1.8	(2.3)			
Stress	1	11.4	(9.4)	11.4	(7.6)	5.0	(3.7)	4.1*	6.0**	4.3**
	2	10.8	(9.9)	7.1	(6.4)	5.9	(5.2)			
	3	10.4	(9.3)	6.7	(5.8)	5.9	(6.3)			
Sensitivity	1	10.7	(9.0)	11.4	(7.9)	7.5	(8.0)	2.3	5.1**	1.8
	2	11.5	(8.8)	8.2	(6.0)	6.0	(5.7)			
	3	11.5	(8.7)	8.5	(4.6)	5.9	(6.5)			
Intensity	1	9.8	(6.2)	10.3	(6.2)	7.4	(6.1)	2.7~	1.8	0.6
	2	9.1	(6.6)	8.8	(4.6)	7.1	(5.0)			
	3	9.0	(6.4)	8.2	(5.5)	7.2	(5.2)			
Persistence	1	6.1	(4.4)	5.2	(3.8)	4.3	(3.5)	3.8*	5.8*	0.9
	2	6.0	(4.1)	3.7	(3.1)	3.5	(3.2)			
	3	5.4	(4.1)	4.2	(3.0)	3.4	(3.0)			
Quality of Life	1	69.4	(20.6)	66.6	(21.3)	76.7	(13.8)	7.7**	2.1	1.0
	2	72.4	(21.2)	72.7	(17.6)	79.9	(13.7)			
	3	72.3	(21.1)	73.9	(16.5)	78.3	(15.0)			
Self Esteem	1	31.8	(6.8)	31.5	(5.5)	35.4	(4.4)	1.4	5.1**	0.7
	2	32.2	(5.9)	32.3	(5.7)	35.5	(5.0)			
	3	33.0	(6.3)	31.9	(5.4)	35.5	(4.2)			

~ $p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 9. Long-term effects (12 months) of cross-sex hormones on gender role in FTMs using a MANOVA with time (T1 vs. T2 vs. T3) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 47)	(SD)	FTM (n = 36)	(SD)	Male (n = 37)	(SD)	Time F(2, 234)	Gender F(2, 117)	Time x Gender F(4, 234)
Masculinity	1	93.7	(15.5)	98.1	(14.5)	103.4	(16.9)	1.4	5.2**	1.2
	2	91.8	(15.9)	97.9	(14.1)	102.5	(16.0)			
	3	94.0	(17.3)	96.8	(14.0)	105.1	(15.4)			
Femininity	1	99.6	(12.5)	87.7	(11.3)	92.6	(11.0)	1.4	14.2***	0.2
	2	98.7	(11.8)	86.6	(10.8)	90.8	(11.6)			
	3	99.1	(12.3)	87.5	(11.2)	90.6	(10.1)			

** $p < .01$

*** $p < .001$

Table 10. Long-term effects (12 months) of cross-sex hormones on psychopathology in FTMs using a MANOVA with time (T1 vs. T2 vs. T3) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 47)	(SD)	FTM (n = 33)	(SD)	Male (n = 36)	(SD)	Time F(2, 226)	Gender F(2,113)	Time x Gender F(4, 226)
Hypochondria	1	53.8	(10.6)	52.3	(10.3)	49.3	(8.0)	8.2***	1.8	2.0
	2	52.0	(8.6)	48.5	(9.3)	48.6	(9.4)			
	3	50.7	(10.3)	46.8	(10.7)	49.1	(9.8)			
Depression	1	55.7	(13.3)	53.7	(10.5)	48.4	(10.0)	3.6*	3.3*	1.7
	2	54.0	(12.8)	49.5	(10.0)	49.0	(10.3)			
	3	54.2	(14.7)	51.1	(12.2)	47.6	(10.3)			
Hysteria	1	52.4	(10.6)	51.1	(10.0)	48.9	(9.2)	4.8**	1.0	1.7
	2	50.8	(10.8)	46.9	(9.1)	48.8	(9.4)			
	3	49.9	(12.4)	46.9	(9.2)	49.2	(10.4)			
Psychopathic	1	57.5	(10.7)	57.2	(11.2)	51.8	(12.5)	7.3**	2.3	1.7
Deviate	2	55.1	(10.2)	52.8	(9.0)	49.8	(10.9)			
	3	54.3	(9.7)	52.6	(9.2)	52.1	(11.8)			
Mf	1	56.8	(10.3)	64.1	(10.7)	47.1	(10.0)	1.0	27.2***	0.3
	2	55.8	(10.6)	65.2	(11.4)	46.1	(12.8)			
	3	57.6	(11.7)	65.2	(11.0)	48.2	(14.6)			

Paranoia	1	53.0	(10.9)	54.4	(9.9)	47.9	(11.0)	5.4**	2.7~	4.3**
	2	53.1	(10.9)	48.0	(8.4)	47.3	(9.8)			
	3	51.7	(11.3)	48.0	(9.3)	48.6	(10.6)			
Psychasthenia	1	57.5	(12.3)	54.7	(12.4)	48.9	(12.4)	1.5	4.9**	1.4
	2	56.3	(11.9)	51.1	(9.8)	50.3	(10.5)			
	3	55.5	(11.5)	51.7	(11.5)	49.5	(9.0)			
Schizophrenia	1	59.5	(12.3)	60.0	(10.9)	51.6	(10.9)	7.6**	5.0**	1.2
	2	56.8	(10.1)	56.4	(10.7)	51.8	(8.6)			
	3	55.8	(9.3)	55.7	(12.2)	50.7	(9.7)			
Hypomania	1	53.4	(9.9)	51.2	(10.4)	52.6	(10.1)	7.6**	0.4	1.3
	2	52.1	(10.2)	51.2	(9.7)	52.6	(11.0)			
	3	50.9	(8.8)	50.8	(10.4)	54.1	(13.1)			
Social	1	50.0	(11.4)	54.2	(12.4)	46.8	(10.2)	0.2	3.4*	1.2
Introversion	2	50.8	(10.9)	53.8	(11.4)	47.5	(11.0)			
	3	51.9	(12.6)	53.5	(12.1)	47.0	(9.6)			

~ $p < .1$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 11. Number and percentage (in parentheses) of participants with clinical elevations on MMPI-2 scales over one year

Scale	Time	F (n = 47)	FTM (n = 33)	M (n = 36)
Hypochondria	1	7 (14.9)	2 (6.1)	1 (2.8)
	2	3 (6.4)	1 (3.0)	2 (5.6)
	3	4 (8.5)	2 (6.1)	1 (2.8)
Depression	1	10 (21.3)	3 (9.1)	1 (2.8)
	2	7 (14.9)	3 (9.1)	2 (5.6)
	3	6 (12.8)	5 (15.2)	2 (5.6)
Hysteria	1	4 (8.5)	2 (6.1)	1 (2.8)
	2	5 (10.6)	1 (3.0)	2 (5.6)
	3	5 (10.6)	1 (3.0)	3 (8.3)

Psychopathic Deviate	1	15 (31.9)	7 (21.2)	5 (13.9)
	2	6 (12.8)	3 (9.1)	4 (11.1)
	3	7 (14.9)	4 (12.1)	6 (16.7)
Masculinity/ Femininity	1	11 (23.4)	15 (45.5)	2 (5.6)
	2	9 (19.1)	15 (45.5)	4 (11.1)
	3	15 (31.9)	14 (42.4)	4 (11.1)
Paranoia	1	6 (12.8)	6 (18.2)	2 (5.6)
	2	7 (14.9)	0 (0.0)	2 (5.6)
	3	6 (12.8)	1 (3.0)	2 (5.6)
Psychasthenia	1	11 (23.4)	6 (18.2)	3 (8.3)
	2	11 (23.4)	2 (6.1)	2 (5.6)
	3	9 (19.1)	4 (12.1)	2 (5.6)
Schizophrenia	1	16 (34.0)	9 (27.3)	4 (11.1)
	2	9 (19.1)	9 (27.3)	1 (2.8)
	3	10 (21.3)	8 (24.2)	3 (8.3)
Hypomania	1	10 (21.3)	4 (12.1)	5 (13.9)
	2	5 (10.6)	3 (9.1)	4 (11.1)
	3	2 (4.3)	4 (12.1)	7 (19.4)
Social Introversion	1	4 (8.5)	6 (18.2)	3 (8.3)
	2	5 (10.6)	6 (18.2)	4 (11.1)
	3	7 (14.9)	4 (12.1)	2 (5.6)

Table 12. Non-Gendered MMPI-2 Means and Standard Deviations at the Initial Assessment

Scale	n = 78	n = 71	n = 70
Hypochondria	54.4 (10.9)	53.46 (10.8)	49.6 (8.6)
	16.7	16.9	4.3
Depression	56.6 (13.5)	56.4 (11.6)	47.3 (9.1)

	23.1	18.3	2.9
Hysteria	52.2 (11.3)	52.2 (10.4)	48.3 (9.5)
	10.3	7.0	4.3
Psychopathic deviate	55.7 (11.8)	60.6 (12.1)	54.2 (12.5)
	21.8	26.8	15.7
Masculinity/ Femininity	52.3 (5.7)	48.9 (7.6)	41.7 (7.1)
	2.6	1.4	0.0
Paranoia	52.4 (11.9)	55.9 (10.8)	49.6 (11.5)
	12.8	19.7	8.6
Psychasthenia	58.0 (12.9)	57.5 (12.1)	50.4 (10.4)
	32.1	25.4	10.0
Schizophrenia	59.5 (13.9)	61.6 (12.0)	54.1 (11.0)
	33.3	33.8	14.3
Hypomania	52.6 (10.1)	53.6 (12.7)	56.6 (11.8)
	11.5	16.9	20.0
Social introversion	51.8 (11.0)	55.1 (10.6)	47.7 (10.4)
	9.0	14.1	8.6

*Percentages in clinical range (T > 65) listed under Means and Standard Deviations

Table 13. Short-term effects (2 months) of cross-sex hormones on psychopathology in FTMs using a MANOVA with time (T1 vs. T2) as within-subjects factor and gender as between-subjects factor using Non-Gendered Norms

Variable	Time	Female (n = 59)	(SD)	FTM (n = 45)	(SD)	Male (n = 54)	(SD)	Time F(1, 155)	Gender F(2,155)	Time x Gender F(2, 155)
Hypochondria	1	54.1	(10.4)	54.7	(10.3)	48.6	(8.0)	7.2**	6.2**	3.0~
	2	53.4	(9.2)	50.6	(10.0)	48.1	(8.8)			
Depression	1	57.4	(13.5)	55.9	(10.3)	46.3	(8.6)	7.7**	13.9***	6.4**

