

Department of Plastic Surgery,
University of Helsinki and Helsinki University Hospital

Doctoral Program in Clinical Research,
Faculty of Medicine, University of Helsinki

Dissertationes Universitatis Helsingiensis 181/2025

Chest masculinization in transgender men

Clinical outcomes, aesthetic result, and health-related quality of life

Mirjam Linnea Saarinen

ACADEMIC DISSERTATION

To be presented, with the permission of the Faculty of Medicine of the University of Helsinki, for public examination in lecture hall Niilo Hallman, Meilahti Park Hospital, on the 19th of September 2025, at 12 o'clock.

Helsinki 2025

Supervised by Associate professor Sinikka Suominen, MD, PhD
Department of Plastic Surgery,
University of Helsinki and Helsinki University Hospital,
Helsinki, Finland

Kaisu Ojala, MD, PhD
Department of Plastic Surgery,
University of Helsinki and Helsinki University Hospital,
Helsinki, Finland

Reviewed by Professor Riittakerttu Kaltiala, MD, PhD, BSc
Department of Adolescent Psychiatry,
Tampere University Hospital,
Tampere, Finland

Associate professor Minna Kelloniemi, MD, PhD
Department of Plastic Surgery,
Tampere University Hospital
Tampere, Finland

Opponent Professor Marlon Buncamper, MD, PhD
Department of Plastic Surgery,
Ghent University Hospital,
Ghent, Belgium

Custos Professor Virve Koljonen, MD, PhD
Department of Plastic Surgery,
University of Helsinki and Helsinki University Hospital,
Helsinki, Finland

Publisher: University of Helsinki

Series: Dissertationes Universitatis Helsingiensis 181/2025

ISBN 978-952-84-0958-8 (print)

ISBN 978-952-84-0957-1 (online)

ISSN 2954-2898 (print)

ISSN 2954-2952 (online)

PunaMusta, Joensuu 2025

Freedom is the right to live as we wish

- Epictetus

Table of Contents

Abstract	8
Abstrakti	10
List of original publications	12
List of abbreviations	13
1 Introduction	15
2 Review of the literature	16
2.1 A brief history of gender minorities and gender-affirming surgery	16
2.2 Definition and terminology	18
2.2.1 Definition of transgender	18
2.2.2 Terminology	18
2.3 The modern world	20
2.3.1 Population and prevalence	20
2.3.2 Condition versus illness	21
2.3.3 Legislation in the world	22
2.3.4 Guidelines on treatment	22
2.3.5 The ethical grounds for treatment	23
2.4 Legislation and treatment in Finland	25
2.4.1 Finnish public healthcare	25
2.4.2 Finnish legislation before 2023	25
2.4.3 Finnish legislation since 2023	27
2.4.4 The transition Process before 2023	27
2.4.5 The transition Process since 2023	29
2.5 Short description of psychometrics	30
2.5.1 Patient-reported outcome measures	30
2.6 Chest masculinization	32
2.6.1 Surgical techniques	32
2.6.2 Complications	36
2.6.3 Secondary corrections	37
2.6.4 Patient-reported satisfaction	39
2.6.5 Health-related quality of life and gender dysphoria measurements	40

2.6.6	Alternative outcomes of chest masculinization	41
2.7	Summary of the literature	42
3	Aims of the study	44
4	Material and methods.....	45
4.1	Ethical consideration	45
4.2	Patients	45
4.3	Instruments	46
4.3.1	BODY-Q Chest module (Study I, III, IV).....	46
4.3.2	15D (Study I, III)	46
4.4	Clinical data collection.....	47
4.5	Survey collection	48
4.6	Panel evaluation.....	48
4.7	Statistical analysis.....	49
4.7.1	Validation of the BODY-Q Chest module (Study I).....	49
4.7.2	Study II.....	50
4.7.3	Study III.....	51
4.7.4	Study IV	51
5	Results	52
5.1	Validation of the BODY-Q Chest module (Study I)	52
5.2	Sociodemographic features and surgical techniques (Study II)	60
5.3	Complication rates and secondary corrections (Study II)	62
5.4	Surgical process and trends over time (Study II)	66
5.5	Regret (Study II)	68
5.6	Patient-reported satisfaction (Study III)	69
5.7	Patient-reported health-related quality of life (Study III).....	73
5.8	Panel evaluation of postoperative result (Study IV)	76
6	Discussion.....	80
6.1.1	The BODY-Q Chest module is a valid instrument in transgender men	80
6.1.2	Sociodemographic and clinical features	81
6.1.3	Choice of surgical technique	82
6.1.4	High complication rates	83
6.1.5	High rates of secondary corrections	84
6.1.6	Changes in trends over time	85
6.1.7	Good postoperative patient-reported satisfaction	86
6.1.8	Good postoperative health-related quality of life	88
6.1.9	Panel evaluation of the aesthetic result lacks consistency.....	89
6.2	Strengths and limitations	90
6.3	Future research.....	91
7	Conclusions	93

Acknowledgements.....	94
References	95
Original publications.....	112

Abstract

Chest masculinization is the most common, and often only, gender-affirming surgery performed in transgender men. The aim of this thesis was to validate a patient-reported outcome measurement for transgender men undergoing chest surgery, study clinical and patient-reported outcomes of chest masculinization, and evaluate the aesthetic postoperative result by panel evaluation.

The thesis is based on a retrospective patient material of 225 transgender men who underwent chest masculinization at Helsinki University Hospital between 1.1.2005 and 31.12.2018. Study I and III are based on a survey containing the BODY-Q Chest module and 15D sent to all patients included in the dataset. Study II is based on data collected from patient records. In Study IV, the 48 patients with sufficient postoperative photographs underwent an aesthetic evaluation by a 6-member expert panel, and for 26 patients, the panel evaluation was compared to patient-reported satisfaction.

A periareolar technique was applied on 53% of the patients, while horizontal incision with pedicular nipple–areolar complex relocation and horizontal incision with a free nipple graft were applied on 27% and 15%, respectively. Surgically managed complications occurred in 15% and minor complications in 44% of participants. Corrective surgery under general anesthesia was performed on 24% and with local anesthetics on 38%. Except for an association between older age and minor complications, no sociodemographic or clinical features were associated with complication rates or the need for secondary corrections. The survey yielded a response rate of 55%. When evaluating the validity of the Finnish translation of the BODY-Q Chest module, Cronbach's α was 0.92 and 0.88 for the chest and nipple scales, respectively, indicating sufficient internal consistency. In exploratory factor analysis, both scales loaded to one factor, confirming one-dimensionality. Correlation with the generic 15D questionnaire was low. The median chest and nipple scores were 76 and 68 out of 100, respectively, which is in line with previous studies. The number of secondary corrections had a negative association with the chest score. The 15D index score was lower than in the age-standardized male population but similar to the age-standardized female population. Psychiatric comorbidity was associated with lower 15D index scores. The surgical technique did not have an association with BODY-Q Chest module scores or the 15D index score. The panelists' overall scores yielded a median of 3.2 on a scale from 0 (poor) to 4 (very good). Inter-rater reliability was low. The scores did not correlate with patient-reported satisfaction.

We conclude that the BODY-Q Chest module is valid when applied to transgender patients undergoing chest masculinization. Minor complications are common, and the need for secondary corrections is high. The surgical technique is not associated with complications, secondary corrections or patient-reported outcomes. The postoperative health-related quality of life is good. The aesthetic result after chest masculinization is rated good, both

by the patients as well as by an expert panel, however, aesthetic evaluation by a panel lacks reliability in this setting.

Abstrakti

Rintakehän maskulinisaatio on yleisin ja usein ainoa kirurginen toimenpide transsukupuolisilla miehillä. Tämän väitöskirjan tavoitteena oli tutkia kliinisiä ja potilaiden raporttoimia päätemuuttujia rintakehän maskulinisaation jälkeen. Tavoitteena oli myös validoida tälle potilasryhmälle tyytyväisyysmittari sekä arvioida esteettistä tulosta asiantuntijaneelin avulla.

Väitöskirja pohjautuu 225 potilaan taannehtivaan potilasaineistoon, joka sisältää kaikki Helsingin yliopistollisessa sairaalassa rintakehän maskulinisaation läpikäyneet transmies potilaat ajanjaksolta 1.1.2005-31.12.2018. Osatyöt I ja III pohjautuvat kyselytutkimukseen, jossa BODY-Q Rinta ja 15D kyselyt lähetettiin kaikille aineiston potilaista. Osatyö II pohjautuu potilastietojärjestelmistä kerättyyn aineistoon. Osatyössä IV kaikki 48 potilasta, joista löytyi riittävät leikkauksen jälkeiset valokuvat, läpikävivät asiantuntijaneelin tekemän esteettisyysarvion ja 26 potilaan osalta paneeliarviota verrattiin potilaan omaan arvioon lopputuloksesta.

53 prosenttia aineiston potilaista leikattiin periareolaarisella tekniikalla, 27 % horisontaalisella viillolla yhdistettynä pedikulaariseen nännisiirteeseen ja 15 % horisontaalisella viillolla ja vapaalla nännisiirteellä. Kirurgisesti hoidettavia komplikaatioita ilmaantui 15 %:lle ja lieviä komplikaatioita 44 %:lle. Yleisanestesiassa tehtävään korjaustoimenpiteeseen eteni 24 % ja paikallispuudutuksessa tehtiin korjauksia 38 %:lle. Lukuun ottamatta korkeamman iän yhteyttä lieviin komplikaatioihin, ei sosiodemografisten tai kliinisten taustamuuttujien todettu liittyvän komplikaatioiden ilmaantumiseen tai korjaustoimenpiteiden tarpeeseen. Kyselytutkimukseen vastanneiden osuus oli 55 %. Suomenkielisen BODY-Q Rinta kyselyn validiteettia arvioitaessa Cronbachin α oli rintakyselyn osalta 0.92 ja nännikyselyn osalta 0.88 viitaten riittävään sisäiseen konsistenssiin. Eksploraatiivisella faktorianalyysillä sekä rintakysely että nännikysely latautuivat kummatkin yhdelle faktorille vahvistaen yksiulotteisuuden. Korrelaatio yleiseen terveyteen liittyvään elämänlaadun mittariin, 15D:hen, oli matala. Rintakyselyn mediaani tulos oli 76 ja nännikyselyn 68 sadasta, mikä on linjassa aiempien tutkimusten kanssa. Korjaustoimenpiteiden määrä liittyi huonompaan rintakyselytulokseen. 15D indeksi vastasi ikävakioidun naisväestön tuloksia mutta oli huonompi kuin ikävakioidulla miesväestöllä. Psykiatrinen liittännäissairaus oli yhteydessä huonompaan 15D indeksiin. Leikkaustekniikan valinta ei liittynyt BODY-Q Rinta tuloksiin eikä 15D tuloksiin. Panelistien yleisarvosana esteettisyydestä oli 3.2 skaalalla 0 (huono) – 4 (erittäin hyvä). Paneelin arvioitsijoidenvälinen luotettavuus oli matala. Paneelin tulokset eivät korreloineet potilaiden tyytyväisyyden kanssa.

Tutkimus osoittaa, että BODY-Q Rinta on pätevä mittari rintakehän maskulinisaation läpikäyneillä potilailla. Lievät komplikaatiot ovat yleisiä ja korjaustoimenpiteiden tarve suurta. Leikkaustekniikan valinta ei liity komplikaatioihin, korjaustoimenpiteisiin eikä potilastytyväisyyteen. Leikkauksenjälkeinen terveyteen liittyvä elämänlaatu on hyvä.

Leikkauksen esteettinen lopputulos on hyvä sekä potilaiden että asiantuntijapaneelin raportoimana. Asiantuntijapaneelin luotettavuus tässä tutkimusasetelmassa on huono.

List of original publications

This thesis is based on the following publications:

I Validation of the BODY-Q Chest module in Finnish trans men undergoing chest wall masculinization. **M Saarinen**, K Ojala, S Suominen, J Repo. *Scandinavian Journal of Surgery*. 2023 Sep;112(3):180-186. doi: 10.1177/14574969231176111. Epub 2023 Jun 1. PMID: 37264645.

II Quality of Chest Masculinization in Trans Men: A Retrospective Study Evaluating Surgical Technique, Complications, Secondary Corrections, and Trends. **M Saarinen**, K Ojala, M Kolehmainen, S Suominen. *Transgender Health*. 2023. Published online 27 November 2023. DOI: 10.1089/trgh.2023.0034.

III Patient-reported satisfaction and health-related quality of life after chest masculinization in transgender men using BODY-Q Chest module and the 15D. **M Saarinen**, S Suominen, H Sintonen, M Kolehmainen, K Ojala. *Journal of Plastic, Reconstructive & Aesthetic Surgery*. 2024 Sep; 96:43-49. doi: 10.1016/j.bjps.2024.07.006. Epub 2024 Jul 15. PMID: 39047514.

IV Panel evaluation of aesthetic result after chest masculinization: reliability and comparison to patient-reported satisfaction. **M Saarinen**, S Suominen, M Kolehmainen, K Ojala. Submitted to *Plastic and Reconstructive Surgery*.

The publications are referred to in the text by their Roman numerals. The publications are reprinted with the permission of the copyright holders.

List of abbreviations

ADHD – Attention deficit hyperactivity disorder
AFAB – Assigned female at birth
AMAB – Assigned male at birth
APA – American Psychiatric Association
BCT – Breast-conserving therapy
BCCT.core – Breast Cancer Conservative Treatment. cosmetic result
BDI – Beck depression inventory
BIQLI – Body image–related quality of life
BMI – Body mass index
BUT-A – Body uneasiness test - A
CD – Clavien–Dindo
CI – Confidence interval
COHERE Finland – the Council for Choices in Health Care in Finland
DIFNG – Double incision free nipple graft
DSM – Diagnostic and Statistical Manual of Mental Disorders
EFA – Exploratory factor analysis
EUnetHTA – European Network for Health Technology Assessment
GAD-7 – Generalized anxiety disorder 7-item scale
GIDYQ-AA – Gender Identity/Gender Dysphoria Questionnaire for Adolescents and Adults
HRQoL – Health-related quality of life
ICC – Intraclass correlation coefficient
ICD – International Statistical Classification of Diseases and Related Health Problems
IMF – Inframammary fold
IQR – Interquartile range
MGR – Mammogram
N – Count
NAC – Nipple–areolar complex
NCSS – Number Cruncher Statistical Systems
PHQ-9 – Patient health questionnaire
PRO – Patient-reported outcome
PROM – Patient-reported outcome measure

SD – Standard deviation

UCSF Gender QoL – University of California, San Francisco, Gender Quality of Life Survey

UGDS – Utrecht Gender Dysphoria Scale

US – ultrasound

USA – United States of America

QoL – Quality of life

WHO – World Health Organization

WPATH – World Professional Association on Transgender Health

1 Introduction

Transgender individuals experience incongruence between their gender and sex assigned at birth. This incongruence may cause gender dysphoria, e.g., distress related to gender characteristics. The estimates of the proportion of transgender people range between 0.1 and 0.5% in the adult population.¹

To alleviate gender dysphoria, transgender people may go through various interventions including changing their social role to express their gender, changing their legal gender marker or undergoing medical interventions. One aspect of the medical interventions is gender-affirming surgery. The number of people seeking gender-affirming surgery is increasing rapidly.² The most common gender-affirming surgery among transgender men is chest masculinization, which often remains the only surgery.^{3, 4}

In chest masculinization, the breast tissue is reduced and the breast shape is remodeled to achieve a more masculine appearance. Simultaneously, additional skin can be removed, and the nipple–areolar complex may be reshaped and relocated. Acute complications are rare, but minor complications are significant.⁵ Secondary corrections are often made, either on functional- or appearance-related grounds.^{6, 7}

Gender-affirming surgery is performed to alleviate gender dysphoria and thereby increase quality of life. Outcomes of interest include the aesthetic result, patient-reported satisfaction and different aspects of quality of life.

Helsinki is one of the two main centers for gender-affirming care in Finland. Chest masculinization is the most common gender-affirming surgery in our clinic, and has been performed since the turn of the millennium. However, we lacked data on the types of our surgical procedures and their results. Since patient-reported outcome tools are usually developed in English, we also lacked tools for patient-reported outcome evaluation.

The aim of this study was to provide a Finnish patient-reported outcome tool by validating the recently translated to Finnish BODY-Q Chest module in transgender men. Further, we aimed to provide information on clinical outcomes and patient-reported satisfaction in this rapidly increasing patient group. For a more comprehensive approach, we wanted to evaluate health-related quality of life and discover alternative ways to evaluate the postoperative result.

2 Review of the literature

2.1 A brief history of gender minorities and gender-affirming surgery

The concept of gender and sex varies between cultures and changes over time. The *Hijras* of Pakistan and India have been a recognized part of society since pre-colonial times, with a *third gender* mentioned as early as in ancient Hindu scripts.^{8, 9} The Hijras are considered neither men nor women, but something in between with characteristics of both.¹⁰ They typically comprise eunuchs, transvestites, people assigned male at birth but with the gender identity of a woman, and intersex people, and are included in society and play a significant role in several Hindu rituals and traditions.⁹

In western society during the Middle Ages, gender norms were dictated by the Bible. Men were expected to behave in masculine and women in feminine ways, and any deviation of this was considered sinful and punishable. The two sexes were considered opposite and exclusive, and intimate relationships were expected to occur between partners of the opposite sex. It was crucial to classify all individuals to either one category or the other due to legislative aspects and different rights and duties defined by society. Sex was considered simply biological and determined on external characteristics. Later in the 19th century, deviation from the binary concept of sex and sexuality was defined and started to occur in the literature.^{11, 12} Before this, the English (and Finnish) vocabulary lacked terms to describe people of different gender or sexual orientations. For example, the term *homosexualität* (homosexuality) is known to be documented for the first time in a German pamphlet from 1869.¹¹ Why this matters is that homosexuality, cross-sex behavior and cross-sex identification was, in the late 19th century and beginning of the 20th century, interpreted as one and the same phenomenon.¹³ Historical research going further back than this is made difficult due to the lack of existing terminology. Besides being sinful, homosexuality and cross-sex behavior and identification was considered pathologic and classified as illness.

In 1910, a German physician and sexologist Magnus Hirschfeld published a book *Die Transvestiten* (The Transvestites), where he for the first time describes a distinction between homosexuals and *transvestiten* (which included both people with cross-sex identification as well as crossdressers).¹⁴ Later, he coined the term *transsexualität* (transsexuality).¹⁵ Hirschfeld was a pioneer and advocated for treatment of people with cross-sex identification.¹³ He developed recommendations for the treatment of gender minorities, recommending gender-affirming hormonal treatments and surgery. The treatment was organized and provided at his clinic *Institut für Sexualwissenschaft* (Institute for Sexual Science) in Berlin. Much of Hirschfeld's lifework and material from the Institute for Sexual Science was destroyed due to political reasons in 1933.¹²

Although it was theorized as early as the 20th century that sexual behavior did in some way originate in the testicles and ovaries,¹⁶ the sex hormones were not isolated until 1929 and 1935, respectively.^{17, 18} Further studies concluded that neither sex hormone was exclusive to one's gender, but rather that both male and female sex hormones are expressed in men and women but in different proportions. This finding promoted the idea of overlapping sexes rather than two exclusive sexes.¹³

Reconstructive genital surgeries had been attempted due to war injuries and in intersex people.¹⁹ In the beginning of the 20th century, occasional surgeries were made on gender-reassignment indications, mainly chest surgeries, but the treatment was experimental.^{13, 20} The first person known to undergo phalloplasty with the aim to change their sex assigned at birth was a British transgender man named Michael Dillon.²¹ Dillon was assigned female at birth and named Laura in 1915. He later underwent a mastectomy, started hormonal treatment and registered as male.²² In the 1940s, he was introduced to Sir Harold Gillies, considered the father of modern plasticsurgery.²³ Gillies performed a series of surgeries on Dillon, ending in the first known phalloplasty.

In the early 1900s, identifying as the sex opposite to that assigned at birth was seen as a psychiatric disorder, and psychotherapeutic approaches were used to return the patients to their sex-accordant identity. The effect of the treatment was unclear. For example, Sigmund Freud expressed his observations of the limited benefit of conversion therapy.^{24, 25} His ideas, however, were opposed by several other professionals, among them his own daughter Anna Freud.²⁶

Whether one's gender identity is a result of or affected by biological factors or social aspects has been under debate. In the 1970s, gender identity was suggested in case series to be simply a social construct.²⁷ However, this theory lacks evidence. Some studies suggest that even if partially affected by society, gender identity might originate in the individual due to genetics and prenatal development.²⁸⁻³⁰ However, a clear biologic etiology has not been discovered.³¹ Recently, the impact

of social aspects in forming transgender identity has also been discussed.³² For the present, the etiology of transgender identity is unknown.

2.2 Definition and terminology

2.2.1 Definition of transgender

The term transgender is used as an umbrella term including any or all non-conventional gender identities and to describe a person whose sense of personal identity and gender does not correspond to that person's sex assigned at birth.³³ However, the use and definition of the term transgender varies widely.³⁴

2.2.2 Terminology

The terminology and language concerning gender and gender-affirming treatment is tied to time and context and changes rapidly.³⁵ In the following section, essential terms regarding this thesis are described. There are several terms used to describe gender and sex. In Table 1, a range of English terms commonly used in the literature when describing sex, gender and terms related to gender-affirming care are described.

Table 1 List of terms related to sex, gender and gender-affirming care

AFAB = Assigned female at birth, AMAB = Assigned male at birth, ICD = The International Statistical Classification of Disease and Related Health Problems

Term	Explanation
Sex	The sex assigned at birth based on sexual characteristics, usually the external genitalia, of the child.
Gender	Can refer to the social construct of gender comprising norms and behaviors or be used to describe an individual's internal experience of self from the gender perspective of being a man, woman or something alternative.
Gender identity	An individual's internal experience of self from the gender perspective of being a man, woman or something alternative.
Transgender	An umbrella term describing a person whose gender identity differs to varying degrees from their sex assigned at birth.
Transsexual	Previously used in medical context to describe people seeking medical care to change sex characteristics. Still occurring in ICD-10.
Transvestite	A person who has a desire to wear clothes traditionally worn by the other sex. Also referred to as crossdresser . Previously misleadingly used to describe transgender people.
Cisgender	A person whose gender identity is in line with their sex assigned at birth.
Transgender man / Trans man	A person with the gender identity of a man who was assigned female at birth. The equivalent term referring to people assigned male at birth with female gender identity is transgender woman or trans woman .
Trans masculine	A person assigned female at birth and having a gender identity on the masculine spectrum.
Female to male transgender / transsexual	Older term referring to transgender men. Falling out of use.
AFAB	Abbreviation for assigned female at birth. Referring only to the sex assigned at birth.
AMAB	Abbreviation for assigned male at birth. Referring only to the sex assigned at birth.
Nonbinary	A person with a gender experience outside the gender binary of men and women, for example people who identify as partially man or woman, a gender other than man or woman, or not having a gender at all.
Gender dysphoria	The distress caused by the incongruence between one's gender identity and their sex assigned at birth.
Transition	The process whereby people change from the gender expression associated with their assigned sex at birth to another gender expression that better matches their gender identity.
Gender-affirming treatment	Medical treatments affirming one's gender. Also referred to as gender-affirmation treatment .
Gender-correcting treatment / Change of gender	Terms used to describe gender-affirming treatment. Falling out of use since the gender itself is not considered the target of the treatment nor that the gender is actually being changed.

A variety of terms are used to describe surgical interventions involved in the transition process. When referring to chest surgery aiming for a more masculine result, the following terms have been found in the literature: mastectomy, subcutaneous or gender-affirming mastectomy, masculinization, gender-affirming top surgery, chest reconstruction, chest surgery, chest wall contouring, reduction mammoplasty, sex reassignment surgery, and trans mastectomy. In Table 2, some of the applied terms are explained.

Table 2 List of terms related to chest surgery

NAC = Nipple–areolar complex

Term	Explanation
Mastectomy	Usually referring to surgeries done due to oncologic indications and therefore utilizing a surgical approach of removing the breast tissue completely.
Reconstruction	Referring to rebuilding or reshaping something affected by aging, injury or previous surgery.
Reduction mammoplasty	Used to describe the reductive operations of gynecomastia patients, a technique that is sometimes applied to transgender men as well.
Chest masculinization	Referring to the surgical intervention creating a more masculine appearance of the chest by removing and remodeling skin, breast tissue, subcutaneous fat and the NAC.

In this thesis, we will apply the main terms as follows:

- *Gender identity* is used when referring to an individual’s internal experience of self.
- *Sex* is used when referring to sex assigned at birth.
- *Transgender man* is used to describe binary transgender people assigned female at birth, with the gender identity of a man, unless otherwise stated.
- *Chest masculinization* is used to refer to the masculinizing surgical intervention of the chest.

