IJIR: Your Sexual Medicine Journal (2021) 33:694–702
https://doi.org/10.1038/s41443-020-00402-7

ARTICLE

Sexual orientation in transgender individuals: results from the longitudinal ENIGI study

J. Defreyne[1] · E. Elaut[2] · M. Den Heijer[3] · B. Kreukels[3] · A. D. Fisher[4] · G. T'Sjoen[5]

Received: 29 May 2020 / Revised: 5 September 2020 / Accepted: 16 December 2020 / Published online: 22 January 2021

Abstract

Transgender people and their next-of-kin may request information on sexual orientation and preferred partners during hormonal affirming process. Although previous research on sexual orientation in transgender people is extensive, this literature may already be outdated and/or the methodology of studies assessing sexual orientation may fall short. This prospective cohort study was part of the European Network for the Investigation of Gender Incongruence (ENIGI). Gender role and preferred partner in sexual fantasies, sexual orientation and gender of current sexual partner were assessed at baseline (initiation of HT) and every follow-up visit. Data from 469 transgender women (TW) and 433 transgender men (TM) were analyzed cross-sectionally and prospectively. At baseline, more than half reported having no partner (35% of TW, 47% of TM). After 12 months, more than half reported having a partner (59% of TW, 56% of TM), with no changes between one and three years of HT. The majority of TM preferred a female partner, TW preferred male and female partners. The sexual identity of their partner matched their sexual orientation in >80%. Sexual orientation did not change over time. We did not observe associations with serum levels of sex steroids or gender-affirming surgery (chest or genital surgery). Sexual orientation did not change during hormonal transition and was not associated with sex steroids or surgery. Also, preferences matched the partner's sexual identity. We do not assume that changing serum levels of sex steroids is directly associated with changes in partner choice. The number of people with a current partner increased, possibly due to the indirect effects of gender-affirming care.

Introduction

Previous research in adult transgender men (TM) as well as transgender women (TW) showed a highly heterogeneous distribution of sexual orientation/sexual identity [1–14], with changed preferences after gender-affirming surgery [2, 5, 6], after initiating gender-affirming hormonal therapy (HT) [5], and—in general—over the course of life [1]. The results on the causality of gender-affirming treatment—and the use of testosterone in particular—remain mixed [1, 3, 4]. Anecdotally, transgender people and their significant others (especially their current partners) presenting at the Ghent University Hospital gender clinic have expressed concern about possible changes in sexual orientation during gender-affirming treatment. Also, their partners often worry about the potential effects of such a change on their current relationship.

Three previous papers [15–17] also report on (a smaller sample of) participants included in the European Network for the Investigation of Gender Incongruence (ENIGI) study, although assessment took place upon the first clinical contact with a psychologist from the team. In these previous ENIGI papers, the majority of the TM were attracted to women (80–91%), whereas TW were attracted to men (36–46%) as well as women (29–64%).

Although previous research on sexual orientation in transgender people is extensive, this literature may already be outdated and/or the methodology of studies assessing

✉ J. Defreyne
Justine.defreyne@ugent.be

1 Department of Endocrinology, Ghent University Hospital, C. Heymanslaan 10, 9000 Ghent, Belgium

2 Center for Sexology and Gender, Ghent University Hospital, C. Heymanslaan 10, 9000 Ghent, Belgium

3 Amsterdam University Medical Center, VUmc, Department of Endocrinology and Center of Expertise on Gender Dysphoria, De Boelelaan 1117, 1081HV Amsterdam, The Netherlands

4 Andrology, Women's Endocrinology and Gender Incongruence Unit, Department of Experimental, Clinical and Biomedical Sciences, University of Florence, Florence, Italy

5 Department of Endocrinology, Ghent University Hospital and Center for Sexology and Gender, De Pintelaan 185, 9000 Ghent, Belgium

sexual orientation may fall short. Most previous research does not report sexual orientation using a continuous scale. Most researchers classify transgender persons' sexual orientation using sexual identity labels, such as "heterosexual", "bisexual", "homosexual", or "other". Previous studies are not always consistent in how these sexual identity labels are classified: relative to birth-assigned sex or to gender identity [3]. In addition, many recent papers on sexual orientation in cohorts of transgender people have methodological shortcomings due to their cross-sectional [3, 4, 11, 12, 14–17] or retrospective design [1, 2, 7, 8, 13].

Sexual orientation was deemed relevant in transgender healthcare of the past, but today, it is mainly considered clinically relevant in the context of offering sufficient support to transgender individuals potentially experiencing stronger minority distress due to their sexual orientation (e.g., transman attracted to men has higher minority distress) [18] or for people desiring genetically related children in the future [19]. In order to answer the questions raised by transgender people and their significant others, the current study aims to prospectively assess sexual orientation during different steps of the gender-affirming process, starting from the initiation of HT, until 3 years of HT, with subgroup analyses by birth-assigned gender and by type of surgical care.

Aims

To assess whether sexual fantasies, preferred partner, sexual orientation, and partnership status change after the initiation of HT in a prospective sample of transgender people.

As the results showed changes in the frequency distributions for two out of four questions after the initiation of gender-affirming hormones, we decided to test two additional hypotheses:

(1) The hypothesis that serum levels of sex steroids were related to changes in sexual fantasies, preferred sexual partner during fantasies, sexual orientation, and partnership status.
(2) The hypothesis that the choice to undergo surgical care depends on sexual orientation and/or gender role during sexual fantasies and/or current or preferred sexual partner.

