ORIGINAL RESEARCH—INTERSEX AND GENDER IDENTITY DISORDERS

Sexual Desire in Trans Persons: Associations with Sex Reassignment Treatment

Katrien Wierckx, MD,* Els Elaut, MrSc,† Birgit Van Hoorde, MrSc,† Gunter Heylens, MD,† Griet De Cuypere, MD, PhD,† Stan Monstrey, MD, PhD,‡ Steven Weyers, MD, PhD,§ Piet Hoebeke, MD, PhD,¶ and Guy T'Sjoen, MD, PhD*†

*Department of Endocrinology, Ghent University Hospital, Ghent, Belgium; †Center for Sexology and Gender Problems, Ghent University Hospital, Ghent, Belgium; ‡Department of Plastic Surgery, Ghent University Hospital, Ghent, Belgium; §Department of Gynaecology, Ghent University Hospital, Ghent, Belgium; ¶Department of Urology, Ghent University Hospital, Ghent, Belgium

DOI: 10.1111/jsm.12365

ABSTRACT

Introduction. Sex steroids and genital surgery are known to affect sexual desire, but little research has focused on the effects of cross-sex hormone therapy and sex reassignment surgery on sexual desire in trans persons.

Aim. This study aims to explore associations between sex reassignment therapy (SRT) and sexual desire in a large cohort of trans persons.

Methods. A cross-sectional single specialized center study including 214 trans women (male-to-female trans persons) and 138 trans men (female-to-male trans persons).

Main Outcome Measures. Questionnaires assessing demographics, medical history, frequency of sexual desire, hypoactive sexual desire disorder (HSDD), and treatment satisfaction.

Results. In retrospect, 62.4% of trans women reported a decrease in sexual desire after SRT. Seventy-three percent of trans women never or rarely experienced spontaneous and responsive sexual desire. A third reported associated personal or relational distress resulting in a prevalence of HSDD of 22%. Respondents who had undergone vaginoplasty experienced more spontaneous sexual desire compared with those who planned this surgery but had not yet undergone it ($P = 0.03$).

In retrospect, the majority of trans men (71.0%) reported an increase in sexual desire after SRT. Thirty percent of trans men never or rarely felt sexual desire; 39.7% from time to time, and 30.6% often or always. Five percent of trans men met the criteria for HSDD. Trans men who were less satisfied with the phalloplasty had a higher prevalence of HSDD ($P = 0.02$).

Trans persons who were more satisfied with the hormonal therapy had a lower prevalence of HSDD ($P = 0.02$).

Conclusion. HSDD was more prevalent in trans women compared with trans men. The majority of trans women reported a decrease in sexual desire after SRT, whereas the opposite was observed in trans men. Our results show a significant sexual impact of surgical interventions and both hormonal and surgical treatment satisfaction on the sexual desire in trans persons. **Wierckx K, Elaut E, Van Hoorde B, Heylens G, De Cuypere G, Monstrey S, Weyers S, Hoebeke P, and T'Sjoen G. Sexual desire in trans persons: Associations with sex reassignment treatment. J Sex Med 2014;11:107–118.**

Key Words. Gender Identity Disorder; Transsexual; Sexual Desire; Sexual Functioning; Cross-Sex Hormone Therapy

Introduction

Hormonal therapy is an established part of gender dysphoria treatment and induces secondary sex characteristics development of the desired sex while reducing those of the natal sex [1].

Trans women (male-to-female transsexual persons) at our center generally receive cyproterone acetate together with oral or transdermal estrogens to induce feminization [1]. Female-to-male transsexual persons, denoted as trans men, generally receive progestins to suppress menstruation and intramuscular testosterone preparations to induce virilization [1,2].

It is well known that sex steroids play a role in motivational aspects of sexual functioning such as sexual desire, particularly in cisgender men [3]. Numerous studies have observed an improvement in sexual desire during T administration in hypogonadal young and aging men [4–6] but not in eugonadal men [7]. Whether T treatment resulting in supraphysiological levels of testosterone increases sexual desire is less clear as one study [8] observed a significant increase, whereas another did not [9].

In contrast, our current knowledge about the role of androgens in female sexual desire is still scarce with inconsistent and often contradictory evidence [3]. In epidemiological studies, serum T levels were not correlated with sexual desire in cisgender women [10,11], whereas other studies did observe an association [12,13]. Also, evidence concerning the effects of oral contraceptives on sexual desire, which are known to decrease free testosterone levels [14], are conflicting [15]. Furthermore, several studies [16,17], but not all [18], observed that T supplementation in surgical or natural menopausal women increases sexual desire.

Effects of estrogens on sexual desire in both cisgender men and women are poorly understood [3]. Given that T is aromatized into estradiol (E2) in many tissues, it may be possible that effects of T on sexual desire are mediated by E2. Only a few studies examined the relation between sexual desire and circulating E2 levels in cisgender men but most studies observed no clear associations [19,20]. However, as E2 is known to exert an important role in the negative feedback of T in men at both the hypothalamic and pituitary levels, administration of exogenous estrogens has been used historically as an antiandrogen treatment in prostate cancer patients and sex offenders, where a reduction in sexual desire was observed [3]. In cisgender women, some [21], but not all [22,23], studies observed associations between E2 levels and sexual desire. Several studies examining the effects of estrogen therapy in postmenopausal women found an increase in sexual desire [23,24]. However, others reported that high doses of estrogens were associated with lower sexual desire [25,26].

In view of the effects of sex steroids on sexual desire in cisgender men and women, several effects of cross-sex hormone therapy on sexual desire in trans persons can be hypothesized. In trans women, a decline in serum T levels or T action together with increased sex hormone binding globulin and high E2 levels may lower sexual desire, whereas in trans men, increasing serum T levels may facilitate sexual desire. However, these theoretical effects may be influenced in trans persons because of prior brain masculinization or feminization. Aside from effects of cross-sex hormone therapy, the experience of breast augmentation and removal, genital surgery and post-surgical outcome clearly affects sexual functioning in trans persons [27–32]. Sex reassignment surgery (SRS) in trans women consists of orchidectomy, penectomy, and vaginoplasty. SRS in trans men includes mastectomy, hysterectomy, and oophorectomy. Due to availability and extensive experience at our center, most trans men proceed immediately with phalloplasty (creation of a full-sized phallus) [33].