	2	56.3	(12.8)	51.2	(10.3)	47.1	(9.1)			
Hysteria	1	52.3	(10.5)	52.0	(10.2)	48.1	(8.6)	5.4*	2.7~	3.0~
	2	51.6	(11.5)	48.0	(9.4)	48.1	(8.9)			
Psychopathic	1	56.2	(11.2)	59.7	(12.0)	52.4	(11.6)	20.4***	3.6*	3.3*
Deviate	2	54.3	(11.3)	54.2	(10.1)	50.7	(10.7)			
Mf	1	52.7	(5.9)	49.0	(7.0)	41.7	(7.5)	0.8	41.7***	1.5
	2	53.3	(6.4)	47.6	(7.2)	41.3	(9.2)			
Paranoia	1	53.4	(12.3)	56.2	(11.7)	48.0	(10.9)	12.1**	4.5*	9.2***
	2	53.0	(11.7)	49.5	(8.8)	47.9	(10.0)			
Psychasthenia	1	59.4	(12.6)	56.3	(12.4)	48.2	(9.2)	4.5*	11.0***	5.1**
	2	57.5	(13.3)	52.3	(10.7)	49.7	(10.1)			
Schizophrenia	1	59.7	(13.4)	62.2	(13.4)	51.7	(10.2)	10.6**	6.7**	7.0**
	2	56.7	(12.1)	57.6	(12.3)	52.9	(9.0)			
Hypomania	1	52	(10.4)	52.5	(12.3)	54.7	(10.4)	0.2	1.5	0.4
	2	51.2	(10.8)	52	(10.9)	55.2	(12.5)			
Social	1	51.7	(10.9)	56	(11.3)	47.2	(10.0)	1.2	7.7**	0.5
Introversion	2	52.2	(10.6)	55.9	(10.8)	48.3	(10.8)			

~ $p < .1$
* $p < .05$
** $p < .01$
*** $p < .001$

Table 14. Number and percentage (in parentheses) of participants with clinical elevations on MMPI-2 scales over three months

Scale	Time	F (n = 59)	FTM (n = 45)	M (n = 54)
Hypochondria	1	10 (17.0)	7 (15.6)	1 (1.9)
	2	7 (12.0)	4 (8.9)	1 (1.9)
Depression	1	14 (23.7)	6 (13.3)	1 (1.9)
	2	11 (18.6)	4 (8.9)	2 (3.7)

Hysteria	1	6 (10.2)	3 (6.7)	1 (1.9)
	2	7 (11.9)	1 (2.2)	3 (5.6)
Psychopathic Deviate	1	13 (22.0)	11 (24.4)	6 (11.1)
	2	8 (13.6)	5 (11.1)	6 (11.1)
Masculinity/ Femininity	1	2 (3.4)	0	0
	2	2 (3.4)	0	0
Paranoia	1	8 (13.6)	10 (22.2)	3 (5.6)
	2	9 (15.3)	0	2 (3.7)
Psychasthenia	1	20 (33.9)	11 (24.4)	3 (5.6)
	2	14 (23.7)	4 (8.9)	3 (5.6)
Schizophrenia	1	19 (32.2)	16 (35.6)	5 (9.3)
	2	12 (20.3)	14 (31.1)	3 (5.6)
Hypomania	1	7 (11.9)	7 (15.6)	9 (16.7)
	2	6 (10.2)	8 (17.8)	12 (22.2)

Social		5	8	4
Introversion	1	(8.5)	(17.8)	(7.4)
	2	5 (8.5)	11 (24.4)	5 (9.3)

Table 15. Long-term effects (12 months) of cross-sex hormones on psychopathology in FTMs using a MANOVA with time (T1 vs. T2 vs. T3) as within-subjects factor and gender as between-subjects factor using Non-Gendered Norms

Variable	Time	Female (n = 48)	(SD)	FTM (n = 33)	(SD)	Male (n = 36)	(SD)	Time F(2, 228)	Gender F(2,114)	Time x Gender F(4, 228)
Hypochondria	1	54.7	(10.5)	53.4	(10.3)	48.3	(7.7)	8.2***	3.6*	1.9
	2	52.8	(8.9)	49.6	(9.3)	47.5	(9.1)			
	3	51.5	(10.2)	48.2	(10.8)	48.1	(9.4)			
Depression	1	57.6	(13.1)	55.9	(10.7)	46.7	(9.0)	4.5*	8.4***	1.8
	2	55.8	(12.7)	51.5	(10.4)	47.2	(9.8)			
	3	55.8	(14.4)	52.8	(12.4)	46.1	(9.7)			
Hysteria	1	53.1	(10.8)	52.0	(10.2)	47.6	(8.9)	4.6*	2.1	1.6
	2	51.4	(11.0)	47.9	(9.3)	47.5	(9.1)			
	3	50.8	(12.6)	48.1	(9.2)	48.0	(9.9)			
Psychopathic Deviate	1	56.6	(10.9)	56.7	(11.3)	52.2	(12.8)	8.2***	1.0	1.6
	2	54.0	(10.6)	52.1	(9.1)	50.2	(11.2)			
	3	52.9	(10.8)	51.9	(9.3)	52.1	(12.5)			
Mf	1	53.1	(6.1)	48.7	(6.2)	40.7	(7.1)	0.8	42.2***	0.4
	2	53.7	(6.2)	48.3	(6.9)	40.0	(9.2)			
	3	52.6	(7.0)	48.3	(6.6)	39.8	(8.2)			
Paranoia	1	53.7	(11.2)	54.9	(10.1)	47.8	(10.9)	6.9**	3.3*	4.1**
	2	53.1	(11.2)	48.3	(8.7)	47.0	(9.8)			
	3	51.9	(11.6)	48.2	(9.6)	48.3	(10.3)			
Psychasthenia	1	59.0	(12.8)	56.2	(12.9)	48.7	(9.1)	3.0~	8.2***	1.1
	2	57.5	(12.2)	52.3	(10.0)	49.2	(9.9)			
	3	56.8	(11.7)	52.9	(11.9)	48.6	(8.7)			
Schizophrenia	1	59.6	(13.0)	60.1	(11.5)	51.7	(10.	7.7**	4.4*	1.4

							7)			
	2	56.4	(10.9)	56.4	(11.3)	51.9	(8.5)			
	3	55.7	(9.8)	55.9	(12.2)	50.8	(9.6)			
Hypomania	1	51.7	(9.4)	49.9	(10.0)	53.6	(10.0)	0.1	2.0	1.0
	2	51.1	(10.0)	50.0	(9.4)	53.5	(11.0)			
	3	49.8	(8.7)	49.7	(10.1)	54.9	(13.2)			
Social	1	52.4	(11.3)	56.6	(12.3)	47.3	(9.5)	0.4	6.1**	1.0
Introversion	2	53.0	(10.8)	56.4	(11.4)	47.8	(10.3)			
	3	54.1	(12.6)	56.0	(12.0)	47.5	(9.0)			

~ $p < .1$
* $p < .05$
** $p < .01$
*** $p < .001$

Table 16. Number and percentage (in parentheses) of participants with clinical elevations on MMPI-2 scales over one year using Non-Gendered Norms

Scale	Time	F (n = 48)	FTM (n = 33)	M (n = 36)
Hypochondria	1	9 (20.0)	4 (12.1)	1 (2.8)
	2	5 (10.0)	2 (6.1)	1 (2.8)
	3	5 (10.0)	2 (6.1)	1 (2.8)
Depression	1	10 (20.8)	4 (12.1)	0
	2	8 (16.7)	4 (12.1)	2 (5.6)
	3	8 (16.7)	5 (15.2)	2 (5.6)
Hysteria	1	5 (10.4)	2 (6.1)	1 (2.80
	2	5 (10.4)	1 (3.0)	2 (5.6)
	3	6 (12.5)	1 (3.0)	3 (8.3)
Psychopathic Deviate	1	11 (22.9)	5 (15.2)	5 (13.9)
	2	5 (10.4)	2 (6.1)	4 (11.1)
	3	5 (10.4)	2 (6.1)	6 (16.7)

Masculinity/		2	0	0
Femininity	1	(4.2)		
		2	0	0
	2	(4.2)		
		2	0	1
	3	(4.2)		(2.8)
		6	6	2
Paranoia	1	(12.5)	(18.2)	(5.6)
		7	0	2
	2	(14.6)		(5.6)
		6	1	2
	3	(12.5)	(3.0)	(5.6)
		17	7	3
Psychasthenia	1	(35.4)	(21.2)	(8.3)
		12	2	2
	2	(25.0)	(6.1)	(5.6)
		11	4	1
	3	(22.9)	(12.1)	(2.8)
		16	9	4
Schizophrenia	1	(33.3)	(27.3)	(11.1)
		9	9	1
	2	(18.8)	(27.3)	(2.8)
		10	8	3
	3	(20.8)	(24.2)	(8.3)
		6	4	6
Hypomania	1	(12.5)	(12.1)	(16.7)
		5	3	6
	2	(10.4)	(9.1)	(16.7)
		2	4	9
	3	(4.2)	(12.1)	(25.0)
Social		5	8	2
Introversion	1	(10.4)	(24.2)	(5.6)
		5	9	3
	2	(10.4)	(27.3)	(8.3)
		9	6	2
	3	(18.8)	(18.2)	(5.6)

Table 17. Short-term effects (3 months) of cross-sex hormones on intelligence in FTMs using a MANOVA with time (T1 vs. T2) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 33)	(SD)	FTM (n = 20)	SD	Male (n = 36)	(SD)	Time F(1, 86)	Gender F(2, 86)	Time x Gender F(2, 86)
VIQ	1	107.6	(12.5)	107.4	(10.0)	112.7	(13.8)	10.7**	0.8	2.8~
	2	112.1	(12.7)	110.6	(12.9)	113.0	(12.9)			

PIQ	1	109.4	(13.2)	110.5	(11.3)	116.9	(13.0)	25.0***	3.1*	0.8
	2	113.7	(11.9)	113.9	(9.5)	119.3	(12.0)			

~ $p < .1$
* $p < .05$
** $p < .01$
*** $p < .001$

Table 18. Short-term effects (3 months) of cross-sex hormones on psychosocial functioning in FTMs using a MANOVA with time (T1 vs. T2) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 54)	(SD)	FTM (n = 46)	(SD)	Male (n = 51)	(SD)	Time F(1, 148)	Gender F(2,148)	Time x Gender F(2, 148)
Depression	1	6.4	(7.3)	7.0	(6.9)	2.7	(4.0)	1.6	4.9**	2.0
	2	5.8	(8.3)	5.1	(5.9)	3.3	(5.1)			
Anxiety	1	4.7	(5.7)	5.2	(6.1)	2.3	(2.7)	0.9	4.1*	0.7
	2	4.0	(5.7)	4.5	(4.9)	2.6	(4.2)			
Stress	1	11.4	(9.1)	12.3	(8.1)	5.6	(4.4)	4.7*	8.4***	4.7*
	2	10.3	(9.0)	9.1	(7.4)	6.4	(5.6)			
Sensitivity	1	10.4	(8.4)	12.9	(8.5)	7.3	(7.3)	4.2*	6.6**	2.6~
	2	10.7	(8.2)	9.9	(7.0)	6.3	(6.0)			
Intensity	1	9.2	(6.0)	11.3	(6.6)	7.3	(5.6)	1.6	5.5**	0.4
	2	8.8	(5.9)	10.3	(5.8)	7.2	(5.0)			
Persistence	1	5.7	(4.0)	5.4	(3.8)	4.2	(3.5)	4.7*	3.6*	1.0
	2	5.5	(3.8)	4.3	(3.3)	3.6	(3.2)			
Quality of Life	1	69.7	(20.0)	65.0	(20.5)	74.5	(17.0)	7.5**	2.5	1.0
	2	71.4	(20.9)	70.2	(18.4)	76.6	(16.4)			
Self Esteem	1	32.4	(6.6)	30.9	(5.7)	35.1	(4.1)	1.5	6.3**	1.0
	2	32.7	(5.9)	31.8	(5.7)	35.0	(4.7)			