Methods

Participants

Four dimensions of sexual orientation were prospectively assessed in transgender people from the endocrine part of the ENIGI study at the initiation of HT and over 3 years of follow-up at the endocrinology department, using a self-constructed questionnaire. Before visiting the endocrinology department, transgender people first visited a mental health specialist from the participating clinics. More information on the psychological protocol of the ENIGI initiative was previously published [20]. After assessment, transgender persons are referred to the endocrinology department, if desired. In total, 1669 people were included in the endocrine part of the ENIGI study, which started in 2010 (1055 in Amsterdam, 357 in Ghent, 67 in Florence, and 190 in Oslo) (Fig. 1). The study protocol of the endocrine part of ENIGI was also previously published [21]. The protocol of the ENIGI study was approved by the Ghent University Hospital Ethical Committee. A written informed consent was obtained according to the institution's guidelines. Sexual orientation was assessed using a self-constructed questionnaire, which was added to the battery of questionnaires in September 2012. In Ghent, 93 participants did not complete the questionnaire, as they were included in the ENIGI protocol before the introduction of this questionnaire. Participants in Oslo did not participate in this study arm. At data lock, data from 708 participants were entered into the database in Amsterdam (of which 82 participants did not complete the questionnaire at baseline), whereas in Ghent and Florence, data were entered from all participants who completed the survey (Ghent: $n = 266$, 91 participants did not fill in the questionnaire at baseline, Florence: $n = 20$, 42 participants did not fill in the questionnaire at baseline). In total, 902 participants who completed the questionnaire at baseline were included in this prospective analysis (469 TW and 433 TM).

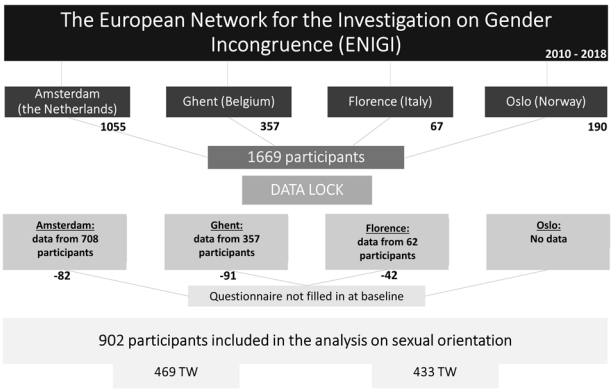


Fig. 1 Flowchart of the study population. The number of people included at each center at the time of data lock is shown in this flowchart. TM transgender men, TW transgender womens.

Gender-affirming hormone therapy

After filling out baseline questionnaires, gender-affirming hormone therapy was initiated according to the ENIGI study protocol, in accordance with the World Professional

Association for Transgender Health Standards of Care, edition 7 [22]. In Ghent, TM received intramuscular long-acting testosterone undecanoate (Nebido® 1000 mg once every 12 weeks). In Amsterdam and Florence, treatment options for TM included testosterone gel in a daily dose of 50 mg and intramuscular administration, either as testosterone esters (Sustanon® 250 mg every 2 weeks) or testosterone undecanoate (Nebido® 1000 mg every 12 weeks). In TW, estrogens plus antiandrogens are administered. Anti-androgen therapy consisted of cyproterone acetate 25–50 mg once daily (Androcur®). Estrogen therapy generally consisted of estradiol valerate 2 mg (Progynova®) twice daily. In patients older than 45 years of age, estradiol was administered transdermally in the form of estradiol patches (Dermestril® or Systen®) in a dose of 100 µg/72 h, to avoid the increased risk for thrombosis from oral estrogens caused by the first-pass effect of the liver. In case of intolerance, estrogens were administered as gel (Estrogel®) in a dose of 1.5 mg twice daily.

Prospective measures

Sexual orientation was assessed using a self-constructed questionnaire, in lack of a validated questionnaire on sexual orientation in transgender people. The questionnaire consists of four questions (Table 1). Question #1 asked about sexual fantasies. Question #2 asked about which partner people fantasized sexually. Question #3 was an adaptation of the Kinsey scale [23] and was used to assess to whom the participants felt sexually attracted. Question #4 asked people to describe the sexual identity of their current (sexual) partner. Question #4 was also recoded to people having a partner (partnership status = yes, options 1–6) versus those without (partnership status = no, option 7).

Type of gender-affirming surgery was assessed at each follow-up visit. Participants were asked if and when they underwent certain procedures (gonadectomy, mastectomy, breast augmentation, vaginoplasty, metoidioplasty, and phalloplasty). Before 2014, gonadectomy was required to be able to change the legal gender marker in the Netherlands. In Italy, this was no longer required from 2015 onward and in Belgium from 2018 onward. This situation has led to people undergoing gonadectomy without vaginoplasty, phalloplasty, or metoidioplasty.

Laboratory analyses

In Ghent, Amsterdam, and Florence, laboratory analyses were performed using commercially available immune assays, as previously described in Wiepjes et al. [24] and Defreyne et al. [25, 26]. However, in Amsterdam, estradiol was measured using a LC–MS/MS after July 2014 (VUmc, Amsterdam, the Netherlands) with an interassay CV of 7% and a LOQ of 20 pmol/L.

Statistical analyses

Data were analyzed prospectively and cross-sectionally (for correlations between sex steroids or to compare groups based on undergoing certain surgical procedures). Cross-sectional data were analyzed using analyses of covariance. Prospective data were analyzed using the Friedman's test or Wilcoxon's signed-rank test for continuous non-normally distributed data. For categorical variables, the difference between prospective scores between categories was assessed by the Mann–Whitney U test or Kruskal–Wallis H test. Both in the cross-sectional and prospective analyses, we assessed whether serum levels of sex steroids and undergoing certain gender-affirming procedures (chest surgery, gonadectomy, and gender-affirming genital surgery) had a significant impact on the results to the four questions. Gender identity, type of HT, and visit were included as factors.