Considering the important potential effects of both hormonal treatment and genital surgery, the current knowledge of the effect of sex reassignment therapy on sexual desire is limited and based on small sample studies. Evidence concerning sexual desire in trans women is conflicting as some studies using direct or indirect measures of sexual desire observed no change [34,35] or decrease [27,28,36], whereas others observed an increase after sex reassignment treatment [29,37,38]. In trans men, a single study investigated sexual desire directly [39], whereas others used indirect measures such as frequency of masturbation [27,35,36] and sexual activity [37].

The present study aimed to investigate the effects of sex reassignment therapy on sexual desire in a well-described, large cohort of both trans men and women almost all treated by the same endocrine and surgical team.

Methods

Study Procedures and Population

All persons who were diagnosed with gender dysphoria/transsexualism (*Diagnostic and Statistical*

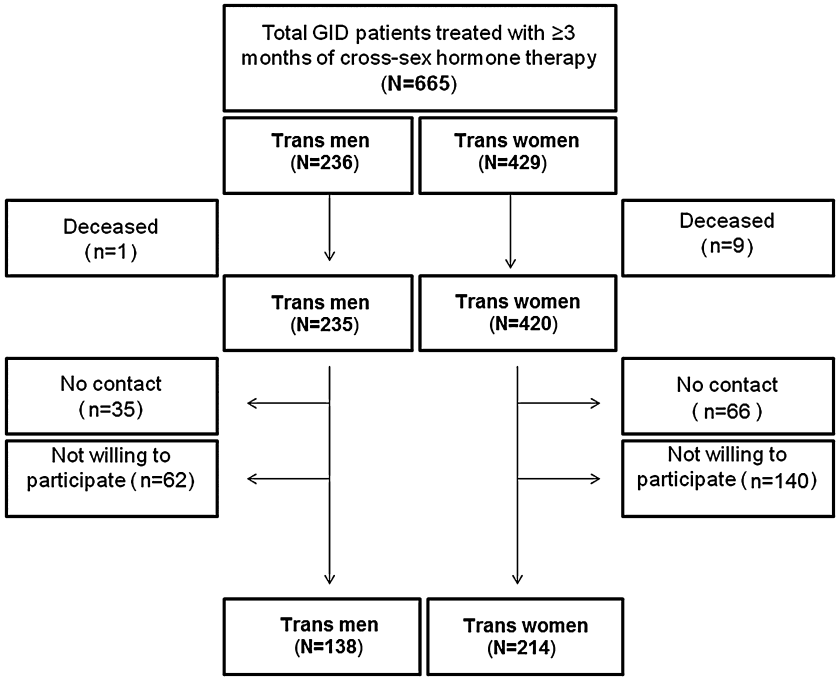

Figure 1 Subject enrollment.

Manual of Mental Disorders—DSM-5/International Classification of Diseases, 10th revision, F64.0) at the Center for Sexology and Gender Problems at the Ghent University Hospital (Ghent, Belgium) between 1986 and June 2012 and underwent at least 3 months of cross-sex hormonal therapy were invited by letter to participate in this study. Respondents received a paper version of the questionnaire by post or filled out the survey online. A reminder message was sent to nonresponders. All surveys were collected between August and December 2012. Three hundred fifty-two participants including 214 trans women and 138 trans men agreed to participate in this study, resulting in a total response rate of 54% (51% in trans women and 58.7% in trans men). Ten of the invited persons had died by the time of the follow-up (Figure 1).

This study was part of a multidisciplinary study in which participants were questioned about their physical health and incidence of possible treatment-related adverse events, socio-demographic status, health-related quality of life (QOL), and treatment related symptoms such as changes in sexual desire, surgical results, and satisfaction with hormonal and surgical treatment. Data concerning morbidity and QOL are addressed in other articles [40,41].

The trans women were on hormonal therapy for a median duration of 7 years (range: 3 months–35 years). One hundred thirty-nine trans women (65%) underwent SRS (orchidectomy, penectomy, and vaginoplasty), 60 trans women (28%) had plans for this surgery in the future, four (1.8%) were still in doubt. The others (n = 11; 5%) did not wish this surgery or did not undergo it for medical reasons. About half of trans women (53.5%) underwent breast augmentation, 17.8% underwent vocal cord surgery or cricoid reduction, and 21.5% had facial feminizing surgery.

Trans men were on testosterone treatment for a median duration of 6 years (range 3 months–49 years). Eighty-six percent of the trans men underwent hysterectomy/oophorectomy. Seventy-six men (59.4%) had undergone phalloplasty. Nine men were treated with metoidioplasty, eight of whom subsequently underwent a phalloplasty. Sixty-three percent of those who had undergone a phalloplasty had an erection prosthesis implanted (n = 48).

This study was approved by the ethical review board of Ghent University Hospital, Belgium. All participants gave their consent to participate in the study.

Main Outcome Measures

General Characteristics

Civil status, current working situation, current job, and household income were addressed. All participants were asked whether they had children (yes/

no) and if so, to describe the method of conception for each child.

Sex Reassignment Treatment

Current and past hormonal treatments were addressed through a self-developed questionnaire. Patients were questioned about the medical procedures they underwent during transition. Satisfaction with different surgical procedures was evaluated by the participants on a five-point Likert scale from very unsatisfied to very satisfied. Moreover, trans men were asked whether they had experienced surgical complications of metoidioplasty, phalloplasty, or implantation of erection prosthesis. Trans women were asked whether they had experienced surgical complications of the vaginoplasty procedure.

Definition of Hypoactive Sexual Desire Disorder (HSDD)

The definition of HSDD in this particular patient population is difficult. The renewed definitions of HSDD in women and men that will be used in *DSM-5* may not be applicable for trans persons given the important interference of sex reassignment treatment with the potential to experience genital arousal in these patients. Indeed, previous research from our center observed that the Female Sexual Functioning Index was not unequivocally suitable for trans women, especially concerning sexual arousal [42].

We evaluated HSDD in trans women as defined by Elaut et al. [43], who used the Sexual Function Health Council's consensus definition [44]. They defined HSDD as "the persistent or recurrent deficiency (or absence) of sexual fantasies, thoughts, desire for sexual activity alone or with a partner and the inability to respond to sexual cues that would be expected to trigger responsive sexual desire. These symptoms must be causing personal distress."

Sexual desire in trans women was therefore assessed by the evaluation of spontaneous and responsive sexual desire in the past month using a five-point scale from never to almost always. In addition, respondents were asked about the presence of distress caused by low sexual desire (yes or no) and to describe whether this caused distress for themselves, their partner, and/or their relationship. Respondents met the distress level when they experienced personal or relational distress. HSDD in trans women was scored when a participant indicated that (i) she never/rarely experienced either spontaneous (ii) or responsive sexual desire, and when this was (iii) causing her personal or relational distress.