2.3 The modern world

2.3.1 Population and prevalence

Estimations of the number and proportion of gender minorities are sparse and often rely on people seeking medical care.^{1, 36} Therefore, the numbers might be highly affected by factors that hinder attendance to medical care. The definition and recognition of gender minorities and transgender people vary between cultures and must be taken into consideration when evaluating outcomes. Furthermore, there are still countries where cross-sex behavior is illegal and many

more countries where the accessibility of treatment is inadequate, which might bias the estimations. For example, in current Iran, homosexual acts are punishable by death, while gender-affirming care is accepted.^{37, 38} Yet, most of the population estimates are from western countries.

It is noted that the number of transgender people seeking care in western countries is increasing.^{39, 40} The increase is assumed to be partially caused by wider tolerance in society and better access to clinical care. Additionally, the legislation in many countries has been updated in recent years, and for example health insurance has extended to cover gender-affirming treatments.³⁹ The increasing trend in western societies has in other words been assumed to be a consequence of transgender people becoming visible rather than a true increase in the number of these people. However, the role of the social environment and media has been of interest, but requires more research.⁴¹⁻⁴³

Estimations based on people attending medical care have reported the prevalence to range from 1 to 27 per 100,000.^{1, 34, 36, 40, 44} The self-reported prevalence of being transgender ranges between 0.1% and 0.5% regarding adults and up to 1.2% concerning adolescents.^{1, 34, 36, 45-47} In Finland, the proportion of referrals of minors to gender identity services was 16.7 per 100,000 in 2017.⁴¹

2.3.2 Condition versus illness

The modern understanding seeks to de-pathologize transgender identities.

The Diagnostic and Statistical Manual of Mental Disorders (DSM) is a classification provided by the American Psychiatric Association (APA). The diagnosis *Transsexualism* occurred for the first time in 1980 in DSM-III.⁴⁸ In the next updated version DSM-IV, published in 1994, this diagnosis was replaced with *Gender identity disorder in adults and adolescence*.⁴⁹ The latest classification, DSM-5, replaced the previous diagnosis with *Gender dysphoria*.⁵⁰ The APA has aimed to emphasize that any gender identity alone is not a pathology, but that dysphoria from the distress caused by the incongruence of the body and mind is.

The International Statistical Classification of Disease and Related Health Problems (ICD) is a classification system maintained by the World Health Organization (WHO) providing widely used classification of diseases. In their previous classification, ICD-10, gender minorities were described with codes *Transsexualism* and *Gender identity disorder of children*, that were categorized under *Mental and behavioral disorders*.⁵¹ The newest update of the classification from 2019 has included changes to reflect the modern understanding of gender identity. In the new ICD-11, published in 2019, gender-related diagnoses are relocated to *Conditions related to sexual health*.⁵² This reflects the understanding that being transgender is not considered a medical condition and the gender identity itself does not require medical treatment. However, the dysphoria caused

by incongruence between an individual's experienced gender and their assigned sex might require treatment that may include medical interventions.

2.3.3 Legislation in the world

Numerous countries have made efforts to recognize gender minorities and transgender people in the legislation. Countries with actual gender recognition and available treatment remain rare. Most of the European and North American countries enable gender-affirming treatments and change of gender marker, but the preconditions vary. On the other hand, in Japan, to change one's gender marker one must be infertile, have no minor children, be unmarried and have completed sex reassignment genital surgery. Numerous countries have imposed laws that indirectly or directly criminalize transgender people.³⁷

2.3.4 Guidelines on treatment

The World Professional Association on Transgender Health (WPATH) recommendation for medical care of transgender people aims to provide information and guidelines for medical care providers concerning all aspects of gender-affirming treatment.⁵³ Regarding surgical treatments, the guideline recommends:

- Having marked and sustained gender incongruence
- Identifying and excluding other possible causes of gender incongruence
- Meeting diagnostic criteria if a diagnosis is necessary to access healthcare
- Considering a minimum of six months of preoperative hormone treatment before certain surgical interventions, however, not before masculinizing chest surgery
- Understanding the effect on reproductive health and have explored reproductive options
- Assessing mental and physical health conditions that could negatively affect the outcome of gender-affirming surgery
- Having the capacity to consent to the specific surgical intervention

Further, the guidelines recommend when a medical opinion is required to initiate medical care and when to initiate care based on a single opinion and not requiring a second opinion.

In addition, there are several local and medical field-specific guidelines providing recommendations regarding the care of gender minorities. One of the few national guidelines is the Swedish guideline on the treatment of gender dysphoria in adults made by *Socialstyrelsen* in 2015.⁵⁴ Regarding surgical treatment, the guideline requires a gender incongruence-related diagnosis, assessing mental and physical conditions as far as possible, and providing surgical

masculinizing chest surgery regardless of previous hormone treatment. In 2022, *Socialstyrelsen* further provided a guideline on the treatment of children and adolescents. This guideline states that masculinizing chest surgery should be restricted to only being performed in a research setting. Until such an acceptable ethically valued research setting exists, masculinizing chest surgery can be provided in exceptional cases according to the older national recommendation that requires reaching full physical maturity.⁵⁵

In 2023, the WHO announced that they are starting to develop a guideline on the health of trans and gender diverse people.

Finland is one of the very few countries with a national guideline regarding gender-affirming care. In 2020, the Council for Choices in Health Care in Finland (COHERE Finland) published a national guideline on the treatment of gender dysphoria in transgender people in Finland, funded by public healthcare.⁵⁶ COHERE Finland is the organ monitoring, defining and assessing the public health services in Finland and the guideline was based on a systematic review. Simultaneously, COHERE Finland published separate recommendations for minors and for non-binary people. The guideline focuses on treatments to alleviate gender dysphoria and thereby ease psychological and social suffering while improving functional capacity. It engages the primary healthcare to provide psychosocial support in the beginning and later during the treatment. It emphasizes that the medical treatment should be planned individually, and requires a stable gender experience, adequate treatment of simultaneous psychiatric comorbidities, and confirming that the patient has a realistic understanding of the advantages and risks of the treatment. The guideline acknowledges the need for hormonal and surgical treatments in transgender people but excludes corrections made solely on aesthetic grounds. Regarding medical treatment, the guideline provides the following criteria:

- The gender experience is consistent. The gender dysphoria is long-lasting (over 2 years) and disturbs one's social life or career or causes major suffering.
- Possible simultaneous mental conditions have been evaluated and addressed.
- The patient understands the risks and consents to reshape their body to reflect their experience of self.

The Finnish guideline on the treatment of minors excludes surgical interventions as a part of treatment for gender dysphoria.

2.3.5 The ethical grounds for treatment

In accordance to general medical principles, ethical evaluations are a fundamental part of medical decision making. Since ancient times, the Hippocratic oath has

guided doctors to do no harm. A more recent approach to ethical evaluations is provided in the *Principles of Biomedical Ethics*, where the four main ethical principles in medical decision making are defined as autonomy, beneficence, nonmaleficence and justice.⁵⁷ These principles are followed and evaluated regardless of medical field.

Before COHERE Finland published their national guideline in 2020, an extensive literature review was conducted. In addition, due to the nature of gender-affirming care, they produced a separate ethical evaluation to address specific ethical aspects of the treatment of gender dysphoria.⁵⁸ The evaluation was made according to the European Network for Health Technology Assessment (EUnetHTA) model, which aims to identify significant ethical aspects of a matter.⁵⁹ The evaluation acknowledged several ethical dilemmas regarding the treatment of gender dysphoria in transgender people, and a part of those are described below.

One major challenge is the theoretical conceptualization of the phenomenon of gender identities. There are several definitions and conceptions of the phenomenon and some of them are clearly politically loaded. However, the lack and continuous change in the conceptualization of gender variations hinders the accumulation of empirical data.⁵⁸ The justification for treatment in public healthcare is generally based on medical need defined by diagnoses. Thereby, conceptualization with medical diagnoses appears essential.

Another challenge is the evaluation of harm and benefits. Gender dysphoria may cause multidimensional harm, extending to physical, social and psychological aspects. Besides medical treatment, attitudes and actions in society play a crucial role. This raises the question of to what extent a societal phenomenon should and can be managed with medical interventions. The aim of medical treatment is to do good and avoid harm. Since knowledge on the benefits is limited and especially difficult to evaluate outside of the patient-reported experience and harm is possible in surgical treatment, there persists a desire to limit harm.⁵⁸

Concerning autonomy, the question of who decides on treatments and on what grounds is essential. The public healthcare system is based on the idea that a healthcare provider offers treatments that are believed to benefit the patient, while the patient has the right to decline them. In this assumption, the healthcare provider is required to evaluate and support the decision-making competence of the patient. Conversely, the patient organizations emphasize the individuals' subjective right to choose treatments that they consider helpful. The patients might view the multiphase diagnostic process as limiting their autonomy, while medical personnel consider it crucial to ensure and support the autonomy of the patient.⁵⁸

Regarding fairness and equality, a crucial aim is to make the recommendations in line with other patient groups and aspects of healthcare. One question is whether body dysphoria in transgender people should be treated on different

grounds than body dysphoria in cisgender patients. Regarding equality, the right to require treatment would be inconsistent with the rest of the public healthcare system. Treatment of gender dysphoria in transgender people is considered ethically justified and has its own recognition in the law, in contrast to body dysphoria in cisgender people. The exceptional treatment of transgender individuals can be justified due to the vulnerability of the group and special exposure to discrimination.⁵⁸ When treating groups in a vulnerable position, the alternative behavior resulting from not providing treatment might also be taken into consideration. People may for example seek their desired treatments on the black market.

In addition to the aspects identified in COHERE's ethical evaluation, another everlasting challenge is to determine the acceptable aesthetic result, since treatments for solely aesthetic purposes are excluded from public healthcare.

2.4 Legislation and treatment in Finland

2.4.1 Finnish public healthcare

The Finnish healthcare system is publicly funded and everyone permanently residing in Finland is entitled to it. The majority of the costs are covered with public funding, while the patient pays a minor client fee.

The private healthcare sector stands for about one-fifth of the healthcare costs.⁶⁰ Private healthcare providers sell their services directly to the client. If a person who has not received the F64.0 diagnosis undergoes chest masculinization in the private sector, they will have to pay value added tax. If, on the other hand, a person undergoing chest masculinization in the private sector does have the F64.0 or the F64.8 diagnosis, no value added tax needs to be paid.

2.4.2 Finnish legislation before 2023

The Finnish law of gender affirmation in transsexual people (informal translation: *Laki transseksuaalin sukupuolen vahvistamisesta*) came into force at the beginning of 2003.⁶¹ It was the first law in Finland recognizing transgender people and overruled the castration law from 1970 (informal translation: *Kastroimislaki*), which stated that a person can be castrated on their own firm request if their sexual drive is expected to cause them mental suffering.⁶² The law of gender affirmation in transsexual people originally defined the following requirements for legal gender affirmation to the opposite gender than the one assigned at birth:

1. The person provides a medical report confirming the permanent experience of belonging to the opposite gender, living according to the gender role of

the opposite gender, and that he or she is sterilized or is for other reasons infertile

2. The person is at least 18 years old
3. The person is neither married nor in a registered partnership
4. The person has Finnish citizenship or lives in Finland

In 2016, the law was updated and the requirement of the person not being married or in a registered relationship was replaced with the following: if the person is in a registered partnership, the affirmation requires that the partner has declared their acceptance of changing the registered partnership to marriage. If the person is married, the registry office has to inform the spouse about the affirmation.⁶³

In 2002, simultaneously with the preparing of the *trans-law*, the following decree *The decree of the arrangement of treatment and examination aiming to change genders and the medical report to affirm the gender of a transsexual by the Ministry of Social Affairs and Health* defining the national treatment protocol took effect.⁶⁴ The decree defined the following:

- The treatment and examination aiming to change one's gender is centralized to the Helsinki University Hospital and Tampere University Hospital. Genital surgery, apart from hysterectomy and oophorectomy, is centralized to Helsinki University Hospital.
- The examination of a person's transsexuality shall be made by a multiprofessional expert group led by a psychiatrist.
- After sufficient examination is made, the psychiatrist can direct the patient to another specialist to discuss hormonal treatment, when the criteria for hormonal treatment are reached.
- All genital surgery requires a favorable second opinion statement from a psychiatrist in the other unit (Helsinki or Tampere).
- The carrying out of the real-life phase can be followed up in healthcare institutions other than the university hospital of Helsinki and Tampere.
- The report stating that the patient's gender should be changed should state the following:
 - o The experience of belonging to the opposite gender is permanent
 - o The person lives in the role of the opposite gender AND
 - o The person is sterilized or due to other reasons infertile

All patients included in this thesis underwent chest masculinization and the preceding transition process in the time when the above-described law and statute was applied.

2.4.3 Finnish legislation since 2023

The law of gender affirmation in transsexual people was replaced with the law of gender affirmation (informal translation: *Laki sukupuolen vahvistamisesta*) in April 2023.⁶⁵ The requirements for legal gender affirmation in the current law are the following:

1. The person provides a report that they experience permanent belonging to the affirmed gender
2. The person is at least 18 years old
3. The person has Finnish citizenship or lives in Finland

In practice, the new law enables people to apply for legal gender affirmation and thereby a change of name without a medical report and before any medical evaluation or treatment. The other major change is the elimination of the infertility requirement.

2.4.4 The transition process before 2023

Defined by the *trans-law* and the Statement of the Ministry of Social Affairs and Health, the medical transition process in the public healthcare system has been carried out as described below. The main aspects of the process are visualized in Figure 1.

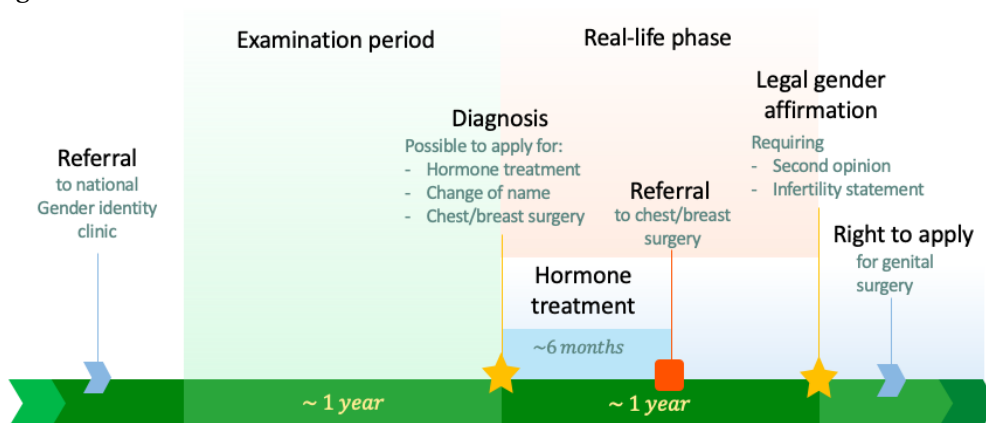


Figure 1 The transition process in Finland before 2023. Created by Mirjam Saarinen.

When a person experiences the urge to undergo gender-affirming treatment, the local healthcare provider provides a remittance to one of the two national Gender Identity Clinics at the Helsinki University Hospital and Tampere University Hospital.

The examination period in the university hospital aims to, with interviews and psychological testing, evaluate the gender experience, to establish an understanding of the person's stable and persistent gender identity as the basis for medical interventions, and to exclude severe psychiatric disorders that may require more urgent treatment and may delay medical gender-affirming interventions. The duration of the examination period is usually around one year. The visits are free. At the end of the examination period, the diagnosis can be made if the patient fulfills the following criteria:

- The patient has a will to live as the opposite gender compared to the sex assigned at birth
- The will is permanent
- The gender identity is not a symptom of some other psychiatric condition

The diagnosis provided is either F64.0 *Transsexuality* or F64.8 *Other gender identity disorder*.

Once the diagnosis is received, the patient can apply for feminizing or masculinizing hormonal treatment, breast or chest surgery and change of name. Usually, the patient can request a remittance to breast or chest surgery when hormonal treatment has lasted at least six months.

In the so-called *real-life phase*, the person aims to live according to the experienced gender. The real-life phase usually lasts for at least one year. The real-life phase starts once the diagnosis is made.

The legal gender affirmation can be applied for when the real-life phase is completed, and the person is at least 18 years old. Legal gender affirmation requires the person to provide an infertility statement, a statement from the treating gender identity unit and a second opinion statement from the other national gender identity unit. The social security numbers in Finland are gender profiled, and after the legal affirmation the person is provided a new social security number reflecting the experienced gender.

During the process, the person is encouraged to evaluate which forms of treatment will be best suitable for them. Some steps in the gender-affirming process require the finishing of previous steps, but the person chooses themselves which treatments they want to go through. The different surgeries also have specific preoperative requirements. Regarding requirements for non-urgent elective operations, the abstinence of smoking has generally been used as a clinical requirement due to the higher complication risk and wound-healing issues associated with active smoking.⁶⁶⁻⁶⁸ In addition, body mass index (BMI) under 30 has been applied as a clinical requirement due to anesthesia-related safety aspects, such as respiratory, pharmacologic and cardiovascular risks.^{69,70} For multi-phased surgical interventions such as phalloplasty, sufficient psychiatric wellbeing is clinically required to manage the postoperative treatment and healing period.

Once the gender is legally affirmed, the person can apply for genital surgery. Except for hysterectomy and oophorectomy, the genital surgery is centralized to Helsinki University Hospital. More recently, vaginectomies have been performed in Tampere University Hospital.

When the desired treatments have been stabilized, the follow-up of for example the hormonal treatment is returned to the local healthcare provider.

The costs of the process that the patient must cover are limited and includes caused for example medication bills and bills for polyclinic visits and overnight stays in the hospital.

Even though the diagnostic process is centralized by law, some people may seek hormonal and surgical treatment from the private sector or abroad. Unfortunately, we lack estimations on how large the proportion of these patients is.

All patients included in this thesis underwent chest masculinization and the preceding transition process in the time when the above-described process was applicable.

2.4.5 The transition process since 2023

Since the *law of gender affirmation* came into force in 2023, three aspects of the transition process were updated. The new transition process is visualized in Figure 2.

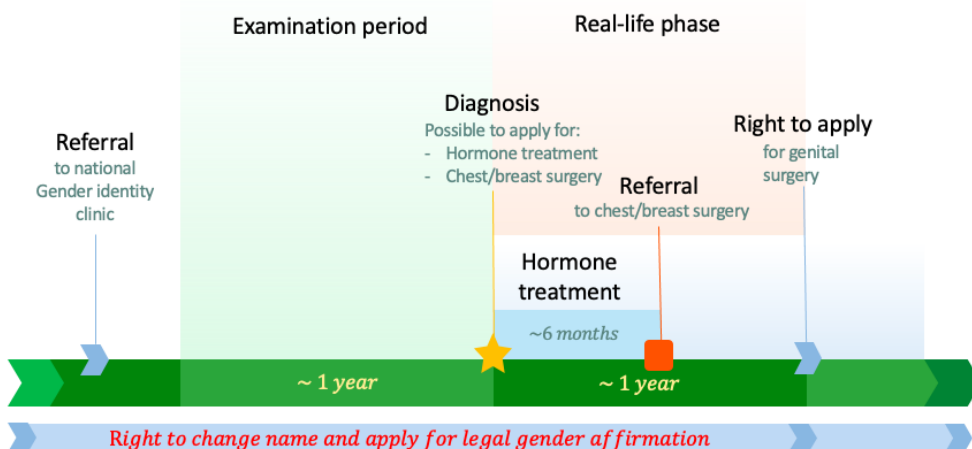


Figure 2 The transition process in Finland since 2023. Created by Mirjam Saarinen.

The legal affirmation of gender was separated from the medical process. Therefore, the legal affirmation of one's gender and the change of one's name to be in line with the gender became possible with the person's own declaration without any medical report.

The requirement of a second opinion statement ahead of diagnosis or genital surgery was removed. Otherwise, the medical process regarding the psychiatric examination, hormonal treatments and surgical interventions remained the same.

The infertility statement was removed as a requirement for legal gender affirmation and thereby as a requirement for genital surgery. However, the legal gender affirmation remained as a criterion for genital surgery.

2.5 Short description of psychometrics

Psychometrics is the science of constructing models and measuring psychological processes. It aims to create models for quantitative measurement of different phenomena. The models are designed to measure the desired condition (validity), measure it consistently (reliability) and detect alterations in the condition measured (responsiveness).⁷¹⁻⁷³

One way to approach validity is to divide it into two different types: content validity and construct validity. Content validity refers to whether the tool is representative of the measured construct.⁷⁴ Construct validity refers to whether the tool measures the construct it intends to measure.⁷⁴ Construct validity includes aspects of cross-cultural validity as well, where a tool valid in one society does not possess similar validity in another cultural context. In addition to the two above-described validity types, a third dimension is criterion validity, referring to the extent to which the result agrees with a so-called gold standard (external separately measured criterion).⁷⁴

Reliability refers to to what degree the tool is consistent and free from error.⁷⁴ This comprises test–retest reliability or intra-rater reliability (degree of agreement when one person performs a rating several times) and inter-rater reliability (degree of agreement when different raters rate the same thing).⁷⁴ Reliability also includes internal consistency, which refers to to what extent the items of a tool measure various aspects of the same construct.⁷⁴ The last dimension of reliability is measurement error, which indicates the level of systematic and random error that is not caused by true changes in the construct to be measured.⁷⁴

Responsiveness refers to sensitivity to change and the ability of a tool to detect small but still clinically significant alterations in the measured construct.⁷⁴

2.5.1 Patient-reported outcome measures

Patient-reported outcome measures (PROMs) are tools or instruments used to assess a patient's perception of their health status, quality of life, symptoms or functional status. PROMs can be generic or target a specific condition or area. They are widely used as measurements, when evaluating and guiding the

development of clinical care. They enable us to measure patient-related experiences and aspects, engage the patient in the clinical process and provide a new perspective to care. Since patient-centered care is becoming of major interest, PROMs play a crucial role in the process.⁷⁵ The use of PROMs usually involves the patient filling in a health-related questionnaire and can be used to screen for problems, monitor changes in patient experience or engage the patient in clinical decision making.⁷⁶ Some PROMs are intended to be filled out outside of consultation time, while others can be applied as a tool for communication during healthcare appointments.⁷⁷

Quality of life (QoL) instruments are a subgroup of PROMs and aim to measure QoL.⁷⁸ Definitions of QoL vary to a great extent but are considered to involve a broad range of life domains, such as physical, material, social and emotional well-being.^{78, 79} Health-related quality of life (HRQoL) instruments aim to assess solely the health aspect of QoL, although these often overlap and the conceptualization of these two constructs is challenging.^{79, 80} Some widely used HRQoL instruments assess aspects such as physical and social functioning, mental health, pain or discomfort and vitality.^{81, 82}

However, as the use of PROMs becomes an established part of clinical processes, it becomes important to understand their strengths and limitations.

The strengths of PROMs include accessibility and feasibility. PROMs engage patients in their healthcare.⁸³ The process of filling out the PROMs encourages the patients to reflect over their own condition and might serve as a tool to raise issues with the clinician and encourage discussion on sensitive topics that would otherwise go unnoted.⁷⁷ Validated instruments provide data that is comparable and possible to monitor over time.⁸⁴ PROMs have been shown to be helpful to determine the effectiveness of care and to evaluate outcomes.⁸⁵ They can also provide a reassurance that the clinicians care about the patients and take their concerns seriously.^{86, 87}

However, limitations and biases include suspicion toward healthcare providers and their motives, redundant information, and inaccuracy in estimating problems.^{85, 88} Furthermore people tend to report satisfaction on things they have chosen themselves. Suspicion toward healthcare providers and the worry of limiting access to care might affect the reported outcomes.^{89, 90} Furthermore, clinicians have reported concerns of PROMs constraining the communication between the patient and the clinician.⁷⁷ Patients report being reluctant to fill in PROMs if they have the sense that the PROMs are not being used or taken seriously.⁹¹ This emphasizes the role of the relationship and communication between the clinician and the patient. Both patients and clinicians have expressed concerns about PROMs simplifying health issues and only providing a narrow understanding of a problem.^{86, 92} Clinicians have emphasized the role of experience and wider clinical

judgement in the evaluation of a patient instead of simplifying nuanced problems to a simple score.^{86, 93}

Opinions on how PROMs affect honesty or dishonesty vary. Some patients have experienced PROMs as facilitating honesty, while others suggested the opposite.^{85, 86} Similarly, clinicians' views varied on whether PROMs facilitate the honest reporting of issues or on the contrary enable the hiding of symptoms.⁸⁵

2.6 Chest masculinization

Among transgender men, the most common surgical procedure is chest masculinization.^{3, 94-99} The feminine breasts are for many the single factor causing the greatest dysphoria, and chest masculinization often remains the only gender-affirming surgery.^{3, 98} Currently, the demand for gender-affirmation surgery is increasing rapidly.^{94, 100}

2.6.1 Surgical techniques

In chest masculinizing surgery, the chest area is surgically corrected to look more masculine by removing and remodeling breast tissue, reducing the size of nipples and areolas, repositioning the nipple–areolar complex (NAC) and releasing the inframammary fold (IMF). Several surgical techniques are described and differ regarding the position and length of the scar and the technique used to relocate the NAC. The selection of the optimal technique is individual and depends on patient characteristics such as breast size, size of the NAC, skin elasticity, degree of ptosis and IMF–NAC distance. Algorithms have been proposed to select the optimal technique based on patient characteristics.^{101, 102} Typically, the longer hormonal therapy has been used the less breast tissue there is,^{103, 104} thereby enabling the use of techniques with a smaller scar burden. Some commonly reported techniques are described below and are listed from less invasive to more invasive.