~ $p < .1$
* $p < .05$
** $p < .01$
*** $p < .001$

Table 19. Short-term effects (3 months) of cross-sex hormones on gender role in FTMs using a MANOVA with time (T1 vs. T2) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 58)	(SD)	FTM (n = 50)	(SD)	Male (n = 53)	(SD)	Time F(1, 158)	Gender F(2, 158)	Time x Gender F(2, 158)
Masculinity	1	94.5	(16.2)	98.7	(15.1)	103.6	(16.0)	0.5	5.7**	0.7
	2	92.9	(17.0)	99.0	(14.7)	103.3	(15.3)			
Femininity	1	101.0	(12.2)	88.5	(10.7)	91.4	(12.1)	5.6*	20.9***	0.2
	2	99.9	(11.5)	86.4	(10.8)	89.9	(13.2)			

* $p < .05$
** $p < .01$
*** $p < .001$

Table 20. Short-term effects (3 months) of cross-sex hormones on psychopathology in FTMs using a MANOVA with time (T1 vs. T2) as within-subjects factor and gender as between-subjects factor

Variable	Time	Female (n = 58)	(SD)	FTM (n = 45)	(SD)	Male (n = 54)	(SD)	Time F(1, 154)	Gender F(2,154)	Time x Gender F(2, 154
Hypochondria	1	53.2	(10.4)	53.6	(10.3)	49.6	(8.2)	6.7**	2.3	2.9~
	2	52.6	(9.0)	49.5	(9.9)	49.2	(9.1)			
Depression	1	55.5	(13.8)	53.6	(10.1)	48.0	(9.5)	6.0*	5.4**	6.0**
	2	54.5	(13.0)	49.2	(9.8)	48.9	(9.6)			
Hysteria	1	51.5	(10.3)	51.1	(10.1)	49.5	(9.0)	5.1*	0.9	3.4*
	2	51.0	(11.2)	47.0	(9.2)	49.5	(9.3)			
Psychopathic	1	57.1	(11.1)	60.2	(12.0)	52.0	(11.3)	18.9***	5.7**	2.9~
Deviate	2	55.3	(11.0)	54.9	(10.0)	50.3	(10.4)			
Mf	1	57.6	(10.0)	63.6	(11.9)	48.4	(10.5)	0.4	32.6***	2.1
	2	56.6	(11.0)	66.3	(12.1)	48.0	(12.8)			
Paranoia	1	52.7	(11.9)	55.6	(11.5)	48.2	(11.1)	9.9**	3.5*	10.1***
	2	53.0	(11.5)	49.1	(8.5)	48.2	(10.0)			
Psychasthenia	1	57.9	(12.3)	54.9	(12.0)	48.7	(11.5)	2.2	6.4**	5.7**
	2	56.3	(12.9)	51.1	(10.6)	50.9	(10.6)			
Schizophrenia	1	59.6	(12.7)	61.9	(12.6)	51.6	(10.4)	9.5**	7.2**	6.6**

	2	56.9	(11.4)	57.5	(11.7)	52.8	(9.2)			
Hypomania	1	53.7	(10.7)	53.8	(12.4)	53.7	(10.5)	0.5	0.1	0.8
	2	52.3	(10.9)	53.2	(11.2)	54.3	(12.5)			
Social	1	49.3	(11.1)	53.6	(11.3)	46.9	(10.7)	1.3	4.0*	0.8
Introversion	2	50.0	(10.6)	53.3	(10.8)	48.0	(11.5)			

~ $p < .1$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 21. Number and percentage (in parentheses) of participants with clinical elevations on MMPI-2 scales over three months

Scale	Time	F (n = 58)	FTM (n = 45)	M (n = 54)
Hypochondria	1	7 (12.1)	5 (11.1)	1 (1.9)
	2	4 (6.9)	2 (4.4)	2 (3.7)
Depression	1	14 (24.1)	5 (11.1)	2 (3.7)
	2	10 (17.2)	3 (6.7)	2 (3.7)
Hysteria	1	4 (6.9)	3 (6.7)	1 (1.9)
	2	7 (12.1)	1 (2.2)	3 (5.6)
Psychopathic Deviate	1	17 (29.3)	15 (33.3)	6 (11.1)
	2	10 (17.2)	7 (15.6)	6 (11.1)
Masculinity/ Femininity	1	13 (22.4)	21 (46.7)	3 (5.6)
	2	12 (20.7)	23 (51.1)	6 (11.1)
Paranoia	1	8 (13.8)	10 (22.2)	3 (5.6)
	2	9 (15.5)	0 (0.0)	2 (3.7)
Psychasthenia	1	14 (24.1)	10 (22.2)	4 (7.4)
	2	13 (22.4)	4 (8.9)	3 (5.6)
Schizophrenia	1	19 (32.8)	16 (35.6)	5 (9.3)
	2	12 (20.7)	14 (31.1)	3 (5.6)

Hypomania	1	7 (12.1)	7 (15.6)	8 (14.8)
	2	6 (10.3)	8 (17.8)	9 (16.7)
Social Introversion	1	4 (6.9)	6 (13.3)	5 (9.3)
	2	5 (8.6)	7 (15.6)	5 (9.3)

Table 22. Qualitative descriptions of testosterone related changes

	T1 (n = 21)	T2 (n = 49)	T3 (n = 38)
Physical			
Voice			
Deepened voice	11	44	26
Sexual Functioning			
Increased sex drive	9	25	14
Decrease in sex drive		1	
Enlargement of the clitoris	6	23	9
Lighter menses		1	
Cessation of menses		4	4
Increased genital sensitivity		2	1
Increased nipple sensitivity		1	
Increased vaginal lubrication			2
Decreased vaginal lubrication		1	
Erections easier to get and maintain		1	
Gained ability to have multiple orgasms			1
Increased vaginal infections			1
Hair/nails			
Increased hair growth	7	40	28
Darker hair		4	3
Receding hairline		3	3
Curlier hair			1
Faster and thicker nail growth		3	3
Skin			
Increased acne	6	14	11
Reduced acne		1	
Increased oily skin		2	1
Thickened skin texture		3	1
Darker skin			1

Body			
Increased muscle mass	5	26	17
Increased body mass	2	14	9
Fat redistribution	2	15	15
Weight loss		2	1
Face structure change	1	10	8
Breast mass reduction		1	1
Increased height		1	
Developed small Adam's apple		1	1
Somatic			
Body odor changed	3	7	4
Increased sweat	1	6	2
Increased appetite	2	10	5
Increased thirst	1	1	
Taste preferences changed		2	
Better hearing		1	
Better sense of smell		1	
Increased clumsiness		1	
Faster metabolism			1
Increased snoring		1	
Negative Side Effects			
Increased heart palpitations		1	
Increased blood pressure			1
Worsening of sleep apnea			1
Psychological			
Emotional			
Increased well being/happiness	3	11	7
Increased confidence	3	6	7
Increased emotional stability	2	8	6
Increased mood swings		2	1
Increased irritability	1	6	3
Decreased empathy			1
Increased restlessness			1
Decreased restlessness			1
Increased aggression			2
Decreased patience		2	1
Increased patience		1	3
Decreased anger			1
More calm/relaxed		4	5
Increased assertiveness		4	4

Increased intense emotions that appear slower			4
Decreased social anxiety		2	1
Decreased general anxiety			2
Increased general anxiety		1	1
Decreased depression		1	4
Increased desire for emotional intimacy		1	
More in touch with emotions			1
Increased difficulty accessing feelings			1
Less emotional			7
Less emotional persistence		1	
Less emotional sensitivity		1	1
Decreased desire to talk about feelings			1
Increased dysphoria related to chest and genitals		1	
Less dysphoric related to non-chest or genital body areas		1	1
Decreased overall body dysphoria			2
More comfortable with femininity			1
Increased comfort with self			1
Increased hopefulness		1	1
Increased self-esteem			2
Less jealous/insecure			1
Increased empathy			1
Increased generosity			1
Increased self-reliance			3
More easily embarrassed			1
Decreased stress			1
Cognitive			
Better memory	1		
Decreased attention span			3
Increased concentration			1
Behavioral			
More energy	2	4	2
Increased fatigue		1	
More social	1	1	5
Lack of sleep		1	
Sleep better and more	2	3	1
Cry less		6	8
Less emotional eating		1	
More productive	1		
More concise language			2
Difficulty communicating		2	

Worse handwriting	1	
Clearer thinking		2
Handle decision making better		1
Increased athletic endurance		1
Increased enjoyment of physical activity		2
Enjoy statistics/math more		1
Sexual		
More visually sexually oriented	2	1
Increased attraction to men	1	
Sex feels better	1	
Spiritual		
Increased spirituality		1

APPENDIX A

RECRUITMENT

FTM RESEARCH STUDY!

Are you 18 or older? Do you currently identify as a female-to-male transgender or transsexual, or have identified as FTM in the past and now identify as male but have NOT started T or JUST started within the past month?

A self-identified transgender male, Stacey Colt Meier, is conducting a research study on persons who identify as transgender men. He is a doctoral student at the University of Houston and the results from this study will be used for his Doctoral Dissertation. The purpose of this research is to examine changes in cognitive functioning, emotional reactivity, and personality due to testosterone. In order to qualify for this study you must be at least 18 years old. You must not have started testosterone or taken testosterone for less than one month before the first testing session. You must plan to start testosterone within the next few months and plan on taking testosterone for at least one year. If you are interested, email Colt at ftmresearch@gmail.com with your first name and telephone number. He or his assistant Levi will call you for an initial telephone screen. The study consists of three measures lasting 2 to 3 hours each. These measures will be conducted over the period of one year: first pre-T, second 3-4 months after starting T, and third 10-12 months after starting T. You will be asked to fill out questionnaires that assess basic demographic information, personal transitioning plans, personality, and emotional reactivity. Local participants will also take a psychological test that measures intellectual functioning. Non-local participants will be mailed questionnaires. This study has been reviewed by the Committee for Protecting Human Subjects at the University of Houston.

Stacey “Colt” Meier
University of Houston
Department of Psychology
126 Heyne Building
Houston, TX
77204-5022

DATE

Dear (Insert Provider Name Here):

My name is Stacey “Colt” Meier. I am currently serving on the Operations Committee for the Transgender Foundation of America and as the President and Coordinator of STAG, the Female to Male Transsexual (FTM) support group in Houston. I am beginning my third year in the Clinical Psychology doctoral program at the University of Houston and have begun research on FTMs for my dissertation.

I am writing you to inform you of my research on FTMs. We know many of the physical changes brought about by testosterone treatment, yet there have not been any studies in the United States examining the psychological changes associated with starting testosterone. This is due to the lack of longitudinally designed studies and the difficulty associated with recruiting this population. My dissertation requires me to measure at least 30 FTMs before they begin testosterone, three to four months after their first dose and ten to twelve months after their first dose. Each appointment will be held at the University of Houston and will last 2.5-3 hours. I’ve included a copy of the consent form for you to look over.