HSDD in trans men was defined according to Diagnostic and Statistical Manual of Mental Disorders (*DSM-IV-TR*). HSDD was scored when a participant indicated that (i) he never/rarely experienced sexual desire in the past month, and when this was (ii) causing him personal or relational distress.

Relational and Sexual Functioning

Participants also reported on the following items: marital status, duration of relationship, current sexual orientation (five-point scale from only attracted to men to only attracted to women or other), comparison of sexual desire before and after SRS (five-point scale from much higher to much lower), frequency of experiencing too low sexual desire in the past month (five-point scale from never to almost always), experience of symptoms of high sexual desire, and experience of symptoms of low sexual desire (four-point scale from no to severe).

Physical and Mental Functioning

QOL was measured using the Dutch version of the Short Form-36 Health Survey (SF-12). This questionnaire includes 12 questions with fixed response choices, organized in two scaled scores, based on the weighted sums of the questions in their section. These scores were converted into a summary score for each section: physical functioning and mental functioning, with higher scores indicating higher levels of functioning or well-being [45]. Internal consistency with the SF-12 was high (total group: Cronbach's $\alpha = 0.8$).

Statistical Analysis

The normal distribution of all variables was tested by the Kolmogorov–Smirnov one-sample test. Normally distributed variables were described in terms of mean and standard deviation and skewed variables in terms of median, first, and third quartiles. Comparisons of continuous variables between trans women and men were made by linear regression analyses with group as independent variable. Dichotomous and categorical variables were analyzed using, respectively, logistic regression and chi-square test. Data were analyzed using PASW software, v.19 (SPSS Inc., Chicago, IL, USA). Statistical significance was set at $P < 0.05$, and all tests were two tailed. Given the well-known association between age and sexual desire, linear and logistic regression analyses were adjusted for age.

Results

Patient Characteristics

Patient characteristics are summarized in Table 1.

Ten trans women were no longer on estrogen therapy due to previous thromboembolic events (N = 5), dissatisfaction (N = 2), or another cause (N = 3). Current hormonal treatment in trans women mostly consisted of transdermal estradiol (17-β estradiol gel 1.5 mg/24u [n = 76; 35.5%]; estradiol patch 50 μg/24u [n = 29;13.6%]); or daily intake of oral estrogens; (estradiol valerate 2 mg [n = 91; 42.5%], estriol 2 mg [n = 1; 0.4%], ethinyl estradiol 50 μg [n = 2; 0.9%], and oral contraceptive ethinyl estradiol 30–50 μg [n = 5; 2.3%]). Cross-sex hormonal therapy in trans men consisted of intramuscular testosterone treatment with either a mixture of testosterone esters (testosterone decanoate 100 mg, testosterone isocaproate 60 mg, testosterone fenylpropionate 60 mg, testosterone propionate 30 mg/mL) every 2 or 3 weeks (n = 64; 46.4%); testosterone undecanoate 1000 mg per 12 weeks (n = 62; 44.9%); transdermal testosterone 50 mg daily (n = 9; 6.5%); or oral testosterone undecanoate (n = 2; 1.4%).

Sexual Desire in Trans Women

Sexual Desire and HSDD in Trans Women

The majority of trans women (83.4%) never or rarely experienced spontaneous sexual desire, whereas 6.5% often or always experienced spontaneous sexual desire. Almost 76% (75.8%) never or rarely experienced responsive sexual desire. Fourteen percent experienced responsive sexual desire from time to time; 10.1% experienced responsive sexual desire often or always. Seventy-three percent never or rarely experienced either spontaneous or responsive sexual desire. About one in three trans women, who never or rarely experienced either spontaneous or responsive sexual desire, indicated to be distressed by this, personally or within the relationship, resulting in a prevalence of HSDD of 22.1% (Figure 2). However, the vast majority of trans women did not experience this lack or absence of sexual desire as distressing.

Of the trans women who reported to experience spontaneous sexual desire often or always (6.5%), only one reported associated personal or relational distress.

Table 1 General characteristics of the study population

	Trans women (N = 214)	Trans men (N = 138)	*P*
Age at time of study (years)	45 [32.8–52]	37.5 ± 11.0	<0.001
Nationality (%)			
Belgian	86.0	87.0	*NS*
Other	14.0	12.5	
Civil status (%)			<0.001
Married/living together	36.0	44.5	
Not married or living together	36.4	47.4	
Divorced	25.2	8.0	
Widow	2.3	0	
Children (%)	41.1	23.9	<0.001
Birth before HRT (%)	81.8	36	<0.001
Work status (%)			0.001
Unemployed	14.2	9.4	
Employed	55.9	64.5	
Retired	9.5	1.5	
Student	5.2	13.0	
Unable to work	13.7	9.4	
Household	1.4	2.2	
Monthly income (%)			*NS*
≤999 euro	10.3	14.2	
1,000–1,999 euro	42.2	35.8	
2,000–2,999 euro	27.5	24.6	
3,000–5,999 euro	16.7	23.9	
≥6,000 euro	3.4	1.5	
SRS (%)	64.8	85.5	<0.001
Time since SRS (years)	6.0 [2–11]	7.0 [4–13]	*NS*
Duration of hormonal therapy (years)	6.0 [3–11]	7.0 [4–13]	0.041
Active smoking (%)	29.9	29.4	*NS*
BMI	24.4 [21.7–27.9]	24.3 [22–27.5]	*NS*

Data are presented as % or median (first to third quartiles). Categorical variables using chi-square test; continuous variables using linear regression analysis. HRT = hormone replacement therapy; NS = not significant; SRS = sex reassignment surgery (defined as orchidectomy/penectomy/vaginoplasty in trans women and hysterectomy/ovariectomy in trans men).

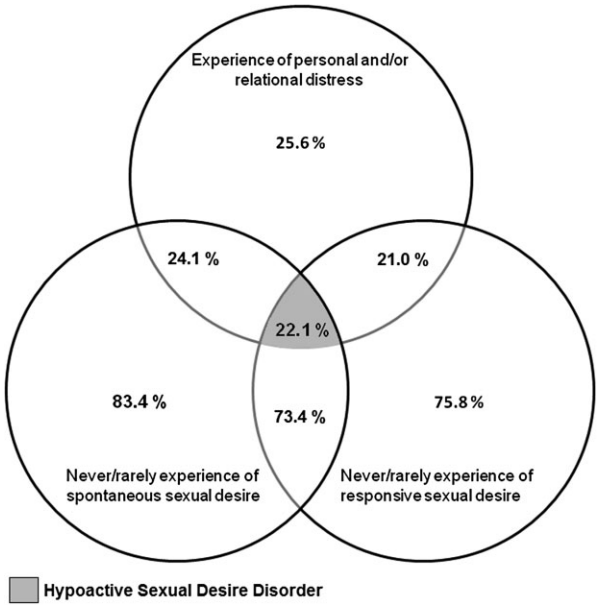

Figure 2 Prevalence of HSDD in trans women.