Question #4 was also recoded to people with versus people without a partner. To assess whether the current (sexual) partner matched the participant's sexual orientation, the answers to questions three and four were compared to each other. A match between sexual orientation and identity of the current sexual partner was identified by one of the following combinations: (1) people having a female partner (Q4) and being oriented toward women or both men and women (Q3), (2) people having a male partner (Q4) and being oriented toward men or both men and women (Q3), or (3) people who indicated that their partner was transgender (Q4) and were oriented toward transgender people (Q3).

We constructed a model for prospective changes in each of the four questions using mixed model analyses, with serum levels of sex steroids as a covariate and undergoing surgery as a factor, but this was not possible, as the data were skewed and nontransformable.

For normally distributed data, values are shown as mean ± standard deviation, for non-normally distributed data, values are shown as median [percentile 25–percentile 75]. The significance level was set at $P < 0.05$. All tests were two-sided. If required, a Bonferroni–Holm correction was applied to adjust for multiple comparisons [27], which explains why some P values < 0.05 are not being marked as significant.

Results

In total, information on sexual orientation was available in 902 people at baseline (of whom 469 TW and 433 TM). Baseline characteristics of the study population are shown in Table 2. The frequency distribution for the answers to the four questions over the study follow-up is shown in Figs. 2–5.

Table 1 Overview of the questions and answering options of the self-constructed SEXOR questionnaire.

	Answering option								
	1	2	3	4	5	6	7	8	9
Question one ("If you fantasize sexually, about what do you fantasize?")	"Having sexual intercourse in the male gender role"	"Having sexual intercourse in the female gender role"	"Having sexual intercourse, sometimes in the male and sometimes in the female gender role"	"I do not fantasize about myself in a sexual way"	"I do not have any sexual fantasies."				
Question two ("In your sexual fantasies, is your partner a …"),	"A woman"	"A man"	"Sometimes a man, sometimes a woman"	"A transgender person"	"I do not fantasize about sexual partners"	"I do not have any sexual fantasies"			
Question three ("To who do you currently feel sexually attracted?")	"To men only, without any feelings of attraction toward women"	"Predominantly to men, seldom to women"	"Predominantly to men, but often to women as well"	"Men and women equally"	"Predominantly to women, but often to men as well"	"Predominantly to women, seldom to men"	"To women only, without any feelings of attraction toward men"	"To transgender people"	"Not applicable"
Question four ("My current sexual partner is…")	"A heterosexual woman"	"A gay or bisexual woman"	"A gay or bisexual man"	"A heterosexual man"	"A transgender person"	"Other"	"No partner"		

Table 2 Baseline characteristics of the study population.

	TW (469)	TM (433)
Age (years)	27.0 [22.0–41.0]	22.0 [20.0–28.0]
Serum estradiol levels (pg/mL)	25.3 [21.1–30.1]	36.9 [22.5–76.8]
Serum testosterone levels (nmol/L)	18.5 [14.0–23.4]	1.2 [0.9–1.6]
Serum FSH levels (U/L)	3.5 [2.5–5.3]	6.0 [3.9–7.5]
Serum LH levels (U/L)	4.0 [2.8–5.3]	4.5 [2.5–8.0]

Due to data lock, the number of people included in this analysis decreased over time, as shown in the tables underneath the figures.

Current sexual partner

The sexual identity of the current sexual partner (heterosexual/gay/bisexual man, woman, trans, other, or none) differed significantly among birth-assigned gender groups ($P < 0.001$) (Fig. 2): at the initiation of HT, TM were more likely to have a partner at baseline, compared to TW (204; 47.1% vs. 164; 35.0%, $P < 0.001$). Of the participants with a partner, TW mostly reported a heterosexual, gay/bisexual female or male partner, TM were mostly partnered with heterosexual or gay/bisexual women.

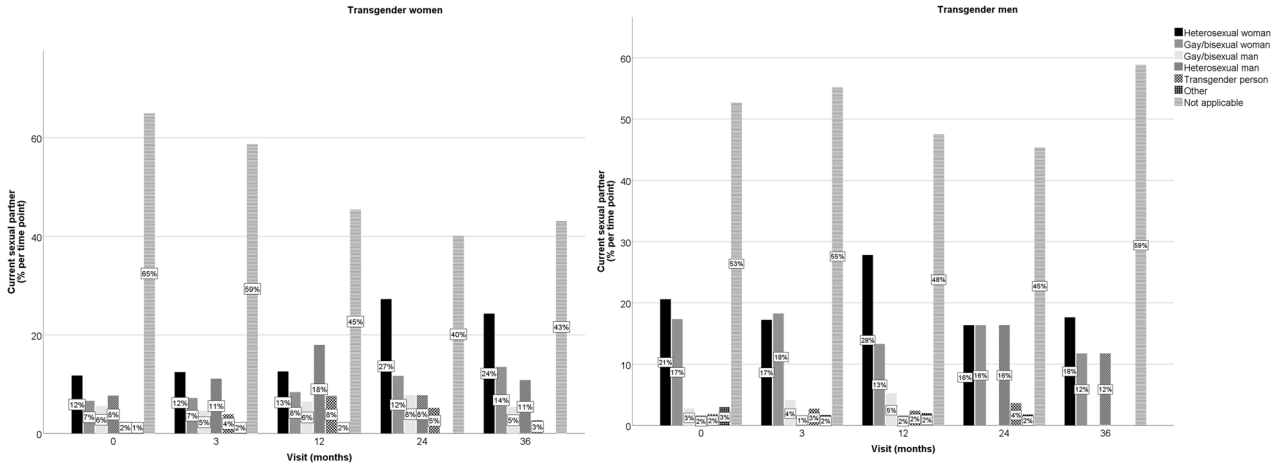
In the group of people with a partner, there was no prospective change in the frequency distributions for sexual identity of the partner over time in TM or TW (all $P = \text{NS}$).