I am writing to you because of you work with FTMs in your practice. If you work with FTMs beginning their transition that may be interested in finding out more about FTM research or participating in this study, please refer them to me as soon as possible before they being taking testosterone. Recruitment will continue over the next 1.5 years.

If you have any questions or concerns about the project, please contact me at ftmresearch@gmail.com

Thank you for your time,

Stacey “Colt” Meier

FTM Phone Interview

1. Do you identify as an FTM?

_____

2. How old are you?

_____

3. Where do you live?

_____

4. Are you right or left handed?

_____

5. Have you started testosterone?

_____

6. When are you beginning testosterone treatment?

_____

7. Do you plan to take testosterone for at least one year?

_____

8. Are you willing to be tested on three different occasions for three hours each time during the first year you are on testosterone?

_____

Appendix B

SCRIPTS

Undergraduate Research Assistant Script

"Thank you for coming in today. We really value your participation."
(To females) "Before we begin, I have a quick question for you. Are you menstruating today?"

- If "yes," proceed. If "no," reschedule.

"As you know, this is a longitudinal study on the effects of hormones on cognitive functioning and personality. Since it is longitudinal, we will ask that you come in 3 months from now and 10 months from now for follow-up sessions where you'll do the same things you'll be doing today. Is this something you can commit to?"

- If "yes," proceed. If "no," discontinue.

"First, we're going to go over the consent form together." (Hand the participant the consent form and read the following points aloud).

- The non-participation statement basically says that your participation is voluntary and that you may withdraw at any time. You may also refuse to answer any question.

- In terms of procedures, you will be one of 60 participants in the control group. You will be asked to do things like define words, solve different kinds of problems, and complete questionnaires. Each session will last approximately 2-3 hours.

- In terms of risks and discomforts, you will be asked some questions that may be personal. Again, you may refuse to answer any question or withdraw your participation at any time. If any of the questions are upsetting to you, and you would like to talk about them, please let me know, and I can refer you to someone who can help

- The confidentiality sections states that everything you say in this room will be confidential with two exceptions. One is if you indicate any thoughts or intents to harm yourself or someone else, and two is if you mention child or elder abuse. In these cases, I will need to talk to my supervisor to ensure everyone's safety.

- In terms of incentives, you will receive 3 hours of extra credit immediately after each session.

- The benefits section states that you may not directly benefit from participating; however, you will help us to increase our understanding of changes in cognitive functioning and personality over time. In addition, you will receive extra credit, and at the end of the second session, you will receive a $10 gift card and at the end of the third session, you will receive a $20 gift card.

- In terms of alternatives, the only alternative to participating is to withdraw from the study.

- Lastly, in for the publication statement, data we collect from you and the other participants may be published in a journal or presented on a poster. In this case, your information will not be singled out. It will be grouped with everyone else's.

"Do you have any questions?"
- If "yes," answer as best you can. If "no," obtain the participant's signature.
- After they sign, offer to give them a copy of the consent form for their records.

"What I'd like you to do now is fill out some brief questionnaires. Some of them are front and back, so be sure to double check. It will take about 10-15 minutes." (Go over the directions for EACH questionnaire with the participant and have them fill out the last three questions on the demographic questionnaire to make sure that they qualify before they fill out the rest of the questionnaires).
(During this time, offer the participant a bag of chips and beverage. Please sit in the room with the control while he or she fills out the brief questionnaires.)
(Explaining the MMPI):
"Now you are going to take another questionnaire. This test consists of over 500 statements. Read each statement and decide whether it is true as applied to you or false as applied to you. Mark the answers on the answer sheet.
Notice that #1 starts here (point to #1 on the answer sheet). The items on this test range from 'I like mechanics magazines' to 'evil spirits possess me at times' to 'I would like to be a florist' to 'I've tried to harm myself and no one knows it'.
Items may not be 100% true or 100% false, but choose whether they are mostly true or mostly false. Don't spend too much time thinking about each item. Most people finish in about an hour."

Graduate Assistant Script

This is a longitudinal study designed to examine psychological changes due to testosterone treatment in female to male transsexuals (FTMs).

Local and non-local FTMs are the experimental group and males and females will serve as the two control groups.

Subjects that come into the PRSC for their assessments will come in three times (typically lasts 2.5-3 hours):
T1 at 0 months
T2 between 3 and 4 months after T1
T3 between 10 and 12 months after T1

Females will need to be menstruating during their assessment in order to control for varying hormone levels during their cycle. If they are taking birth control, then they will need to be on the same dose during the entire study. Males can come in at any time.

Generally we will have one RA and one GA run the subject who comes in for their appointment. (If you have time, you and the RA may run multiple subjects at a time, or you may run a subject without an RA present). The RA is to greet the subject and start them on the questionnaires and the MMPI (while the subject is working on the MMPI, the RA should make them a folder if it is T1 and enter their data into the excel file), then the GA is to check their MMPI critical items and administer the WASI. If the subject has not done a WRAT-4, the GA will give them the WRAT-4 reading subtest.

The GA will pay the subject out with gift cards. If the started the study after 4/2010, they receive $10 at T2 and $20 at T3. If they started the study before 4/2010, they receive $10 at T3 only. The GA will have the participant sign the 'payment received' form and place the form in the receipt folder. The GA will ensure that we have the subject's contact information and the subject knows when they are to come back for the next measure. The GA will email the research coordinator to let them know that the subject showed up (or not) so that they can give them SONA credit and mark their participation on the excel sheet.

The GA will score the WASI and WRAT-4 and leave the materials in the subject's file.

The RAs are responsible for data entry.

******If a critical item is marked TRUE on the MMPI***, talk to the subject and assess for current or past suicidal ideation/attempts. If the subject is not distraught or suicidal, you may proceed with the WASI/WRAT-4 after asking about any critical items. *No matter what*, call Dr. Babcock and inform her before the subject leaves. She may ask you to give them a referral etc.
***Subjects must have at least an 8th grade reading level. Inform me ASAP if a subject does not meet this requirement.

Appendix C

CONSENT FORMS

FTMs

The University of Houston

FTM Testosterone Study

CONSENT BY SUBJECT FOR PARTICIPATION IN A RESEARCH PROJECT

PROJECT TITLE: Psychological effects of exogenous testosterone on female-to-male transsexuals: A longitudinal study on cognitive functioning, personality changes, and emotional reactivity

Principal Investigator: Stacey Meier, B.A.
Faculty Sponsor: Julia Babcock, Ph.D.

You are being invited to participate in a research project conducted by Dr. Julia Babcock and Stacey Meier from the Psychology Department at the University of Houston. Stacey Meier is a doctoral student in Clinical Psychology and this project is part of his doctoral dissertation. The project is being conducted under the supervision of Dr. Julia Babcock who is an Associate Professor of Psychology at the University of Houston. Stacey Meier identifies as a member of the transmasculine community.

NON-PARTICIPATION STATEMENT

Your participation is voluntary and you may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to answer any question.

This is an optional research study, which involves answering personal questions concerning your status as a transgender male. The purpose of this research is to examine the effects of testosterone on psychological functioning in female to male transsexuals.

PROCEDURES

You will be one of approximately 50 subjects to be asked to participate in this project.

By signing this consent form, you are giving your consent to participate in this research study. You will be asked to complete questionnaires that ask you questions regarding your age, religious preference, sexual orientation, gender identification, emotional reactivity, and personality. You will be asked to answer a battery of questions from a

psychological test that measures intellectual functioning. All of these procedures will be repeated three to four months from the original session and once more ten to twelve months after the original session. Each session will last approximately 3 hours. Your total time commitment to this project will be no longer than 9 hours.

Your contact information will be retained so that you may be contacted again in 5 to 7 years in order to complete a long term follow up measure.

RISKS/DISCOMFORTS

These procedures may entail some personal discomfort in revealing personal feelings and opinions. You will be asked sensitive, personal, and potentially upsetting questions like: "what biological sex were you identified as at birth?" "have you ever been married?" "Have you ever attempted suicide?" You may stop your participation at any time without any loss of benefits otherwise entitled to you.

CONFIDENTIALITY

Researchers will assign a unique identification number to your information, which will be stored in a confidential, secure file that only members of the research team have access to. Your data will not be connected to your name.

You will not be asked any questions about elder abuse, child abuse or neglect of your children, but if you disclose such things, the researchers are obligated by law to make a report to the Child Protective Services. If you reveal a plan to harm or kill yourself or someone else, the researchers may also be obligated by law to report this to the authorities.

BENEFITS

While you will not directly benefit from participation, your participation may help investigators better understand the effects of testosterone in the female-to-male transgender population. The investigator will also explain your results on your personality and IQ tests to you. If you complete all three measures, you will receive a total of $40 in gift cards to Target, Barnes and Noble, or Smoothie King. You will receive $10 at your first measure, $10 at your second measure and $20 at your third measure.

ALTERNATIVES

Participation in this project is voluntary and the only alternative to this project is non-participation.

PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual participant will be identified.

While you will not receive feedback on your individual results, if you are interested in receiving the publications resulting from this research, these will be provided to you when they are available. Notify the research assistant if this is something you would like.

If you have any questions, you may contact Stacey Meier at ftmresearch@gmail.com. You may also contact Dr. Julia Babcock, faculty sponsor, at 713-743-8621.

I HAVE READ THE INFORMATION PROVIDED ABOVE AND HAD MY QUESTIONS ANSWERED TO MY SATISFACTION. I VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY. AFTER IT IS SIGNED, I WILL RECEIVE A COPY OF THIS CONSENT FORM.

_____
Name (Please print)

_____ _____
Signature of Research Participant Date

_____ _____
Signature of Principal Investigator Date

ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204).

Controls

The University of Houston

FTM Research Study

CONSENT BY SUBJECT FOR PARTICIPATION IN A RESEARCH PROJECT

PROJECT TITLE: A longitudinal study on cognitive functioning, personality changes, and emotional reactivity induced by exogenous testosterone

Principal Investigator: Stacey Meier, B.A.
Faculty Sponsor: Julia Babcock, Ph.D.

You are being invited to participate in a research project conducted by Dr. Julia Babcock and Stacey Meier from the Psychology Department at the University of Houston. Stacey Meier is a doctoral student in Clinical Psychology and this project is part of his doctoral dissertation. The project is being conducted under the supervision of Dr. Julia Babcock who is an Associate Professor of Psychology at the University of Houston.

NON-PARTICIPATION STATEMENT

Your participation is voluntary and you may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to answer any question.

This is an optional research study, which involves answering personal questions concerning your personality and cognitive functioning over a one year period of time. The purpose of this research is to examine the effects of testosterone on psychological functioning in female to male transsexuals. Non-transsexuals are asked to participate in this research to serve as a control group.

PROCEDURES

You will be one of approximately 100 subjects to be asked to participate in this project.

By signing this consent form, you are giving your consent to participate in this research study. You will be asked to complete questionnaires that ask you questions regarding your age, religious preference, sexual orientation, emotional reactivity, and personality. You will be asked to answer a battery of questions from a psychological test that measures intellectual functioning. All of these procedures will be repeated three to four months from the original session and once more ten to twelve months after the original session. Each session will last approximately 3 hours. Your total time commitment to this project will be no longer than 9 hours.