One fourth of trans women (24.2%) often or always experienced too low sexual desire (Table 2). In retrospect, the majority of trans women (69.7%) described their current sexual desire lower or much lower as compared with before sex reassignment therapy. In contrast, 17.4% reported no change in sexual desire and 13% of participants described an increase in sexual desire (Figure 3).

Associations Between Sexual Desire and Sex Reassignment Treatment in Trans Women

Cross-Sex Hormonal Therapy. Type of hormonal therapy, duration of hormonal therapy, and satisfaction with hormonal therapy were not associated with frequency of spontaneous or responsive sexual desire or prevalence of HSDD (data not shown).

SRS. Respondents who already had undergone a vaginoplasty experienced more spontaneous sexual desire ($P = 0.002$) compared with those who were still scheduled for this surgery. Satisfaction with

Table 2 Sexual desire in trans persons

		Trans women (N = 214)	Transsexual men (N = 138)	*P*
Current in relationship (%)	Yes	47.2	62.3	<0.001*
	No	52.8	37.7	
Duration of relationship (%)	<6 months	7.1	4.7	NS†
	6–12 months	4.0	5.8	
	1–2 years	14.1	14.0	
	2–5 years	16.2	19.8	
	>5 years	58.6	55.8	
Sexual orientation (%)	(Mainly) attracted to males	36.0	10.2	<0.001†
	Bisexual	11.2	6.5	
	(Mainly) attracted to females	47.7	81.8	
	Other	5.1	1.4	
Current sexual desire (%) compared with sexual desire before sex reassignment treatment	Much higher	5.5	31.3	<0.001†
	Higher	7.5	39.7	
	Equally	17.4	16.8	
	Lower	26.4	9.2	
	Much lower	43.3	3.1	
Frequency of experience of too low sexual desire (%)	Almost never or never	46.0	74.0	<0.001†
	Rarely	19.7	15.3	
	From time to time	10.1	5.3	
	Often	10.1	4.6	
	Almost always or always	14.1	0.8	
Experience of symptoms of low sexual desire (%)	No	40.8	81.6	<0.001†
	Mild	16.8	13.2	
	Moderate	15.2	4.4	
	Severe	27.2	0.9	
Experience of symptoms of high sexual desire (%)	No	82.3	31.6	<0.001†
	Mild	9.2	35.1	
	Moderate	4.9	22.8	
	Severe	3.8	10.5	
Hypoactive sexual desire disorder (%)	Yes	22.2	5.0	<0.001*
	No	77.8	95.0	

*Logistic regression analysis
†Chi-square test
Data are expressed as %; logistic regression analyses are adjusted for age; NS = not significant

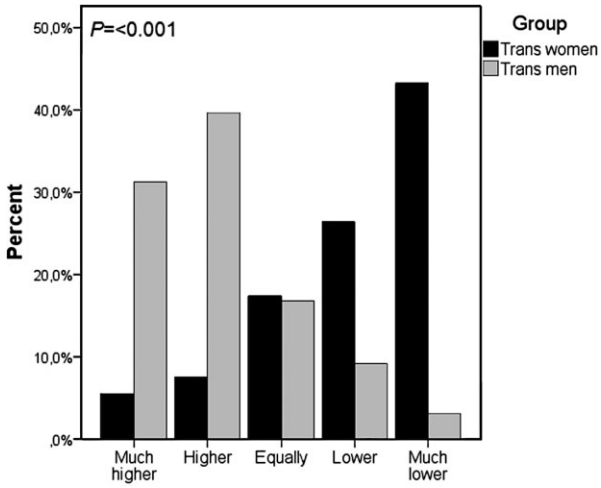

Figure 3 Current sexual desire in trans men and women compared with sexual desire before sex reassignment treatment.

genital reassignment surgery and experience of complications of vaginoplasty were not associated with sexual desire scores (data not shown).

Sexual Orientation and Relationship. Involvement in a romantic relationship or relationship duration were not related to frequency of spontaneous or responsive sexual desire (data not shown), but respondents involved in a relationship had a higher prevalence of HSDD ($P < 0.001$). Trans women (mostly) attracted to men had higher levels of spontaneous and responsive sexual desire compared with trans women (mostly) attracted to women ($P = 0.008$ and $P = 0.009$, respectively) (Figure 4A, B), but sexual orientation was not associated with prevalence of HSDD (data not shown).

General Characteristics. Age was negatively associated with frequency of spontaneous and responsive sexual desire ($P = 0.008$ and $P < 0.001$, respectively). Employment status, having children, physical well-being, and mental well-being were not associated with frequency of sexual desire or prevalence of HSDD (data not shown).

Sexual Desire in Trans Men

Sexual Desire and HSDD in Trans Men

Forty percent of trans men reported experiencing sexual desire from time to time, whereas 30.6% often or always experienced this. Thirty percent of trans men never or rarely experienced sexual desire and about one in six trans men in our sample indicated to be distressed by this, personally or within the relationship, resulting in a prevalence of 5.0% of HSDD in our sample of trans men.

Of the trans men who reported experiencing sexual desire often or always (30.6%), a majority reported no associated distress (76.9%), 12.8% reported personal or relational distress, and 10.3% expressed that this caused no personal distress but exclusively stress for their partners. Of the total sample, 3.6% of trans men often or always experienced sexual desire and reported this caused personal or relational distress.

In retrospect, the majority of trans men (71.0%) reported an increase in sexual desire after sex reassignment treatment, whereas 12.3% reported a decrease. Almost 17% experienced no change in sexual desire.