After 12 months, more people indicated having a partner, compared to baseline ($P < 0.001$): 59.0% of the TW and 56.4% of the TM, there was no longer a statistical difference in partnership status between TW and TM. This proportion of partnered participants did not change during the following assessment times (all $P = \text{NS}$).

Of those with a partner ($n = 368$, 40.9% of valid responses), 303 people (84.2%, TW: 131, 81.9%, TM: 172, 86.0%) reported having a partner congruent with their sexual orientation preferences at baseline. Once again, this proportion did not change during the subsequent assessment times (all $P = \text{NS}$).

Sexual orientation

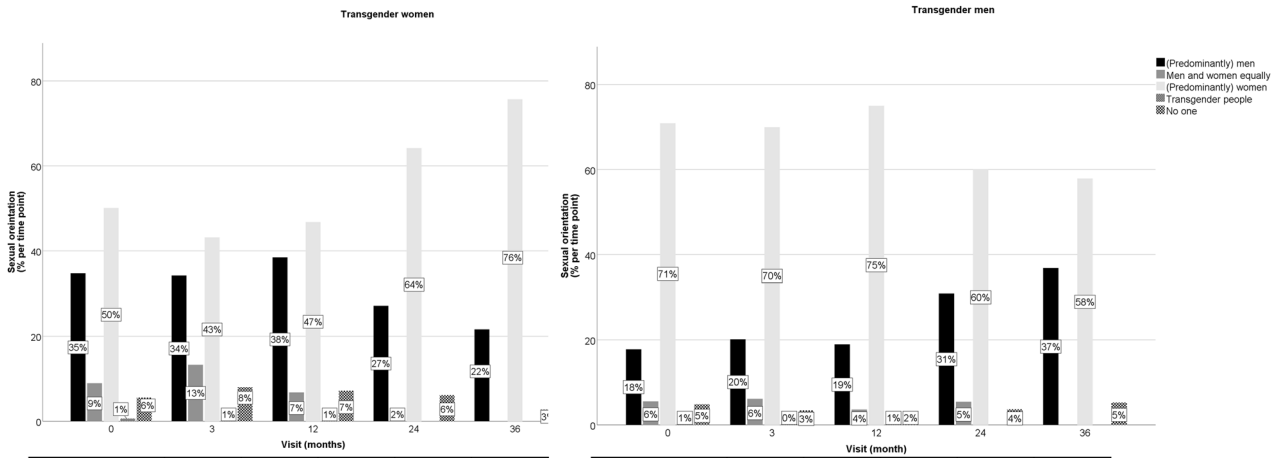
At baseline, 101 TW (21.5%) indicated being attracted to men only, 49 (10.4%) almost exclusively to men, 13 (2.8%) predominantly to men, sometimes women, 42 (9.0%) both, 5 (7.0%) predominantly women, sometimes men, 108 (23.0%) almost exclusively women, 7 (20.0%) only women, 3 (0.6%) to trans-people, and 26 (5.5%) indicated "not applicable." In the TM, 33 (7.6%) were attracted to men only, 33 (7.6%) almost exclusively to men, 11 (2.5%) predominantly to men, sometimes women, 24 (5.5%) both, 14 (3.2%) predominantly women, sometimes men, 54 (12.5%) almost exclusively



Time point (months)	0	3	12	24	36
Number of TW (n)	468	305	262	77	37

Time point (months)	0	3	12	24	36
Number of TM (n)	432	290	248	55	17

Fig. 2 Percentages for the frequency distributions for people's selfdescribed sexual orientation (to whom they feel sexually attracted) in transgender women (left) and transgender men (right) at baseline and after the initiation of gender-affirming hormonal therapy, by study visit. The number of people included in this analysis at each time point are shown underneath the graph.



Time point (months)	0	3	12	24	36
Number of TW (n)	469	301	265	81	37

Time point (months)	0	3	12	24	36
Number of TM (n)	433	293	248	55	19

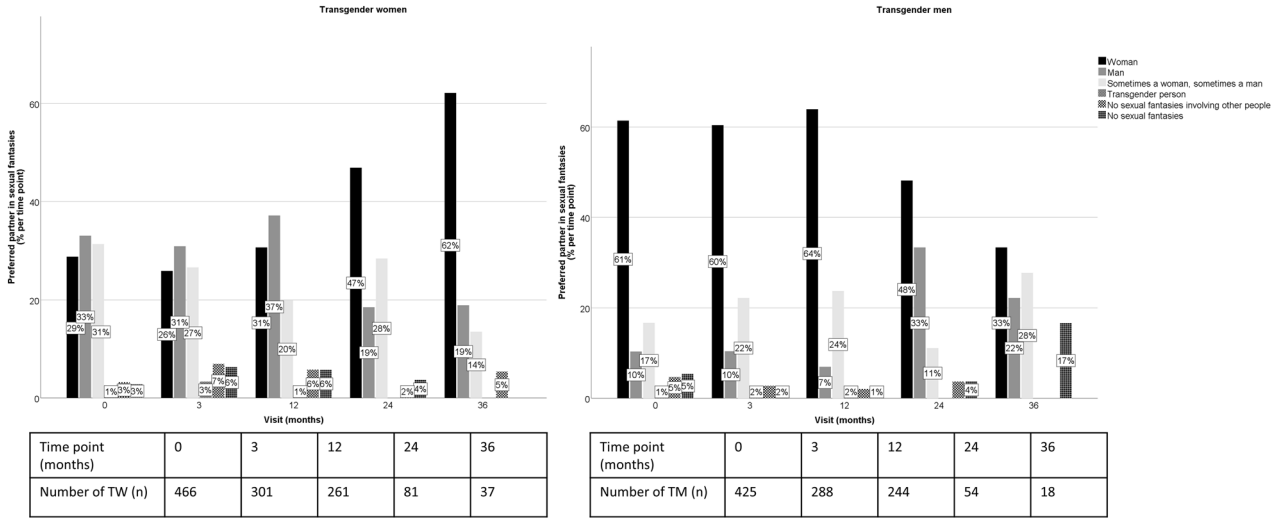
Fig. 3 Percentages for the frequency distributions for sexual identity of the current sexual partner in transgender women (left) and transgender men (right) at baseline and after the initiation of gender-affirming hormonal therapy, by study visit. The number of people included in this analysis at each time point are shown underneath the graph.