Your contact information will be retained so that you may be contacted again in 5 to 7 years in order to complete a long term follow up measure.

RISKS/DISCOMFORTS

These procedures may entail some personal discomfort in revealing personal feelings and opinions. You will be asked sensitive, personal, and potentially upsetting questions like: "have you ever been married?" "Have you ever attempted suicide?" You may stop your participation at any time without any loss of benefits otherwise entitled to you.

CONFIDENTIALITY

Researchers will assign a unique identification number to your information, which will be stored in a confidential, secure file that only members of the research team have access to. Your data will not be connected to your name.
You will not be asked any questions about elder abuse, child abuse or neglect of your children, but if you disclose such things, the researchers are obligated by law to make a report to the Child Protective Services. If you reveal a plan to harm or kill yourself or someone else, the researchers may also be obligated by law to report this to the authorities.

INCENTIVES/RENUMERATION

If you are enrolled in a psychology course at the University of Houston, you will receive 2 to 3 hours of credit for a psychology course each session you participate in this study.

BENEFITS

While you will not directly benefit from participation, your participation may help investigators better understand any changes that take place in personality, emotional reactivity and cognitive functioning over time. If you complete all three measures, you will receive a total of $40 in gift cards to Target, Barnes and Noble, or Smoothie King. You will receive $10 at your first measure, $10 at your second measure and $20 at your third measure.

ALTERNATIVES

Participation in this project is voluntary and the only alternative to this project is non-participation.

PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual participant will be identified.

While you will not receive feedback on your individual results, if you are interested in receiving the publications resulting from this research, these will be provided to you when they are available. Notify the research assistant if this is something you would like.

If you have any questions, you may contact Stacey Meier at ftmresearch@gmail.com. You may also contact Dr. Julia Babcock, faculty sponsor, at 713-743-8621.

I HAVE READ THE INFORMATION PROVIDED ABOVE AND HAD MY QUESTIONS ANSWERED TO MY SATISFACTION. I VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY. AFTER IT IS SIGNED, I WILL RECEIVE A COPY OF THIS CONSENT FORM.

_____
Name (Please print)

_____ _____
Signature of Research Participant Date

_____ _____
Signature of Principal Investigator Date

ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204).

FTM Assent

UNIVERSITY OF HOUSTON
ASSENT TO PARTICIPATE IN A RESEARCH STUDY

PROJECT TITLE: Psychological effects of exogenous testosterone on female-to-male transsexuals: A longitudinal study on cognitive functioning, personality changes, and emotional reactivity.

You are invited to participate in a research study conducted by Stacey "Colt" Meier a Clinical Psychology Doctoral Student at the University of Houston.

You can say no if you do not want to participate in this study. Adults cannot make you participate in this study if you do not want to. If you agree to participate in the study now, but change your mind about it later, you can stop being in the study, and no one will be mad at you.

WHAT IS RESEARCH?

Research is a way to learn information about something. Researchers study different subjects the way you study English or math as a subject in school. There are many reasons people choose to be in a research study. Sometimes people want to help researchers learn about ways to help people or make programs better.

You should understand why you would say yes to being a research participant. Take the time you need to decide if you want to be in this study. You can ask Colt any questions you have about the study.

WHY ARE WE DOING THIS RESEARCH?

Even though doctors understand what happens to the bodies of FTMs when they take testosterone, doctors do not fully understand what happens to the minds of FTMs who take testosterone. In our research we want to learn about what effects testosterone has on the cognitive functioning, personality, and emotional reactivity in FTMs. You are being asked to participate in this study because you are planning on beginning to take testosterone very soon.

WHAT WILL HAPPEN DURING THE STUDY

You will come in for the study three times. The first time is today and is before you start testosterone. The second time you come in will be after you have been on testosterone for 3 months, but before 4 months. The last time you come in will be after you have been on testosterone for 10 months, but before your 1 year anniversary on testosterone.

You will be asked to fill out questionnaires that ask you questions about your age,

religion, sexual orientation, gender, personality, and emotional reactivity. You will also be asked to answer questions about defining words and solving picture puzzles. You can skip any questions that you do not understand or do not want to answer.

Everything you do the first time you come will be repeated the other two times you come in. Each time you come in, you will stay for about three hours. In 5 to 7 years from now, you will be contacted again to come in one more time to do similar activities.

COULD GOOD THINGS HAPPEN TO ME FROM BEING IN THIS STUDY?

What we learn in this research will not help you now. When we finish the research we hope to know more about what testosterone does to the minds of FTMs, as we already know a lot about what it does to their bodies. This may help other FTMs who are deciding whether or not to take testosterone.

You will receive a $10 gift card today after you finish filling out the questionnaires and solving puzzles. You will also receive a $10 gift card the next time you come in. You will receive a $20 gift card the last time you come in.

COULD BAD THINGS HAPPEN TO ME FROM BEING IN THIS STUDY?

Sometimes things happen to people in research studies that may hurt them or make them feel bad. The questionnaires that you will be asked to fill out ask personal questions that may make you feel sad or upset like "what biological sex were you identified at birth?" or "Have you ever attempted suicide?" You do not have to answer any questions that you do not want to answer. If you tell the researcher that you are hurting yourself or that someone is hurting you, the researcher will share that information with your parent in order to keep you safe.

DO I HAVE OTHER CHOICES?

You can choose not to participate in this study, and you can decide you no longer want to be in the study at any time. You may choose to not answer any question that you are not comfortable with. If you choose not to participate at any time, you will not be penalized.

WHAT IF I HAVE QUESTIONS?

If you have any questions or worries about the research, you can ask Dr. Julia Babcock at 713-743-8621 before, during, or after your completion of the survey. If you wish to talk to someone else or have questions about your rights as a participant, call the University of Houston Committee for the Protection of Human Subjects at (713) 743-9204.

DOCUMENTATION OF PARTICIPANT'S ASSENT

I agree to participate in this study called: Psychological effects of exogenous testosterone on female-to-male transsexuals: A longitudinal study on cognitive functioning, personality changes, and emotional reactivity.

Signature of minor participant: _____

Date: _____

ANY QUESTIONS REGARDING MY RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT THE UNIVERSITY OF HOUSTON ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT

The University of Houston

FTM Testosterone Study

CONSENT BY PARENT FOR CHILD'S PARTICIPATION IN A RESEARCH PROJECT

PROJECT TITLE: Psychological effects of exogenous testosterone on female-to-male transsexuals: A longitudinal study on cognitive functioning, personality changes, and emotional reactivity

Principal Investigator: Stacey Meier, B.A.
Faculty Sponsor: Julia Babcock, Ph.D.

Your child is being invited to participate in a research project conducted by Dr. Julia Babcock and Stacey "Colt" Meier from the Psychology Department at the University of Houston. Stacey Meier is a doctoral student in Clinical Psychology and this project is part of his doctoral dissertation. The project is being conducted under the supervision of Dr. Julia Babcock who is an Associate Professor of Psychology at the University of Houston. Stacey Meier identifies as an transgender person.

NON-PARTICIPATION STATEMENT

Your child's participation is voluntary and you may refuse to allow him to participate or withdraw him from the study at any time without penalty or loss of benefits to which either of you are otherwise entitled.

This is an optional research study, which involves your child answering personal questions concerning his status as a transgender person. The purpose of this research is to examine the effects of testosterone on psychological functioning in female to male transsexuals.

PROCEDURES

Your child will be one of approximately 50 subjects to be asked to participate in this project.

By signing this consent form, you are giving your consent for your child to participate in this research study. Your child will be asked to complete questionnaires that ask him questions regarding his age, religious preference, sexual orientation, gender identification, emotional reactivity, and personality. Your child will be asked to answer a battery of questions from a psychological test that measures intellectual functioning. All of these procedures will be repeated three to four months from the original session and

once more ten to twelve months after the original session. Each session will last approximately 3 hours. Your child's total time commitment to this project will be no longer than 9 hours.

Your contact information will be retained so that your child may be contacted again in 5 to 7 years in order to complete a long-term follow up measure.

RISKS/DISCOMFORTS

These procedures may entail some personal discomfort in revealing personal feelings and opinions. Your child will be asked sensitive, personal, and potentially upsetting questions like: "what biological sex were you identified as at birth?" or "Have you ever attempted suicide?" Your child may stop your participation at any time without any loss of benefits otherwise entitled to you. Your child may also skip any questions he does not want to answer or does not understand.

CONFIDENTIALITY

Researchers will assign a unique identification number to your child's information, which will be stored in a confidential, secure file that only members of the research team have access to. Your data will not be connected to your name.

Your child will not be asked any questions about elder abuse, child abuse or neglect, but if your child discloses such things, the researchers are obligated by law to make a report to the Child Protective Services. If your child reveals a plan to harm or kill yourself or someone else, the researchers may also be obligated by law to report this to the authorities.

BENEFITS

While your child will not directly benefit from participation, your child's participation may help investigators better understand the effects of testosterone in the female-to-male transgender population. The investigator will also explain your child's results to you and your child on his personality and IQ tests after all data has been collected. If your child completes all three measures, he will receive a total of $40 in gift cards to Target, Barnes and Noble, or Smoothie King. Your child will receive $10 at your first measure, $10 at the second measure, and $20 at the third measure.

ALTERNATIVES

Participation in this project is voluntary and the only alternative to this project is non-participation.

PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual participant will be identified.

While your child will not receive specific feedback on his individual results, if you are interested in receiving the publications resulting from this research, these will be provided to you when they are available. Notify the research assistant if this is something you would like.

If you have any questions, you may contact Stacey Meier at ftmresearch@gmail.com. You may also contact Dr. Julia Babcock, faculty sponsor, at 713-743-8621.

I HAVE READ THE INFORMATION PROVIDED ABOVE AND HAD MY QUESTIONS ANSWERED TO MY SATISFACTION. I VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY. AFTER IT IS SIGNED, I WILL RECEIVE A COPY OF THIS CONSENT FORM.

_____
Name (Please print)

_____ _____
Signature of Research Participant Date

_____ _____
Signature of Principal Investigator Date

ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204).

Appendix D

QUESTIONNAIRES

FTM Demographic Questionnaire

1. What is your age? _____

2. Where are you currently living? (Please list city, state, and country)
If you are not from the United States, please list the city and country.
_____

3. How would you classify the city where you currently live?
    a. Metropolitan/Large City
    b. Small City
    c. Rural/Country

8. Where were you born? (Please list city, state, country)
If outside of the United States, please list city and country.
_____

4. In your own words, what is your sexual orientation?
_____

5. I am sexually attracted to
    a. Men
    b. Women
    c. Men and Women

6. In what way has your sexual orientation changed since you started your transition?
    a. it has not changed
    b. I was attracted to males, now I am attracted to females
    c. I was attracted to males, now I am attracted to both males and females
    d. I was attracted to females, now I am attracted to males
    e. I was attracted to females, now I am attracted to both males and females
    f. I was attracted to both males and females, now I am attracted to females only
    g. I was attracted to both males and females, now I am attracted to males only
    i. I have not started my transition

7. Ethnicity (select all that apply)
    a. Asian
    b. Black/African American
    c. American Indian/Alaskan Native
    d. White
    e. Latino/Hispanic/Chicano
    f. Pacific Islander

g. Middle Eastern
h. Other

9. What type of family were you raised with for the majority of your childhood? Examples include: Step-family/blended, Single mother family, Single father family, two biological parents, same-gender parents, grandparents, adoptive, foster etc.

