Hormonal and surgical treatment for gender dysphoria in young people – beneficial or not?

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- Gender dysphoria refers to anxiety or suffering due to conflict between gender identity and biological sex.
- Treatments can be divided into medical and surgical. The gold standard for treating juveniles, the Dutch model, is based on follow-up research, the quality of which has been challenged.
- Later evidence of treatment outcomes is likewise inconsistent and the methodology is of poor quality.
- Based on current knowledge, conclusions cannot be drawn, especially regarding the psychosocial effectiveness of hormonal treatments.

Gender dysphoria beginning in childhood and intensifying in puberty has been considered so permanent that interventions shaping sex characteristics have been considered warranted for its alleviation. Recommendations have been formulated for diagnostic examinations and treatments (1–3), of which one (2) is based on consensus rather than evidence (4).

The commonly used Dutch model (5,6) treatment path is described in Table 1. Treatment can be divided into medical and surgical.

The former are GnRH analogues (GnRHa) and cross-sex hormones (CSH) of the sex desired. GnRH analogues (”blockers”) can be used to suppress pubertal development and sex hormones of the opposite sex are used to shape physical characteristics in the direction of the sex desired. (7) Surgical treatments include vaginoplasty, phalloplasty and chest masculinization.

Since the development of the Dutch model, the numbers of those seeking gender identity assessment have increased exponentially and the distribution has changed. Instead of boys who

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first experienced gender dysphoria before adolescence, now the majority are girls who are experiencing gender dysphoria for the first time in their youth (8–10).

The natural course of gender dysphoria with onset in adolescence is not known. The use of the Dutch model as the gold standard for treatment is based on selected sample follow-up research (5,6), the quality of which has been challenged (11).

We scrutinize the evidence on the effects of physical treatments initiated due to gender dysphoria on mental health disorders, psycho-social well-being and functioning and on neurocognitive development. Tables 2 and 3 present the terminology of the field and a summary of the research evidence. Details of the studies are presented in the supplementary material.

Studies

Body image and gender dysphoria

GnRH analogues have had no effect on gender dysphoria and body image in prospective studies (5,6,12,13).

One study reported improvement in body image when GnRHa and CSH treatments were analyzed together. However, no independent effect of either treatment was reported (13). Another cross-sectional study reported a connection between testosterone treatment and better body satisfaction, which for its part was in an inverse relation to symptoms of anxiety and depression (14). Of the prospective studies on CSH treatment, one reported a significant reduction in gender dysphoria (15) while in another the sense of having the right sort of appearance increased (16).

Three studies explored patients' body image and gender dysphoria after surgical treatments. In the only prospective study, body image improved and gender dysphoria diminished after surgery (6). In two others, those undergoing chest masculinization reported alleviation of gender dysphoria (17,18).

Psychiatric symptoms

Six studies researched the connection between GnRHa treatment and psychiatric symptoms. In the cross-sectional study, those just recently attending gender identity assessment had more psychiatric symptoms than those who had already received GnRHa treatment. Recipients of GnRHa treatment had fewer internalizing symptoms (depression and anxiety) than CIS gender controls in general population (i.e., those identifying with their biological sex) and approximately the same amount of suicidal thoughts and behaviors (19).

Of the prospective studies in the original Dutch model studies, symptom scores mostly fell within the non-clinical range (5,6). In one study there was a connection between treatment and fewer depressive symptoms, but after controlling for psychiatric medication and therapy, this was only seen in transgender girls (20). In one study, externalizing symptoms (behavioral symptoms)

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diminished, while internalizing symptoms persisted (21). In two studies treatment did not clinically significantly reduce psychiatric symptoms (12,13).

The connection between psychiatric symptoms and CSH treatment was studied in one cross-sectional study, in three retrospective chart reviews and in six prospective studies. In the cross-sectional study, anxiety and depression, but not self-harm, were less severe among transgender boys receiving testosterone treatment than among those not receiving it (14).

Of the retrospective studies, the first reported no changes after initiation of CSH treatment in depression, anxiety or self-harm compared to those without CSH or those with only GnRHa treatment (22). In a Finnish study, overall need for psychiatric treatment remained unchanged in spite of CSH (23). A third study reported a decrease in self-harm (24).

Of the prospective studies, one reported a reduction in symptoms that nevertheless remained in the clinical range, with the exception of externalizing symptoms (21). A second study reported no independent effect of treatment once subjects' medication and therapy had been controlled for as confounding factors (20). In the third study, CSH treatment did not alleviate psychiatric symptoms (25).