women, 239 (55.2%) women only, 4 (0.9%) trans-people, and 21 (4.8%) indicated not applicable. In Fig. 3, categories are regrouped to (predominantly) men, both men and women, (predominantly) to women, transgender people, and no one. The frequency distributions for sexual orientation did not change over time in TM and TW (all $P = \text{NS}$).

Preferred partner in sexual fantasies

At baseline, TW had fantasies about women (34, 28.8%), men (154, 33.0%), or both men and women (146, 6–31.3%), only a minority indicated fantasizing about transgender people (4, 0.9%), not having sexual fantasies involving a partner (15, 3.2%), or not having sexual fantasies at all (13, 2.8%). TM predominantly preferred women (261, 61.4%) and fantasized less about men (44, 10.4%), both men and women (71, 16.7%), or transgender people (6, 1.4%). Some TM did not have sexual fantasies involving a partner (20, 4.7%) or did not have sexual fantasies at all (23, 5.4%) (Fig. 4).

After three months of HT, there was a slight increase in the percentage of TW preferring transgender people (10, 3.3%), people without sexual fantasies involving a partner (21, 7.0%), or people without any sexual fantasies at all (19, 6.3%) ($P = 0.004$). The number of people fantasizing



Time point (months)	0	3	12	24	36
Number of TW (n)	466	301	261	81	37

Time point (months)	0	3	12	24	36
Number of TM (n)	425	288	244	54	18

Fig. 4 Percentages for the frequency distributions for the preferred partner in sexual fantasies in transgender women (left) and transgender men (right) at baseline and after the initiation of gender-affirming hormonal therapy, by study visit. The number of people included in this analysis at each time point are shown underneath the graph.

about women (78, 25.9%), men (93, 30.9%), or both men and women (80, 26.6%) decreased. Thereafter, the answers to this question did not change over time in the group of TW (all $P = \text{NS}$). In TM, the frequency distributions for a preferred partner in sexual fantasies did not change over time (all $P = \text{NS}$).

Sexual fantasies

Before starting HT, TW predominantly fantasized about themselves in a female gender role (373, 79.7%), TM predominantly fantasized about themselves in a male gender role (338, 76.3%) during sexual fantasies (Fig. 5). After three months, the percentage of TW without sexual fantasies increased (from 17, 3.6–35, 11.5%, $P = 0.007$). Thereafter, the frequency distributions for this item remained stable over time in TW (all $P = \text{NS}$).

The frequency distributions for this item did not change over the first 18 months of HT in TM. Between 18 and 24 months of HT, a shift occurred from having sexual fantasies predominantly in the male gender role at 18 months (male gender role: 41, 73.2%, female gender role 3, 5.4%) to people having sexual fantasies in the male as well as female gender role at 24 months (male gender role 30, 50.8%, female gender role 20, 33.9%, $P = 0.007$). There were no changes over the third year of HT (all $P = \text{NS}$), although the sample sizes also decreased after 36 months.

Correlation with serum levels of sex steroids

Cross-sectionally as well as prospectively, serum levels of sex steroids or prolactin were not correlated to scores for the four questions ($P = \text{NS}$).

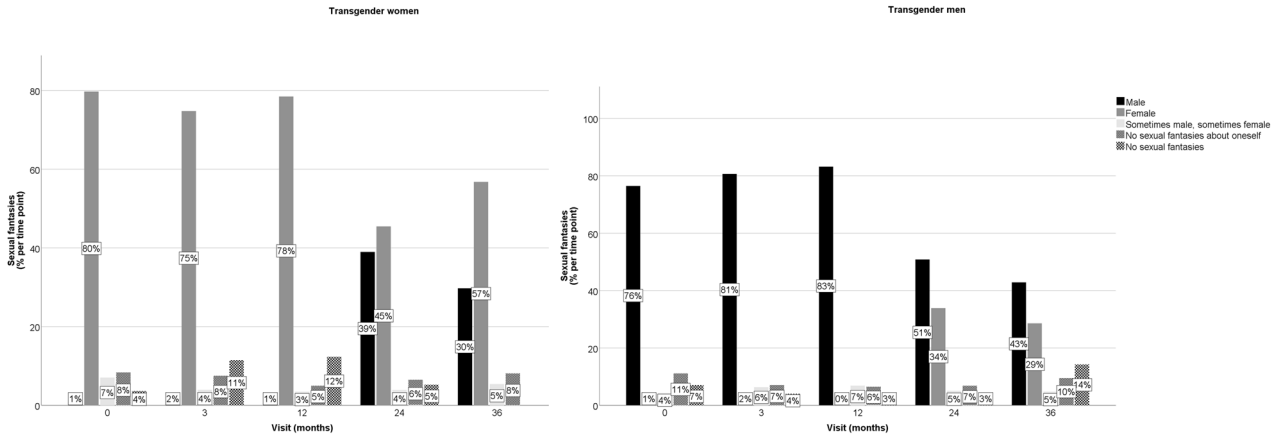
Correlation with gender-affirming care

Cross-sectionally as well as prospectively, frequency distributions for the four items did not differ in groups of TW and TM with versus without chest surgery, gonadectomy, or gender-affirming genital surgery at any of the study time points (all $P = \text{NS}$).