_____

10. What religious background were you raised in?

11. What is your current religious preference?

12. What hand do you prefer to write with?
    a. Right
    b. Left
    c. I use both equally when writing

13. Select your highest level of completed education
    a. 8th grade or less
    b. Some high school (did not complete)
    c. High school graduate or GED
    d. Some college, Associate's degree, Technical school
    e. College graduate
    f. Postgraduate
    g. other (please specify)

14. What is your current work status?
    a. Full-time
    b. Part-time
    c. Seasonal-Temporary
    d. Homemaker
    e. Retired
    f. Unemployed/Not working
    g. Disability
    h. Student

15. How many times have you been married/partnered? _____

16. What is your current relationship status?

17. Do you have children?
    a. Yes, biological
    b. Yes, adopted
    c. Yes, step-children
    d. No

18. If you have children, how many do you have? _____

19. Are you stealth? (living as male and not disclosing trans history)
    a. Yes
    b. No

20. If you are currently stealth, how long have you been stealth?
Move to the next question if you are not currently stealth.
_____

21. If you are not currently stealth, do you plan to be in the future?
Move on if you are currently stealth

22. Have you ever attended a transgender support group?
    a. Yes
    b. No

23. Were you with a primary partner when you decided to transition?
    a. Yes
    b. No

24. If you were with a primary partner when you decided to transition, how did that turn out?
_____

25. If married or partnered, how long have you been in this relationship?
_____

26. Have you ever had a problem with drugs?
    a. Yes
    b. No

27. Have you ever had a problem with alcohol?
    a. Yes
    b. No

28. Have you ever attempted suicide? If yes, how many times? _____

Medical Information Related to Transitioning

29. What was your biological sex as identified at birth?
    a. Female
    b. Intersex

30. If you have been on T, please let us know for how long and what dose you take and method you use when taking T.
If you have not been on T before, do you wish to start T in the future?
If you have a special situation with T such as you started but then stopped, please tell us about it here.

_____

_____

31. What of the following have you had to aid in your transition? (Check all that apply)
    a. Estrogen blockers
    b. Testosterone
    c. Top Surgery Double Incision
    d. Top Surgery Peri/Keyhole
    e. Top Surgery Lipo Only
    f. Hysterectomy
    g. Metoidioplasty
    h. Centurion
    i. Oophorectomy
    j. Vaginectomy
    k. Phalloplasty
    l. Pectoral Implants
    m. Testicular Implants
    n. None of the Above

32. Have you ever used hormones as part of gender confirmation?
    a. Yes
    b. No

33. Are you currently using hormones?
    a. Yes
    b. No

34. Which of the following do you plan to have to aid in your transition? Check all that apply
    a. Estrogen blockers
    b. Testosterone
    c. Top Surgery Double Incision
    d. Top Surgery Peri/Keyhole
    e. Top Surgery Lipo Only
    f. Hysterectomy
    g. Metoidioplasty
    h. Centurion
    i. Oophorectomy

j. Vaginectomy
k. Phalloplasty
l. Pectoral Implants
m. Testicular Implants
n. None of the Above

35. If you have started T, what changes have you or others noticed about you?

Control Demographic Questionnaire

1. What is your age? _____

2. Where are you currently living? (Please list city, state, and country)
If you are not from the United States, please list the city and country.
_____

3. How would you classify the city where you currently live?
   a. Metropolitan/Large City
   b. Small City
   c. Rural/Country

4. Where were you born? (Please list city, state, country)
If outside of the United States, please list city and country.
_____

5. In your own words, what is your sexual orientation?
_____

6. I am sexually attracted to
   a. Men
   b. Women
   c. Men and Women

7. Ethnicity (select all that apply)
   a. Asian
   b. Black/African American
   c. American Indian/Alaskan Native
   d. White
   e. Latino/Hispanic/Chicano
   f. Pacific Islander
   g. Middle Eastern
   h. Other

8. What type of family were you raised with for the majority of your childhood?
Examples include: Step-family/blended, Single mother family, Single father family, two biological parents, same-gender parents, grandparents, adoptive, foster etc.
_____

9. What religious background were you raised in?

10. What is your current religious preference?

11. What hand do you prefer to write with?
    a. Right
    b. Left
    c. I use both equally when writing

12. Select your highest level of completed education
    a. 8th grade or less
    b. Some high school (did not complete)
    c. High school graduate or GED
    d. Some college, Associate's degree, Technical school
    e. College graduate
    f. Postgraduate
    g. other (please specify)

13. What is your current work status?
    a. Full-time
    b. Part-time
    c. Seasonal-Temporary
    d. Homemaker
    e. Retired
    f. Unemployed/Not working
    g. Disability
    h. Student

14. How many times have you been married/partnered? _____

15. What is your current relationship status?

16. Do you have children?
    a. Yes, biological
    b. Yes, adopted
    c. Yes, step-children
    d. No

17. If you have children, how many do you have? _____

18. Are you currently using hormones?
    a. Yes
    b. No

19. Do you identify as transgender? _____

20. Have you ever been diagnosed with a hormonal disorder such as hypogonadism, hormone imbalance, Congenital Adrenal Hyperplasia (CAH), Polycystic Ovarian Syndrome (PCOS)?

Depression, Anxiety, Stress Scales

DASS: Please read each statement and circle a number 0, 1, 2 or 3, which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:
0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

I found myself getting upset by quite trivial things
I was aware of dryness of my mouth
I couldn't seem to experience any positive feeling at all
I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)
I just couldn't seem to get going
I tended to over-react to situations
I had a feeling of shakiness (eg, legs going to give way)
I found it difficult to relax
I found myself in situations that made me so anxious I was most relieved when they ended
I felt that I had nothing to look forward to
I found myself getting upset rather easily
I felt that I was using a lot of nervous energy
I felt sad and depressed
I found myself getting impatient when I was delayed in any way (eg, lifts, traffic lights, being kept waiting)
I had a feeling of faintness
I felt that I had lost interest in just about everything
I felt I wasn't worth much as a person
I felt that I was rather touchy
I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion
I felt scared without any good reason
I felt that life wasn't worthwhile
I found it hard to wind down
I had difficulty in swallowing
I couldn't seem to get any enjoyment out of the things I did
I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)
I felt down-hearted and blue
I found that I was very irritable
I felt I was close to panic
I found it hard to calm down after something upset me

I feared that I would be “thrown” by some trivial but unfamiliar task
I was unable to become enthusiastic about anything
I found it difficult to tolerate interruptions to what I was doing
I was in a state of nervous tension
I felt I was pretty worthless
I was intolerant of anything that kept me from getting on with what I was doing
I felt terrified
I could see nothing in the future to be hopeful about
I felt that life was meaningless
I found myself getting agitated
I was worried about situations in which I might panic and make a fool of myself
I experienced trembling (eg, in the hands)
I found it difficult to work up the initiative to do things

ERS

This questionnaire asks different questions about how you experience emotions **on a regular basis (for example, each day)**. When you are asked about being "emotional," this may refer to being angry, sad, excited, or some other emotion. Please rate the following statements.

0 Not at all like me	**1** A little like me	**2** Somewhat like me	**3** A lot like me	**4** Completely like me

1	When something happens that upsets me, it's all I can think about it for a long time.	**0**	**1**	**2**	**3**	**4**
2	My feelings get hurt easily.	**0**	**1**	**2**	**3**	**4**
3	When I experience emotions, I feel them very strongly/intensely.	**0**	**1**	**2**	**3**	**4**
4	When I'm emotionally upset, my whole body gets physically upset as well.	**0**	**1**	**2**	**3**	**4**
5	I tend to get very emotional very easily.	**0**	**1**	**2**	**3**	**4**
6	I experience emotions very strongly.	**0**	**1**	**2**	**3**	**4**
7	I often feel extremely anxious.	**0**	**1**	**2**	**3**	**4**
8	When I feel emotional, it's hard for me to imagine feeling any other way.	**0**	**1**	**2**	**3**	**4**
9	Even the littlest things make me emotional.	**0**	**1**	**2**	**3**	**4**
10	If I have a disagreement with someone, it takes a long time for me to get over it.	**0**	**1**	**2**	**3**	**4**
11	When I am angry/upset, it takes me much longer than most people to calm down.	**0**	**1**	**2**	**3**	**4**
12	I get angry at people very easily.	**0**	**1**	**2**	**3**	**4**
13	I am often bothered by things that other people don't react to.	**0**	**1**	**2**	**3**	**4**
14	I am easily agitated.	**0**	**1**	**2**	**3**	**4**
15	My emotions go from neutral to extreme in an instant.	**0**	**1**	**2**	**3**	**4**
16	When something bad happens, my mood changes very quickly. People tell me I have a very short fuse.	**0**	**1**	**2**	**3**	**4**
17	People tell me that my emotions are often too intense for the situation.	**0**	**1**	**2**	**3**	**4**
18	I am a very sensitive person.	**0**	**1**	**2**	**3**	**4**
19	My moods are very strong and powerful.	**0**	**1**	**2**	**3**	**4**
20	I often get so upset it's hard for me to think straight.	**0**	**1**	**2**	**3**	**4**
21	Other people tell me I'm overreacting.	**0**	**1**	**2**	**3**	**4**

Other relevant questions/comments:

Bem Sex Role Inventory

Rate yourself on each item, on a scale from 1 (never or almost never true) to 7 (almost always true).