The fourth study reported clinically significant reductions in depression and anxiety approaching that of CIS gender controls (15). In the fifth study, treatment did not reduce anxiety or depressive symptoms. Moreover, self-harm and use of psychiatric medications actually increased somewhat in follow-up, but the groups receiving GnRHa and CSH treatment were not differentiated (13). In the sixth study, depression and anxiety diminished on average from mild symptoms to non-clinical level, but only in transgender boys (16).

Two prospective studies scrutinized the effects of surgical treatment. In the first, psychiatric symptoms were alleviated to the level of general population after treatment (6). In the second, internalizing symptoms diminished from clinical level to normal range and externalizing symptoms decreased within normal range (21).

Three studies did not distinguish more precisely between those receiving different treatments. Of these, in the prospective study, no change was reported in proportions of depression, anxiety, or self-harm among those receiving GnRHa and/or CSH treatment (26). In the retrospective study, it was reported that suicide attempts and psychiatric inpatient admissions diminished after first visit to the gender identity clinic, but statistical significance was not tested for (27).

In a register-based American study with a considerably bigger data than in other studies published, GnRHa or CSH treatment did not in follow-up change overall numbers of visits to mental health facilities although in two thirds of subjects the number of visits declined. However, visits due to self-harm increased, likewise the use of psychiatric medications (28).

Other psycho-social outcomes

Effect of GnRH treatment on psycho-social functioning was researched in four prospective studies. In the original Dutch study, GnRHa treatment did not clinically significantly improve subjects' functioning (5,6). In the second study, GnRHa treatment in combination with psychosocial support improved functioning more than did psycho-social support alone (29). In a third study, no changes

were observed in functioning (12). In a fourth study, functioning improved clinically significantly in both GnRH, CSH, and surgical treatment groups (21).

In a Finnish study, school and peer relations problems and declined functioning persisted in follow-up (23). The functioning of those undergoing surgical treatment improved clinically significantly in the original Dutch study (6). In one cross-sectional study those undergoing chest masculinization reported subjective improvement in their own functioning (17).

Seven studies scrutinized the effects of treatment on quality of life and overall well-being with widely varying methods. In one of these all subjects initially had poorer quality of life than general population. If the subjects did not get treatment, quality of life in follow-up was below the normal range. The physical and mental well-being of those receiving GnRHa treatment corresponded in follow-up to normal range in general population. The physical well-being of those receiving CSH and surgical treatment likewise improved to within the normal range, but mental well-being remained below this (21).

Another study did not find that GnRHa treatment improved quality of life (12,20). In a third study, satisfaction with life improved with CSH treatment, but only among transgender boys (16). In a fourth study, neither GnRH nor CSH treatment improved quality of life after psychiatric medication and therapy were controlled for as confounding factors (20). In a fifth study, CSH treatment improved subjects' overall well-being at least statistically significantly (24).

In the original Dutch study, surgically treated subjects were at the end of follow-up comparable to general population in terms of subjective well-being (6) and in another those undergoing chest masculinization reported subjective improvement in their well-being (17).

Neurocognition

Three studies explored the associations between treatment and neurocognition. Two of these were cross-sectional. In one of them, executive functioning in transgender girls receiving GnRHa treatment, but not executive functioning in transgender boys, was weaker than among CIS gender age peers (30). In the second, GnRHa treatment lasting for over a year was associated with poorer executive functioning. In that same study, CSH was seen to be associated with better executive functioning than GnRHa treatment (31).

In the only prospective study, brain activation in mental rotation tests among gender dysphoric biological girls was similar before testosterone treatment to that in cisgender boys and changed similarly as it did in them during treatment (32).

Satisfaction with treatment and regrets

In the follow-up studies by the treating gender identity clinics, participating subjects have been very satisfied with treatment outcomes and expressed no regrets (6,12,17,18,25,33). In two retrospective chart reviews, of those embarking on GnRHa treatment, only some 3% did not desire further medical treatments (34,35). Mention should be made, however, of two register studies in

which 20–30% discontinued medical gender reassignment after on average 4-5 years of treatment (36,37).

Conclusions

The evidence for the effects on mental health of medical gender reassignment treatment initiated in youth is contradictory, studies are few and of poor quality. Samples are small, comparable control groups lacking, follow-up times at their longest between one and two years and the measures used to assess effectiveness variable. In many, loss to follow-up is considerable.