Discussion

The current study describes a highly heterogeneous sexual orientation in transgender people, without any changes over the course of HT. We did not observe any effect of HT or gender-affirming surgery on the four dimensions of sexual orientation. Previous studies have reported mixed results on the causality of gender-affirming treatment [1, 3, 4]. This may be explained by the cross-sectional or retrospective methodology of these previous studies. The current study repeatedly asked the same question over a three-year follow-up and calculated a difference based on these answers, instead of asking participants whether they perceived a change, as previous studies did [1, 3, 4].

The current study describes a high number of TW and TM being sexually attracted to women (exclusively), similar to a previous report of a (smaller) group of transgender people who did not initiate HT (yet), from the ENIGI study [16]. In TM, this number was higher compared to online samples in previous research [5]. In a study by Fein et al. [28], both TM and TW reported cis-gender women most frequently as their sexual partner pre-transition, but TW who started their transition more than 10 years after first identifying as transgender were more likely to report a change in sexual preference than



Time point (months)	0	3	12	24	36
Number of TW (n)	468	305	260	77	37

Time point (months)	0	3	12	24	36
Number of TM (n)	443	300	262	59	21

Fig. 5 Percentages for the frequency distributions for the gender role in sexual fantasies in transgender women (left) and transgender men (right) at baseline and after the initiation of gender-affirming hormonal therapy, by study visit. The number of people included in this analysis at each time point are shown underneath the graph.

those who began it fewer than 10 years ago. In TW, this was explained as "a phase of gender identity conflict, with overcompensation with hypermasculine behaviors that include relationships with cis-gender women." However, hypotheses about reasons for sexual orientation preferences should be based on scientific research, for instance obtained from in-depth interviews with transgender people. Therefore, we suggest researchers to attach a qualitative part to their questionnaires, so that they can investigate the results obtained from quantitative research.

Although the current study did not describe prospective changes in sexual orientation after the initiation of HT, previous (retrospective) studies have described changes [1, 5, 6, 28]. Previous research [5, 29] described how testosterone enabled TM to pass as a man, which enforced their male gender identification and opened the door of sexual possibilities. It is possible that TM previously identified as gay, heterosexual, or bisexual men prior to transition, or that TW previously identified as gay, heterosexual, or bisexual women, but felt that this did not make sense to them. Some people may even have considered some of these preferences as disconfirming of their gender identities until HT enabled them to live (more) according to their gender identity. However, it is also possible that sexual orientation is fluid over the course of one's life, as in *cis*-gender people, irrespective of gender-affirming care [30]. In order to truly disentangle the effect of HT on sexual orientation, different "control" groups not undergoing HT would be needed (e.g., one group not seeking care, one group seeking mental help only, and one group seeking HT).

After the initiation of HT, more TW reported having no sexual fantasies, not fantasizing about themselves in a sexual way, or not fantasizing about a sexual partner, compared to before the initiation of HT. However, this also fits with the earlier results in this ENIGI cohort showing a decrease in sexual desire over the first three months of HT in TW [26]. While sexual desire was previously reported to return to baseline levels, sexual fantasies among TW in the current study remained decreased compared to baseline. This may be due to small subgroups of people indicating they had no sexual fantasies, which may have reduced the power of these analyses. As in the current study, there was no correlation with serum levels of sex steroids.

The number of people reporting being in a relationship (40.9%) was in line with previous research in a large European sample of transgender people (52%) [31]. It is difficult to compare partnership status in the current study to population-based samples in cis-gender people because national statistics departments predominantly gather information on marital status [32]. The number of people reporting being in a relationship increased after the initiation of gender-affirming HT. This is most likely not a direct effect of gender-affirming HT, but may be related to indirect effects of gender-affirming care, such as improved body image, decreased depressive and anxious feelings, or increased self-esteem [33–36].

In those with a partner in the current study, the number of people with a partner congruent with their sexual orientation preferences was higher (TW 81.9%, TM 86.0%) than in a previous smaller sample of participants from the ENIGI study (TW 27.3%, TM 51.6%) [17]. Previous research in a relatively large sample of transgender people from Italy [37]

reported a female partner in all TM (100%), the majority also indicated being attracted to women (89.6%). In the same study, the majority of the TW had a male partner (83.9%) and were attracted to men (82.6%). Research in a small online sample of TM attracted to men ($n = 17$) showed that the majority (88.2%) had men attracted to men as sexual partners [29]. This difference could be due to increased openness about sexual orientation in Western societies, as Cerwenka et al. [16] included participants from 2007 to 2011, whereas we assessed sexual orientation from 2012 to 2018. In addition, possible bias could be that people who did not currently report having a (sexual) partner were single because they struggled finding a partner that matches their preferences.

Our study results may have been affected by several limitations. First, in some participants, the questionnaire was not assessed at all visits, which—together with the data lock—led to a decrease in sample size and power for the analyses of the 24th and 36th month. Second, historically, a participant's gender identity was not assessed in the questionnaires that were filled out upon the first clinical contact, nor during the endocrine follow-up visits in the ENIGI study. Assigned females at birth transgender people were automatically coded as "TM", assigned male at birth people as "TW". Previous research in community-based samples showed higher fluidity in gender nonbinary persons [38, 39]. Since 2018, a question on gender identity has been added to the questionnaires. This may provide additional insights into different groups of transgender people, as the broad group of gender nonbinary and gender fluid transgender people is often overlooked in studies. We chose not to correlate our findings to psychosocial and sexuality outcomes, as we believe that the associations reported between outcomes and sexual orientation by previous studies [2, 40, 41] may be mediated by other factors and therefore not related to sexual orientation per se. In addition, the self-constructed questionnaire on sexual orientation may have led to some limitations: first, data on length of the relationship were not assessed, which may have played a role in changing partnership status over the course of the transitioning process. Second, we did not conduct in-depth interviews. Qualitative data may provide more insight into changes in sexual orientation or partnership preference. The results presented here only show assumptions that have been made based on associations. Third, our participants were presented the same questionnaires during each visit, which may have influenced the responses. Also, our questionnaires were self-constructed in 2012. As both the transgender community and transgender research have changed over time, we recommend updating these questionnaires, with the help of stakeholders from within the transgender community.