	Never or almost never true						Almost always true
1. self reliant	1	2	3	4	5	6	7
2. yielding	1	2	3	4	5	6	7
3. helpful	1	2	3	4	5	6	7
4. defends own beliefs	1	2	3	4	5	6	7
5. cheerful	1	2	3	4	5	6	7
6. moody	1	2	3	4	5	6	7
7. independent	1	2	3	4	5	6	7
8. shy	1	2	3	4	5	6	7
9. conscientious	1	2	3	4	5	6	7
10. athletic	1	2	3	4	5	6	7
11. affectionate	1	2	3	4	5	6	7
12. theatrical	1	2	3	4	5	6	7
13. assertive	1	2	3	4	5	6	7
14. flatterable	1	2	3	4	5	6	7
15. happy	1	2	3	4	5	6	7
16. strong personality	1	2	3	4	5	6	7
17. loyal	1	2	3	4	5	6	7
18. unpredictable	1	2	3	4	5	6	7
19. forceful	1	2	3	4	5	6	7

20. feminine	1	2	3	4	5	6	7
21. reliable	1	2	3	4	5	6	7
22. analytical	1	2	3	4	5	6	7
23. sympathetic	1	2	3	4	5	6	7
24. jealous	1	2	3	4	5	6	7
25. leadership ability	1	2	3	4	5	6	7
26. sensitive to other's needs	1	2	3	4	5	6	7
27. truthful	1	2	3	4	5	6	7
28. willing to take risks	1	2	3	4	5	6	7
29. understanding	1	2	3	4	5	6	7
30. secretive	1	2	3	4	5	6	7
31. makes decisions easily	1	2	3	4	5	6	7
32. compassionate	1	2	3	4	5	6	7
33. sincere	1	2	3	4	5	6	7
34. self-sufficient	1	2	3	4	5	6	7
35. eager to soothe hurt feelings	1	2	3	4	5	6	7
36. conceited	1	2	3	4	5	6	7
37. dominant	1	2	3	4	5	6	7
38. soft spoken	1	2	3	4	5	6	7
39. likable	1	2	3	4	5	6	7
40. masculine	1	2	3	4	5	6	7
41. warm	1	2	3	4	5	6	7
42. solemn	1	2	3	4	5	6	7

43. willing to take a stand	1	2	3	4	5	6	7
44. tender	1	2	3	4	5	6	7
45. friendly	1	2	3	4	5	6	7
46. aggressive	1	2	3	4	5	6	7
47. gullible	1	2	3	4	5	6	7
48. inefficient	1	2	3	4	5	6	7
49. acts as a leader	1	2	3	4	5	6	7
50. childlike	1	2	3	4	5	6	7
51. adaptable	1	2	3	4	5	6	7
52. individualistic	1	2	3	4	5	6	7
53. does not use harsh language	1	2	3	4	5	6	7
54. unsystematic	1	2	3	4	5	6	7
55. competitive	1	2	3	4	5	6	7
56. loves children	1	2	3	4	5	6	7
57. tactful	1	2	3	4	5	6	7
58. ambitious	1	2	3	4	5	6	7
59. gentle	1	2	3	4	5	6	7
60. conventional	1	2	3	4	5	6	7

Short Form 36-Item Questionnaire version 2

In general, would you say your health is
a. Excellent
b. Very Good
c. Good
d. Fair
e. Poor

Compared to one year ago, how would you rate your health in general now?
a. Much better now than one year ago
b. Somewhat better now than one year ago
c. About the same as one year ago
d. Somewhat worse now than one year ago
e. Much worse now than one year ago

The following items are about activities you might do during a typical day.
Does your health now limit you in these activities?
If so, how much?
a. Yes, limited a lot
b. Yes, limited a little
c. No, not limited at all

Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.
Lifting or carrying groceries
Climbing on several flights of stairs
Climbing one flight of stairs
Bending, kneeling, or stooping
Walking more than a mile
Walking several hundred yards
Walking one hundred yards
Bathing or dressing yourself

During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?
a. All of the time
b. Most of the time
c. Some of the time
d. A little of the time
e. None of the time

Cut down on the amount of time you spent on work or other activities

Accomplished less than you would like
Were limited in the kind of work or other activities
Had difficulty performing the work or other activities (for example, it took extra effort)

During the past four weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?
a. All of the time
b. Most of the time
c. Some of the time
d. A little of the time
e. None of the time

Cut down on the amount of time you spent on work or other activities
Accomplished less than you would like
Did work or other activities less carefully than usual

During the past 4 weeks, to what extent has your physical health or emotion problems interfered with your normal social activities with family, friends, neighbors, or groups?
a. Not at all
b. Slightly
c. Moderately
d. Quite a bit
e. Extremely

How much bodily pain have you had during the past 4 weeks?
During the past 4 weeks, how much did pain interfere with your normal work (including both outside the home) and housework?

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...

a. All of the time
b. Most of the time
c. Some of the time
d. A little of the time
e. None of the time

Did you feel full of life?
Have you been nervous?
Have you felt so down in the dumps that nothing could cheer you up?
Have you felt calm and peaceful?
Did you have a lot of energy?
Have you felt down hearted and depressed?

Did you feel worn out?
Have you been happy?
Did you feel tired?

During the past 4 weeks how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?
How true or false is each of the following statements for you?
a. Definitely true
b. Mostly true
c. Don't know
d. Mostly false
e. Definitely false

I seem to get sick a little easier than other people
I am as healthy as anybody I know
I expect my health to get worse
My health is excellent

Rosenberg Self Esteem Scale

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree

1. I feel that I am a person of worth, at least on an equal plane with others.
2. I feel that I have a number of good qualities.
3. All in all, I am inclined to feel that I am a failure.
4. I am able to do things as well as most other people.
5. I feel I do not have much to be proud of.
6. I take a positive attitude toward myself.
7. On the whole, I am satisfied with myself.
8. I wish I could have more respect for myself.
9. I certainly feel useless at times.
10. At times I think I am no good at all.

Hoffman Gender Scale

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

Using the scale above, please fill in the number from above that best responds to the statements below:

____ 1. When I am asked to describe myself, being male is one of the first things I think of.

____ 2. I am confident in my masculinity (maleness).

____ 3. I meet my personal standards for masculinity (maleness).

____ 4. My perception of myself is positively associated with my biological sex.

____ 5. I am secure in my masculinity (maleness).

____ 6. I define myself largely in terms of my masculinity (maleness).

____ 7. My identity is strongly tied to my masculinity (maleness).

____ 8. I have a high regard for myself as a male.

____ 9. Being a male is a critical part of how I view myself.

____ 10. I am happy with myself as a male.

____ 11. I am very comfortable being a male.

____ 12. Masculinity (maleness) is an important aspect of my self-concept.

____ 13. My sense of myself as a male is positive.

____ 14. Being a male contributes a great deal to my sense of confidence.

____ 15. I have a high regard for myself as a masculine person.

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

Using the scale above, please fill in the number from above that best responds to the statements below:

____ 1. When I am asked to describe myself, being female is one of the first things I think of.

____ 2. I am confident in my femininity (femaleness).

____ 3. I meet my personal standards for femininity (femaleness).

____ 4. My perception of myself is positively associated with my biological sex.

____ 5. I am secure in my femininity (femaleness).

____ 6. I define myself largely in terms of my femininity (femaleness).

____ 7. My identity is strongly tied to my femininity (femaleness).

____ 8. I have a high regard for myself as a female.

____ 9. Being a female is a critical part of how I view myself.

____ 10. I am happy with myself as a female.

____ 11. I am very comfortable being a female.

____ 12. Femininity (femaleness) is an important aspect of my self-concept.

____ 13. My sense of myself as a female is positive.

____ 14. Being a female contributes a great deal to my sense of confidence.

____ 15. I have a high regard for myself as a feminine person.

Novel Transgender Scale

1	2	3	4	5	6
Strongly Disagree					Strongly Agree

Using the scale above, please fill in the number from above that best responds to the statements below:

____ 1. When I am asked to describe myself, being male or female or trans is one of the first things I think of.

____ 2. I am confident in my gender presentation.

____ 3. I meet my personal standards for expressing my gender identity.

____ 4. My perception of myself is positively associated with my preferred gender identity.

____ 5. I am secure in my gender presentation.

____ 6. I define myself largely in terms of my preferred gender expression.

____ 7. My identity is strongly tied to my preferred gender expression.

____ 8. I have a high regard for myself as a transgender person.

____ 9. My gender as a man or trans is a **critical** part of how I view myself.

____ 10. I am happy with myself as my preferred gender (i.e., as a male, female, trans, gender queer, etc).

____ 11. I am very comfortable being masculine and/or feminine.

____ 12. I am very comfortable being my preferred gender (i.e., being a male, female, trans, gender queer, etc).

____ 13. My sense of myself in my preferred gender is positive.

____ 14. Being read in my preferred gender (i.e. passing) contributes a great deal to my sense of confidence.

____ 15. When I am asked to describe myself, being masculine and/or feminine is one of the first things I think of.

____ 16. My sex as having been born male or female or intersex is a critical part of how I view myself.

____ 17. I am very comfortable being transgender.

____ 18. When I am asked to describe myself, being trans is one of the first things I think of.

Follow Up Questionnaire

1. Have you taken any medications in the past year including psychotropic/mood medications?
If so, which ones?

1a. For *females*: If you were on birth control, did the dose or type of medication change over the course of the study?

2. Did you receive therapy at any time during the study?

3. Did you undergo any major life changes or stressors during the study, such as a break up with a romantic partner, losing or gaining a job, graduating from school, a death in your family, or moving into a different living situation?

4. For *FTMs* only: We would like to show a few photos of FTM participants before they started T and after at presentations in the next few years. This would be completely voluntary and anonymous. Would you like to contribute a few photos of yourself for this?

Appendix E

Non-Gendered MMPI-2 Analyses

Initial Assessment. Similar to the previous analyses, all mean scores were found to be in the non-clinical range for all groups. To test whether FTMs, males, and females differed on psychopathology using non-gendererd norms (Ben-Porath & Forbey, 2003), a between-subjects MANOVA of gender (3 levels: FTM, M, or F) on the dependent variables of the 10 scales of the MMPI-2 was conducted (refer to Table 12). In line with previous findings, a significant effect of gender $F(20, 416) = 6.7$, $p < .001$ was found. Follow up analyses revealed main effects for Scale 1 (Hypochondria) $F(2, 216) = 4.6$, $p < .05$, Scale 2 (Depression) $F(2, 216) = 14.9$, $p < .001$, Scale 3 (Hysteria) $F(2, 216) = 3.4$, $p < .05$, Scale 4 (Psychopathic deviate) $F(2, 216) = 5.3$, $p < .01$, Scale 5 (Masculinity/femininity) $F(2, 216) = 45.8$, $p < .001$, Scale 6 (Paranoia) $F(2, 216) = 5.5$, $p < .01$, Scale 7 (Psychasthenia) $F(2, 216) = 9.2$, $p < .01$, Scale 8 (Schizophrenia), $F(2, 216) = 7.0$, $p < .01$, and Scale 0 (Social introversion) $F(2, 216) = 8.6$, $p < .001$. In regard to gender differences on these scales, females displayed significantly higher scores than males on Scale 1 (Hypochondria) $t(146)$- -4.8, $p < .01$, Scale 2 (Depression) $t(146)$ estimate = -9.3, $p < .001$, Scale 3 (Hysteria) $t(146) = -3.9$, $p < .05$, Scale 5 (Masculinity/femininity) $t(146) = -10.6$, $p < .001$, Scale 7 (Psychasthenia) $t(146) = -7.6$, $p < .001$, Scale 8 (Schizophrenia) $t(146) = -5.4$, $p < .01$), and Scale 0 (Social introversion) $t(146) = -4.1$, $p < .05$. FTMs displayed higher scores than males on Scale 1 (Hypochondria) $t(139) = -3.9$, $p < .05$, Scale 2 (Depression) $t(139) = -9.0$, $p < .001$, Scale 3 (Hysteria) $t(139) = -4.0$, $p < .05$, Scale 4 (Psychopathic deviate) $t(139) = -6.3$, $p < .01$), Scale 5 (Masculinity/femininity) $t(139) = -7.2$, $p < .001$, Scale 6 (Paranoia) $t(139) = -6.3$,

p <.01), Scale 7 (Psychasthenia) $t(139) = -7.1$, $p < .01$, Scale 8 (Schizophrenia) $t(139) = -7.6$, $p < .001$, and Scale 0 (Social introversion) $t(139) = -7.4$, $p < .001$. As expected, FTMs scored higher than females on Scale 4 (Psychopathic deviate) $t(147) = -4.9$, $p < .05$ and lower than females on Scale 5 (Masculinity/femininity) $t(147) = 3.9$, $p < .01$.