The semicircular technique shown in Figure 3 is a technique where the incision is made in the periphery of the lower half of the areola.¹⁰⁵ From this opening, the excess glandular tissue is removed without a skin resection. The benefit of this technique is the small and discrete scar. The limitations include the small opening, which limits the removal of tissue and makes the hemostasis more challenging.

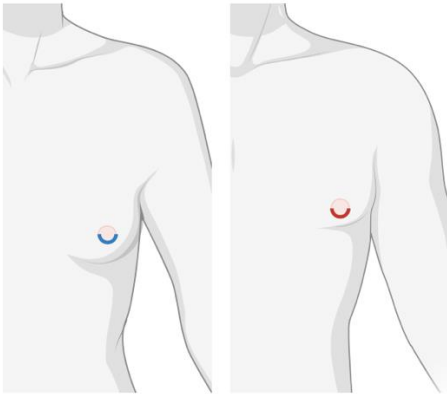


Figure 3 The semicircular technique. Incision marked with blue. Final scar marked with red. Created by Mirjam Saarinen with BioRender.com

The transareolar technique, shown in Figure 4, is also performed without skin resection. The incision is made through the NAC and allows for the reduction of the NAC and removal of excess glandular tissue. The benefits include a discrete scar, even though it is often more apparent than in the semicircular technique. The disadvantages are the same as in the semicircular technique.¹⁰²

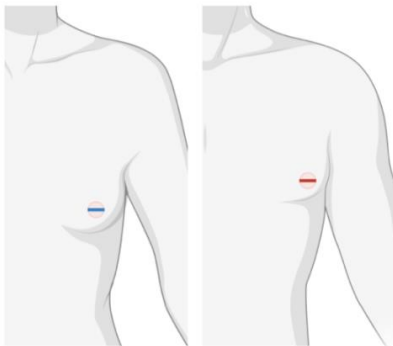


Figure 4 The transareolar technique. Incision marked with blue. Final scar marked with red. Created by Mirjam Saarinen with BioRender.com

The concentric circular technique, shown in Figure 5, allows for a modest skin resection as well as the resection of the areola.¹⁰⁶ The circular incisions are made around and within the areola, skin of the NAC pedicle is de-epithelized and otherwise resected. The circumference of the outer incision is reduced with a purse-string suture and the final scar is positioned in line with the new areola. This technique is applicable to larger, yet moderate sized, breasts than the semicircular and transareolar techniques since it allows for a reduction of excess skin in

addition to reducing the glandular tissue and size of the areola. However, the estimation of the optimal amount of de-epithelized skin requires expertise and if applied to large breasts, may result in undesirable stretched-out scars and excess skin.

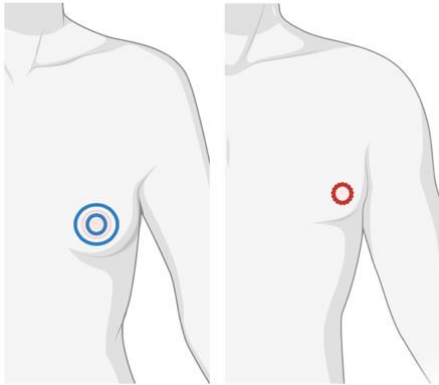


Figure 5 The concentric circular technique. Incision marked with blue. Final scar marked with red. Created by Mirjam Saarinen with BioRender.com

The extended concentric circular technique extends the incisions of the regular concentric circular technique with one or two triangular incisions, allowing for a more extensive removal of excess skin and subcutaneous tissue, shown in Figure 6. The benefits include good exposure to glandular tissue reduction and hemostasis. The limitations comprise a larger scar burden and a risk of stretched out scars.

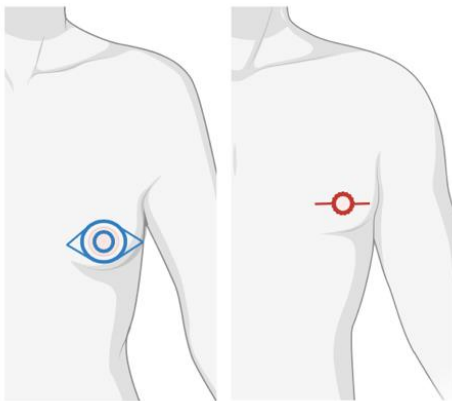


Figure 6 The extended concentric circular technique. Incision marked with blue. Final scar marked with red. Created by Mirjam Saarinen with BioRender.com

The double incision technique with inferior pedicle, shown in Figure 7, allows for an even greater reduction of breast tissue as well as de-epithelization of the

skin.¹⁰⁷ The resection area is defined with two elliptical horizontal incisions where the upper is positioned above the NAC and the lower above the IMF close to the inferior edge of the pectoralis major.¹⁰⁸ The NAC preserves its circulation via an inferior pedicle, which is de-epithelized, and the NAC is relocated to the new desired position slightly above the inferior edge of the pectoralis major and more lateral than in the female breast. This technique can be applied on larger breasts and enables the repositioning of the NAC. Although resulting in long horizontal scars, the positioning of the scars in the fold of the new masculine breast is often less noticeable than the extended scars in the extended concentric circular technique. The length and size of the pedicle limits the applicability of this technique since a large amount of ptosis would lead to a bulgy pedicle, compromising NAC vascularity.

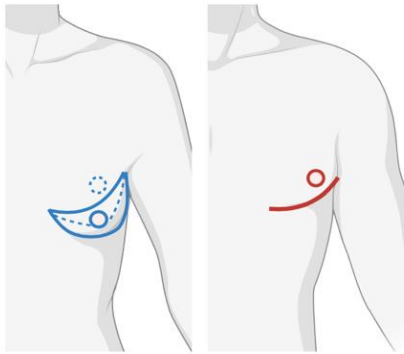


Figure 7 The double incision technique with inferior pedicle. Incision marked with blue. Final scar marked with red. Created by Mirjam Saarinen with BioRender.com

The double incision free nipple graft (DIFNG) technique, shown in Figure 8, can be used in large breasts with a large amount of ptosis.¹⁰⁹ The elliptical horizontal incisions are positioned similarly as in the double incision technique with inferior pedicle. The NAC, again, is now harvested as a full-thickness skin graft and grafted to its new location on the chest. The benefits are excellent conditions for tissue resection and hemostasis and the free relocation of the NAC. The disadvantages include the long scars and the possible loss of function in the NAC graft, such as loss of sensation or in worst cases necrosis.

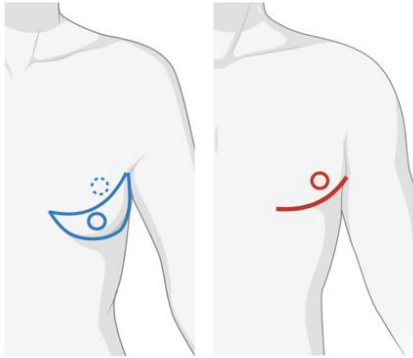


Figure 8 The double incision technique with free nipple graft. Incision marked with blue. Final scar marked with red. Created by Mirjam Saarinen with BioRender.com

2.6.2 Complications

The complication risk in chest masculinization surgeries is notable and has been reported to vary greatly, from 9% to 33% when reported per person,^{6, 110-117} and from 11% to 25% when reported per breast.^{7, 102, 107, 118, 119}

The most common acute complication is acute hematoma requiring evacuation in the operating room. The rates of acute hematoma requiring operative management vary from 1.6% to 9.6% per patient,^{110, 111, 113, 114, 116, 118} and from 0.3% to 20% when reported per breast.^{102, 107, 119, 120} Conservatively managed hematomas have been reported in 1–7% of patients.^{110, 113-115} Conservative treatment of hematomas usually comprise drainage or puncture. Several studies have noted a trend of more frequent hematomas in techniques with limited visibility during the operation such as transareolar and concentric circular techniques.^{6, 102, 113, 114, 116} One study has suggested testosterone treatment as a possible risk factor for hematomas.¹¹² Regarding the prevention of hematomas, there are promising results in other patient groups indicating significant reduction of acute wound-site hematomas when applying prophylactic topical tranexamic acid to the wound site before closure.¹²¹

Most studies divide complications into major and minor, with major complications usually requiring the operating room while minor complications are managed conservatively. While hematomas are the most common major complications, seromas, total NAC necrosis and abscesses have also been reported as rarer causes for returning to the operating room.^{102, 107, 113} One study even observed a symptomatic pneumothorax in two of their patients.¹²⁰

Other commonly reported issues that are usually conservatively managed include seromas (2.0–7%), partial or total NAC necrosis (0.4–4.2%), wound infections (0.4–3.7%) and dehiscence (0.4%).^{6, 110, 113, 114, 116}

Due to the high complication rates, the prevention and prediction of complications is of the highest interest. The surgical technique has in several studies been observed to be associated with complication rates, with techniques with the main scar within or around the NAC leading to higher overall complication rates compared to double incision techniques.^{6, 7, 114} However, some studies have failed to detect a similar finding.^{6, 111, 122} Furthermore, surgical technique type has been reported to affect the type of complications that occur. As previously mentioned, the limited visibility of the operated site in techniques with the main scar within or around the NAC has been thought to make it difficult to reach sufficient hemostasis and in addition to being associated with hematomas, have been associated with more frequent seromas.¹¹⁴ Furthermore, as one might expect, the rate of NAC necrosis has been reported to be highest in the DIFNG technique.^{111, 118} BMI has not been confirmed to be associated with higher complication rates.¹¹⁵ However, older age and smoking have been reported to be associated with higher complication rates.⁷

Unfortunately, the comparison of complication rates is hindered by the various reporting practices. Some studies report complications per patient while others prefer reporting per breast. Simultaneously, some studies report solely hematoma evacuations, while others include a wider range of etiologies. Similarly, classification into major and minor complications shows great variety and often lacks definition.¹²³

2.6.3 Secondary corrections

Secondary corrections or revisions include appearance-related and functional corrections made under either general anesthesia or with local anesthetics. The rate of secondary corrections reported after chest masculinization varies drastically. Often the proportion of patients undergoing secondary corrections ranges from 5 to 25%.^{107, 110, 112-114, 116, 122, 124-127} When reported per breast, the revision rates vary from 23 and 25%.^{7, 118} Occasional studies with small sample sizes have even reported a total lack of revision demand.^{128, 129} However, several studies have reported revision rates as high as 38–50%.^{6, 111, 117, 130, 131} While many patients might have undergone revision in several areas,⁶ only a few patients have needed tertiary corrections.^{102, 111}

There are multiple causes of secondary corrections. Despite the lack of clear definitions and classifications on appearance-related and functional causes, dehiscences, hypertrophic scars and excess skin leading to mechanical irritation are considered functional issues, while clear asymmetry or feminine shape of the breast are considered appearance-related. Reporting practices vary widely, but the underlying causes are often combined into three groups: chest contouring, scar-related corrections and NAC-related corrections.¹⁰⁷ Contouring usually comprises

resection of dogears, excess skin or liposuctions. Scar-related corrections often include scar revisions and resection of hypertrophic scars. NAC-related revisions include the reduction and reshaping of either the nipple or areola, and sometimes even reconstruction of the NAC. Contouring-related revisions are usually the most common cause of secondary corrections.^{107, 111, 114, 130} Several studies have compared the revision rates between surgical techniques, and most have reported the smallest need for secondary corrections among patients operated with DIFNG and the largest need in techniques with the main scar within or around the NAC.^{7, 111, 116, 122, 130, 131}

One study reported the highest frequency for secondary correction in patients operated with pedicular techniques and another found that both techniques with the main scar within or around the NAC and pedicular techniques have significantly higher revision rates than DIFNG.^{107, 130} In contrast, one study reported the most frequent need for secondary corrections in patients operated with the extended concentric circular technique.¹⁰² Of the studies not reaching statistical significance, two still reported a trend of more secondary corrections in techniques with the main scar within or around the NAC.^{6, 113} Only one study reported similar rates of secondary corrections in techniques with the main scar within or around the NAC and DIFNG.¹¹⁴ The etiology for secondary corrections also differed between surgical techniques, with techniques with the main scar within or around the NAC often requiring NAC-related revisions while DIFNG demanded contouring revisions.^{7, 114, 130}

Besides the higher rate of secondary corrections in patients operated with techniques with the main scar within or around the NAC, other factors associated with secondary corrections include prior breast surgery,¹¹³ postoperative complication,¹¹¹ positive smoking history and age.¹¹⁶

Direct comparison of the proportions of secondary corrections is limited by the variable reporting. Most of the studies report secondary corrections in the proportion of operated patients. However, some report the rate of secondary corrections per operated breast.^{7, 118, 126}

Only a fraction of studies distinguish revisions requiring the operating room and revisions made in the office, and reporting the type of anesthesia required is rare. One study reported that most of the corrections were performed with local anesthetics.¹¹⁰ Two studies reported the majority of revisions were performed in the operating room.^{113, 132}

Reporting also differs in what is considered as a secondary correction or revision surgery. Although many define hematoma and possible evacuation as a complication, one study also included hematoma evacuation as a revision surgery.¹¹⁴

The attitudes and accessibility to corrective interventions, as well as the duration of follow-up, might also affect the reporting of secondary corrections.

While many studies aim for a follow-up of one year, the majority of patients might not attend the follow-up or the median follow-up might end as early as three months postoperatively.^{110, 129, 132} Since secondary corrections are usually preferable to be performed once the wound healing process is finished, a short follow-up might be unable to detect the possible need for correction. Another probable cause affecting attendance to corrective interventions are costs. Studies done in Nordic countries, with publicly funded healthcare, appear to consistently report higher rates of secondary corrections than other studies.^{111, 116, 117} In these cases, the limited costs might encourage patients to seek corrective intervention at a low threshold. In contrast, in insurance-based systems only a fraction of insurances cover revisionary procedures, leaving the expenses for the patient to cover.¹³³

2.6.4 Patient-reported satisfaction

Patient-reported satisfaction after chest masculinization is high, up to 90%.^{107, 134, 135} PROMs designed for transgender men and gender-affirming surgery have only been developed in recent years, therefore researchers have lacked a valid tool for measuring patient-reported satisfaction in these patients. Previously, PROMs have been designed to evaluate chest surgery when aiming for a feminine result.¹³⁶ The methods used for measuring patient satisfaction when aiming for a masculine result vary from author-designed single items graded with Likert scales,^{107, 128, 137} to wider questionnaires either modified from pre-existing tools,^{135, 138} or custom designed by the authors.^{112, 122, 134}

Satisfaction on Likert scales has been reported to be good: 3.8/4,¹³⁷ 4.15/5,¹⁰² and 4.25/5.¹¹⁰

Lacking better instruments, the BREAST-Q has been used to evaluate patient-reported satisfaction. This instrument has been developed to evaluate satisfaction with the appearance of reconstructed breasts in women.¹³⁹ The instrument comprises six domains: satisfaction with breasts, overall outcome, process of care, psychosocial wellbeing, physical wellbeing and sexual wellbeing. Each of the domains yield a single index score from 0 to 100. The items regarding satisfaction of the breasts ask to evaluate different aspects of the “reconstructed breast” and comprise some aspects related to femininity such as how a bra is considered to fit. When applied as such, the BREAST-Q has yielded a satisfaction of 85 out of 100 among transgender men after chest masculinization.¹²⁴

Recently, the first PROM designed for the evaluation of masculinizing chest contouring surgery, the BODY-Q Chest module, has been developed.¹⁴⁰ It comprises a chest scale, containing ten items on chest appearance and one standalone item on scars, and a nipple scale, containing five items on nipple appearance. The patient sample used in the developing process comprised

gynecomastia patients, weight-loss patients and patients undergoing gender-affirming surgery. Later, the BODY-Q Chest module was further validated in the pre- and postoperative setting on patients seeking chest masculinizing surgery.¹⁴¹ In line with other tools of the BODY-Q, the item scores are converted into a single score ranging from 0 (worst) to 100 (best). The newly developed tool has likewise provided favorable outcomes of patient-reported satisfaction, with the postoperative satisfaction with the chest appearance ranging from 67–93 on a scale from 0 to 100, and the satisfaction with nipples ranging from 58–85.^{108, 142-144}

Thus far, only a few prospective evaluations have been reported. In these settings, the chest masculinization has been associated with a significant improvement in patient-reported satisfaction.^{124, 143, 144} Another study compared postoperative satisfaction to non-operated patients and detected a similar phenomenon of better satisfaction in postoperative patients.¹⁴²

The impact of the surgical technique on the patient-reported satisfaction is under debate. Some studies report no difference in satisfaction between different surgical techniques,^{135, 142} whereas others observe trends of less favorable results after surgeries with the main scar within or around the NAC compared to DIFNG.¹²² Planned secondary corrections have been associated with less favorable satisfaction scores.¹⁴² While often causing concern, high BMI, postoperative complications, and preexisting mental health diagnoses were not associated with less favorable satisfaction outcomes.^{115, 122, 135, 143}

Due to the irreversibility of gender-affirming surgery, regret is considered the most dreaded outcome. Data on regret is seldom collected but when reported, the rate of patients regretting their chest masculinization remains low, with 0–3% of participants reporting regretting their surgery.^{134, 135, 145, 146} However, the response rate in these settings have considerable variation. The underlying causes of regret and possible actions taken due to the regret remain to be studied.

2.6.5 Health-related quality of life and gender dysphoria measurements

HRQoL is an important outcome after chest masculinization. HRQoL can be measured with generic HRQoL instruments, or specific aspects can be evaluated separately. After chest masculinization, the psychosocial aspects of HRQoL have been of special interest and so far, the use of generic HRQoL instruments is sparse. Several studies have utilized the domains of the BREAST-Q or BODY-Q that address psychosocial wellbeing and appearance-related distress.^{142, 143, 147} Others use psychological questionnaires to address specific psychological phenomena such as the generalized anxiety disorder 7-item scale (GAD-7) for symptoms of general anxiety, patient health questionnaire (PHQ-9) or Beck depression

inventory (BDI) for depressive symptoms, or body uneasiness test - A (BUT-A) for body uneasiness.^{117, 124, 143, 144} The use of generic HRQoL tools is rare, but one study was found to have used the EQ-5D.¹⁴⁴ The EQ-5D is a generic HRQoL tool comprising five levels (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) each having three response levels.¹⁴⁸ Recently, a QoL tool specifically for transgender men has been developed, University of California, San Francisco, Gender Quality of Life Survey (UCSF Gender QoL survey), but wider applicability is still awaited.¹⁴⁹ Some studies apply completely author-designed items.¹³⁴

Regarding psychosocial wellbeing, several studies have reported significant improvement in postoperative patients measured with the psychosocial wellbeing domain of the BREAST-Q.^{124, 143, 147} A similar improvement has been reported regarding QoL reported by the UCSF Gender QoL.¹⁴⁹ However, a study using a generic HRQoL tool did not find significant improvement in general HRQoL in a prospective setting.¹⁴⁴

The effect of psychiatric comorbidities is unclear since some have detected worse psychosocial or HRQoL outcomes in patients with psychiatric comorbidities, while others lack such a finding.¹⁴²⁻¹⁴⁴

The need for gender-affirming treatment is often argued for because it will reduce gender dysphoria. However, only a few studies regarding gender-affirming treatment address gender dysphoria.

Gender-affirming treatment has been indicated to alleviate gender dysphoria measured with the Utrecht Gender Dysphoria Scale (UGDS), reaching the level of cisgender controls.^{150, 151} The UGDS is a validated 12-item scale designed to evaluate the degree of gender dysphoria.¹⁵¹ However, since the applied scale changes at transition, the actual difference in the absolute score might be ambiguous.

Another questionnaire designed for the recognition of gender dysphoria is the Gender Identity/Gender Dysphoria Questionnaire for Adolescents and Adults (GIDYQ-AA).¹⁵² However, it has not yet been applied to transgender men undergoing chest surgery.

2.6.6 Alternative outcomes of chest masculinization

2.6.6.1 Panel evaluation of the aesthetic result

For evaluation of the postoperative aesthetic result, panel evaluation has been widely used in several surgical areas and has in some circumstances been shown to be a somewhat reliable method for aesthetic evaluation.¹⁵³⁻¹⁵⁵ However, reliability depends on the tool.¹⁵⁶ The optimal size of a panel is under debate, but has been suggested to be 3–4 people.¹⁵⁷⁻¹⁵⁹ The composition of the panel is also

known to affect the results, and therefore, a gender-balanced panel with various professionals is often favored.^{158, 160, 161}

Tools for clinician-reported aesthetic evaluation have been developed but focus on a feminine result.^{157, 162} Meanwhile, validation of panel evaluations and the development of a structured tool for clinician-reported outcomes after chest masculinization have not yet been accomplished. Instead, authors apply author-designed items often on Likert scales or modify tools developed for other target groups.^{7, 108, 114, 137} Despite the lack of knowledge in the area concerning masculinizing chest surgery, in breast-conserving therapy (BCT) a multi-item scale has been shown to provide slightly better reliability compared to a simple four-point scale, but due to the simplicity of use and interpretation, a four-point scale was recommended for panel evaluation.¹⁵⁸

2.6.6.2 Objective assessment of the aesthetic result

Software programs have been developed for the objective assessment of the aesthetic result in other areas of surgery, such as oncoplastic breast surgery.¹⁶³ In contrast to relying on evaluations of observers, the objective evaluations are based on measurements taken either from patients or photographs and evaluating asymmetries.¹⁶⁴ The Breast Cancer Conservative Treatment. cosmetic result (BCCT.core) was developed to assess the cosmetic result after oncoplastic surgery. It is a semi-automated program that assesses symmetry, volume, scar appearance and color difference based on measurements and parameters extracted from postoperative photographs.¹⁶⁵ The BCCT.core has been evaluated to have good concordance between users but lacks concordance with specialist assessments and PROMs.^{166, 167} However, such tools are restricted by being procedure specific and to date no such tool has been developed to evaluate the aesthetic result of a masculine chest.

Even harnessing artificial intelligence and machine learning has been attempted for evaluating the aesthetic result, but to date the construction of models remains unaccomplished.¹⁶⁸ Objective assessment of the aesthetics of a masculine chest would require a consensus and definition of an aesthetic masculine chest, which remains to be done.

2.7 Summary of the literature

Chest masculinization is the most common gender-affirming surgical intervention in transgender men, and the number of patients undergoing gender-affirming surgery is increasing.⁹⁴ Several techniques are applied depending on the characteristics of the patient, and the goal is to reach a masculine outcome with moderate scar burden.¹⁰²

Severe complications are rare but minor complications are reported in up to one-third of patients.^{111, 118} Due to the high frequency of complications, factors associated with complications are of high interest. Surgical techniques with limited visibility of the operating site have been reported to yield higher complication rates, with one issue being the difficulty of providing sufficient hemostasis. The results, however, remain inconsistent.^{6, 114}

Secondary corrections are frequently performed and for multiple reasons.¹¹⁶ Patients operated with DIFNG are reported to undergo fewer secondary corrections compared to patients operated with other techniques.¹²² Prior breast surgery, postoperative complications and positive smoking history have also been associated with more frequent secondary corrections.^{111, 113, 116} The frequency of secondary corrections is reported to be high in studies from the Nordic countries,^{111, 116} and the role of insurance policies in other countries in this matter remains uncertain.