Despite these limitations, this study has several strengths. To our knowledge, this is the largest—and only—prospective study to date in which sexual orientation in both TM and TW was evaluated and correlated cross-sectionally as well as prospectively, over three years of follow-up. The self-constructed questionnaire reports on four dimensions of sexual orientation, predominantly using terms such as "attracted toward" instead of sexual identity labels (e.g., heterosexual and homosexual). The use of sexual identity labels in previous studies may have led to a large amount of error in reporting sexual orientation in previous cohorts of gender minority samples [4].

Conclusion

The current study reports heterogeneous sexual orientation preferences in transgender people. We advise that healthcare professionals providing gender-affirming care leave heteronormative assumptions aside and openly discuss sexual orientation with their clients, if desired. Although the percentage of people with a partner increased after the initiation of HT, sexual orientation preferences did not change. Clinicians working with transgender people can reassure their clients and their significant others; initiating gender-affirming care (HT and/or surgery) is not directly related to a change in partner choice.

Acknowledgements We would like to thank the people who contributed to the ENIGI study: Sarah Collet, Meltem Kiyar, Thomas Schreiner, Timo Nieder, Inga Becker, Yona Greenman, Chantal Wiepjes, Maartje Klaver, Christel De Blok, Nienke Nota, Carlotta Cocchetti, Koen Dreijerink, Daan Van Velzen, Dennis Van Dijk, Margot Morssinkhof, Elfi Conemans, Brand Coumou, and Iris de Nie. We also thank all endocrinology residents who made a valuable contribution to the ENIGI study: Greet Roef, Mirra Boer, Marijn Carpentier, Liesbeth Van Huffel, Sara Vandewalle, Loes Moernaut, Sabine Vermeersch, Gertjan Vereecke, Xavier-Philippe Aers, Charlotte Verroken, Emmanuelle Versele, Eva Van Caenegem, Katrien Wierckx, and Bram Vantomme for their outpatient care; Charlotte Bultynck, Charlotte Pas, Anne-Sophie De Maertelaere, and Kessewa Abosi-Appeadu for their help with the dataset; our study nurse Kaatje Toye for handling the extensive administration to the study, and all participants in the ENIGI study protocol.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Auer MK, Fuss J, Höhne N, Stalla GK, Sievers C. Transgender transitioning and change of self-reported sexual orientation. PLoS ONE. 2014;9:e110016.
2. Weyers S, Elaut E, De Sutter P, Gerris J, T'Sjoen G, Heylens G, et al. Long-term assessment of the physical, mental, and sexual health among transsexual women. J Sex Med. 2009;6:752–60.