In light of this, it is not feasible to draw conclusions - notably on the efficacy of hormonal treatments in any of the subareas mentioned. The frequently mentioned suicide risk and its reduction through gender reassignment treatments has not been proven (38,39). For surgical treatments, the positive findings appear more uniform. On the other hand, at that stage of treatment processes the patients are more selected.

Treatments are not without their adverse effects (40,41). In particular, not enough is known about their effects on neurocognitive development (42). Clinical assessment needs to be cautious; identity formation in young people is frequently incomplete and for some young people the significance of societal influences on gender dysphoria cannot be ignored (2).

Future studies, in keeping with the principles of evidence-based medicine, should focus on bridging the methodological gaps identified. Notably, the needs for larger samples, longer follow-up times, controls in general population and, in due course, systematic meta-analyses are urgent.

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Table 1. Treatment of gender dysphoria with onset in childhood and exacerbating during puberty according to “the Dutch Model”

Developmental stage	**Intervention**	**Objective**
Before puberty	Psychosocial interventions as required	To support childhood development, to reduce psychosocial stress and symptoms
Tanner 2–3	GnRH-analogue treatment	To delay changes of puberty, to reduce psychiatric symptoms
≥ 16 years of age	Hormonal treatment according to the desired gender (cross-sex hormones) (testosterone, estrogen + antiandrogen)	To provide desired secondary sex characteristics, to reduce psychiatric symptoms
≥ 18 years of age	Surgical treatments (e.g., vaginoplasty, falloplasty, chest masculinization)	To further confirm desired secondary sex characteristics, to reduce psychiatric symptoms

(5,6). Appropriateness and timeliness of physical treatments are according to the recommendations of the COHERE Finland (1) evaluated in careful multi-disciplinary assessment.

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Table 2. Research evidence on hormonal and surgical treatments initiated on gender dysphoria indication during adolescent development

	GnRH	**CSH**	**Surgery** [1]
Body image and gender dysphoria	No evidence	Positive evidence with short follow-up times	Positive evidence
Psychiatric symptoms	Contradictory evidence	Contradictory evidence	Positive evidence
Neurocognition	No difference in or even poorer executive functioning as compared to age peers	No clinically significant research evidence	No studies
Other psychosocial outcomes (such as functioning ability, quality of life and general well-being)	Contradictory evidence	Contradictory evidence	Mostly positive evidence

GnRHa = GnRH-analogues. CSH = cross-sex hormones.

[1] In the surgical treatment phase, patients are highly selected.

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Table 3. Terminology

GnRHa, ”blocker”	Gonadotropin releasing hormone agonist
CSH	Cross-sex hormone, sex hormone promoting the desired secondary sex characteristics (testosterone, estrogen)
Gender dysphoria	Anxiety and suffering due to incongruence of subject’s gender identity and their biological sex
Cisgender	Person whose gender identity aligns with their sex
Transsexual (ICD-10)	Person identifying with the opposite sex (ICD-10 term)
Non-binary	Person whose gender identity does not fit the gender binary of male and female
Transgender boy	Person with male sex, identifies as a girl
Transgender girl	Person with female sex, identifies as a boy
Internalizing symptoms	Emotional symptoms
Externalizing symptoms	Behavioural symptoms
Clinical area, clinically significant score	A score on for example of a psychiatric symptoms scale that exceeds the normal range in general population and is suggestive of psychiatric disturbance

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Supplementary materials

BODY IMAGE, GnRHa

Research	Design	n	Follow-up (M)	Measures	Main findings
de Vries et al. 2011 (5) & 2015 (6) [a]	Prospective	41/57 [b]	1.9 years	UGDS [c], BIS	No improvement in body image. No relief from gender dysphoria
Carmichael et al. 2021 (12)	Prospective	0–42 [d]	31 months	UGDS [c], BIS	No improvement in body image No relief from gender dysphoria
Kuper et al. 2020 (13)	Prospective	10	11–18 months	BIS	No improvement in body image [e]

[a] Same research cohort.

[b] Depending on measures used.

[c] Using the UGDS for measuring outcomes of medical gender reassignment interventions has been challenged.

[d] Depending on measures and time point.

[e] No improvement in body image when focusing on GnRHa subgroup without CSH subgroup. Body image improved in the total study group.