In addition to clinical outcomes, patient-reported outcomes after gender-affirming surgery are of high interest. Since the aim is to alleviate gender dysphoria and thereby increase QoL, the HRQoL and patient-reported satisfaction are appropriate outcomes. Transgender men generally report good satisfaction with the postoperative chest masculinization result.¹⁶⁹ However, HRQoL has rarely been assessed. PROMs addressing the surgical result after chest masculinization are limited, and so far only one has been translated into Finnish.¹⁷⁰

Other ways to evaluate the aesthetic result after chest masculinization have rarely been applied. Panel evaluation has widely been used to evaluate the aesthetic result in other surgical areas.^{153, 155} However, regarding chest masculinization, we lack consensus on the desired result as well as tools to measure it. To better cater to the patients' needs, a view of the surgeon's understanding of a desirable result and plausible discrepancy between the perspectives of surgeons and patients should be addressed.

3 Aims of the study

The aim of this thesis is to provide knowledge about transgender men undergoing chest masculinization, the clinical procedure and suitable outcome measures. More specifically, the aims are:

- I. To validate the Finnish patient-reported outcome tool, the BODY-Q Chest module, in transgender men who have undergone chest masculinization.
- II. To evaluate the surgical techniques, complication rates and secondary corrections of chest masculinization and factors associated with the outcomes.
- III. To evaluate postoperative patient-reported satisfaction and HRQoL after chest masculinization.
- IV. To evaluate the postoperative aesthetic result by an expert panel and examine the suitability of panel evaluation for the postoperative result of chest masculinization.

4 Material and methods

4.1 Ethical consideration

The study plan was approved by Helsinki University Hospital with decision numbers HUS/575/2019 and HUS/206/2022. The study protocol was approved by the Ethics Committee of Helsinki University Hospital, Finland with the decision number HUS/2711/2019. The principles of the Helsinki Declaration were followed.¹⁷¹

4.2 Patients

A retrospective patient material, containing all transgender men receiving surgical chest masculinization at Helsinki University Hospital between 1 January 2005 and 31 December 2018, was collected from patient records. A total of 225 patients were identified using the ICD-10 code F64.0 for transsexualism combined with Nordic Medico-Statistical Committee H-codes for surgical procedures on mammary glands.¹⁷² Since surgical treatment of gender dysphoria in non-binary patients was not included in the service choices of Finnish public healthcare until 2020, non-binary patients identified with the ICD-10 code F64.8 for other gender identity disorders were not included in the study. In Finland, gender-affirmation surgery is included in public healthcare and, by law, requires the patient to be 18 years of age.

Studies I, III and IV were completely or partially based on a survey filled out by the 225 patients. Five patients could not be invited to the survey and were excluded from the material: two due to an unknown address, two due to a foreign address, and one due to non-disclosure for personal safety reasons. Informed consent was obtained from the survey participants.

In Study II, five patients were excluded due to previous chest surgery: four had undergone reduction mammoplasty and one had undergone removal of a nipple tumor.

In Study IV, we identified 48 patients from the original data, with sufficient postoperative photographs saved in patient files, that were included in the panel evaluation. Postoperative photographs are usually taken at the 1-year

postoperative appointment. Of the 48 patients evaluated by the panel, 26 had participated in the survey.

4.3 Instruments

4.3.1 BODY-Q Chest module (Study I, III, IV)

The right to use Q-questionnaires was applied for from the copyright holders (Memorial Sloan Kettering Cancer Center) and registered for this thesis. The BODY-Q Chest module, used in Study I, III and IV, is a PROM developed for evaluation of the result of masculinizing chest contouring surgery.¹⁴⁰ It has been translated, culturally adapted and linguistically validated to Finnish.¹⁷⁰ It comprises a chest scale and a nipple scale. The chest scale contains ten items on the appearance of the chest and one standalone item on scar appearance, while the nipple scale contains five items on nipple appearance. Each item is assessed on a scale from one to four (very dissatisfied – somewhat dissatisfied – somewhat satisfied – very satisfied). In cases of missing items, when the missing data are less than 50% the missing items are replaced with the mean of the completed items. If the missing data are 50% or more, the questionnaire is excluded from the analyses. The sum of items of each scale is transformed into a single score according to the instructions of the instrument, yielding a final score with a range from 1 to 100 and a range from 0 to 100 for the chest and nipple scales, respectively.¹⁴⁰

4.3.2 15D (Study I, III)

The 15D, used in Study I and III, is a generic, self-administered Finnish HRQoL instrument. The development of the 15D began in the 1970s.^{173, 174} The need for assessing HRQoL had been acknowledged, but there was a lack of a gold standard measurement among generic HRQoL instruments. The 15D was developed to address the main aspects of health according to the definition of the WHO: physical, mental and social.¹⁷³ The main goal was to establish an instrument that could be used as a single index score as well as a profile. The 15D was developed to meet the requirements of generic measurements in being feasible and having general applicability, reliability and sensibility.¹⁷³ The feasibility has been interpreted as good due to the high completion rate in studies applying the 15D.¹⁷⁵ When developing the 15D, the dimensions of previously developed generic HRQoL tools were included and further expanded upon to provide a more comprehensive approach to HRQoL.^{176, 177} The test–retest reliability has been confirmed to be good.¹⁷⁸ The calculation of the utility index is based on valuations from a 2500–

person Finnish sample population using the multi-attribute utility method.¹⁷⁹ The responsiveness and stability of the 15D is considered good.¹⁸⁰

The instrument comprises 15 dimensions: mobility, vision, hearing, breathing, sleeping, eating, speech, excretion, usual activities, mental function, discomfort and symptoms, depression, distress, vitality, and sexual activity. Each dimension is assessed on a 1–5 scale, from best to worst. The single index score (15D score), representing the overall HRQoL on a 0–1 scale (0=dead, 1=full health-related quality of life), and the dimension-level values, reflecting the goodness of the levels relative to no problems in the dimension and to being dead, are calculated using a set of population-based preference or utility weights. Mean dimension-level values are used to create 15D profiles for groups.

In Finnish HRQoL studies, the 15D has been considered the gold standard for decades and is currently available at 37 languages.¹⁸¹

4.4 Clinical data collection

Information on participants was collected from the Helsinki University Hospital's patient records, which cover all records from the hospital. Collection of data was finalized in October 2020 and all records available at that time were used.

The data contained sociodemographic factors, somatic and psychiatric comorbidities, preoperative radiologic interventions, complications, secondary corrections, follow-up time, number of out-patient clinic contacts, attendance to genital surgery and later regret regarding the transition process.

Data from the surgical procedure included surgical incision, relocation technique of the NAC, tissue removal and histopathological diagnoses. Surgical techniques were categorized into three groups with techniques leading to the main scar in or around the NAC, including semicircular, transareolar, concentric circular and extended concentric circular techniques, being referred to as periareolar techniques. The two other groups are the double incision technique with pedicular NAC relocation and the DIFNG.

In the clinical databases, the preoperative assessment of breast size was evaluated subjectively and often described imprecisely as a combination of sizes, for example "A–B". In these cases, the cup size was rounded down to the smaller size.

Complications were classified according to the Clavien-Dindo (CD) classification, which grades surgical complications based on the level of intervention required to manage them.¹⁸² For simplicity and comparability to other studies on the subject, the complications were combined to form two groups: minor complications representing CD grade I–II and major complications representing CD grades III and higher. CD grade I includes any deviation from the normal postoperative course. Since there were no complications of grade IV–V on

the CD classification (life-threatening complications requiring intensive care unit treatment), major complications consist solely of CD grade III, with complications requiring surgical, endoscopic or radiological intervention with or without general anesthesia.

The secondary corrections comprise all appearance-related and functional corrections performed, including surgeries under general anesthesia as well as smaller corrections done with local anesthesia. The corrections also include planned phase-two interventions such as NAC tattoos and NAC reconstructions, when instead of relocating the NAC, it was intentionally removed in the primary operation due to the understanding that later reconstruction or tattooing would yield a more favorable result. We defined scar-related problems as all deviations from uneventful scar healing.

Information regarding regret about the transition process was collected from patient journals. Patients experiencing regret of some part or the whole process to the extent that they desired to undergo legal detransitioning or surgical detransition interventions were managed by a multidisciplinary team and therefore documented in patient journals.

4.5 Survey collection

The surveys used in Study I, III and IV were collected in 2020. The invitation packages were sent to patients by mail in May 2020. The packages contained a general information letter, an informed consent form, the BODY-Q Chest module, the 15D questionnaire, and a prepaid return envelope. Those who did not reply to the initial invitation received a second invitation in September 2020.

4.6 Panel evaluation

The panel comprised four plastic surgeons (two female, two male), one licensed physician (female) and one registered nurse (male). The plastic surgeons were not involved in operating on the evaluated patients.

Postoperative images were collected from clinical databases. The images required for panel evaluation comprised one image directly from the front with an upright position, one image directly from the front with a forward-leaning position, one image from the right side with an upright position, and one image from the left side with an upright position. The images were taken at least 12 months after the primary operation or, in the case of secondary corrections, the images were taken at least 6 months after the last correction.

The panelists were requested to evaluate 12 author-designed aspects in the images on a four-point Likert scale (poor – satisfactory – good – very good). The

aspects were listed as follows: 1, position of the scar; 2, appearance of the scar; 3, size of the areola; 4, positioning of the areola; 5, shape of the areola; 6, shape of the nipple; 7, size of the nipple; 8, shape of the breast; 9, breast size; 10, masculinity of the chest from the front; 11, masculinity of the chest from the side; 12, symmetry of the chest. An overall grade was calculated as the mean of the separate aspects. The process is illustrated in Figure 9.

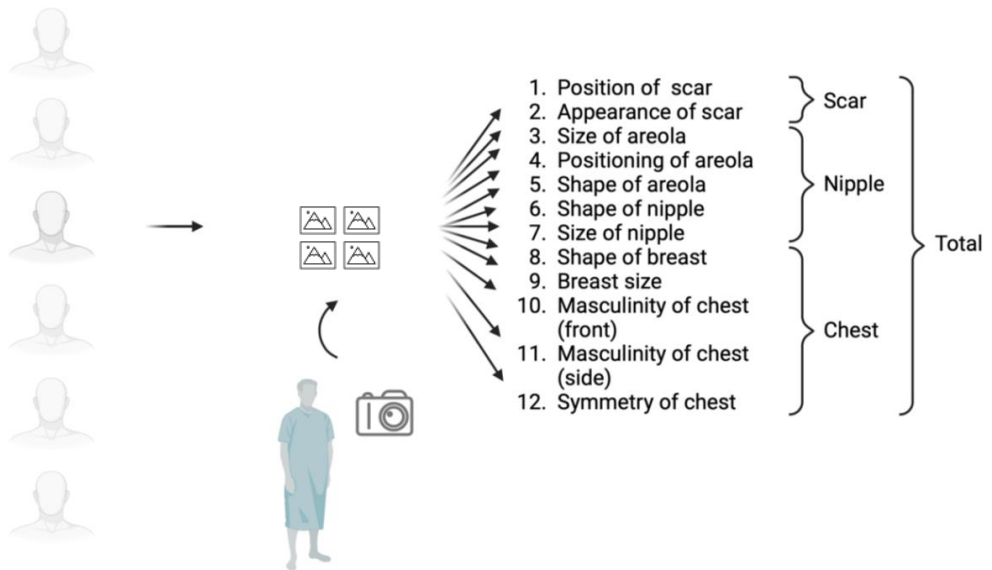


Figure 9 Illustration of the panel evaluation and division of separate items into scar-, nipple-, and chest-specific items. Created by Mirjam Saarinen with BioRender.com

4.7 Statistical analysis

4.7.1 Validation of the BODY-Q Chest module (Study I)

The statistical analyses were completed using RStudio 1.4.1106 with packages “ggplot2,” “devtools,” “ggbiplot,” “lavaan,” “semPlot,” “psych,” “pspearman,” and “psychometric”. Continuous data are reported as medians and interquartile ranges (IQR). Categorical and discrete data are reported as counts (N) and percentages (%). To exclude selection bias, the sociodemographic data of the respondents and non-respondents were compared with Fisher’s exact test for categorical variables and the Mann–Whitney U test for continuous variables.

Ceiling and floor effects of the chest scale and the nipple scale were evaluated with proportions of maximum and minimum scores. The ceiling or floor effect was confirmed if >15% had the maximum or minimum scores, respectively. Internal consistency of the chest scale and the nipple scale was determined using Cronbach's α . Values exceeding 0.8 were considered sufficient.¹⁸³

Linear regression models were used to evaluate the correlation between the scales of the BODY-Q Chest module and the time from the primary operation. The autocorrelation between the chest and nipple scales was also evaluated. We reported non-adjusted R-squared, β , 95% confidence intervals (95% CI) for β , and the p-value for β . R-squared was determined as very weak (<0.02), weak (0.02–0.12), moderate (0.13–0.26), or substantial (>0.26), in agreement with Cohen's reference values. β was interpreted as a small (<0.1), moderate (0.1–0.5), or strong (>0.5) effect.

The correlation between 15D dimensions and the scores of the scales of the BODY-Q Chest module was evaluated with Spearman's correlation coefficient (Spearman's ρ), and CIs were computed with the "CIr" function. The correlation was interpreted as follows: 0.0–0.1 negligible, 0.1–0.4 low, 0.4–0.7 moderate, 0.7–0.9 high, and 0.9–1.0 very high.¹⁸⁴

Exploratory factor analysis (EFA) with varimax rotation was conducted to evaluate the internal structure of the chest scale and the nipple scale. The factors were chosen according to the Kaiser criteria, including factors with a minimum eigenvalue of one.¹⁸⁵ In loading values, a cut-off of 0.4 was used.

4.7.2 Study II

The statistical analyses were performed with Number Cruncher Statistical Systems (NCSS) 12 Statistical Software (2018). Continuous data are reported as medians and IQRs. Categorical and discrete data are reported as counts (N) and percentages (%). Due to the numerous statistical analyses, statistical significance was defined as $p < 0.01$ to reduce the risk of random significant p-values.

Non-normal continuous variables were Box-Cox transformed to resemble normal distribution when possible. Equal variance t-test was used to compare two independent groups of continuous responses with normal distribution. To compare two independent groups with non-normal continuous responses, Mann-Whitney U test was used. When comparing two or three independent groups with categorical responses, Pearson's chi square was used for large sample sizes. If the sample size was smaller than five, Fisher's exact test was used for comparison of two independent groups with categorical responses. When comparing three independent groups, one-way analysis of variance was used for normal continuous responses, and Kruskal-Wallis test for continuous non-normal or discrete responses.

4.7.3 Study III

The statistical analyses were completed using RStudio 1.4.1106 with packages “ggplot2”, “devtools”, “ggbplot”, “lavaan”, “semPlot”, “psych”, “pspearman” and “psychometric”. The data are reported as medians, IQRs, means, counts (N), and percentages (%). When comparing two independent groups, we used the independent samples t-test to compare normal continuous variables and the Mann–Whitney U test to compare non-normal continuous variables. The chi-square test was applied to compare the categorical variables of two independent groups except for small groups (less than five respondents), where Fisher’s exact test was applied. Due to the numerous statistical analyses, statistical significance was defined as $p < 0.01$ to reduce the risk of type I error. To evaluate selection bias, the sociodemographic and clinical data of the patients who assessed the survey were compared to those who did not.

The 15D results were compared to the age-standardized Finnish male and female populations.¹⁸⁶ The minimum clinically important change or difference in the 15D score was determined as ± 0.015 .¹⁸⁷

4.7.4 Study IV

Statistical analyses were conducted using RStudio version 2023.12.0+369 with packages “lpSolve”, “devtools”, “irr”, “dplyr”, and “ggplot2”. Data are reported as medians and IQRs for non-normal variables, means and standard deviations (SD) for normal variables, counts (N), and percentages (%). Normality of data was evaluated with the Shapiro–Wilk test.

Inter-rater reliability for the panel was evaluated per question with the intraclass correlation coefficient (ICC) using a two-way random-effects model (type = consistency, unit = single). The reliability was interpreted from the ICC estimate as poor (< 0.5), moderate ($0.5–0.75$), good ($0.75–0.9$), or excellent (> 0.9).¹⁸⁸

An overall grade of the evaluation of the aesthetic result of every patient was calculated for each panelist as a mean of the separate items.

To evaluate the difference between the score given by male and female panelists, the overall grades given by the panelists were compared with Wilcoxon signed-rank tests.

Due to the numerous statistical analyses, the level of statistical significance was defined after Bonferroni correction.

In the subgroup of patients for whom there was both BODY-Q Chest module and panel assessment, single items included in the BODY-Q and evaluated by the expert panel were analyzed for correlation. The correlation between the panel and participants was estimated with Kendall rank correlation.

5 Results

5.1 Validation of the BODY-Q Chest module (Study I)

Of the 220 patients invited to the study, 123 patients responded, giving us a response rate of 56%. The follow-up time from primary operation to replying to the questionnaire had a median of 63 (IQR 60) months. The sociodemographic features of those patients who responded and those patients who did not are compared in Table 3.

Score distributions of the scales are presented in Figure 10 and Figure 11. Regarding the chest scale, 6 patients had missing data: missing data >50% n=1, missing data <50% n=5. Concerning the nipple scale, 3 patients had missing data: missing data >50% n=1, missing data <50% n=2. On the chest scale, patients scored between 25 and 100 points, with a median score of 76 and IQR 29. Regarding content validity, the distribution was skewed to the high points and showed a trimodal structure. Maximum points were scored by 23 patients (19%), showing a clear ceiling effect (>15% scoring maximum points). No patients scored minimum points. Thus, no floor effect was observed. On the nipple scale, patients scored between 0 and 100 points. Here, the scores were also skewed toward the high points, leading to non-normal distribution. The median score was 68 and IQR 34. One patient scored minimum points, indicating no floor effect. Maximum points were scored by 25 patients (20%), showing a clear ceiling effect. The median, IQR, proportion of maximum and minimum scores, and correlation to total score for all individual items are presented in Table 4 and Table 5. A shift toward high points can be observed here as well. Concerning internal consistency, Cronbach's α was 0.92 and 0.88 for the chest and nipple scales, respectively.

Table 3 Sociodemographic characteristics of patients in Study I

N = count, % = percentage, IQR = interquartile range, BMI = body mass index, ADHD = attention deficit hyperactivity disorder. Reproduction permitted by Sage Journals.¹⁸⁹

	Respondents, N=123 (56%)	Non-respondents, N=97 (44%)	p-value
Age years, median (IQR)	23 (7)	23 (7)	0.68
BMI, median (IQR)	23.5 (6)	23.9 (6)	0.83
Clinical follow-up time months, median (IQR)	15 (19)	14 (16)	0.76
Preoperative hormone treatment, median (IQR)	11 (11)	14 (12)	0.07
Employment			0.53
Employed / Student, N (%)	87 (87)	64 (81)	
Unemployed, N (%)	9 (9)	11 (14)	
Longtime sick leave and disability pension, N (%)	4 (4)	4 (5)	
Somatic co-morbidity, N (%)	51 (44)	36 (39)	0.57
Psychiatric co-morbidity, N (%)	90 (78)	78 (82)	0.60
Depression, N (%)	70 (62)	59 (63)	1.0
Anxiety disorder, N (%)	31 (27)	25 (27)	1.0
Personality disorder, N (%)	19 (17)	10 (11)	0.23
ADHD, N (%)	9 (8)	7 (7)	1.0
Autism spectrum, N (%)	2 (1.8)	4 (4.3)	0.41
Other, N (%)	26 (23)	23 (24)	0.87
History of self-harming, N (%)	42 (84)	38 (72)	0.16
Previous suicide attempt, N (%)	13 (16)	13 (17)	1.0
Previous psychiatric outpatient visit, N (%)	71 (70)	67 (79)	0.24
Previous psychiatric inpatient hospitalization, N (%)	20 (32)	21 (41)	0.33
Regret of transition process, N (%)	1 (0.8)	4 (4)	0.20

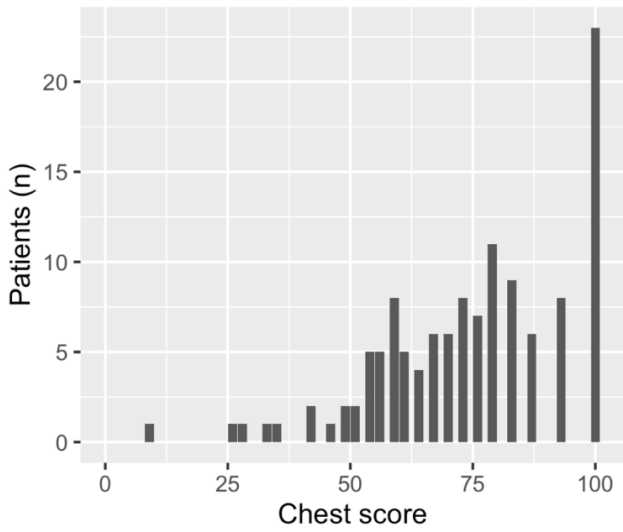


Figure 10 Score distribution of the chest scale. Reproduction permitted by Sage Journals.¹⁸⁹

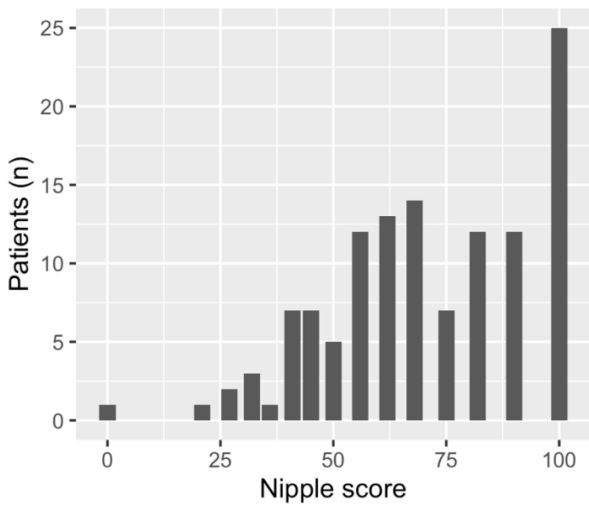


Figure 11 Score distribution of the nipple scale. Reproduction permitted by Sage Journals.¹⁸⁹

Table 4 Distribution of scores in the chest scale items. Reproduction permitted by Sage Journals.¹⁸⁹

IQR = interquartile range, % = percentage

Items measuring satisfaction with the chest. Scale 1–4	Median	IQR	Min. points %	Max. points %	Item-total correlation, Spearman
1. How your CHEST (breast area) looks in a loose T-shirt?	4	0	0	83	0.53
2. How your CHEST (breast area) looks when you lie on your back?	4	0	0	78	0.54
3. How flat your CHEST (breast area) looks when you stand up straight?	3	1	3.3	49	0.78
4. How masculine your CHEST (breast area) looks?	4	1	1.6	54	0.75
5. How your CHEST (breast area) looks when you are active (e.g., run or jump)?	4	1	2.5	61	0.76
6. How your CHEST (breast area) looks in a snug T-shirt?	3	1	4.1	47	0.79
7. The shape of your CHEST (breast area) without a shirt on?	3	1	3.3	31	0.84
8. How your CHEST (breast area) looks when you bend over?	3	2	5.7	43	0.81
9. How your CHEST (breast area) looks from the side (i.e., profile view) without a shirt on?	4	1	0.8	53	0.77
10. How your CHEST (breast area) looks in the mirror without a shirt on?	3	1	3.3	34	0.78
11. How the scars from your surgery look?	3	1	3.3	35	0.26

Table 5 Distribution of scores in the nipple scale items. Reproduction permitted by Sage Journals.¹⁸⁹

IQR = interquartile range, % = percentage

Items measuring satisfaction with nipples. Scale 1–4.	Median	IQR	Min. points %	Max. points %	Item-total correlation, Spearman
1. The shape of your nipples?	4	1	1.6	61	0.66
2. The size of your nipples?	3	1.75	5.7	32	0.87
3. How flat your nipples look?	3	1	3.3	48	0.83
4. How much your nipples show through a snug T-shirt?	3	1	4.9	35	0.85
5. How your nipples look without a shirt on?	3	2	4.9	45	0.84

Figure 12 and Figure 13 show linear regression between total score and the time from surgery expressed in months. Regarding the chest scale, the regression model is considered statistically significant because it had a p-value of 0.01. The non-adjusted R-squared shows a weak goodness of fit, and β indicates the effect to be small and negative. On the nipple scale, statistical significance was not achieved.