--insert Table 12 here--

Short-Term Analyses. An overall significant main effect of gender over three months emerged on psychopathology $F(20, 294) = 6.3$, $p < .001$. There was also an overall significant overall effect of time $F(10, 146) = 3.3$, $p < .01$ and the interaction of time x gender $F(20, 294) = 2.1$, $p < .01$ was also found to be significant (see Table 13). Follow up analyses on the overall main effect of gender revealed that FTMs' T scores did not differ from females on any scale, except Scale 5 (Masculinity/femininity), where females scored higher than FTMs $t(102) = 4.6$, $p < .01$. FTMs scored higher than males on Scale 1 (Hypochondria) $t(97) = -4.3$, $p < .05$, Scale 2 (Depression) $t(97) = -6.8$, $p < .01$, Scale 4 (Psychopathic deviate) $t(97) = -5.4$, $p < .05$, Scale 5 (Masculinity/femininity) $t(97) = -6.8$, $p < .001$, Scale 6 (Paranoia) $t(97) = -4.9$, $p < .05$, Scale 7 (Psychasthenia) $t(97) = -5.3$, $p < .05$, Scale 8 (Schizophrenia) $t(97) = -7.6$, $p < .01$, and Scale 0 (Social introversion) $t(97) = -8.2$, $p < .001$. Females displayed higher T scores than males on Scale 1 (Hypochondria) $t(111) = -5.4$, $p < .01$, Scale 2 (Depression) $t(111) = -10.2$, $p < .001$), Scale 3 (Hysteria) $t(111) = -3.9$, $p < .05$, Scale 5 (Masculinity/femininity) $t(111) = -11.5$. $p < .001$, Scale 6 (Paranoia) $t(111) = -5.3$, $p < .01$, Scale 7 (Psychasthenia) $t(111) = -9.4$, $p < .001$, Scale 8 (Schizophrenia) $t(111) = -5.9$, $p < .01$, and Scale 0 (Social introversion) $t(111) = -4.2$, $p < .05$. A significant main effect of time was present for the

Scale 1 (Hypochondria), Scale 2 (Depression), Scale 3 (Hysteria), Scale 4 (Psychopathic deviate), Scale 6 (Paranoia), Scale 7 (Psychasthenia), and Scale 8 (Schizophrenia). All groups' scores on Scale 1 (Hypochrondria), Scale 4 (Psychopathic deviate), and Scale 6 (Paranoia) decreased. Females and FTMs' scores on Scale 2 (Depression), the Scale 7 (Psychasthenia), and Scale 8 (Schizophrenia) decreased from T1 to T2, whereas males' scores on these scales increased. Females and FTMs' scores on Scale 3 (Hysteria) decreased from T1 to T2, whereas males' scores did not change. The overall interaction effect of time x gender was attributed to multiple significant interaction effects for the Scale 2 (Depression), Scale 4 (Psychopathic deviate), Scale 6 (Paranoia), Scale 7 (Psychasthenia), and Scale 8 (Schizophrenia), where FTMs scores were found to decrease more rapidly than those of female or male controls over three months (see Figures 5-9). Refer to Table 14 for a display of participants by gender who displayed clinical elevations for each scale at each time point.

--insert Table 13 here--

--insert Table 14 here--

--insert Figure 5-9 here--

Long-term Analyses. An overall significant main effect of gender over one year emerged for psychopathology $F(20, 212) = 4.5$, $p < .001$ (refer to Table 15). There was also an overall significant overall effect of time $F(20, 95) = 1.9$, $p < .05$. However, the interaction of time x gender $F(40, 192) = 1.1$ was not found to be significant. Follow up analyses on the overall main effect of gender revealed that females scored higher than males on Scale 1 (Hypochondria) $t(82) = -5.0$, $p < .01$, Scale 2 (Depression) $t(82) = -9.7$, $p < .001$, Scale 5 (Masculinity/femininity) $t(82) = -13.0$, $p < .001$, Scale 6 (Paranoia)

$t(82) = -5.2$, $p < .05$, Scale 7 (Psychasthenia) $t(82) = -8.9$, $p < .001$, Scale 8 (Schizophrenia) $t(82) = -5.8$, $p < .01$, and Scale 0 (Social introversion) $t(82) = -5.6$, $p < .05$. FTMs scored higher than males on Scale 2 (Depression) $t(67) = -6.7$, $p < .05$), Scale 5 (Masculinity/femininity) $t(67) = -8.3$, $p < .001$, Scale 7 (Psychasthenia) $t(67) = -4.9$, $p < .05$, Scale 8 (Schizophrenia) $t(67) = -6.0$, $p < .05$, and Scale 0 (Social introversion) $t(67) = -8.8$, $p < .01$. Females scored higher on Scale 5 (Masculinity/femininity) $t(79) = 4.7$, $p < .01$ than FTMs. A significant main effect of time was present for Scale 1 (Hypochondria), Scale 2 (Depression), Scale 3 (Hysteria), Scale 4 (Psychopathic deviate), Scale 6 (Paranoia), and Scale 8 (Schizophrenia). More specifically, Scale 1 (Hypochondria), Scale 2 (Depression), Scale 3 (Hysteria), and Scale 4 (Psychopathic deviate) decreased for FTMs and females, and remained relatively consistent for males. FTM's scores on Scale 6 (Paranoia) decreased quickly from T1 to T2 and remained constant from T2 to T3, while males and females' scores remained relatively constant (refer to Figure 10). Scale 8 (Schizophrenia) scores decreased for all groups, in females and FTMs more so than males. See Table 16 for a display of participants by gender who displayed clinical elevations for each scale at each time point.

--insert Table 15 here--

--insert Table 16 here--

--insert Figure 10 here--

Appendix F

Three Month Follow Up Analyses

Cognitive Ability. A repeated measures MANOVA was performed to examine the effects of testosterone on intelligence over three months. VIQ and PIQ were entered as the dependent variables with time (T1 and T2) as the within-subjects factor and gender (F, FTM, and M) as the between-subjects factor. While there was no main effect of gender $F(4, 172) = 1.5$, ns, an overall significant effect of time was found $F(2, 85) = 15.0$, $p < .001$. The interaction of time x gender was not found to be significant $F(4, 172) = 1.5$, ns. A significant main effect of time was present for both VIQ and PIQ, where scores increased over time in all groups (see Table 17). On average, all groups scores improved on both VIQ and PIQ, with a stronger impact of time on PIQ. A trend of the interaction of time x gender on VIQ revealed that females' and FTMs' VIQ scores increased more than those of males over 3 months (refer to Figure 11).

--insert Table 17 here--

--insert Figure 11 here--

Psychosocial Functioning. The data revealed an overall significant main effect of gender over three months on psychosocial functioning $F(16, 284) = 2.4$, $p < .01$. There were no overall effects of time $F(8, 141) = 1.7$, ns, nor interaction of time x gender interaction on psychosocial functioning $F(16, 284) = 1.4$, ns (See Table 18 and Figures 12-13). Follow up contrast analyses on the overall main effect of gender found that FTMs did not differ from females on any of the psychosocial functioning variables assessed. Compared to males, FTMs did, however, score higher on depression $t(95) = -3.1$, $p < .01$, anxiety $t(95) = -2.4$, $p < .01$, stress $t(95) = -4.7$, $p < .01$, emotional sensitivity $t(95) = -4.6$,

$p < .01$, emotional intensity $t(95) = -3.6$, $p < .01$, and lower on self esteem $t(95) = 3.7$, $p < .01$. Females scored higher than males on depression $t(103) = -3.1$, $p < .01$, anxiety $t(103) = -1.9$, $p < .05$, stress $t(103) = -4.8$, $p < .001$, emotional sensitivity $t(103) = -3.7$, $p < .01$, emotional persistence $t(103) = 5.0$, $p < .01$, and lower than males on self esteem $t(103) = 2.4$, $p < .05$).

--insert Table 18 here--

--insert Figure 12 here--

--insert Figure 13 here--

Gender Role. An overall significant main effect of gender over three months emerged for gender role $F(4, 316) = 11.9$, $p < .001$ (refer to Table 19). A trend emerged for the effect of time $F(2, 157) = 2.8$, $p = .07$. The interaction of time x gender $F(4, 316) = 0.5$ was not found to be significant. Follow up contrast analyses revealed that while FTMs displayed lower femininity scores than females $t(106) = 13.0$, $p < .001$, they did not differ from males on masculinity or femininity nor females on masculinity. As expected, males scored higher on masculinity than females $t(109) = 9.8$, $p < .01$) and females scored higher than males on femininity $t(109) = -9.9$, $p < .001$).

--insert Table 19 here--

Psychopathology. An overall significant main effect of gender over three months emerged on psychopathology $F(20, 292) = 5.5$, $p < .001$. There was also an overall significant overall effect of time $F(10, 145) = 3.1$, $p < .01$ and the interaction of time x gender $F(20, 292) = 2.3$, $p < .01$ was found to be significant (see Table 20). Follow up analyses on the overall main effect of gender revealed that while FTMs' T scores did not differ from females on any scale, FTMs displayed higher scores on Scale 4 (psychopathic

deviate) $t(97) = -6.4$, $p < .01$, Scale 5 (Masculinity/femininity) $t(97) = -16.8$, $p < .001$, Scale 6 (Paranoia) $t(97) = -4.2$, $p < .05$, Scale 8 (Schizophrenia) $t(97) = -7.5$, $p < .01$, and Scale 0 (Social introversion) $t(97) = -6.0$, $p < .01$. Females displayed higher T scores than males on Scale 1 (Hypochondria $t(110) = -3.5$, $p < .05$, Scale 2 (Depression) $t(110) = -6.5$, $p < .01$, Scale 4 (Psychopathic deviate) $t(110) = -5.0$, $p < .01$, Scale 5 (Masculinity/femininity) $t(110) = -8.9$, $p < .001$, Scale 6 (Paranoia) $t(110) = -4.6$, $p < .05$, Scale 7 (Psychasthenia) $t(110) = -7.3$, $p < .001$, and Scale 8 (Schizophrenia) $t(110) = -6.0$, $p < .01$. A significant main effect of time was present for Scale 1 (Hypochondria), Scale 2 (Depression), Scale 3 (Hysteria), Scale 4 (Psychopathic deviate), Scale 6 (Paranoia), and Scale 8 (Schizophrenia). Specifically, females and FTMs' scores on Scale 1 (Hypochondria), Scale 2 (Depression), Scale 3 (Hysteria), and Scale 8 (Schizophrenia) decreased from T1 to T2. All groups scores on Scale 4 (Psychopathic deviate) decreased over three months. Only FTMs scores decreased on Scale 6 Paranoia) from T1 to T2. The overall interaction effect of time x gender was attributed to multiple significant interaction effects for the Scale 2 (Depression), Scale 3 (Hysteria), Scale 6 (Paranoia), Scale 7 (Psychasthenia), and Scale 8 (Schizophrenia), where FTMs scores were found to decrease more rapidly than those of female or male controls over three months (See Figures 14-18). See Table 21 for a display of participants by gender who displayed clinical elevations for each scale at each time point.

--insert Table 20 here--

--insert Table 21 here--

--insert Figures 14-18--