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BODY IMAGE, CSH

Studys	Design	n	Follow-up (M)	Measures	Main findings
Kuper et al. 2020 (13)	Prospective	86	11 months	BIS	No improvement in body image [a]
Grannis et al. 2021 (14)	Cross-sectional	19	–	BIS	Testosterone treatment associated with better body image compared to untreated subjects (n = 23)
de Lara et al. 2020 (15)	Prospective	23	1 v	UGDS [b]	Gender dysphoria diminished
Chen et al. 2023 (16)	Prospective	213	24 kk [c]	Transgender Congruence Scale	Increased experience of right appearance

[a] No improvement in body image when focusing on CSH subgroup separate from GnRHa group. Body image improved in the total study group.

[b] Using the UGDS for measuring outcomes of medical gender reassignment interventions has been challenged.

[c] Longest follow-up, interval or average not reported.

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BODY IMAGE, surgery

Study	Design	n	Follow-up (M)	Measures	Main findings
de Vries et al. 2014 (6)	Prospective	45	At least one year after surgery	BIS, UGDS [a]	Body image improved. Gender dysphoria diminished
Mehringer et al. 2021 (17)	Cross-sectional	30	–	Semi-structured qualitative interview	Gender dysphoria diminished with chest masculinization
Olson-Kennedy et al. 2018 (18)	Cross-sectional	68	–	Questionnaire developed by researchers themselves	Gender dysphoria diminished with chest masculinization

[a] Using the UGDS for measuring outcomes of medical gender reassignment interventions has been challenged.

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PSYCHATRIC SYMPTOMS, GnRHa

Study	Design	n	Follow-up (M)	Measures	Main findings
van der Miesen et al. 2020 (19)	Cross-sectional	178	–	YSR	Fewer psychiatric symptoms among those having received GnRHa treatment than among those only recently attending for gender identity assessment (n = 272) Slightly fewer internalizing symptoms among those having received GnRHa treatment than among cisgedergender controls in general population (n = 651) and as much suicidal thoughts or actions
de Vries et al. 2011 (5) & 2014 (6) [a]	Prospective	41/54 [b]	1.9 years	CBCL, YSR, BDI, TPI, STAI	Symptom were mostly reduced within the non-clinical range

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Achille et al. 2020 (20)	Prospective	47 [c]	Approx. 1 year [d]	PHQ-9, CESD-R	Treatment was associated with fewer depressive symptoms, but when psychiatric medications and therapies were controlled for, only among transgender girls
Becker-Hebly et al. 2021 (21)	Prospective	11	12 months	YSR/ASR	Externalizing symptoms diminished. No change in internalizing symptoms
Carmichael et al. (2020) (12)	Prospective	11–44 [b]	31 months	CBCL, YSR	No change in psychiatric symptoms
Kuper et al. 2020 (13)	Prospective	13–22 [b]	15 months [e]	QIDS, SCARED	No change in symptoms of anxiety or depression [f]

[a] Same cohort.

[b] Depending on measure used and point in time.

[c] Total number of subjects; no reliable information on sizes of GnRHa and CSH subgroups.

[d] Precise duration of follow-up not given.

[e] In total sample; duration of follow-up not reported for GnRHa subgroup.

[f] No change when GnRHa subgroup compared separately from CSH subgroup. In the total group symptoms diminished slightly within clinical range.

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PSYCHIATRIC SYMPTOMS, CSH

Study	Design	n	Follow-up (M)	Measures	Main findings
Grannis et al. 2021 (14)	Cross-sectional	19	–	SCARED, LSAS, CDI, SBQ-R	Testosterone treatment was associated with less anxiety and depression, but not with less suicidality, as compared to those subjects not receiving treatment (n = 23)
Cantu et al. 2020 (22)	Retrospective	28	5 months	PHQ-9, GAD-7	No changes in depression, anxiety or suicidality compared to those who had not yet begun treatment (n = 38) or had only received GnRHa treatment (n = 12)

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Kaltiala et al. 2020 (23)	Retrospective	52	approx. 1 year [a]	entries in medical records	Reduction in need for treatment for depression, anxiety and suidcidality/self-harm, but 27% developed new need for psychiatric treatment and for 68% the need for treatment during assessment persisted
Allen et al. 2019 (24)	Retrospective	47	349 days	ASQ	Suicidality diminished
Becker-Hebly et al. 2021 (21)	Prospective	32	2 v	YSR/ASR	No clinically significant changes except in externalizing symptoms
Achille et al. 2020 (20)	Prospective	47 [b]	Approx. 1 year [c]	CESD-9, PHQ-9	No effect after controlling for psychiatric medications and

					therapy as confounding factors
Pauli et al. 2020 (25)	Prospective	31	2.1 years	YSR	No effect
de Lara et al. 2020 (15)	Prospective	23	1 year	SDQ, BAI, BDI, STAI	Depression and anxiety diminished clinically significantly approaching values for cisgender controls (n = 30)