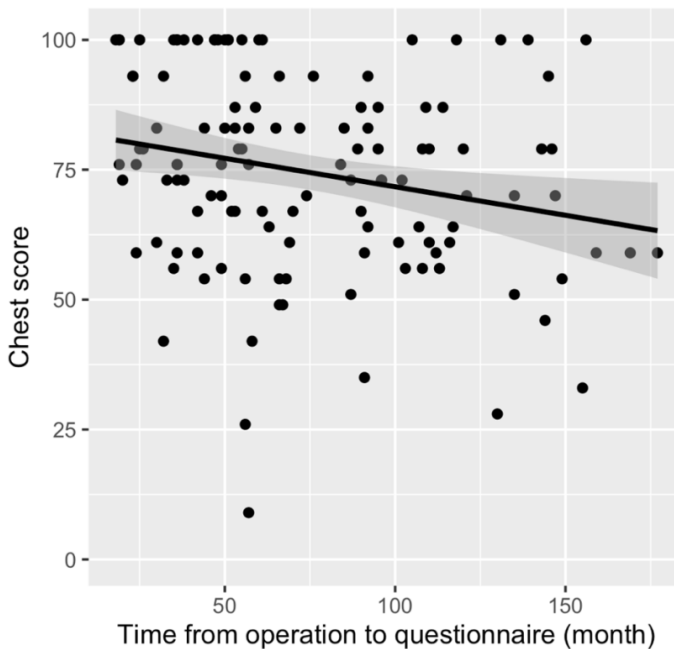


Figure 12 Correlation between chest scale score and time from operation. Gray area showing 95% CI. R-squared = 0.05, beta = -0.11 (95% CI = -0.19 to -0.03, p-value = 0.01). CI = confidence interval. Reproduction permitted by Sage Journals.¹⁸⁹

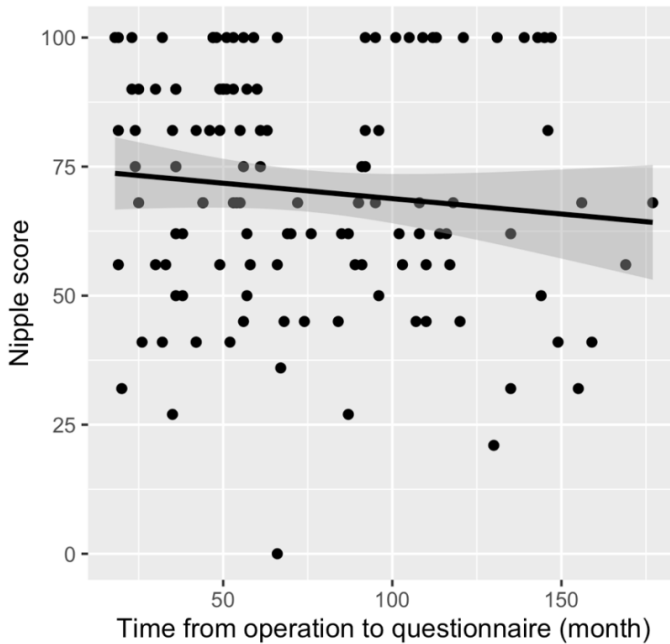


Figure 13 Correlation between nipple scale score and time from operation. Gray area showing 95% CI. R-squared = 0.01, beta = -0.06 (95% CI = -0.16 to -0.04, p-value = 0.25). CI = confidence interval. Reproduction permitted by Sage Journals.¹⁸⁹

Correlations between the dimensions of the 15D and the scores of each scale are presented in Table 6. Regarding the 15D, one patient had missing dimensions. The table comprises Spearman's ρ and 95% CI. Spearman's ρ varied from 0.04 to 0.34 and from 0.01 to 0.22 for the chest and nipple scales, respectively. On the chest scale, the strongest correlation was observed with dimension 14. However, on the nipple scale, the correlation was strongest with dimensions 11, 12, and 14. All patients reported the same response on dimension 6, and therefore correlation could not be measured.

Table 6 Spearman's ρ between 15D dimensions and scores of the chest scale and nipple scale. Reproduction permitted by Sage Journals.¹⁸⁹

CI = confidence interval

15D dimensions	Chest – Spearman's ρ (95% CI)	Nipple – Spearman's ρ (95% CI)
1. Mobility	-0.04 (-0.17 to 0.09)	-0.02 (-0.15 to 0.11)
2. Vision	-0.04 (-0.17 to 0.10)	0.07 (-0.06 to 0.20)
3. Hearing	-0.14 (-0.27 to -0.01)	0.09 (-0.04 to 0.22)
4. Breathing	-0.09 (-0.22 to 0.05)	0.01 (-0.12 to 0.14)
5. Sleeping	-0.07 (-0.20 to 0.06)	0.01 (-0.12 to 0.14)
6. Eating	-	-
7. Speech	-0.10 (-0.23 to 0.03)	-0.14 (-0.26 to 0.00)
8. Elimination	-0.21 (-0.33 to -0.08)	-0.11 (-0.24 to 0.02)
9. Usual activities	-0.30 (-0.42 to -0.18)	-0.07 (-0.20 to 0.06)
10. Mental function	-0.20 (-0.32 to -0.06)	-0.13 (-0.26 to 0.00)
11. Discomfort and symptoms	-0.32 (-0.43 to -0.19)	-0.22 (-0.34 to -0.09)
12. Depression	-0.32 (-0.44 to -0.20)	-0.22 (-0.34 to -0.09)
13. Distress	-0.18 (-0.31 to -0.05)	-0.14 (-0.27 to -0.01)
14. Vitality	-0.34 (-0.45 to -0.22)	-0.22 (-0.35 to -0.09)
15. Sexual activity	-0.07 (-0.20 to 0.07)	-0.11 (-0.24 to 0.03)

Figure 14 presents the linear regression between the chest scale and the nipple scale, where high scores in one scale were associated with high scores in the other. Statistical significance is confirmed with p -value <0.001 .

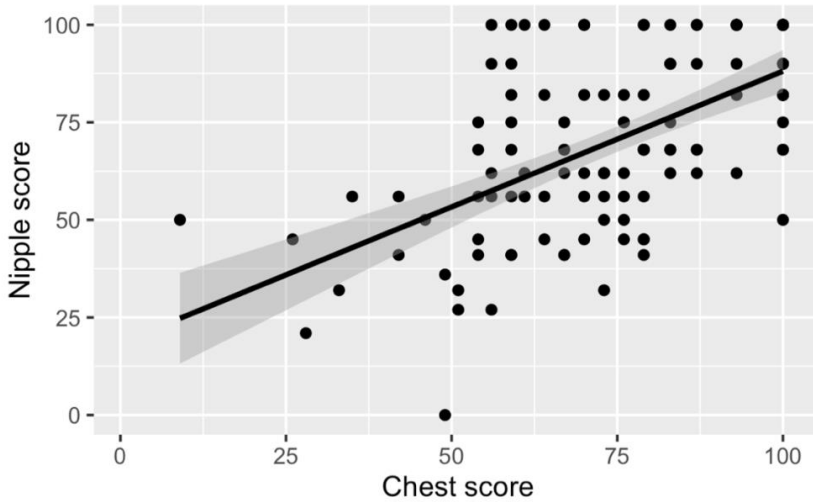


Figure 14 Correlation between scores of the chest and nipple scales. Gray area showing 95% CI. R-squared = 0.35, beta = 0.70 (95% CI = 0.52 to 0.87, p-value < 0.001). CI = confidence interval. Reproduction permitted by Sage Journals.¹⁸⁹

Regarding construct validity, the EFA found both scales had one component each receiving an eigenvalue over one. Observing the chest scale, component one (eigenvalue 6.0) explained 55% of the total variance. Component one loaded rather evenly onto all items of the chest scale, with the lowest loading for item two (0.46). Moreover, the nipple scale loaded onto one separate component (eigenvalue 3.4). On the nipple scale, component one explained 60% of the total variance. Item-specific loading values are presented in Table 7 and Table 8.

Table 7 Loadings of chest scale items to exploratory factor analysis component one. Reproduction permitted by Sage Journals.¹⁸⁹

Chest items	Loading to component one
Item 1	0.62
Item 2	0.46
Item 3	0.80
Item 4	0.79
Item 5	0.76
Item 6	0.82
Item 7	0.82
Item 8	0.75
Item 9	0.77
Item 10	0.77

Table 8 Loadings of nipple scale items to exploratory factor analysis component one. Reproduction permitted by Sage Journals.¹⁸⁹

Nipple items	Loading to component one
Item 1	0.56
Item 2	0.86
Item 3	0.80
Item 4	0.84
Item 5	0.78

5.2 Sociodemographic features and surgical techniques (Study II)

In our data, the median age at the time of chest masculinization was 23. Sociodemographic features are presented in Table 9. The follow-up time had a median of 13 months, ranging from 0 months to over 9 years. One patient had only one nurse postoperative telephone contact because the visits were arranged in a local hospital. Four patients completely lacked information on postoperative follow-up.

Periareolar incision techniques were applied on 115 patients (53.7%). These include the concentric circular technique (70.9%), extended concentric circular technique (25.6%), transareolar technique (2.6%) and semicircular technique (0.9%). The double incision technique combined with pedicular NAC repositioning was applied on 60 (27.3%) and DIFNG on 32 (14.5%). Seven (3.2%) were operated with the double incision technique combined with total removal of the NAC. Three (1.4%) were operated with various techniques different from the traditional masculinization techniques. One (0.5%) lacked surgical technique information. The main surgical technique groups are compared in Table 10, excluding patients with removed NAC, completely different surgical techniques or lacking information on surgical technique.

Table 9 Sociodemographic characteristics of patients in Study II. IQR = interquartile range, ADHD = attention deficit hyperactivity disorder. Reproduction permitted by Mary Ann Liebert, Inc., publishers.¹⁹⁰

	N (%)	Median (IQR)	Range
Age		23 (7)	18–56
BMI		23.8 (5.8)	16.8–40.7
Cup size		B	A–I
Preoperative hormonal treatment (months)		12 (12)	0–92
Smoking	26 (14.1)		
Binding	135 (88.8)		
Somatic comorbidity	84 (40.6)		
Respiratory diseases	19 (9.2)		
Skin diseases	18 (8.7)		
Skeletomuscular diseases and disabilities	15 (7.2)		
Thyroid diseases	13 (6.3)		
Psychiatric comorbidity	167 (79.5)		
- Depression	128 (61.8)		
- Anxiety	56 (27.1)		
- Personality disorders	29 (14.0)		
- ADHD	16 (7.7)		
Psychiatric medication	54 (27.3)		
Time from diagnosis to first preoperative visit (months)		6 (8)	-1–40
Time from diagnosis to chest masculinization (months)		13 (12.5)	3–98
Postoperative follow-up time (months)		13.5 (17.3)	0–113

Table 10 Sociodemographic and clinical features by surgical technique. DIFNG = double incision free nipple graft, IQR = interquartile range, BMI = body mass index
 Reproduction permitted by Mary Ann Liebert, Inc., publishers.¹⁹⁰

	Periareolar incision N=115	Double incision, pedicular N=53	DIFNG N=31	p- value
Age, median (IQR)	23 (5)	23 (9)	28 (13.5)	0.001
BMI, median (IQR)	22.2 (3.9)	24.9 (5.8)	28.5 (4.1)	0.000
Cup size, median (distribution)	A (A–D)	B (A–I)	C (A–F)	0.000
Preoperative hormonal treatment months, median (IQR)	13 (12.75)	13 (9.5)	11 (11)	0.462
Smokers, n (%)	15 (15.6)	4 (8.5)	3 (12.0)	0.488
Binding, n (%)	75 (90.4)	38 (90.5)	12 (80.0)	0.832
Removed tissue g, median (IQR)	117 (99.7)	280.8 (143.3)	653.3 (423.3)	0.000
Major postoperative complication, n (%)	16 (14.3)	8 (16.3)	3 (10.0)	0.765
Minor postoperative complication, n (%)	49 (43.8)	20 (40.0)	17 (54.8)	0.501
Secondary correction, n (%)	68 (61.3)	30 (61.2)	14 (46.7)	0.425
Scar-related problem, n (%)	31 (27.4)	9 (17.3)	7 (24.1)	0.370

5.3 Complication rates and secondary corrections (Study II)

Major postoperative complications CD III occurred in 32 (15.4%) patients and minor complications CD I–II in 92 (43.8%). Major complications were caused by hematoma (11.1%), dehiscence (1.9%) and partial or total NAC necrosis (1%). The dehiscence required operative intervention by a surgeon under local anesthesia and were hence classified as CD IIIA. Nineteen patients (9.1%) developed a postoperative hematoma requiring surgical intervention under general anesthesia (CD IIIB), while four patients (2%) had their postoperative hematoma managed surgically with local anesthetics (CD IIIA). Minor complications included dehiscence (16.2%), seroma (11.9%), scar hypertrophy (8.6%), suture fistula (6.7%), infection (6.2%), hematoma (5.7%) and partial or total NAC necrosis (5.7%). There were no severe complications of CD grade IV or V.

The comparison of patients who developed major postoperative complications to those who did not is presented in Table 11. No statistically significant differences were found, but patients developing major complications tended to be older than

patients without major complications. Concerning minor complications, there was a statistically significant association of patients with minor complications being older (median 25, IQR 8.25) than patients without minor complications (median 22, IQR 5, p-value 0.003). Otherwise, there were no significant differences between these two groups.

Table 11 Complications. Reproduction permitted by Mary Ann Liebert, Inc., publishers.¹⁹⁰

BMI = body mass index, CD = Clavien-Dindo, IQR = interquartile range

	Major complications CD III (N=32)		Minor complications CD I-II (N=92)		p-value
	With major complication N=32	Without major complication N=176	With minor complication N=92	Without minor complication N=118	
Age, median (IQR)	25.5 (11.25)	23 (6)	25 (8.3)	22 (5)	0.003
BMI, median (IQR)	22.9 (4.0)	23.6 (5.9)	23.7 (5.8)	23.5 (5.4)	0.270
BMI >30, n (%)	2 (8.0)	10 (6.8)	7 (10)	5 (5.2)	0.309
Cup size, median (distribution)	A (A-I)	B (A-I)	B (A-F)	B (A-I)	0.400
Preoperative hormonal treatment months, median (IQR)	12 (11)	12 (11)	13 (13)	12 (11)	0.262
Smokers, n (%)	4 (17.4)	20 (13.2)	12 (15.0)	13 (13.5)	0.780
Binding, n (%)	16 (80.0)	111 (89.5)	52 (83.9)	76 (91.6)	0.154
Somatic comorbidities, n (%)	13 (44.8)	66 (39.8)	39 (45.3)	41 (36.9)	0.233
Psychiatric comorbidities, n (%)	25 (80.6)	132 (79.0)	74 (83.1)	85 (76.6)	0.253
Psychiatric medication, n (%)	8 (29.6)	43 (27.0)	21 (28.6)	31 (29.8)	0.464
Removed tissue g, median (IQR)	197 (267.25)	197 (235.8)	231.5 (274)	171 (217.5)	0.034

Scar-related problems occurred in 50 patients (23.8%) after the primary operation. The problems included scar hypertrophy, scar adhesions and widened scars. Treatments ranged from scar tape and cortisone injections to secondary corrections under local or general anesthesia. Patients who developed scar-related problems did not differ from other patients regarding age, BMI, cup size, hormonal treatment, smoking, binding, comorbidities or amount of tissue removed, with the p-value ranging from 0.2 to 1. However, there was a trend of more frequent use of psychiatric medication in participants with scar-related problems (n=18, 40%) compared to patients without scar-related problems (n=32, 22.4%, p-value 0.02). A similar phenomenon was detected regarding secondary corrections reported in Table 12.

Secondary corrections were performed on 120 (58.3%) patients. Of all patients, 24.3% had a corrective operation under general anesthesia or sedation, while 37.8% had an operation under local anesthesia. Nine patients underwent three or more corrective operations. Two of the patients had only planned second-phase operations, while three had planned second-phase operations combined with unplanned corrections. The rest were unplanned corrections. Secondary corrections were performed due to subcutaneous tissue re-modeling (29.1%), NAC-related problems (23.3%), excess skinfolds (21.4%) and scar-related problems (16.5%). Shown in Table 12, no statistically significant differences were detected between patients who did or did not undergo secondary corrections. However, patients with secondary corrections tended to be older, undergo shorter hormonal treatment and use psychiatric medication more often.

Table 12 Secondary corrections. Reproduction permitted by Mary Ann Liebert, Inc., publishers.¹⁹⁰

BMI = body mass index, IQR = interquartile range

	Correction N=120	No correction N=86	p-value
Age, median (IQR)	23 (9)	22 (4)	0.039
BMI, median (IQR)	23.8 (5.2)	22.9 (6.5)	0.109
BMI >30, n (%)	7 (7.1)	5 (6.8)	0.922
Cup size, median (range)	B (A–I)	B (A–D)	0.112
Preoperative hormonal treatment, median (IQR)	11 (11)	14.5 (12)	0.019
Smoking, n (%)	16 (16.2)	8 (11.0)	0.330
Binding, n (%)	79 (91.9)	49 (84.5)	0.167
Somatic comorbidity, n (%)	48 (44.0)	31 (36.9)	0.318
Psychiatric comorbidity, n (%)	94 (83.2)	62 (73.8)	0.109
Psychiatric medication, n (%)	35 (33.3)	16 (20.3)	0.050
Removed tissue, median (IQR)	209 (227.8)	184 (254)	0.311

5.4 Surgical process and trends over time (Study II)

Factors delaying the operative process were postponement due to personal reasons (n=11, 5%) and not meeting eligibility criteria (n=34, 15.5%).

Preoperative imaging had been conducted for 133 (60.5%) patients: 101 (76.0%) patients had a breast ultrasound (US), 6 (4.5 %) had a mammogram (MGR) and 26 (19.5 %) had both a US and MGR.

The median time from chest masculinization to genital surgery was 16 months (IQR=14) regarding internal genital surgery and 33 months (IQR=16.25) regarding reconstructive surgery. Patients proceeding to genital surgery did not differ from other patients regarding age, BMI, hormonal treatment or somatic comorbidities. Although not statistically significant, there was a trend of a smaller proportion of psychiatric comorbidities in patients proceeding to reconstructive genital surgery (60%) compared to other patients (82.7%, p-value 0.027).

Table 13 presents the effect of psychiatric and somatic comorbidities on clinical care. Although not statistically significant, there is a trend toward more frequent interruption of the follow-up for patients with somatic comorbidities.

Table 13 Comorbidities' effect on clinical care. Reproduction permitted by Mary Ann Liebert, Inc., publishers.¹⁹⁰

IQR = interquartile range

	Psychiatric comorbidity	No psychiatric comorbidity	p-value
Time (months) from diagnosis to chest masculinization, median (IQR)	14.5 (12)	12 (12)	0.566
Out-patient clinic contacts, median (IQR)	5 (5)	5 (4.5)	0.818
Interruption of post-operative follow-up, n (%)	31 (18.6)	5 (11.6)	0.282
	Somatic comorbidity	No somatic comorbidity	p-value
Time (months) from diagnosis to chest masculinization, median (IQR)	13 (9.5)	14 (13)	0.110
Out-patient clinic contacts, median (IQR)	5.5 (5.3)	5 (4)	0.065
Interruption of post-operative follow-up, n (%)	20 (23.8)	15 (12.2)	0.037

Table 14 presents the development over time. There is a clear increase in the number of patients over time, with only 21 patients during the first 5-year period and a 6-fold increase in the last (shorter) period. Significant differences were found in the duration of hormonal treatment and progression to genital surgery. Although not statistically significant, there was a decline in smoking and secondary corrections over the years.

Table 14 Development of patient material over time. IQR = interquartile range, BMI = body mass index. Reproduction permitted by Mary Ann Liebert, Inc., publishers.¹⁹⁰

	2005–2009 N=21	2010–2015 N=73	2016–2018 N=126	p-value
Age, median (IQR)	26 (10)	22 (7)	23 (6)	0.378
BMI, median (IQR)	23.8 (11.7)	24.2 (6.2)	23.4 (5.1)	0.403
Cup size, median (distribution)	B (A–C)	B (A–I)	B (A–I)	0.304
Preoperative hormonal treatment months, median (IQR)	12 (9)	10 (6.8)	15 (13.5)	<0.001
Smokers, n (%)	5 (35.7)	10 (18.2)	11 (9.5)	0.016
Binding, n (%)	5 (83.3)	40 (97.6)	90 (85.7)	0.070
Somatic comorbidity, n (%)	6 (42.9)	25 (37.3)	53 (42.1)	0.802
Psychiatric comorbidity, n (%)	14 (87.5)	58 (84.1)	95 (76.0)	0.294
Psychiatric medication, n (%)	2 (18.2)	19 (31.1)	33 (26.2)	0.609
Removed tissue g, median (IQR)	181.5 (166.3)	204.5 (258.8)	189.5 (244.3)	0.808
Major postoperative complication, n (%)	4 (20.0)	10 (14.9)	18 (14.9)	0.834
Minor postoperative complication, n (%)	10 (50.0)	25 (36.8)	57 (46.7)	0.350
Secondary correction, n (%)	15 (79)	42 (63.6)	63 (52.1)	0.049
Removal of internal genitalia, n (%)	19 (95.0)	34 (61.8)	45 (37.8)	<0.001
Reconstructive genital surgery, n (%)	9 (45.0)	15 (27.3)	8 (6.7)	0.000

5.5 Regret (Study II)

In Study II, regret occurred in 4 (1.8%) patients. Of the five patients experiencing regret in Study I, one patient was later noticed to have experienced temporary regret during the diagnostic process and therefore was not included in the regret statistics of later studies.

Patients experiencing regret of the transition process were managed in a multidisciplinary team, and the potential detransition interventions were planned individually. The regret was brought up 13 to 98 months after the chest masculinization. All patients experiencing regret quit their masculinizing hormonal treatment. One patient went through feminizing chest surgery as a part of their detransition, and one patient was considering feminizing chest surgery when the data collection ended. Two patients changed their social security gender status back to woman, one patient had refrained from changing the social security

gender status to man in the first place and one patient lacked information on their change of social security gender status.

5.6 Patient-reported satisfaction (Study III)

Of the 220 patients invited to the study, 123 participated, giving us a response rate of 56%. The median follow-up time since the chest masculinization procedure to replying to the questionnaire was 63 (IQR 60) months. The sociodemographic and clinical features of the participants are shown in Table 15. Regarding the features reported in Table 15, we observed no statistically significant differences between the participants and non-respondents.

Table 15 Sociodemographic and clinical features of patients in Study III. Reproduction permitted by Elsevier.¹⁹¹

IQR = interquartile range, BMI = body mass index, n = count, NAC = nipple–areolar complex

	Respondents n = 123
Age (years), median (IQR)	23 (7)
Preoperative hormonal treatment (months), median (IQR)	11 (11)
BMI, median (IQR)	23.5 (6.2)
Binding, n (%)	69 (88)
Cup size, median	B
Somatic comorbidity, n (%)	51 (44)
Psychiatric comorbidity, n (%)	90 (78)
Psychiatric medication, n (%)	33 (29)
Surgical technique	
- periareolar, n (%)	59 (52)
- double incision, pedicular NAC relocation, n (%)	36 (32)
- double incision, free NAC graft, n (%)	19 (17)
Removed tissue g, median (IQR)	203 (233)
Minor complication, n (%)	54 (46)
Wound infection, n (%)	7 (6)
Major complication, n (%)	16 (14)
Surgically removed hematoma, n (%)	10 (9)
Secondary corrections, n (%)	65 (56)
Postoperative follow-up time (months), median (IQR)	18 (21)

Six participants returned an incomplete chest scale (missing data $\geq 50\%$ n=1, missing data $< 50\%$ n=5), while three participants returned incomplete nipple scales (missing data $\geq 50\%$ n=1, missing data $< 50\%$ n=2).

The median scores on the chest and nipple scales were 76 (IQR 30.5) and 68 (IQR 34), respectively. The distribution of the scores is presented in Figure 15 and Figure 16.

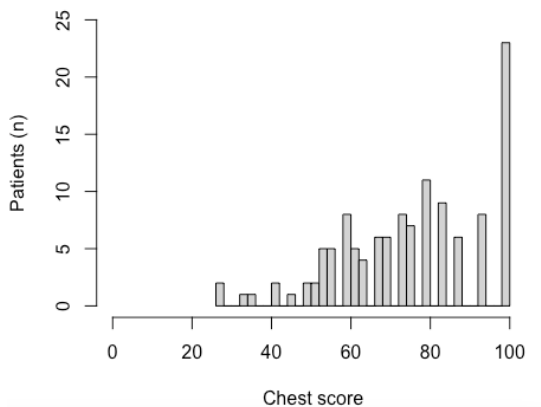


Figure 15 Distribution of chest scores. Reproduction permitted by Elsevier.¹⁹¹

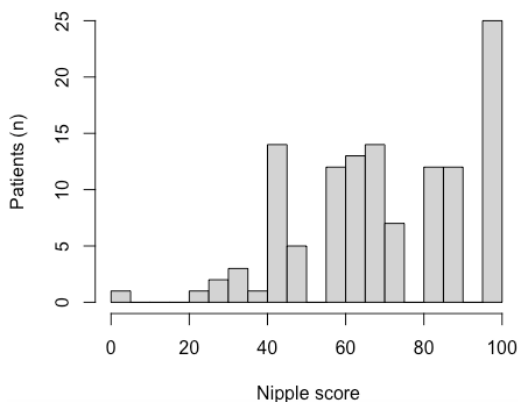


Figure 16 Distribution of nipple scores. Reproduction permitted by Elsevier.¹⁹¹

When evaluating correlations of sociodemographic and clinical features to the patient-reported satisfaction, as shown in Figure 17 and Figure 18, there were no statistically significant differences in BODY-Q Chest module scores between the surgical techniques. Regarding chest and nipple scores, the p-values were 0.024 and 0.177, respectively. When comparing the standalone scar item, there was no significant difference between the techniques (Group 1 median = 3, IQR = 1; Group 2 median = 3, IQR = 1; Group 3 median = 3, IQR = 0; p-value 0.368). As shown in Figure 19, the number of secondary corrections had a negative correlation with the

chest module score (p-value < 0.001). Neither sociodemographic nor clinical features had statistically significant associations with the nipple scores.