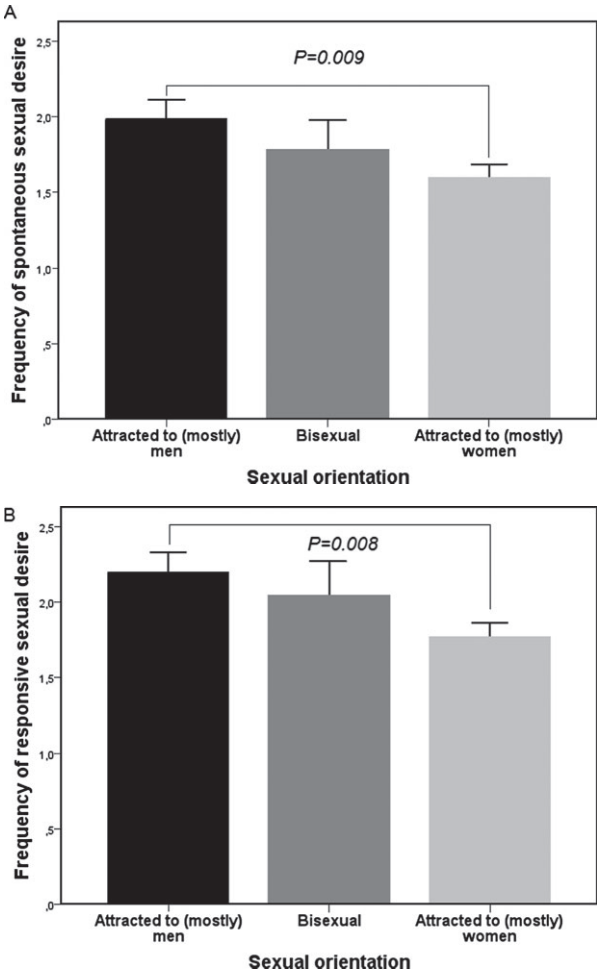

Figure 4 Frequency of sexual desire according to sexual orientation in trans women.
Bars represent mean and whiskers 2 standard error of mean. *P* value result from post-hoc ANOVA.

Associations Between Sexual Desire and Sex Reassignment Treatment in Trans Men

Cross-Sex Hormonal Therapy. Shorter duration of testosterone treatment was significantly associated with more symptoms of high sexual desire ($P = 0.005$). We observed no associations between type of hormonal therapy and satisfaction with hormone replacement therapy and sexual desire scores (data not shown).

SRS. Whether or not trans men had undergone phalloplasty surgery and/or the implantation of an erection prosthesis did not affect sexual desire scores. In addition, time since genital surgery, satisfaction with genital reassignment surgery, and experiences of complications of phalloplasty and/or erection prosthesis were not associated with frequency of experiencing sexual desire (data not shown). However, HSDD was more prevalent in trans men who were less satisfied with their phalloplasty (Fisher's exact test; $P = 0.02$).

Sexual Orientation and Relationship. Shorter relationship duration was associated with a higher frequency of experiencing sexual desire ($P = 0.03$). No associations were found between sexual orientation, involvement in a relationship, and frequency of sexual desire and HSDD in trans men (data not shown).

General Characteristics. No association was observed between age and frequency of sexual desire (data not shown) in trans men. Having children, physical well-being, and mental well-being were not associated with frequency of sexual desire or prevalence of HSDD (data not shown). Unemployed trans men had a lower frequency of sexual desire ($P = 0.015$).

Sexual Desire in Total Transsexual Sample

Comparison Between Trans Women and Trans Men

A comparison between trans women and trans men on relational and sexual desire parameters are shown in Table 2. Trans men were more frequently involved in a romantic relationship compared with trans women. More symptoms of high sexual desire were observed in trans men, whereas trans women reported more symptoms of low sexual desire. HSDD was more prevalent in trans women compared with trans men ($P < 0.001$). We observed no difference in satisfaction with surgical reassignment of genitalia between trans men and women (data not shown).

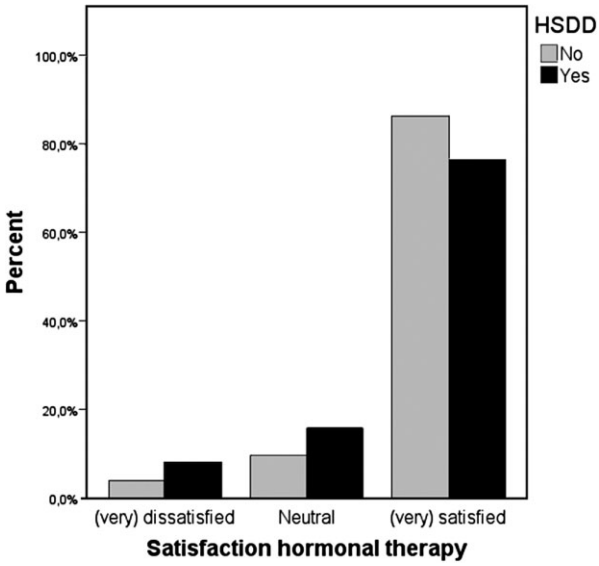

Figure 5 Hormonal satisfaction in trans men and women and prevalence of HSDD.
Bars represent percentage. We observed a higher ratio of trans persons experiencing HSDD in trans persons who are dissatisfied with the hormonal therapy.

Associations Between Sexual Desire and Sex Reassignment Treatment in Total Transsexual Sample

Cross-Sex Hormonal Therapy. Dissatisfaction with hormonal therapy was associated with a higher prevalence of HSDD ($P = 0.02$) (Figure 5). No association was observed between sexual desire scores and duration of hormonal therapy in the total trans sample (data not shown).

SRS. We observed no association between sexual desire scores and satisfaction with surgical reassignment of genitalia in the total transsexual sample.

Relationship. Trans persons involved in a romantic relationship had higher levels of sexual desire ($P = 0.02$) and also had a higher prevalence of HSDD ($P = 0.001$).

General Characteristics. Age was negatively associated with frequency of sexual desire (respectively: $P < 0.001$). Employment status, having children, physical well-being, and mental well-being were not associated with frequency of sexual desire or prevalence of HSDD (data not shown).

Discussion

The present study described the sexual desire frequency (and prevalence of HSDD) and associations between sex reassignment treatment and sexual desire in a large, well-described group of both trans women and men. We observed that almost three-quarters of trans women rarely or never experienced spontaneous and responsive sexual desire. About a third of these women with low sexual desire reported associated distress and met criteria for HSDD, a ratio also reported by studies in cisgender women [46,47]. We observed a lower prevalence of HSDD in trans women (22%) compared with a previous multicenter study [43] in 62 trans women (33%), possibly related to methodological differences. Trans women in our study had a higher prevalence of HSDD compared with male and female population studies using a similar definition, taking distress levels into account, as they found that between 0.5% and 6% of men and 3–14.2% of women reported HSDD [48–52]. In trans men, a similar prevalence of HSDD was found (5.0%) compared with the general male population (range: 0.5–6%) [48–50,52].