3. Meier SC, Pardo ST, Labuski C, Babcock J. Measures of clinical health among female-to-male transgender persons as a function of sexual orientation. Arch Sex Behav. 2013;42:463–74.
4. Katz-Wise SL, Reisner SL, Hughto JW, Keo-Meier CL. Differences in sexual orientation diversity and sexual fluidity in attractions among gender minority adults in Massachusetts. J Sex Res. 2016;53:74–84.
5. Bockting W, Benner A, Coleman E. Gay and bisexual identity development among female-to-male transsexuals in North America: emergence of a transgender sexuality. Arch Sex Behav. 2009;38:688–701.
6. Lawrence AA. Sexuality before and after male-to-female sex reassignment surgery. Arch Sex Behav. 2005;34:147–66.
7. Gaither TW, Awad MA, Osterberg EC, Romero A, Bowers ML, Breyer BN. Impact of sexual orientation identity on medical morbidities in male-to-female transgender patients. LGBT Health. 2017;4:11–6.
8. Papadopulos NA, Lellé JD, Zavlin D, Herschbach P, Henrich G, Kovacs L, et al. Psychological pathologies and sexual orientation in transgender women undergoing gender confirming treatment. Ann Plast Surg. 2020;84:312–6.
9. De Vries ALC, Steensma TD, Doreleijers TAH, Cohen-Kettenis PT. Puberty suppression in adolescents with gender identity disorder: a prospective follow-up study. J Sex Med. 2011;8:2276–83.
10. Lawrence AA. Sexual orientation versus age of onset as bases for typologies (subtypes) for gender identity disorder in adolescents and adults. Arch Sex Behav. 2010;39:514–45.
11. Rachlin K. Factors which influence individual's decisions when considering female-to-male genital reconstructive surgery. Int J Transgender Health. 1999;3:18–20.
12. Chivers ML, Bailey JM. Sexual orientation of female-to-male transsexuals: a comparison of homosexual and nonhomosexual types. Arch Sex Behav. 2000;29:259–78.
13. Reisner SL, White JM, Mayer KH, Mimiaga MJ. Sexual risk behaviors and psychosocial health concerns of female-to-male transgender men screening for STDs at an urban community health center. AIDS Care. 2014;26:857–64.
14. Kenagy GP, Hsieh CM, Kennedy G. The risk less known: female-to-male transgender persons' vulnerability to HIV infection. AIDS Care - Psychol Socio-Med Asp AIDS/HIV. 2005;17:195–207.
15. Nieder TO, Herff M, Cerwenka S, Preuss WF, Cohen-Kettenis PT, De Cuypere G, et al. Age of onset and sexual orientation in transsexual males and females. J Sex Med. 2011;8:783–91.
16. Cerwenka S, Nieder TO, Cohen-Kettenis P, De Cuypere G, Haraldsen IRH, Kreukels BPC, et al. Sexual behavior of gender-dysphoric individuals before gender-confirming interventions: a European multicenter study. J Sex Marital Ther. 2014;40:457–71.
17. Cerwenka S, Nieder TO, Briken P, Cohen-Kettenis PT, De Cuypere G, Haraldsen IRH, et al. Intimate partnerships and sexual health in gender-dysphoric individuals before the start of medical treatment. Int J Sex Health. 2014;26:52–65.
18. Nieder TO, Elaut E, Richards C, Dekker A. Sexual orientation of trans adults is not linked to outcome of transition-related health care, but worth asking. Int Rev Psychiatry. 2016;28:103–11.
19. De Roo C, Tilleman K, T'Sjoen G, De Sutter P. Fertility options in transgender people. Int Rev Psychiatry. 2016;28:112–9.
20. Kreukels BPC, Haraldsen IR, De Cuypere G, Richter-Appelt H, Gijs L, Cohen-Kettenis PT. A European network for the investigation of gender incongruence: the ENIGI initiative. Eur Psychiatry. 2012;27:445–50.
21. Dekker MJHJ, Wierckx K, Van Caenegem E, Klaver M, Kreukels BP, Elaut E, et al. A European network for the investigation of gender incongruence: endocrine part. J Sex Med. 2016;13:994–9.
22. Coleman E, Bockting W, Botzer M, Cohen-Kettenis P, De Cuypere G, Feldman J, et al. Standards of care for the health of transsexual, transgender, and gender-nonconforming people. Int J Transgender Health. 2012;13:165–232.
23. Kinsey AC, Martin CE, Pomeroy WB. Kinsey Scale. WB Saunders; Philadelphia PA, USA; 1948.
24. Wiepjes CM, Vlot MC, Klaver M, Nota NM, de Blok CJM, de Jongh RT, et al. Bone mineral density increases in trans persons after 1 year of hormonal treatment: a multicenter prospective observational study. J Bone Miner Res. 2017;32:1252–60.
25. Defreyne J, Kreukels B, T'Sjoen G, Staphorsius A, Den Heijer M, Heylens G, et al. No correlation between serum testosterone levels and state-level anger intensity in transgender people: results from the European Network for the Investigation of Gender Incongruence. Hormones Behav. 2019;110:29–39.
26. Defreyne J, Elaut E, Kreukels B, Fisher AD, Castellini G, Staphorsius A, et al. Sexual desire changes in transgender individuals upon initiation of hormone treatment: results from the longitudinal European network for the investigation of gender incongruence. J Sex Med. 2020;17:812–25.
27. Holm S. A simple sequentially rejective multiple test procedure. Scand J Stat. 1979;6:65–70.
28. Fein LA, Salgado CJ, Sputova K, Estes CM, Medina CA. Sexual preferences and partnerships of transgender persons mid- or post-transition. J Homosex. 2018;65:659–71.
29. Rowniak S, Chesla C. Coming out for a third time: transmen, sexual orientation, and identity. Arch Sex Behav. 2013;42:449–61.
30. Katz-Wise SL, Hyde JS. Sexual fluidity and related attitudes and beliefs among young adults with a same-gender orientation. Arch Sex Behav. 2015;44:1459–70.
31. Fundamental Rights Agency. Being trans in the EU—comparative analysis of the EU LGBT survey data. Luxembourg: Fundamental Rights Agency; 2014.
32. Statbel. Population by place of residence, nationality (Belgian/non-Belgian), marital status, age and gender. Statbel (Directorate-general Statistics - Statistics Belgium); Brussels, Belgium; 2020.
33. Fisher AD, Castellini G, Ristori J, Casale H, Cassioli E, Sensi C, et al. Cross-sex hormone treatment and psychobiological changes in transsexual persons: two-year follow-up data. J Clin Endocrinol Metab. 2016;101:4260–9.
34. Fisher AD, Castellini G, Bandini E, Casale H, Fanni E, Benni L, et al. Cross-sex hormonal treatment and body uneasiness in individuals with gender dysphoria. J Sex Med. 2014;11:709–19.
35. van de Grift TC, Elaut E, Cerwenka SC, Cohen-Kettenis PT, De Cuypere G, Richter-Appelt H, et al. Effects of medical interventions on gender dysphoria and body image: a follow-up study. Psychosom Med. 2017;79:815.
36. Heylens G, Verroken C, De Cock S, T'Sjoen G, De Cuypere G. Effects of different steps in gender reassignment therapy on psychopathology: a prospective study of persons with a gender identity disorder. J Sex Med. 2014;11:119–26.
37. Fisher AD, Bandini E, Casale H, Ferruccio N, Meriggiola MC, Gualerzi A, et al. Sociodemographic and clinical features of gender identity disorder: an Italian multicentric evaluation. J Sex Med. 2013;10:408–19.
38. Kuper LE, Nussbaum R, Mustanski B. Exploring the diversity of gender and sexual orientation identities in an online sample of transgender individuals. J Sex Res. 2012;56:249–63.
39. Baker WB. The meaning of sexual and gender identities in transgender men. Montclair State University; 2017.
40. Wierckx K, Elaut E, Van Hoorde B, Heylens G, De Cuypere G, Monstrey S, et al. Sexual desire in trans persons: associations with sex reassignment treatment. J Sex Med. 2014;11:107–18.
41. Nuttbrock L, Hwahng S, Bockting W, Rosenblum A, Mason M, Macri M, et al. Lifetime risk factors for HIV/sexually transmitted infections among male-to-female transgender persons. J Acquired Immune Defic Syndr. 2009;52:417–21.