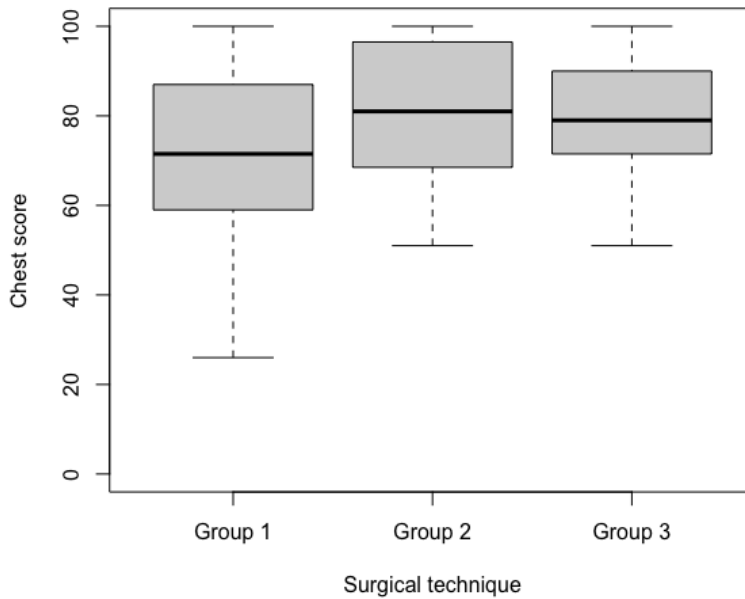


Figure 17 Distribution of chest scores between different surgical techniques. Group 1 = periareolar techniques including the transareolar, infra-areolar, concentric circular, and extended concentric circular techniques. Group 2 = double incision with pedicular NAC relocation. Group 3 = double incision with free NAC graft. p-value = 0.024.

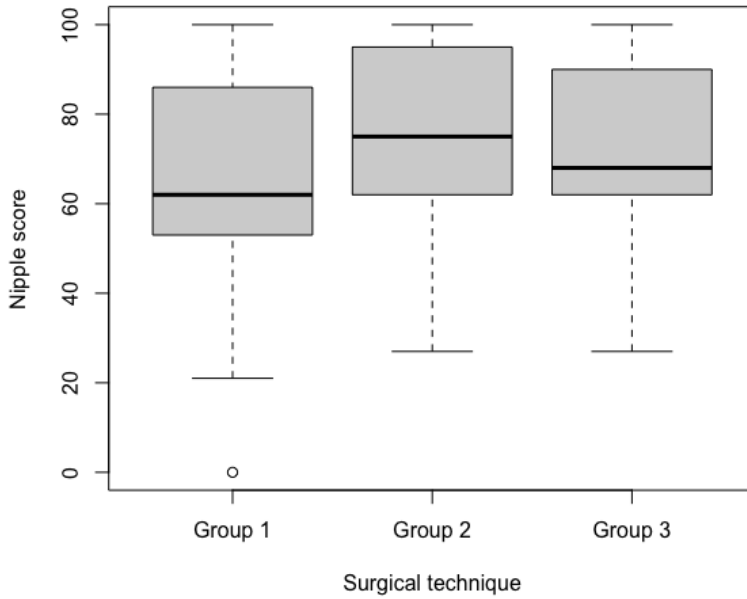


Figure 18 Distribution of nipple scores between different surgical techniques. Group 1 = periareolar techniques including the transareolar, infra-areolar, concentric circular, and extended concentric circular techniques. Group 2 = double incision with pedicular NAC relocation. Group 3 = double incision with free NAC graft. p-value = 0.177.

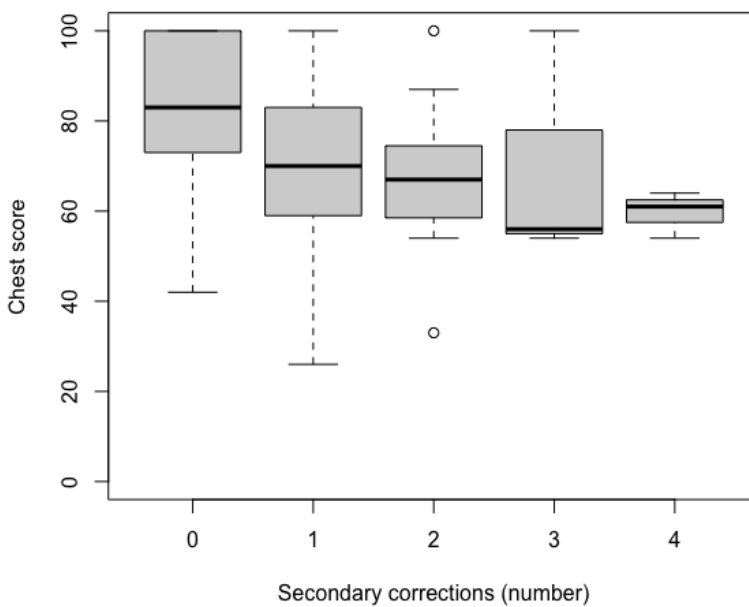


Figure 19 Distribution of chest scores depending on the number of secondary corrections. p-value < 0.001.

5.7 Patient-reported health-related quality of life (Study III)

Of the participants, one participant was excluded due to missing data. The remaining participants had a mean 15D index score of 0.925. The difference compared to the age-standardized Finnish male population was both clinically important and statistically significant, with the reference population having a mean index score of 0.952 (p-value < 0.001). Compared to the age-standardized Finnish female population, neither a clinically important nor a statistically significant difference was detected (15D index score mean 0.935, p-value 0.118). The comparisons of the 15D profiles of our participants and the reference populations are shown in Figure 20 and Figure 21.

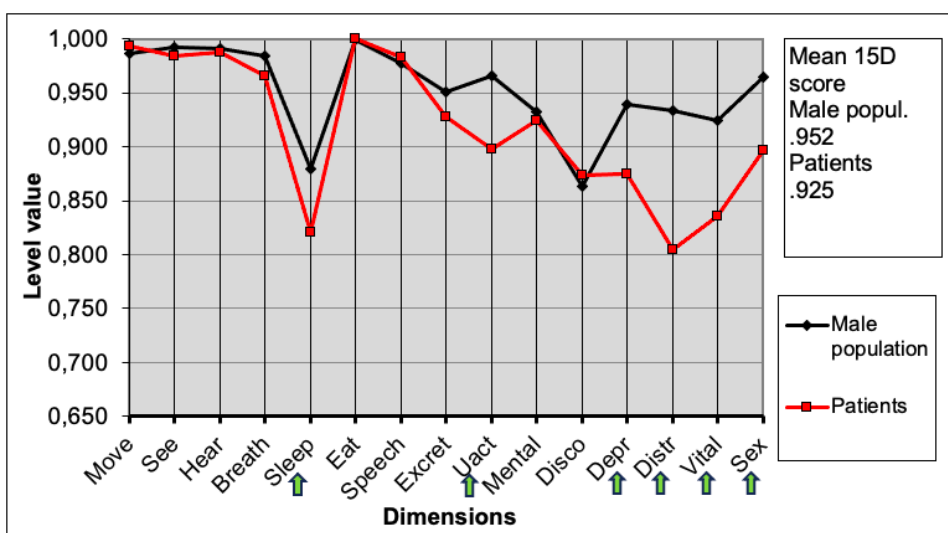


Figure 20 Comparison of the 15D profiles of the participants and the Finnish age-standardized male population. Move = Mobility, See = Vision, Hear = Hearing, Breath = Breathing, Sleep = Sleeping, Eat = Eating, Speech = Speech, Excret = Excretion, Uact = Usual activities, Mental = Mental function, Disco = Discomfort and symptoms, Depr = Depression, Dist = Distress, Vital = Vitality, Sex = Sexual activity. Statistically and clinically significant differences in sleeping (p-value < 0.001), usual activities (p-value < 0.001), depression (p-value < 0.001), distress (p-value < 0.001), vitality (p-value < 0.001), and sexual function (p-value < 0.001). The difference in the mean 15D score between the groups is statistically significant and clinically important (p-value < 0.001). Reproduction permitted by Elsevier.¹⁹¹

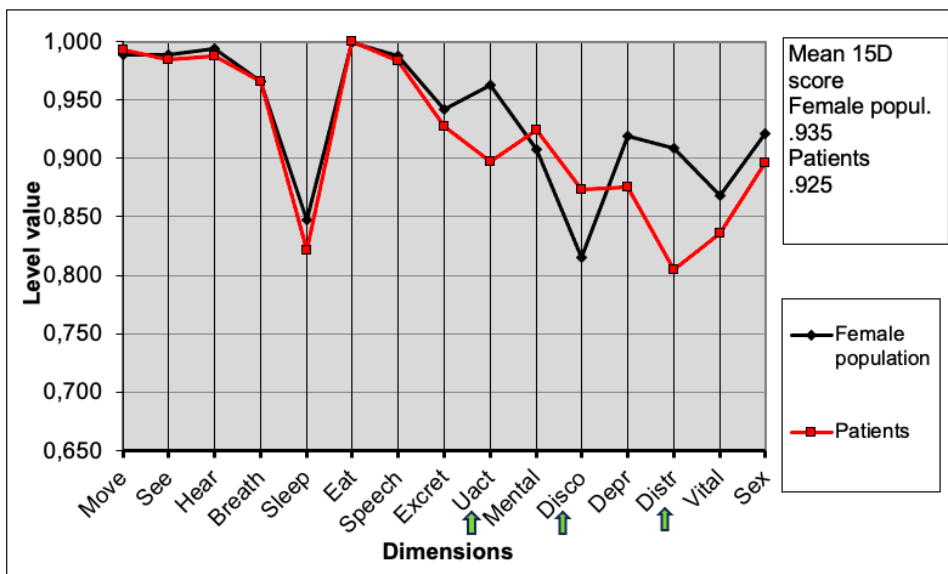


Figure 21 Comparison of the 15D profiles of the participants and the Finnish age-standardized female population. Move = Mobility, See = Vision, Hear = Hearing, Breath = Breathing, Sleep = Sleeping, Eat = Eating, Speech = Speech, Excret = Excretion, Uact = Usual activities, Mental = Mental function, Disco = Discomfort and symptoms, Depr = Depression, Dist = Distress, Vital = Vitality, Sex = Sexual activity. Statistically significant differences detected in usual activities (p-value = 0.001), discomfort and symptoms (p-value = 0.001), and distress (p-value < 0.001). Reproduction permitted by Elsevier.¹⁹¹

Shown in Figure 22 and Figure 23, participants with psychiatric comorbidity or psychiatric medication had significantly lower 15D index scores than other participants. No other significant differences in sociodemographic or clinical features were detected.

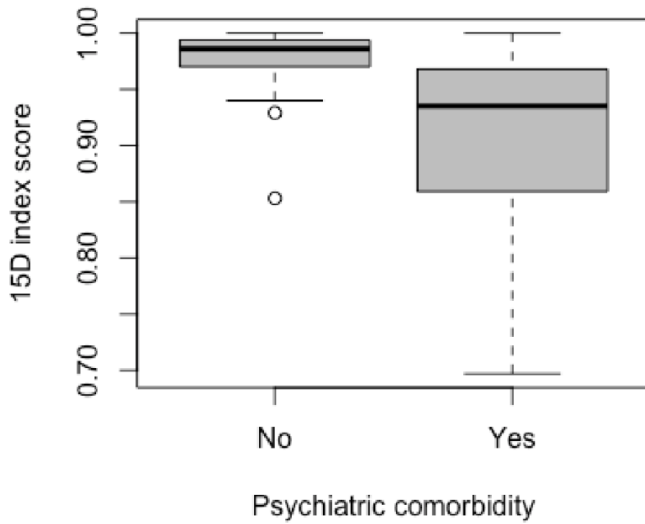


Figure 22 Distribution of 15D index scores depending on psychiatric comorbidity status. No psychiatric comorbidity: 15D index score median = 0.986, IQR = 0.024. With psychiatric comorbidity: 15D index score median = 0.935, IQR 0.109. p-value < 0.001. Reproduction permitted by Elsevier.¹⁹¹

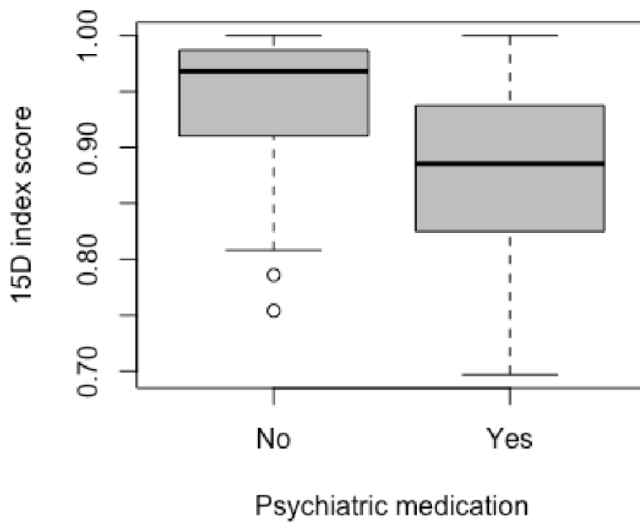


Figure 23 Distribution of 15D index scores depending on psychiatric medication status. No psychiatric medication: 15D index score median = 0.968, IQR = 0.077. With psychiatric medication: 15D index score median = 0.886, IQR = 0.109. p-value < 0.001. Reproduction permitted by Elsevier.¹⁹¹

5.8 Panel evaluation of postoperative result (Study IV)

The selection of the study population is visualized in Figure 24. Forty-eight patients with sufficient postoperative photographs were identified. Of these patients, 26 filled in the BODY-Q Chest module (54%). Clinical features of the patients are shown in Table 16. The threshold for statistical significance was set at $0.05/30 = 0.0017$.

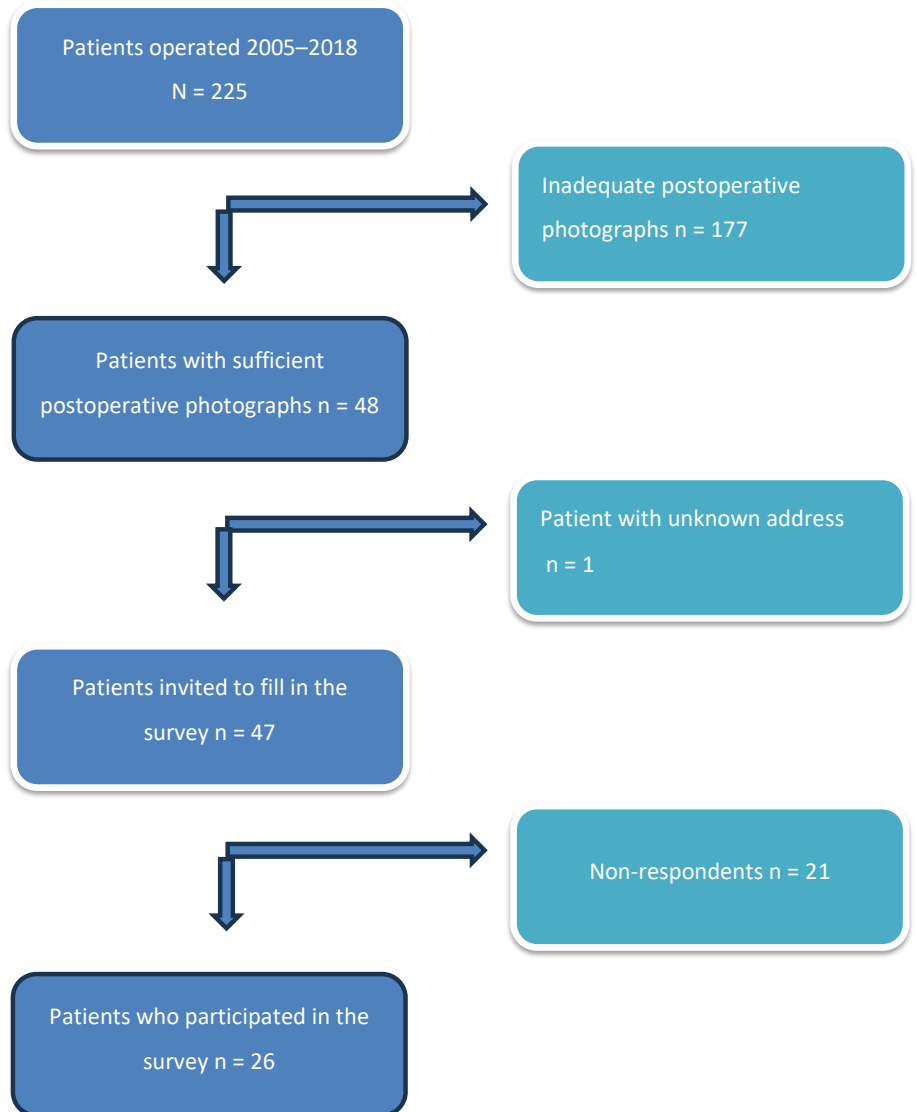


Figure 24 Flowchart of patient selection

Table 16 Clinical features

IQR = interquartile range, NAC = nipple–areolar complex

	Patients N = 48
Age at surgery, median (IQR)	24 (IQR = 6)
Periareolar techniques, n (%)	29 (60%)
Horizontal incision with pedicular NAC relocation, n (%)	10 (21%)
Horizontal incision with free NAC graft, n (%)	7 (15%)
Horizontal incision with other or mixed NAC technique, n (%)	2 (4%)

The median overall score of all items given by the panel was 3.2 (IQR 0.5). The median overall score in chest-specific items was 3.4 (IQR 0.6) and in nipple-specific items 3.2 (IQR 0.6). When looking at the overall score of all items given to each patient, no significant difference emerged between male (median 3.3, IQR 0.6) and female panel members (median 3.1, IQR 0.4).

The ICC value for the panel was poor, 0.48 ($p < 0.001$), and per question ranged between 0.19 and 0.70, yielding poor to moderate inter-rater reliability. In Table 17, the items are listed according to the level of inter-rater reliability from best to worst. The ICC for female and male panelists was 0.44 ($p < 0.001$) and 0.48 ($p < 0.001$), respectively. The surgeons had an ICC of 0.437 ($p < 0.001$) and the non-surgeon 0.562 ($p < 0.001$).

Table 17 Inter-rater reliability of items

*Moderate, ^Poor. ICC = intraclass correlation coefficient

Item	ICC	p-value
8, shape of breast	0.697*	<0.001
2, appearance of scar	0.620*	<0.001
10, masculinity of chest from the front	0.590*	<0.001
11, masculinity of chest from the side	0.563*	<0.001
9, size of breast	0.563*	<0.001
3, size of areola	0.453^	<0.001
1, positioning of scar	0.450^	<0.001
5, shape of areola	0.392^	<0.001
12, symmetry of chest	0.351^	<0.001
4, positioning of areola	0.290^	<0.001
7, size of nipple	0.243^	<0.001
6, shape of nipple	0.191^	<0.001

The delay from the postoperative photographs to participants filling in the questionnaire was a median of 2 years and 5 months, with a range from 2 months to 9 years. The respondents reported a median chest score of 76 (IQR 34) on a scale from 1 to 100 and a median nipple score of 75 (IQR 37) on a scale from 0 to 100. Table 18 presents the scores given by panelists and patients based on the surgical technique applied.

Table 18 Panel scores and patient-reported outcome based on surgical technique. IQR = interquartile range.

Technique	Overall score	Overall chest-specific items	Overall nipple-specific items	BODY-Q Chest score	BODY-Q Nipple score
Periareolar techniques, median (IQR)	3.4 (0.8)	3.4 (1.2)	3.3 (0.6)	67 (17)	62 (41)
Horizontal incisions, median (IQR)	3.2 (0.3)	3.3 (0.4)	3.1 (0.3)	81 (23)	86 (32)
p-value	0.114	0.480	0.042	0.085	0.052

When analyzing single items that were rated by the panelists and included in the BODY-Q Chest module, the correlation coefficients between panelists and patients varied from 0.05 to 0.31, but the correlations were not statistically significant. The items compared are listed in Table 19.

Table 19 List of items filled out by both the panel and patients

*Compared with the panelists' items regarding both areola and nipple

BODY-Q Chest module Item 4. How masculine does your CHEST (breast area) look?
BODY-Q Chest module Item 10. How does your naked CHEST (breast area) look in the mirror?
BODY-Q Chest module Item 11. How do the scars from your surgery look?
BODY-Q Nipple module Item 1 (x2). How does the shape of your nipples look? *
BODY-Q Nipple module Item 2 (x2). How is the size of your nipples? *

As an example, concerning patient A shown in Figure 25, the panelists' scores varied from 1 to 4, ranging from *very dissatisfied* to *very satisfied* regarding the position of the scar, size of the areola, shape of the nipple, size of the nipple, shape of the breast, and masculinity of the chest from the side. Patient A himself reported being *satisfied* with the size of the nipples as well as the shape of the nipples.

Further, Patient A reported being *very satisfied* with the masculinity of the chest from the side.

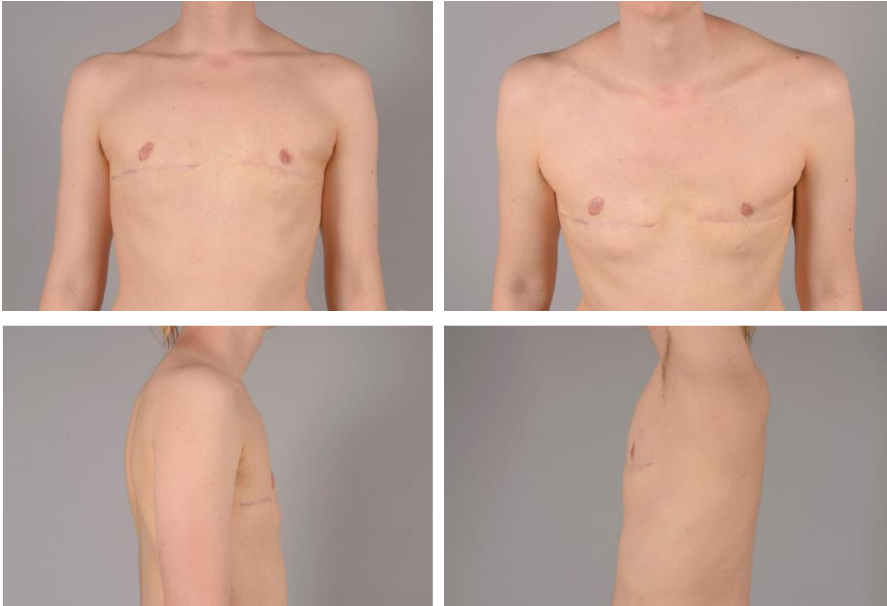


Figure 25 Postoperative images of patient A. Images from HUS patient databases. Patient pictures used with written consent from the patient.

6 Discussion

6.1.1 The BODY-Q Chest module is a valid instrument in transgender men

In Study I, the BODY-Q Chest module showed sufficient consistency and reliability when applied to transgender men after chest wall masculinization. The observed ceiling effect was expected due to the postoperative set up and therefore does not threaten the accuracy of the instrument. The result is in line with the previous study using the BODY-Q Chest module in a transgender population, where a ceiling effect was also observed.¹⁴¹ Moreover, the same phenomenon has also been identified in a population that included gynecomastia and weight-loss patients, with 15% and 17% scoring maximum scores, respectively.¹⁴⁰ Hence, the results appear to confirm the proper postoperative outcome after chest wall masculinization, and the absence of a ceiling effect would have been highly suspicious. However, a change in the long-term recovery could be hard to assess using the BODY-Q Chest module due to the skewed scores.