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Kuper et al. 2020 (13)	Prospective	60–106 [d]	11 kk	QIDS, SCARED [e]	No change in depressive and anxiety symptoms [f] Actually slight increase in suicidality/self-harm and use of psychiatric medications in follow-up when GnRHa and CSH-treatment groups not differentiated
Chen et al. 2023 (16)	Prospective	208–219 [d]	24 months[g]	BDI, Revised Children's Manifest Anxiety Scale	Slight reduction in depression and anxiety symptoms but only in transgender boys

[a] No more precise follow-up time given.

[b] Total number of subjects; sizes of GnRHa and CSH subgroups not reliably reported.

[c] Precise duration of follow-up not given.

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[d] Depending on measures and analyses used.

[e] Suicidality/self-harm and use of psychiatric medications presumably elicited at clinical assessment.

[f] No change when CSH subgroup assessed separately from GnRHa subgroup. IN the total group, symptoms diminished somewhat within clinical range.

[g] Longest follow-up; range or average not reported.

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PSYCHIATRIC SYMPTOMS, surgery

Study	Design	n	Follow-up (M)	Measures	Main findings
de Vries et al. 2014 (6)	Prospective	32–43 [a]	At least 1 year after surgery	BDI, TPI, STAI, CBCL/ABCL, YSR/ASR	After treatment psychiatric symptoms subsided to level of general population
Becker-Hebly 2021 (21)	Prospective	11	3,2 v	YSR/ASR	Internalizing symptoms deiminished from clinical range to normal range and externalizing symptoms within normal range

[a] Depending on measures used.

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PSYCHIATRIC SYMPTOMS, GnRHa and CSH analyzed in same group

Study	Design	n	Follow-up (M)	Measures	Main findings
Tordoff et al. 2022 (26)	Prospective	57	1 year	PHQ-9, GAD-7	No change in follow-up in proportions with depression, anxiety and suicidality
Khatchadourian et al. 2014 (27)	Retrospective	84	2 v	Entries in medical records	Suicide attempts and psychiatric inpatient admissions diminished after first visit to gender identity clinic but statistical significance not tested

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Hisle-Gorman et al. 2021 (28)	Retrospective	963	7.1 years before treatment began and 1.5 years thereafter	Entries in medical records	No change in overall visits to mental health care facilities although in two thirds visits diminished. Visits due to suicidality increased, likewise use of psychiatric medications

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GLOBAL FUNCTIONING, OTHER PSYCHO-SOCIAL VARIABLES, GnRHa

Study	Design	n	Follow-up (M)	Measures	Main findings
de Vries et al. 2011 (5) & 2014 (6) [a]	Prospective	41	1.9 years	CGAS	No clinically significnt improvement
Costa et al. 2015 (29)	Prospective	71	18 months (psycho-social support) or up to 12 months (GnRHa treatment)	CGAS	GnRHa treatment combined with psycho-social support improved functioning more than psycho-social support alone
Carmichael et al. 2021 (12)	Prospective	12–42 [b]	31 months	CGAS, Kidscreen-52	No change in functioning

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Becker-Hebly et al. 2021 (21)	Prospective	11	1 v	CGAS, Kidscreen-27, SF-8	Clinically significantly improved functioning. Physical and mental health related quality of life in follow-up comparable to German norms.
Achille et al. 2020 (20)	Prospective	47 [c]	Approx. 1 year [d]	QLES-Q-SF	Quality of life did not improve after controlling for psychiatric medications and therapy received as confounding factors

[a] Same cohort.

[b] Depending on measures used and point in time.

[c] Total number or subjects; sizes of GnRHa and CSH subgroups not reliably reported.

[d] No more precise follow-up provided.