Trans women had a higher prevalence of HSDD and described more often a decrease in sexual desire after sex reassignment therapy compared with trans men. Sexual desire is a multifaceted process, resulting from the triggering of a sexual response system with a specific arousability based on genetics, the presence of sex steroids and neurotransmitters, as well as by lifelong psychosocial learning experiences. Those sexual stimuli can be both internal (such as sexual thoughts) or external cues (sensory stimuli experienced as erotic) [53]. As trans women have mostly grown up with a highly testosterone-dependent sexual response system and have often had sexual experiences in the male gender role, it requires a certain "reconditioning" of the sexual response system within a less androgenic hormonal milieu. The fact that two in three trans women in our group did *not* experience this lack or absence of sexual desire as distressing, points to the presence of factors that might be compensating for the loss of the "androgen-driven sexuality." This might consist of factors the current study could not assess, such as an increasingly positive self-image due to the transition and a boosted self-esteem from being recognized as female.

Regarding determinants of sexual desire, it was found that trans women attracted to women experienced lower levels of sexual desire. These findings support previous results from Weyers et al. [42]. Interestingly, no differences in distress levels were observed between trans women attracted to men or attracted to women suggesting that trans women attracted to women may be less interested in sexual activity or are less open to sexually adequate stimuli compared with those attracted to men. Indeed, it has already been observed [42] that trans women attracted to women attributed the lowest importance to sex in comparison with the others. These results may also corroborate with observations in lesbian women, as the latter had lower levels of sexual desire compared with heterosexual women [54]. Similar to studies in the general population, it was found that respondents involved in a partner relationship had higher distress levels [46] resulting in a higher prevalence of HSDD.

Concerning the associations between cross-sex therapy and sexual desire, it was observed that trans women who had undergone vaginoplasty experienced higher levels of sexual desire compared with those who were scheduled to undergo this surgery. It is likely that the relief of gender dysphoria due to a body image more congruent with the gender identity has positive effects on sexual functioning or the other way around that the presence of male genitalia has negative effects on sexual functioning. As a result, trans women may experience more satisfying sexual relationships after genital surgery. In contrast, no associations were found between type of surgery and sexual desire scores in trans men, but satisfaction with phalloplasty was negatively associated with prevalence of HSDD. Interestingly, no associations were observed between surgical satisfaction and sexual desire scores in trans women.

These different associations between trans women and trans men are not well understood. One explanation could be that trans men attribute a higher degree of importance to functionality of their newly formed genitalia compared with trans women. Many underlying factors may contribute to these findings such as differences between functional and esthetical surgical satisfaction, body image, self-esteem, etc. This is a point for further exploration and study.

Hormonal therapy satisfaction was related to a lower prevalence of HSDD in the total transsexual sample. Overall, the results underline the importance of different surgical interventions and treatment satisfaction on sexual desire in trans

persons. In earlier research in the same cohort, we observed that both hormonal and surgical satisfaction were strongly related to mental and physical well-being [40]. The current results underline the importance of high-quality sex reassignment treatment on the sexual well-being of trans persons.

As to the limitations of this study, we had a modest response rate (54%) and selection bias cannot be excluded. As in most follow-up studies, respondents who participated in this study may have experienced a more favorable outcome than those who refused. Second, our observations on changes in sexual desire after sex reassignment treatment in both trans men and women are based on retrospective data and should be interpreted with caution; prospective studies are needed to confirm our results. Third, the aim of this study was to investigate the associations between sex reassignment treatment and sexual desire. However, we are aware that the subjective experience of sexual desire for an individual results from a complex interaction between the individuals' sexual response system and adequate sexual stimuli and consequently can be affected by many biological, psychological, social, sexual, and relational factors [53], which were not all addressed in the current study. Also, gender differences in intrinsic and extrinsic factors affecting sexual desire have led to another conceptualization of sexual desire in men and women [55]. Given these gender differences in sexual desire, distinct definitions of HSDD in men and women have been proposed [56,57]. We defined HSDD in trans women and trans men according to the definition of the desired gender, due to changes in both hormonal environment and/or genital anatomy and function in combination with transitioning to the desired gender role. However, this approach has certain limitations considering the presence of male or female genetics, gender differences in imprinting of brain systems, and lifelong psychosocial learning experiences in the natal gender role.

In addition, because of surgical availability and expertise, and a well-organized health insurance system, allowing coverage for SRS, the majority of trans persons at our center who receive cross-sex hormone therapy undergo SRS. Also, postoperative sexual functioning is highly dependent on the quality of, and satisfaction with, surgery [34] and this may differ from center to center. These factors may hamper the generalizability of our results.

Conclusion

Trans women had a higher prevalence of HSDD compared with what has been reported in previous research for cisgender women, whereas trans men had similar or lower prevalence rates of HSDD in comparison with cisgender men. Most trans women reported a decrease in sexual desire after sex reassignment treatment, whereas the opposite was observed in trans men. Our results point out a significant sexual impact of surgical procedures and both hormonal and surgical treatment satisfaction on the sexual desire in trans persons.

Corresponding Author: Katrien Wierckx, MD, Department of Endocrinology, Ghent University Hospital, De Pintelaan 185 9000 Ghent, Belgium. Tel: +32 332 19 66; Fax: +32 9 240 38 17; E-mail: Katrien.wierckx@ugent.be

Conflict of Interest: The authors report no conflicts of interest.

Statement of Authorship

Category 1

(a) Conception and Design
Katrien Wierckx; Els Elaut; Griet De Cuypere; Guy T'Sjoen

(b) Acquisition of Data
Katrien Wierckx

(c) Analysis and Interpretation of Data
Katrien Wierckx; Els Elaut; Griet De Cuypere; Guy T'Sjoen; Birgit Van Hoorde; Gunter Heylens; Piet Hoebeke; Steven Weyers; Stan Monstrey

Category 2

(a) Drafting the Article
Katrien Wierckx; Els Elaut; Griet De Cuypere; Guy T'Sjoen

(b) Revising It for Intellectual Content
Katrien Wierckx; Els Elaut; Griet De Cuypere; Guy T'Sjoen; Birgit Van Hoorde; Gunter Heylens; Piet Hoebeke; Steven Weyers; Stan Monstrey

Category 3

(a) Final Approval of the Completed Article
Katrien Wierckx; Els Elaut; Griet De Cuypere; Guy T'Sjoen; Birgit Van Hoorde; Gunter Heylens; Piet Hoebeke; Steven Weyers; Stan Monstrey

References

1 Wierckx K, Mueller S, Weyers S, Van Caenegem E, Roef G, Heylens G, T'Sjoen G. A long-term evaluation of cross-sex hormone treatment in trans persons. J Sex Med 2012;9:2641–51.