Sufficient internal consistency was ensured with Cronbach's α , and EFA confirmed a unidimensional structure. Since there is a scarcity of previous studies on the subject, the comparison to previous findings lean heavily on the development process of the BODY-Q Chest module and the recent validation of the module in the Canadian population.^{140, 141}

Correlation between the dimensions of the 15D and the scores of the chest and nipple scales was negligible or low at best. This emphasizes the differences between the 15D, being a comprehensive QoL instrument but not sensitive enough, and the BODY-Q Chest module, having a specific aesthetic target. This signifies the demands on a PROM that explicitly measures an aesthetic result and enables the detection of relevant outcomes after chest wall masculinization.

Surprisingly, when we analyzed the correlation between the BODY-Q Chest module scores and the time from chest wall masculinization in Figure 12, we found the score to be higher among those patients who had recently been operated on. However, due to the cross-sectional nature of our study, conclusions about the development of scores over time cannot be made. This could be an indication of the theorized postoperative "honeymoon phase", where the postoperative

satisfaction is reported to be high during the first year after surgery but later decreases to a steadier state.^{192, 193}

Regarding autocorrelation, Study I found substantial goodness of fit and a strong positive correlation between the two scales of the BODY-Q Chest module. Thus, it is justified to include both scales in the BODY-Q Chest module.

What remains to be studied is the test–retest reliability of the BODY-Q Chest module.

After our survey was performed, the development of a new PROM designed for transgender patients specifically, the GENDER-Q, had begun.¹⁹⁴ The GENDER-Q is a part of the Q-portfolio and is being developed to evaluate PRO in adults and adolescents receiving gender-affirming treatment. It comprises numerous unidimensional scales assessing aspects of appearance (face, hair, body, breast, chest, genital surgery, donor site), HRQoL (psychosocial, physical, sexual), and the experience of medical care and devices.¹⁹⁵ Since the development is still ongoing, the evaluation of whether the chest scale of the GENDER-Q differs from the chest scale of the BODY-Q remains to be seen. The GENDER-Q might also offer a long-awaited valid HRQoL tool for transgender patients. However, regarding comparability to populations outside the gender minorities, the use of comprehensive generic HRQoL tools might be preferable.

Furthermore, during our study, another novel questionnaire, the TRANS-Q was developed. The TRANS-Q was developed to evaluate patient-reported outcomes (PROs) in pre- and postoperative patients undergoing gender-affirming chest masculinization.¹⁹⁶ Differing from the BODY-Q Chest module, the TRANS-Q includes items on sexual appearance and sexual confidence. At the beginning of our study, the TRANS-Q was neither in clinical use yet nor had it been translated into Finnish.

For now, the BODY-Q Chest module remains the only PROM designed and validated for patients undergoing chest masculinization in Finnish. Our substantial patient material adds to the validity of the BODY-Q Chest module with a focus on construct validity, content validity and internal consistency. Based on our findings, the BODY-Q Chest module will also offer a suitable reference instrument if developing new tools to evaluate satisfaction with chest wall masculinization. The use of validated instruments enables a comparison of the results and provides a more sensitive quantitative measure of patient-reported satisfaction.

6.1.2 Sociodemographic and clinical features

Psychiatric comorbidities have been shown to be more common in transgender than cisgender populations, and this appears to apply when our data is compared to the Finnish population in general.¹⁹⁷⁻²⁰⁰ In our patient population, depression

was more common than in other studies on transgender individuals, but our levels of anxiety disorders were in line with other studies.^{113, 197} Somatic comorbidities are rarely reported on, but the somatic health in our data appeared to be better or in line with previous studies on the subject and the Finnish population in general.^{113, 200-204}

We previously used BMI <30 as eligibility criteria for chest masculinization and require abstinence of smoking before surgery, as well as preoperative hormonal treatment for 12 months. After this study was conducted, in 2023, the general BMI limit has been reduced to 28. The BMI criteria is applied due to assumed impacts on the postoperative outcomes and aesthetic result, as well as anesthesia-related safety aspects. The use of BMI as a criterion varies across studies and countries, with some units don't having a BMI limit at all. In our Finnish population, obesity (BMI>30) has recently been reported in 19% of women under 30 years old and 17% of men of the same age.²⁰⁵ Of all adults, 30% of women and 27% of men are obese.²⁰⁵ Simultaneously in for example the United States of America (USA), the proportion of obese adults has been reported as 40.3%.²⁰⁶ In particular, in the USA where the weight distribution of the population differs significantly from Finland, chest masculinization has been performed even on patients with a BMI over 50.^{207, 208}

Compared to many other studies, our patients in their early twenties are clearly younger than other studies where patients are generally approaching thirty.^{6, 7, 110, 143} This could be due to our good accessibility to care in public healthcare and a clear path to gender-affirming surgery. Another possible reason could be the comparably low costs for the patient, where treatment can be pursued without major personal savings. Another Nordic study has reported similar age findings as our study.¹¹⁶

Although our study did not indicate that obesity, smoking or shorter hormonal treatment increases the risk for complications or secondary corrections, we are cautious to make conclusions due to our skewed data. The number of smokers and obese patients were modest and only a few patients had hormonal treatment for less than six months.

6.1.3 Choice of surgical technique

Our ratio of different surgical techniques clearly differs from other studies, with an overrepresentation of periareolar techniques compared to other studies.^{107, 114, 130, 131} This could partly be due to our patients having lower BMI and being younger than patients in some other studies. This is associated with smaller breasts and usually better skin quality. In our clinic, the technique is chosen by the operating surgeon together with the patient. Our aim has been to avoid unnecessary scar burden and favor less invasive techniques. Our clinical experience is that patients

also prefer periareolar techniques with less distinguishable scars. Although we did not use an algorithm for selection of the surgical technique, the individual evaluation was based on the same factors that are applied in the published algorithms.^{107, 114} However, even with the increased representation of periareolar techniques, they were not associated with the development of complications or secondary corrections. In a recent multicenter prospective material including our clinic from years 2020–2022, the use of periareolar techniques appears to have decreased to under 20%, while the most frequently applied technique is DIFNG.²⁰⁹

6.1.4 High complication rates

Our total complication rate remained clearly higher than in other studies.^{5, 110, 111, 114} The reporting of complications varies widely.^{112, 118, 128} Studies often lack clear definitions of complications, which hinders the direct comparison of results and underlines the need for systematic reporting. The high complication rate may be partially caused by including CD grade I in our complications, which can sometimes be interpreted as a part of normal postoperative healing. Overall, using the CD classification results in reporting complications despite the etiology, while several studies prefer to predefine the etiologies reported, inevitably leading to underreporting some complications.^{6, 7} Another aspect confusing the comparison of complication rates is the variation of reporting complications either per patient or per breast.

Our 11.1% rate of acute hematoma revisions is in line with previous studies on the subject, reporting a rate of 5–9.2%.^{107, 110, 111, 113}

We found no statistically significant difference in the rates of major or minor complications between the different surgical techniques. Although some studies have noted more complications in patients operated with periareolar techniques, the different results might be partially caused by technical research aspects such as reporting only selected complication etiologies or inspecting complications per breast instead of per person.^{6, 7, 114} Our results are consistent with several studies that show complication rates do not differ between the surgical techniques even if trends toward more complications in periareolar operations are detected.^{6, 111, 113, 122} To conclude, regarding complications, techniques utilizing a horizontal incision appear to have as many, or fewer, complications compared to periareolar techniques.

Despite age, we found no factors associated with postoperative complications. One study has reported a similar finding to ours, that older age is associated with higher complication rates.⁷ It has been suggested that smoking also increases complication rates, but this was not confirmed in our data.⁷ Previous studies on chest masculinization do not indicate a correlation between obesity and postoperative complications.^{113, 115, 208} Study populations have been small,

however. In comparison, studies concerning reduction mammoplasty show an increased risk of complications in obese patients.^{210, 211} Neither psychiatric nor somatic comorbidities were associated with higher complications rates.

Patients developing scar-related problems did not differ from other patients, nor did the surgical technique impact the development of scar-related problems. Knowledge in this area is sparse, and apart from surgical technique, we fail to find data on factors impacting scar-related problems from the literature.¹¹²

6.1.5 High rates of secondary corrections

We detected clearly higher rates of secondary corrections than other studies. This could be partially explained by our long follow-up time and by including corrections done under local anesthesia as well as planned secondary interventions such as NAC tattoos. However, the inconsistent reporting practices complicate direct comparison with other studies. Besides having a high rate of secondary corrections, the repetitive corrections in our data remain exceptional. Only a couple of studies reported a need for tertiary corrections.^{102, 111}

Our long follow-up with a median of over one year and ranging up to nine years might partially explain the high rate of corrections, since a short follow-up fails to identify the need for correction. With some studies reporting a follow-up of about three months, it seems unlikely that the wound-healing process would be finished to the stage where the need for corrections could be reliably evaluated.^{110, 129, 132} It appears that most studies with a follow-up time close to one year or longer have secondary corrections in about one in four or one in five breasts or close to half of the patients.^{111, 117, 118, 126} Only one study reported no need for secondary corrections despite having a follow-up time of over two years.¹²⁸

As argued in the introduction, the impact of the costs of secondary corrections should also be taken into account. Our results of a large portion of patients undergoing secondary corrections are in line with other studies from the Nordic countries, which have similar funding principles of public healthcare.^{111, 116, 117} This probably leads to a greater incidence of final refinement interventions. The threshold for a patient to request secondary corrections is not thought to be significantly affected by financial restrictions. Still, only a fraction of health insurances in the USA cover revisionary procedures, which inevitably effects the possibility for some people to seek care.¹³³

We found no difference in the frequency of secondary corrections between the different surgical techniques. Several studies report a significantly higher rate of secondary corrections in periareolar techniques compared to horizontal incision techniques.^{113, 122, 130, 131} However, other studies have found correction rates to be similar across surgical techniques when looking at unplanned revisions.^{113, 124} With a clearly higher rate of secondary corrections, it might be that our large proportion

of minor revisions outside the operating room blurs the actual impact of the surgical technique. However, the periareolar techniques at least do not appear superior to other techniques in this matter.

We did not detect any sociodemographic or clinical feature to be associated with the rate of secondary corrections. Neither psychiatric nor somatic comorbidities were associated with higher complication rates. One study has reported older age and smoking as risk factors for secondary corrections, while another found all patients with complications underwent secondary corrections.^{111, 116} However, due to our skewed data with only a handful of smokers and obese patients, and only a few patients with hormonal treatment for less than six months, we are cautious to make conclusions regarding these features based on our findings.

6.1.6 Changes in trends over time

Previous studies show that few transgender men proceed to genital surgery.^{3, 96, 97} Therefore, it remains exceptional that nearly all patients in Study II, who underwent chest wall masculinization in 2005–2009, have also proceeded to the removal of internal genitals. Furthermore, almost half of these patients have had reconstructive genital surgery. Since the removal of internal genitalia in our data usually occurs within one year after chest masculinization, and the reconstructive genital surgery within a couple of years, it seems unlikely that this trend would be solely explained with the shorter follow-up of patients operated on in 2010–2018. More likely, it appears like an actual change either within the transgender population or factors related to the healthcare system. Regardless, the shift brings us closer to the situation observed elsewhere in the world.^{3, 96, 97} Reconstructive genital surgery of transgender men, especially phalloplasty, is often performed as a multiphase surgery and the rehabilitation after the intervention is demanding and long-lasting.²¹²⁻²¹⁴ Therefore, this shift might be due to a more realistic approach to the challenges and outcomes of reconstructive masculinizing genital surgery, especially as the recent clinical experience in our clinic is that patients have started to prefer metoidioplasty over phalloplasty.

On the other hand, the gender diverse population appears to be in transit as a whole. Most people seeking gender-affirming care are assigned female at birth (AFAB) and their number grows faster than those assigned male at birth (AMAB).^{2, 3, 4, 215} The large proportion of AFAB patients seeking gender-affirming care has been noted, but the underlying causes are unclear. Furthermore, the understanding of gender identities has shifted from the traditional binary understanding to a more fluid and flexible view, interpreting gender as a spectrum with several possible dimensions. The increased understanding and recognition of gender identities outside the binary division might affect the patient's view of

themselves. The more diverse understanding of gender identities has also been established in ICD-11, where the previous code of *Transsexualism* has been replaced with *Gender incongruence of adolescence and adulthood*.⁵² In our experience, the proportion of gender-fluid people attending gender-identity clinics and seeking care has increased in recent years, but this is inevitably also affected by the new *law of gender affirmation* and the national guideline on the treatment of gender dysphoria, which gave non-binary individuals access to some gender-affirming surgical interventions.

6.1.7 Good postoperative patient-reported satisfaction

Our findings are in line with previous studies using the BODY-Q Chest module, and reflect the findings of studies that apply other PROMs.^{107, 110, 112, 124, 140, 142, 144} Study III supports the general understanding that transgender men are satisfied with the postoperative result after chest masculinization. Even though many studies on satisfaction are made in a retrospective setting, several prospective studies have recently demonstrated clear improvement in patient-reported satisfaction.^{124, 143, 144, 216} The postoperative satisfaction reported in Study III is in line with the postoperative results in other studies using the BODY-Q Chest module.^{108, 142-144, 217}

Regarding the use of the BODY-Q Chest module on cisgender patients, the PROM has been applied mainly on gynecomastia patients. Studies on postoperative gynecomastia patients report mean chest scores from 62 to 82 and nipple scores from 67 to 75, which are in line with our results.^{218, 219} Only one study reports BODY-Q Chest module results in both cis- and transgender patients.¹⁴⁰ In this setting, no direct statistical comparison between cis- and transgender patients was made, but when comparing means, transgender men reported worse satisfaction in their chest appearance compared to preoperative gynecomastia patients and cisgender men waiting to undergo chest contouring surgery after massive weight loss.¹⁴⁰ The increase from pre-operative to post-operative BODY-Q Chest module scores appear greater in postsurgical transgender patients than in postsurgical gynecomastia patients.¹⁴⁰

We found no statistically significant differences in PRO between participants operated on using different techniques. However, when examining the chest scores, though not reaching the threshold of statistical significance, the scores appear inferior in the periareolar incision group. This is in line with previous studies and raises the concern of why patients with less scar burden, better skin quality, and smaller breasts do not have better scores than other patients.^{110, 122} Especially since our patients with periareolar techniques reported similar satisfaction with their scar appearance as participants with larger horizontal scars. However, in our material periareolar techniques were used on a larger proportion

of patients and on larger breasts than in many other studies. This patient selection might have led to a smaller scar burden at the cost of other aspects, for example the shape of the chest. Further, if only applied on small breasts, periareolar techniques would probably yield more favorable results. Based on these results, we argue that periareolar techniques should not be favored simply due to the assumed smaller scar burden.

Knowledge on background factors impacting patient satisfaction is scarce, but planned corrections reportedly have a negative association with chest and nipple scores.¹⁴² The findings of Study III may support this, although most of the corrections were unplanned in our material, since the number of secondary corrections correlated negatively with the patient-reported chest score. Whether the corrections are a consequence of patient-reported dissatisfaction or vice versa remains uncertain. In the Finnish publicly funded healthcare system, corrections have usually been done at a low threshold if a patient expresses dissatisfaction regarding the surgical result. However, since the chest module score is significantly lower in patients with several secondary corrections, the question arises whether the dissatisfaction is caused by something other than just the appearance of the chest. On the other hand, our results could indicate that a dissatisfactory result in the primary operation is challenging to improve upon with secondary corrections. One study has reported higher BMI to correlate with lower satisfaction, but no such phenomenon was detected in Study III.¹⁴² Other studies have suggested that sociodemographic features do not correlate with patient-reported satisfaction.^{122, 143} Since psychiatric comorbidities are reported to be high among transgender men, their impact on patient-reported satisfaction remains an interest.²²⁰ Similarly to results in Study III, psychiatric comorbidities do not appear to be associated with patient-reported satisfaction in other studies.^{122, 143}

Even though some prospective studies on patient-reported satisfaction exist, only one of these provide a follow-up of one year,²¹⁶ while the others' postoperative outcomes are reported at six months.^{124, 143, 144} Due to the length of the wound-healing process, longer postoperative follow-ups are preferred, especially since the appearance of the NAC is known to change until at least one year after surgery.²²¹

Regret after chest masculinization is reported to be rare. In our study, the level of regret was similar to previous studies reporting regret, ranging from 0% to 3%.^{134, 135, 145, 222} However, contrary to our data on regret, previous studies have collected regret from survey results. Due to the rarity of reporting regret, further conclusions on causes and symptoms are difficult to make based on singular results. A systematic review on regret after any gender-affirming surgery showed it to be 1–2%.²²³ The main reasons for regret regarding transition appear to be difficulty in life with the new gender role or failure of surgery to reach their goals.²²³ The proportion of major regret (those aiming to de-transition) versus

mild or occasional regret is challenging to establish due to the variation in reporting.²²³

6.1.8 Good postoperative health-related quality of life

The good postoperative HRQoL reported in our present study agrees with previous studies.^{138, 144, 222} Due to the retrospective nature of our survey, no accurate conclusion can be made concerning the impact of chest masculinization on HRQoL. However, the comparison to the age-standardized reference population in Study III provides a favorable overall view of the participants' QoL.

Only a couple of studies have addressed psychosocial or psychiatric wellbeing aspects after chest masculinization in a prospective setting. One study noted a reduction in anxiety (measured with the GAD-7), depressive symptoms (measured with the PHQ-9), and body image-related quality of life (measured with BIQLI) after chest masculinization.¹⁴³ This study did not observe an association between the aforementioned measurements and psychiatric comorbidities. Another study has also noted a significant improvement in psychosocial wellbeing measured with the psychosocial wellbeing domain of the BREAST-Q.¹²⁴ A third study developed a new UCSF Gender QoL tool and detected a significant improvement in social health.¹⁴⁹ However, the one study using a generic quality of life tool, the EQ-5D, did not observe significant reduction after chest masculinization.¹⁴⁴

In Study III, no aspects of the surgery itself were associated with the HRQoL, but as expected, psychiatric morbidity had a negative correlation with the overall HRQoL. A similar finding has been noted in studies addressing psychosocial wellbeing, as well as studies applying generic HRQoL tools.^{142, 144}

Unfortunately, many of the previous studies using, for example the GAD-7, PHQ-9, BIQLI and BREAST-Q, target specific and limited areas of psychosocial and psychiatric wellbeing rather than generic HRQoL. Similarly, the UCSF Gender QoL is inevitably patient-group specific, which limits comparability to control populations. Despite being widely used, the EQ-5D, having 5 dimensions rated at 3 levels, is not as comprehensive as the 15D.¹⁷³ Although in direct comparison both the 15D and EQ-5D have been found to have sufficient construct validity, the EQ-5D has been reported to be less sensitive than the 15D.^{178, 224}

Since gender dysphoria and therefore gender-affirming care affects an individual's life in a complex and multidimensional way, we do believe in the importance of addressing QoL aspects in gender-affirming care. The use of multiple questionnaires addressing several QoL aspects is ambitious and admirable, but we prefer seeing a wider use of generic HRQoL instruments to provide a holistic approach to the evaluation of our patients.

6.1.9 Panel evaluation of the aesthetic result lacks consistency

Although scales used in previous studies vary, our panel-reported results appear similar to those in the literature, where five-point Likert scales have provided overall scores between 3.4 and 4.6, and four-point scales an average of 3.4.^{7, 108, 114, 137} This indicates that overall the aesthetic result after chest masculinization is good.

Concerning the impact of the surgical technique, previous studies with clinician-reported outcomes have shown more favorable results with “keyhole” or concentric circular techniques than with other techniques, usually DIFNG.^{7, 102, 114, 145} Study IV did not detect a significant difference between these groups. One possible explanation for the discrepancy is selection of the surgical technique. In our data, periareolar techniques were used in over half of the operations, while other studies with panel evaluation, and studies on chest masculinization in general, have more often used double incision techniques.^{7, 114} In one study, periareolar techniques predominated, but aesthetic evaluation was performed by only one surgeon, reducing the reliability relative to a panel evaluation.¹⁰²

Direct statistical comparison of clinician- and patient-reported outcomes has not previously been conducted, although some studies have reported both outcomes.^{102, 137, 145} In our data, no significant correlation emerged between panel evaluation and patient-reported outcomes when identical items from both evaluations were inspected. This supports the theory that patients and clinicians rate aesthetics differently.^{162, 225} However, since the panel and patient evaluations were performed at different time-points, the value of our finding is limited and should be interpreted with caution.

In this study, inter-rater reliability was poor. This applied especially to aspects related to the areola and nipple. The large variation suggests a lack of consensus about the desired outcome and the optimal positioning and shaping of the NAC. On the other hand, regarding aspects like the shape and masculinity of the chest, a better agreement was observed. In contrast to earlier studies on aesthetic evaluation, we found no significant difference between female and male raters.

In previous studies, smaller panels of three or four members have provided reliable evaluations.¹⁵⁷⁻¹⁵⁹ Based on these findings, our panel size should be sufficient for reliable evaluation. The panel was also gender-balanced and contained several professionals, although mostly surgeons with long experience in breast surgery, which should have added to the reliability.

Since postoperative images are usually taken at a certain time after the primary surgery, it is likely that patients with corrective interventions had not yet reached our inclusion criteria of images needing to be taken at least 12 months after the primary surgery or in the case of secondary corrections, at least 6 months after the last correction. Therefore, patients without corrective interventions are more likely to have been included in the data.

Due to the biases of PROMs and the human tendency to report satisfaction on self-chosen matters, we prefer to apply other aesthetic outcome measures besides PROMs to gain a more comprehensive view of the outcome. Surgeons' view of an optimal result is particularly important since it directly impacts the result of the operation. Based on these findings, we argue that, unfortunately, the previous knowledge on the reliability of panel evaluations of surgical results does not apply to chest masculinization. We also claim that this is mainly due to a lack of consensus about the desired result. This might be related to the fact that chest masculinization has clearly increased only in the past decade.^{94, 100} The development of a consensus on the desired and acceptable result should be addressed, and the development of a clinician-reported aesthetic outcome instrument for this patient group would facilitate reaching this goal.

6.2 Strengths and limitations

One main strength of this thesis is the quality of the retrospective patient material it is based on. The material provides a large sample size in a true clinical setting. It comprises patients over a 15 year time period and a significant proportion of patients on a national level due to the centralization of gender-affirming treatment. Even though access to chest masculinization was previously restricted to only patients with the F64.0 diagnosis, it seems likely that our study population comprises some individuals with a more fluid gender experience, who might have emphasized their masculinity in the diagnostic process to obtain access to surgery.

In the survey of Study I and Study III, the response rate of over 50% can be considered very good. Although the response rate can be considered sufficient, face-to-face recruitment would most likely have produced higher participation. This was unfortunately not possible in our study setting. In Study I and III, we found no statistically significant difference between respondents and non-respondents. Hence, the data are considered to represent the population of interest. However, the non-respondents may cause bias in our material since the underlying causes for responding or lack of response remain uncertain.

In Study I, as a characteristic of chest masculinization, the operation usually includes the shaping of both the nipple and the areola. Thus, the lack of areolar items in the BODY-Q Chest module is a limitation that should be taken into consideration when applying the instrument to transgender men. We were also unable to examine test–retest reliability due to the lack of two separate collections of the instrument. This was, however, outside the scope of Study I. Additionally, validation in non-binary patients remains to be done.

In Study II, the follow-up was significantly longer compared to several previous studies.^{110, 113, 118} The application of a systematic and structured classification in the ranking of complications despite the etiology would enable more reliable

comparison in further studies. A main limitation of Study II is the retrospective setting and lack of protocols for patient journals, leading to missing data.

In Study III, the good response rate and long follow-up provides a reliable view of the postoperative situation after chest masculinization. However, due to the lack of preoperative PROMs no conclusions regarding the effect of chest masculinization on the outcome measures can be made.

Another main strength in this study is the aim to apply validated measurements whenever possible. The BODY-Q Chest module is a valid instrument in transgender men and the 15D is a widely used HRQoL instrument. Both instruments were accessible in Finnish.

Due to the lack of a validated clinician-reported outcome tool, the use of author-designed items with Likert scales has thus far been considered acceptable in the evaluation of aesthetic results. A strength of our Study IV is the size and composition of the panel.

An unfortunate limitation of Study IV is the small proportion of patients with sufficient postoperative images taken. This undoubtedly exposes Study IV to selection bias, especially regarding the risk of excluding patients without corrective interventions. Based on the findings in Study III regarding the negative association between repetitive corrective interventions and patient-reported satisfaction, these patients would have been of particular interest in Study IV but are unfortunately likely to have been excluded. Another clear limitation is that the patient images and the PROs were obtained at different time-points. Although the postoperative wound healing should be finished after one year, there are several other factors that could impact the appearance of the chest after the images were taken, possibly affecting panel evaluation and patient-reported results. Therefore, direct comparison of the PROM and panel evaluation might be biased.