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GLOBAL FUNCTIONING, OTHER PSYCHO-SOCIAL VARIABLES, CSH

Study	Design	n	Follow-up (M)	Measures	Main findings
Becker-Hebly et al. 2021 (21)	Prospective	32	2 years	CGAS, Kidscreen-27, SF-8	Clinically significant improvements in executive functining and in physical health related quality of life, but mental health relates QoL remained below German norm
Kaltiala et al. 2020 (23)	Prospective	52	Approx.1 year [a]	Entries in medical records	Among those receiving CSH treatment problems with school and peer relations and executive functioning persisted in follow-up

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Chen ym. 2023 (16)	Prospective	217	24 months [b]	Toolbox Emotion Battery	Only transgender boys' satisfaction with life improved
Achille et al. 2020 (20)	Prospective	47 [c]	Approx. 1 year [d]	QLES-Q-SF	No improvement in quality of life after controlling for psychiatric medications and therapy received as confounding factors
Allen et al. 2019 (24)	Retrospective	47	349 days	GWBS	General well-being improved at least statistically significantly

[a] Exact follow-up time not reported.

[b] Longest follow-up time, range or average not reported.

[c] Total number of subjects, sizes of GnRHa and CSH subgroups not reliably reported.

[d] More precise follow-up time not given.

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GLOBAL FUNCTINING, OTHER PSYCHO-SOCIAL VARIABLES, surgery

Study	Design	n	Follow-up (M)	Measures	Main findings
Becker-Hebly et al. 2021 (21)	Prospective	11	3.2 years	CGAS, Kidscreen-27, SF-8	Global functioning improved clinically significantly. Physical health related QoL improved to within normal range but mental health related QoL remained below German norm
de Vries et al. 2014 (6)	Prospective	32	At least 1 year after surgery	CGAS, WHOQOL-BREF, SWLS, SHS	Global functioning improved clinically significantly. Subjective well-being equivalent to general population

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Mehringer et al. 2021 (17)	Cross-sectional	30	-	Semi-structured qualitative interview	Subjects reported improvement in their own well-being and functioning

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NEUROCOGNITION, GnRHa

Study	Design	N	Follow-up (M)	Measures	Main findings
Staphorsius et al. 2015 (30)	Cross-sectional	20	–	Tower of London	Executive functioning was below the level of cisgender age peers In treansgender girls receiving treatment, but not in transgender boys receiving treatment (n = 25)
Strang et al. 2022 (31)	Cross-sectional	31	–	BRIEF-2	GnRHa treatment lasting over a year was associated with weaker executive functioning.

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NEUROCOGNITION, CSH

Study	Design	N	Follow-up (M)	Measures	Main findings
Strang et al. 2022 (31)	Cross-sectional	52	-	BRIEF-2	CSH treatment was associated with better executive functioning than GnRHa treatment
Burke et al. 2016 (32)	Prospective	21	10 m	WAIS/WISC	Brain activation in mental rotation tests among gender dysphoric biological girls was before testosterone treatment similar to that in cisgender boys, and changed similarly as it did in them in them during treatment.

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ABCL = Adult Behavior Checklist

ASQ = Ask Suicide-Screening Questions

ASR = Adult Self-Report

BAI = Beck Anxiety Inventory

BDI = Beck Depression Inventory

BIS = Body Image Scale

BRIEF-2 = Behavior Rating Inventory of Executive Function 2

CBCL = Child Behavior Checklist

CDI = Children's Depression Inventory

CESD-R = Center for Epidemiologic Studies Depression Scale Revised

CGAS = Children's Global Assessment Scale

GAD-7 = General Anxiety Disorder Scale

GWBS = General Wellbeing Schedule

LSAS = Liebowitz Social Anxiety Scale

PHQ-9 = Patient Health Questionnaire

QIDS = Quick Inventory of Depressive Symptomatology

QLES-Q-SF = Quality of Life Enjoyment and Satisfaction Questionnaire

SBQ-R = Suicide Behaviors Questionnaire

SCARED = Screen for Child Anxiety Related Disorders

SF-8 = Short Form-8 Health Survey

SHS = Subjective Happiness Scale

STAI = Spielberger's Trait Anxiety Scale

SWLS = Satisfaction With Life Scale

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TPI = Spielberger's Trait Anger Scale

UGDS = Utrecht Gender Dysphoria Scale

WAIS = Wechsler Adult Intelligence Scale

WHOQOL-BREF = The World Health Organization Quality of Life

WISC = Wechsler Intelligence Scale for Children

YSR = Youth Self-Report

Clinical significance was estimated according to whether the change was also discernible in the patient's well-being and functioning.

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