2 Hembree WC, Cohen-Kettenis P, Delemarre-van de Waal HA, de Waal HA, Gooren LJ, Meyer WJ 3rd, Spack NP, Tangpricha V, Montori VM. Endocrine treatment of trans persons: An Endocrine Society clinical practice guideline. J Clin Endocrinol Metab 2009;94:3132–54.
3 Bancroft J. The endocrinology of sexual arousal. J Endocrinol 2005;186:411–27.
4 Yassin AA, Saad F. Improvement of sexual function in men with late-onset hypogonadism treated with testosterone only. J Sex Med 2007;4:497–501.
5 Wang C, Cunningham G, Dobs A, Iranmanesh A, Matsumoto AM, Snyder PJ, Weber T, Berman N, Hull L, Swerdloff RS. Long-term testosterone gel (AndroGel) treatment maintains beneficial effects on sexual function and mood, lean and fat mass, and bone mineral density in hypogonadal men. J Clin Endocrinol Metab 2004;89:2085–98.
6 Carani C, Zini D, Baldini A, Della CL, Ghizzani A, Marrama P. Effects of androgen treatment in impotent men with normal and low levels of free testosterone. Arch Sex Behav 1990;19: 223–34.
7 Buena F, Swerdloff RS, Steiner BS, Lutchmansingh P, Peterson MA, Pandian MR, Galmarini M, Bhasin S. Sexual function does not change when serum testosterone levels are pharmacologically varied within the normal male range. Fertil Steril 1993;59:1118–23.
8 Hajjar RR, Kaiser FE, Morley JE. Outcomes of long-term testosterone replacement in older hypogonadal males: A retrospective analysis. J Clin Endocrinol Metab 1997;82:3793–6.
9 Yates WR, Perry PJ, MacIndoe J, Holman T, Ellingrod V. Psychosexual effects of three doses of testosterone cycling in normal men. Biol Psychiatry 1999;45:254–60.
10 Riley A, Riley E. Controlled studies on women presenting with sexual disorders: I. Endocrine status. J Sex Marital Ther 2000;26:269–83.
11 Turna B, Apaydin E, Semerci B, Altay B, Cikili N, Nazli O. Women with low libido: Correlation of decreased androgen levels with female sexual function index. Int J Impot Res 2005;17:148–53.
12 Santoro N, Torrens J, Crawford S, Allsworth JE, Finkelstein JS, Gold EB, Korenman S, Lasley WL, Luborsky JL, McConnell D, Sowers MF, Weiss G. Correlates of circulating androgens in mid-life women: The study of women's health across the nation. J Clin Endocrinol Metab 2005;90:4836–45.
13 Davis SR, Davison SL, Donath S, Bell RJ. Circulating androgen levels in self-reported sexual function in women. JAMA 2005;294:91–6.
14 Bancroft J, Sherwin B, Alexander GM, Davidson DW, Walker A. Contraceptives, androgens, and the sexuality of young women. 2. The role of androgens. Arch Sex Behav 1991;20: 121–35.
15 Burrows LJ, Basha M, Goldstein A. The effects of hormonal contraception on female sexuality: A review. J Sex Med 2012;9:2213–23.
16 Davis SR, van der Mooren MJ, van Lunsen RH, Lopes P, Ribot C, Rees M, Moufarege A, Rodenberg C, Buch A, Purdie DW. Efficacy and safety of a testosterone patch for the treatment of hypoactive sexual desire disorder in surgically menopausal women: A randomized, placebo-controlled trial. Menopause 2006;13:387–96.
17 Davis SR, Moreau M, Kroll R, Bouchard C, Panay N, Gass M, Braunstein GD, Hirschberg AL, Rodenberg C, Pack S, Koch H, Moufarege A, Studd J. Testosterone for low libido in postmenopausal women not taking estrogen. N Engl J Med 2008;359:2005–17.
18 Shifren JL, Braunstein GD, Simon JA, Casson PR, Buster JE, Redmond GP, Burki RE, Ginsburg ES, Rosen RC, Leiblum SR, Caramelli KE, Mazer NA. Transdermal testosterone treatment in women with impaired sexual function after oophorectomy. N Engl J Med 2000;343:682–8.
19 Grades NM, Jacobson DJ, Mcgree ME, St Sauver JL, Lieber MM, Nehra A, Girman CJ, Klee GG, Jacobson SJ. The associations between serum sex steroids, erectile function and sex drive: The Olmsted County Study of urinary symptoms and heath status among men. J Sex Med 2008;5:2209–20.
20 Basar MM, Aydin G, Mert HC, Keles I, Caglayan O, Orkun S, Batislam E. Relationship between serum sex steroids and aging male symptoms score and International Index of Erectile Function. Urology 2005;66:597–601.
21 Avis NE, Stellato R, Crawford S, Johannes C, Longcope C. Menopause 2000;7:297–309.
22 Cawood EH, Bancroft J. Steroid hormones, the menopause, sexuality and well-being of women. Psychol Med 1996;26: 925–36.
23 Dennerstein L, Burrows G, Wood C, Hyman G. Hormones and sexuality: The effects of estrogen and progestogen. Obstet Gynecol 1980;56:316–22.
24 Dow M, Hart D, Forrest C. Hormonal treatments of unresponsiveness in post-menopausal women: A comparative study. Br J Obstet Gynaecol 1983;90:361–6.
25 Redmond G. Hormones and sexual function. Int J Fertil 1999;44:193–7.
26 Graham C, Ramos R, Bancroft J, Maglaya C, Farley T. The effects of steroidal contraceptives on the well-being and sexuality of women: A double-blind, placebo-controlled, two-centre study of combined and progestogen-only methods. Contraception 1995;52:363–9.
27 Cohen-Kettenis PT, Van Goozen SHM. Sex reassignment of adolescent transsexuals: A follow-up study. J Am Acad Child Adolesc Psychiatry 1997;36:263–71.
28 Schroder M, Carroll RA. New women: Sexological outcomes of male-to-female gender reassignment surgery. J Sex Educ Ther 1999;24:137–46.
29 Mate-Kole C, Freschi M, Robin A. A controlled study of psychological and social change after surgical gender reassignment in selected male transsexuals. Br J Psychiatry 1990;157: 261–4.
30 Sørensen T. A follow-up study of operated transsexual males. Acta Psychiatr Scand 1981;63:486–503.
31 Wierckx K, Van Caenegem E, Elaut E, Vandepeer F, Dedecker D, Toye K, Weyers S, Hoebeke P, Monstrey S, De Cuypere G, T'Sjoen G. Quality of life and sexual health after sex reassignment surgery in trans men. J Sex Med 2011;8:3379–88.
32 Klein C, Gorzalska BB. Sexual functioning in transsexuals following hormone therapy and genital surgery: A review. J Sex Med 2009;6:2922–39.
33 Monstrey S, Hoebeke P, Selvaggi G, Ceulemans P, Van Landuyt K, Blondeel P, Hamdi M, Roche N, Weyers S, De Cuypere G. Penile reconstruction: Is the radial forearm flap really the standard technique? Plast Reconstr Surg 2009;124:510–8.
34 De Cuypere G, T'Sjoen G, Beerten R, Selvaggi G, De Sutter P, Hoebeke P, Monstrey S, Vansteenwegen A, Rubens R. Sexual and physical health after sex reassignment surgery. Arch Sex Behav 2005;34:679–90.
35 Rehman J, Lazer S, Benet AE, Schaefer LC, Melman A. The reported sex and surgery satisfactions of 28 postoperative male-to-female transsexual patients. Arch Sex Behav 1999;28: 71–89.
36 Smith YLS, Van Goozen SHM, Cohen-Kettenis PT. Adolescents with gender identity disorder who were accepted or rejected for sex reassignment surgery: A prospective follow-up study. J Am Acad Child Adolesc Psychiatry 2001;40: 472–81.
37 Lief HI, Hubschman L. Orgasm in the postoperative transsexual. Arch Sex Behav 1993;22:145–55.

38 Lobato M, Koff WJ, Manenti C, Seger DF, Salvador J, Fortes MGB, Petry AR, Silveira E, Henriques AA. Follow-up of sex reassignment surgery in transsexuals: A Brazilian cohort. Arch Sex Behav 2006;35:711–5.
39 Wierckx K, Elaut E, Van Caenegem E, Van de peer F, Dedecker D, Vanhoudenhove E, T'Sjoen G. Sexual desire in female-to-male trans persons: An exploration of the role of testosterone replacement. Eur J Endocrinol 2011;165:331–7.
40 Wierckx K, Elaut E, Motmans J, Heylens G, De Cuypere G, Anseeuw E, Geerts L, T'Sjoen G. Quality of life in trans persons: A case control study. manuscript submitted to Arch Sex Behav. Submitted.
41 Wierckx K, Elaut E, Declercq E, De Cuypere G, Taes Y, Kaufman JM, T'Sjoen G. Prevalence of cardiovascular disease and cancer during cross-sex hormone therapy in a large cohort of trans persons: A case control study. Eur J Endocrinol 2013;169:471–8.
42 Weyers S, Elaut E, De Sutter P, Gerris J, T'Sjoen G, Heylens G, De Cuypere G, Verstraelen H. Long-term assessment of the Physical, Mental, and Sexual Health among transsexual woman. J Sex Med 2009;6:752–60.
43 Elaut E, De Cuypere G, De Sutter P, Gijs L, Van Trotsenburg M, Heylens G, Kaufman JM, Rubens R, T'Sjoen G. Hypoactive sexual desire in trans women: Prevalence and association with testosterone levels. Eur J Endocrinol 2008;158: 393–9.
44 Basson R, Berman J, Burnett A, Derogatis L, Ferguson D, Fourcroy J, Goldstein I, Graziottin A, Heiman J, Laan E, Leiblum S, Padma-Nathan H, Rosen R, Segraves K, Segraves RT, Shabsigh R, Sipski M, Wagner G, Whipple B. Report of the international consensus development conference on female sexual dysfunction: Definitions and classifications. J Urol 2000;163:888–93.
45 Ware JE. SF-12 Health Survey. Washington D.C (1994, 2002), WA: Medical Outcomes. Trustand QualityMetric Inc.
46 Rosen RC, Shifren JL, Monz BU, Odom DM, Russo PA, Johannes CB. Correlates of sexually related personal distress in women with low sexual desire. J Sex Med 2009;6:1549–60.
47 Leiblum SR, Koochaki PE, Rodenberg CA, Barton IP, Rosen RC. Hypoactive sexual desire disorder in postmenopausal women: U.S. results from the Women's International Study of Health and Sexuality (WISHeS). Menopause 2006;13:46–56.
48 Kedde H. Seksuele disfuncties in Nederland: Prevalentie en samenhangende factoren. Tijdschrift voor Seksuologie 2012;36:98–108.
49 Christensen BS, Grønbæk M, Osler M, Pedersen BV, Graugaard C, Frisch M. Sexual dysfunctions and difficulties in Denmark: Prevalence and associated sociodemographic factors. Arch Sex Behav 2011;40:121–32.
50 Fugl-Meyer AR, Fulg-Meyer K. Sexual disabilities, problems and satisfaction in 18–74 year old Swedes. Scand J Sexol 1999;2:79–105.
51 Shifren JL, Monz BU, Russo PA, Segreti A, Johannes CB. Sexual problems and distress in United States women: Prevalence and correlates. Obstet Gynecol 2008;112:970–8.
52 Buysse A, Caen M, Dewaele A, Enzlin P, Lievens J, T'Sjoen G, Van Houtte M, Vermeersch H. Seksuele disfuncties. In: Buysse A, Caen M, Dewaele A, Enzlin P, Lievens J, T'Sjoen G, Van Houtte M, Vermeersch H, eds. Seksuele gezondheid in Vlaanderen [Sexual health in Flanders]. Gent: Academia Press; 2013:193–214.
53 Hayes RD, Dennerstein L, Bennett CM, Sidat M, Gurrin LC, Fairley CK. Risk factors for female sexual dysfunction in the general population: Exploring factors associated with low sexual function and sexual distress. J Sex Med 2008;5:1681–93.
54 Applebaum GT. Lesbian sexual function and dysfunction. Doctoral Dissertation, California School of Professional Psychology. Los Angeles, 1983.
55 Basson R. The female sexual response: A different model. J Sex Marital Ther 2000;26:51–65.
56 Brotto LA. The DSM diagnostic criteria for hypoactive sexual desire disorder in men. J Sex Med 2010;7:2015–30.
57 Brotto LA. The DSM diagnostic criteria for hypoactive sexual desire disorder in women. Arch Sex Behav 2010;39: 221–39.