A main limitation of this thesis is that the results only apply to transgender men since our material lacked non-binary patients. Since gender identity in the study population may expand beyond binary gender norms, comparison of HRQoL to the binary reference population can cause bias. Considering the single-center design of the study, the results might not generalize to other contexts due to differences in cultural and structural aspects.

6.3 Future research

The number of chest masculinization surgeries performed on a national and international level is continuing to increase. Previous research has mainly focused on binary transgender people and has often been performed in retrospective postoperative settings.

Due to the challenges caused by the COVID-19 pandemic and postponements in the collection of prospective material, we plan to continue by completing our

multicenter prospective study on patient-reported satisfaction and HRQoL in transgender men undergoing chest masculinization together with Tampere University Hospital. We hope that the prospective setting offers new insight on findings reported in this thesis. The impact and benefit of secondary corrections is of high interest. Since we now have sufficient patient PROMs for the aesthetic result and HRQoL, we call for the development of a non-patient-reported outcome tool. This could be either a clinician-reported measurement or an algorithm. This would also require a welcomed discussion and agreement in the research community regarding the desired and acceptable aesthetic result.

An approach that has been of our particular interest is the impact of gender-affirming treatment on cancer incidence. In a country where we provide national screening programs for malignant diseases, many of which are gender specific, we are highly interested in the incidence of for example breast cancer in our post-masculinization transgender men. The surgery, as well as hormonal treatment, is expected to influence the malignant processes, and the evaluation of transgender-specific screening needs is in our interest.

Overall, a wider inclusion of gender fluid and non-binary people in research settings is desirable. The under-representation of other genders is probably not caused by a low number of patients, but a medical desire to classify things as clear and simply as possible. The idea of binary transgender identities and non-binary identities being completely different phenomena might be outdated, and the medical field needs to adapt to a more complex view on gender.

A true challenge with gender-affirming treatment is its multidimensional, individual and, depending on the treatment, even irreversible nature. The ambitious aim is to reduce gender dysphoria and increase QoL on a life-long scale. Since many undergo the transition process in their twenties and gender-affirming surgery has been routinely performed for only a couple of decades regarding chest masculinization, and a clearly shorter time regarding for example phalloplasties, we are only approaching the time-point when these patients reach their older days. Another main challenge in research on gender-affirming treatment is the numerous interventions that people go through in their transition process. With medical treatment representing only a fraction of the transition process, studying the long-term effect of one particular intervention appears nearly impossible.

Unfortunately, since the treatment of gender dysphoria is constantly under political debate, research on the subject cannot be separated from the political and social context. A main challenge for research regarding gender-affirming treatment is to remain separate from the many influences in our surroundings and continue to add to the collective knowledge, despite the turbulent environment.

The main interest, in my point of view, is to shift from studying the individual interventions to aiming for a more holistic approach of the entire transition process.

7 Conclusions

Based on the results of this study, the following conclusions are drawn:

- I. The BODY-Q Chest module provides valid scores in measuring patient-reported satisfaction in transgender men who have undergone chest wall masculinization. The instrument achieves sufficient consistency and reliability. Furthermore, the BODY-Q Chest module approaches the subject with a specificity that HRQoL instruments cannot provide. The BODY-Q Chest module will also offer a suitable reference instrument for developing new tools to evaluate satisfaction with chest wall masculinization.
- II. In the data, periareolar techniques are the most common techniques applied. Minor complications are common and there is a frequent need for secondary corrections. The surgical technique does not affect the complication rate or the need for secondary corrections when the technique is chosen by the operating surgeon together with the patient. Severe complications are rare, but patients should be informed about the risk for complications and frequent need for secondary corrections.
- III. Patients who have undergone chest masculinization are satisfied with the aesthetic results and their HRQoL is good. Periareolar techniques are not superior to other techniques, trending toward more frequent complications and not yielding better PROs. Patients operated with periareolar techniques should be thoroughly informed about the postoperative course. The underlying causes of secondary corrections and the effect of secondary corrections on patient-reported satisfaction need further inspection.
- IV. The aesthetic results after chest masculinization in transgender men are good. However, even professionals lack a consensus on what constitutes a desirable result after chest masculinization, and no correlation was found between patient-reported results and the panel evaluation. Due to the biases of PROMs, we consider the development of a clinician-reported outcome tool a crucial step in the progress of chest masculinization of transgender patients.

Acknowledgements

Although I would like to cite Snoop Dogg by thanking me for doing all this hard work, I would never have finished this thesis without the input of other people around me.

This study could not have been performed without the funding by *Finska Läkaresällskapet*, the University of Helsinki and the Musculoskeletal and Plastic Surgery Research Center Helsinki, Helsinki University Hospital, and the University of Helsinki, Finland.

Further, I want to thank my supervisors. Sinikka, thank you for the decades of clinical effort and experience that you have invested into this project. Your international network and commitment to your work is admirable. Kaisu, I want to thank you for all the aspects of your warm and humane supervision. Your compassion and dedication for the project has carried me through my moments of doubt. You recognize the struggles of a young scientist and provide firm and pragmatic guidance when needed, yet you leave room for my personal growth and appreciate my views as a professional. Maija, you are an admirable clinician and I hope to one day possess even a fraction of your clinical expertise and understanding of human nature.

I am truly grateful to my co-authors Jussi, for introducing me to the world of psychometrics, and Harri, for his guidance with the use of the 15D.

I address a special thank you to my custos Professor Virve Koljonen for your wise words and guidance during my thesis.

I thank nurse Linda Laamanen, for contributing to the survey collection for this thesis, and the co-panelists Tiina Jahkola, Päivi Merkkola-von Schantz, Ville Puttonen, Jyrki Vuola, and Mikko Vuoristo for their contribution to the panel evaluation.

I have been lucky to have Tiina Jahkola and Katinka Tuisku as my thesis committee members. Your engagement and encouragement played a big role during this process. I thank you for the supportive meetings and for reminding me that there is more in life than just the thesis.

I would also like to thank all patients participating in our survey, this thesis would be an empty shell without the engagement of these patients.

I want to thank my parents Tea and Ilkka for teaching me the importance of persistence, patience (though I might have some learning left), motivation and

believing in myself. Thank you to my sister Sofia for always giving me your honest opinion on matters, no matter the degrees I receive. You put me in my place but also encourage me to cherish and take credit for the achievements I make.

I am lucky to be surrounded by loving friends, who have all supported me during my PhD journey. I want to offer a special thanks to Niklas and Oskar for keeping my feet on the ground and making sure that not a single mistake goes by without a great laugh. Your peer support extending from medical studies to academic work and life in general is irreplaceable. I also owe a thank you to my loving and supportive friends from medical school Emmi, Sonja, Astrid and Hanni. I am also lucky to have lifelong friendships, and want to express my gratitude to Anna, Hannele, Antonia and Tonje, who have followed this academic career of mine since primary school, and whose friendship I am hopefully lucky enough to enjoy for years to come.

My husband Eero. I would love to have words to describe your importance to me. Thank you for always cheering me on on my journey no matter if its academic work, life in general or climbing Vassitjokka without optimal gear. Life with you is a dance I hope will last forever and as you once said *things I like, become things I love, when I get to do them with you.*

References

1. Zhang Q, Goodman M, Adams N, et al. Epidemiological considerations in transgender health: a systematic review with focus on higher quality data. *International Journal of Transgender Health* 2020; 21: 125-137. DOI: 10.1080/26895269.2020.1753136.
2. American Society of Plastic Surgeons. 2017 Plastic Surgery Statistics Report. 2018. Arlington Heights, IL. <https://www.plasticsurgery.org/documents/news/statistics/2017/plastic-surgery-statistics-full-report-2017.pdf> (Accessed 10.12.2024)
3. Aydin D, Buk LJ, Partoft S, et al. Transgender Surgery in Denmark From 1994 to 2015: 20-Year Follow-Up Study. *J Sex Med* 2016; 13: 720-725. DOI: 10.1016/j.jsxm.2016.01.012.
4. James SE, Herman, J. L., Rankin, S., Keisling, M., Mottet, L., & Anafi, M. . *The Report of the 2015 U.S. Transgender Survey*. 2016. Washington, DC: National Center for Transgender Equality.
5. Cohen WA, Shah NR, Iwanicki M, et al. Female-to-male transgender chest contouring: a systematic review of outcomes and knowledge gaps. *Ann Plast Surg* 2019; 83: 589-593. DOI: 10.1097/SAP.0000000000001896.
6. Bluebond-Langner R, Berli JU, Sabino J, et al. Top surgery in transgender men: how far can you push the envelope? *Plast Reconstr Surg* 2017; 139: 873-882. DOI: 10.1097/PRS.0000000000003225.
7. Knox AD, Ho AL, Leung L, et al. A review of 101 consecutive subcutaneous mastectomies and male chest contouring using the concentric circular and free nipple graft techniques in female-to-male transgender patients. *Plast Reconstr Surg* 2017; 139: 1260-1272. DOI: 10.1097/PRS.0000000000003388.
8. Michelraj M. Historical evolution of transgender community in India. *Asian Review of Social Sciences* 2015; 4: 17-19. DOI: 10.51983/arss-2015.4.1.1304.
9. Singh H and Kumar P. Hijra: An understanding. *Journal of Psychosocial Research* 2020; 15: 79-89. DOI: 10.32381/JPR.2020.15.01.6.
10. Nanda S. The Hijras of India: Cultural and individual dimensions of an institutionalized third gender role. *J Homosex* 1986; 11: 35-54. DOI: 10.1300/Jo82v11n03_03.
11. Kertbeny KM. § 143 des Preussischen Strafgesetzbuches vom 14. April 1851 und seine Aufrechterhaltung als § 152 im Entwurfe eines Strafgesetzbuches für

den Norddeutschen Bund: offene, fachwissenschaftliche Zeitschrift an Seine Excellenz Herrn Dr. Leonhardt, königl. preussischen Staats- und Justizminister. Serbe's (Commisssions-) Verlag, 1869.

12. Whisnant CJ. *Queer identities and politics in Germany: A history, 1880–1945*. Columbia University Press, 2016.

13. Meyerowitz J. *How sex changed: A history of transsexuality in the United States*. Harvard University Press, 2004.

14. Hirschfeld M. *Die Transvestiten: eine Untersuchung über den erotischen Verkleidungstrieb: mit umfangreichen casuistischen und historischen Material*. A. Pulvermacher, 1910.

15. Hirschfeld M. Die intersexuelle konstitution. *Jahrbuch für Sexuelle Zwischenstufen* 1923; 23: 3-27.

16. BROWN SC. Note on the effects produced on man by subcutaneous injections of a liquid obtained from the testicles of animals. 1889.

17. Doisy EA, Thayer S and Veler CD. The crystals of the follicular ovarian hormone. *Proc Soc Exp Biol Med* 1930; 27: 417-419. DOI: 10.3181/00379727-27-4791.

18. David K, Dingemans E, Freud J, et al. Über krystallinisches männliches Hormon aus Hoden (Testosteron), wirksamer als aus Harn oder aus Cholesterin bereitetes Androsteron. *Hoppe-Seyler's Zeitschrift für physiologische Chemie* 1935. DOI: 10.1515/bchm2.1935.233.5-6.281.

19. Gillies H and Harrison R. Congenital absence of the penis: with embryological considerations. *Br J Plast Surg* 1948; 1: 8-28. DOI: 10.1016/S0007-1226(48)80006-8.

20. Abraham F. Genitalumwandlung an zwei männlichen Transvestiten. *Zeitschrift für Sexualwissenschaft und Sexualpolitik* 1931; 18: 223-226.

21. Griffiths DA. Diagnosing sex: Intersex surgery and 'sex change' in Britain 1930–1955. *Sexualities* 2018; 21: 476-495. DOI: 10.1177/1363460717740339.

22. Dillon M and Jivaka L. *Out of the ordinary: A life of gender and spiritual transitions*. Fordham Univ Press, 2016.

23. Tolhurst D. *Pioneers in plastic surgery*. Springer, 2015.

24. Freud S. The psychogenesis of a case of female homosexuality. *The International Journal of Psycho-analysis* 1920; 1: 125.

25. Freud S and Freud EL. *Letters of Sigmund Freud*. Courier Corporation, 1992.

26. Freud A. Some clinical remarks concerning the treatment of cases of male homosexuality. *Int J Psychoanal* 1949; 30: 195.

27. Money J. Ablatio penis: normal male infant sex-reassigned as a girl. *Arch Sex Behav* 1975; 4: 65-71.

28. Bao A-M and Swaab DF. Sexual differentiation of the human brain: relation to gender identity, sexual orientation and neuropsychiatric disorders. *Front Neuroendocrinol* 2011; 32: 214-226. DOI: 10.1016/j.yfrne.2011.02.007.
29. Dewing P, Shi T, Horvath S, et al. Sexually dimorphic gene expression in mouse brain precedes gonadal differentiation. *Molecular Brain Research* 2003; 118: 82-90. DOI: 10.1016/S0169-328X(03)00339-5.
30. Diamond M. Transsexuality among twins: identity concordance, transition, rearing, and orientation. *International Journal of Transgenderism* 2013; 14: 24-38. DOI: 10.1080/15532739.2013.750222.
31. Mueller SC, De Cuyper G and T'Sjoen G. Transgender research in the 21st century: a selective critical review from a neurocognitive perspective. *Am J Psychiatry* 2017; 174: 1155-1162. DOI: 10.1176/appi.ajp.2017.17060626.
32. Marchiano L. Outbreak: On transgender teens and psychic epidemics. *Psychological Perspectives* 2017; 60: 345-366. DOI: 10.1080/00332925.2017.1350804.
33. Oxford University Press. (n.d.). *Transgender*. Oxford English Dictionary (Online edition). (Accessed 18.3.2025) <https://www.oed.com>
34. Collin L, Reisner SL, Tangpricha V, et al. Prevalence of transgender depends on the "case" definition: a systematic review. *J Sex Med* 2016; 13: 613-626. DOI: 10.1016/j.jsxm.2016.02.001.
35. Knudson G. Language and terminology in transgender health. In: Schechter L (ed) *Gender confirmation surgery: Principles and techniques for an emerging field*. 2020, pp.41-46.
36. Goodman M, Adams N, Corneil T, et al. Size and distribution of transgender and gender nonconforming populations: a narrative review. *Endocrinology and Metabolism Clinics* 2019; 48: 303-321. DOI: 10.1016/j.ecl.2019.01.001.
37. Zhan C, Sandra D, Matilda GG, et al. *Trans legal mapping report 2019: Recognition before the law*. 2020. Geneva: ILGA WIRLD 2020: ILGA.
38. Karimi A and Bayatrizi Z. Dangerous positions: Male homosexuality in the new penal code of Iran. *Punishment & Society* 2019; 21: 417-434. DOI: 10.1177/1462474518787465.
39. Leinung MC and Joseph J. Changing demographics in transgender individuals seeking hormonal therapy: Are trans women more common than trans men? *Transgend Health* 2020; 5: 241-245. DOI: 0.1089/trgh.2019.0070.
40. Wiepjes CM, Nota NM, de Blok CJM, et al. The Amsterdam Cohort of Gender Dysphoria Study (1972-2015): Trends in Prevalence, Treatment, and Regrets. *J Sex Med* 2018; 15: 582-590. DOI: S1743-6095(18)30057-2 [pii].
41. Kaltiala R, Bergman H, Carmichael P, et al. Time trends in referrals to child and adolescent gender identity services: a study in four Nordic countries and in the UK. *Nordic Journal of Psychiatry* 2020; 74: 40-44. DOI: 10.1080/08039488.2019.1667429.

42. Kaltiala-Heino R, Sumia M, Työläjäarvi M, et al. Two years of gender identity service for minors: overrepresentation of natal girls with severe problems in adolescent development. *Child and Adolescent Psychiatry and Mental Health* 2015; 9: 1-9. DOI: 10.1186/s13034-015-0042-y.
43. Kaltiala R, Holttinen T and Tuisku K. Have the psychiatric needs of people seeking gender reassignment changed as their numbers increase? A register study in Finland. *Eur Psychiatry* 2023; 66: e93. DOI: 10.1192/j.eurpsy.2023.2471.
44. Arcelus J, Bouman WP, Van Den Noortgate W, et al. Systematic review and meta-analysis of prevalence studies in transsexualism. *Eur Psychiatry* 2015; 30: 807-815. DOI: 10.1016/j.eurpsy.2015.04.005.
45. Clark TC, Lucassen MF, Bullen P, et al. The health and well-being of transgender high school students: results from the New Zealand adolescent health survey (Youth'12). *J Adolesc Health* 2014; 55: 93-99. DOI: 10.1016/j.jadohealth.2013.11.008.
46. Conron KJ, Scott G, Stowell GS, et al. Transgender health in Massachusetts: results from a household probability sample of adults. *Am J Public Health* 2012; 102: 118-122. DOI: 10.2105/AJPH.2011.300315.
47. Crissman HP, Berger MB, Graham LF, et al. Transgender demographics: a household probability sample of US adults, 2014. *Am J Public Health* 2017; 107: 213-215. DOI: 10.2105/AJPH.2016.303571.
48. American Psychiatric Association 1980. Diagnostic and statistical manual of mental disorders(3rd ed.). American Psychiatric Association, Washington DC.
49. American Psychiatric Association 1994. Diagnostic and statistical manual of mental disorders (4th ed.). American Psychiatric Association, Washington DC.
50. American Psychiatric Association 2013, Diagnostic and statistical manual of mental disorders : DSM-5, 5th edn, American Psychiatric Association, Washington DC.
51. World Health Organization. 1992. ICD-10: international statistical classification of diseases and related health problems: tenth revision, 1st ed. World Health Organization, Geneva.
52. World Health Organization. 2019/2021. ICD-11: international statistical classification of diseases and related health problems: eleventh revision. World Health Organization, Geneva.
53. Coleman E, Radix AE, Bouman WP, et al. Standards of care for the health of transgender and gender diverse people, version 8. *International Journal of Transgender Health* 2022; 23: S1-S259. DOI: 10.1080/26895269.2022.2100644.
54. Socialstyrelsen. 2015. God vård av vuxna med könsdysfori: Nationellt kunskapsstöd. Socialstyrelsen Stockholm, 2015.
55. Socialstyrelsen. 2022. Vård av barn och ungdomar med könsdysfori. Nationellt kunskapsstöd med rekommendationer till profession och beslutsfattare. Socialstyrelsen Stockholm, 2022.

56. The Council for Choices in Health Care in Finland - Palveluvalikoimaneuvosto (PALKO) 2020. Transsukupuolisuudesta johtuvan dysforian lääketieteelliset hoitomenetelmät. STMO38:00/2020.
57. Beauchamp TL, Childress JF. Principles of Biomedical Ethics. 8th edition. Cary, NC: Oxford University Press, 2010.
58. Saarni S, Uusitalo S. 2020. Sukupuolen variaatioihin liittyvän dysforian lääketieteelliset hoidot - analyysi eettisistä kysymyksistä. Preparation memorandum 5. The Council for Choices in Health Care in Finland - Palveluvalikoimaneuvosto (PALKO).
59. EUnetHTA Joint Action 2, Work Package 8. HTA Core Model ® version 3.0 (Pdf); 2016. Available from www.htacoremodel.info/BrowseModel.aspx.
60. Terveyden ja Hyvinvoinnin laitos (THL). Terveydenhuollon menot ja rahoitus 2020. 2023. 18/2023. Julkkari. https://www.julkari.fi/bitstream/handle/10024/146539/TR18_23.pdf?sequence=1&isAllowed=y (Accessed 3.12.2024)
61. Laki transseksuaalin sukupuolen vahvistamisesta. 563/2002.
62. Kastroidislaki. 282/1970.
63. Laki transseksuaalin sukupuolen vahvistamisesta. 252/2016.
64. Sosiaali- ja terveysministeriö (STM). Sosiaali- ja terveysministeriön asetus sukupuolen muuttamiseen tähtäävän tutkimuksen ja hoidon järjestämisestä sekä lääketieteellisestä selvityksestä transseksuaalin sukupuolen vahvistamista varten. 1053/2002.
65. Laki sukupuolen vahvistamisesta. 295/2023.
66. Bouhadana G, ElHawary H, Alam P, et al. A Procedure and Complication-Specific Assessment of Smoking in Aesthetic Surgery: A Systematic Review and Meta-Analysis. *Plastic Surgery* 2024; 32: 115-126. DOI: 10.1177/22925503221085083.
67. Kainiemi K, Malmivaara A, Sillman-Tetri S, et al. Smoking cessation intervention prior to orthopedic surgery: A study protocol to determine patient outcomes and feasibility. *Tobacco Prevention & Cessation* 2022; 8: 33. DOI: 10.18332/tpc/152608.
68. Silverstein P. Smoking and wound healing. *The American journal of medicine* 1992; 93: S22-S24. DOI: 10.1016/0002-9343(92)90623-J.
69. Domi R and Laho H. Anesthetic challenges in the obese patient. *J Anesth* 2012; 26: 758-765. DOI: 10.1007/s00540-012-1408-4.
70. Adams J and Murphy P. Obesity in anaesthesia and intensive care. *Br J Anaesth* 2000; 85: 91-108. DOI: 10.1093/bja/85.1.91.
71. Prinsen CA, Mookkink LB, Bouter LM, et al. COSMIN guideline for systematic reviews of patient-reported outcome measures. *Qual Life Res* 2018; 27: 1147-1157. DOI: 10.1007/s11136-018-1798-3.

72. Mokkink LB, De Vet HC, Prinsen CA, et al. COSMIN risk of bias checklist for systematic reviews of patient-reported outcome measures. *Qual Life Res* 2018; 27: 1171-1179. DOI: 10.1007/s11136-017-1765-4.
73. Terwee CB, Prinsen CA, Chiarotto A, et al. COSMIN methodology for evaluating the content validity of patient-reported outcome measures: a Delphi study. *Qual Life Res* 2018; 27: 1159-1170. DOI: 10.1007/s11136-018-1829-0.
74. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol* 2010; 63: 737-745. DOI: 10.1016/j.jclinepi.2010.02.006.
75. Øvretveit J, Zubkoff L, Nelson EC, et al. Using patient-reported outcome measurement to improve patient care. *Int J Qual Health Care* 2017; 29: 874-879. DOI: 0.1093/intqhc/mzx108.
76. Greenhalgh J. The applications of PROs in clinical practice: what are they, do they work, and why? *Qual Life Res* 2009; 18: 115-123. DOI: 10.1007/s1136-008-9430-6.
77. Greenhalgh J, Gooding K, Gibbons E, et al. How do patient reported outcome measures (PROMs) support clinician-patient communication and patient care? A realist synthesis. *Journal of patient-reported outcomes* 2018; 2: 1-28. DOI: 10.1186/s41687-018-0061-6.
78. Felce D and Perry J. Quality of life: Its definition and measurement. *Res Dev Disabil* 1995; 16: 51-74. DOI: 10.1016/0891-4222(94)00028-8.
79. Karimi M and Brazier J. Health, health-related quality of life, and quality of life: what is the difference? *Pharmacoeconomics* 2016; 34: 645-649. DOI: 10.1007/s40273-016-0389-9.
80. Ferrans CE. Quality of life: conceptual issues. In: *Semin Oncol Nurs* 1990, pp.248-254.
81. Brazier J, Roberts J and Deverill M. The estimation of a preference-based measure of health from the SF-36. *J Health Econ* 2002; 21: 271-292. DOI: 10.1016/S0167-6296(01)00130-8.
82. Rabin R and Charro Fd. EQ-SD: a measure of health status from the EuroQol Group. *Ann Med* 2001; 33: 337-343. DOI: 0.3109/07853890109002087.
83. Talib TL, DeChant P, Kean J, et al. A qualitative study of patients' perceptions of the utility of patient-reported outcome measures of symptoms in primary care clinics. *Qual Life Res* 2018; 27: 3157-3166. DOI: doi.org/10.1007/s11136-018-1968-3.
84. Schulman-Green D, Cherlin EJ, McCorkle R, et al. Benefits and challenges in use of a standardized symptom assessment instrument in hospice. *J Palliat Med* 2010; 13: 155-159. DOI: 10.1089/jpm.2009.0245.
85. Campbell R, Ju A, King MT, et al. Perceived benefits and limitations of using patient-reported outcome measures in clinical practice with individual patients: a

systematic review of qualitative studies. *Qual Life Res* 2021; 31: 1597–1620. DOI: 10.1007/s11136-021-03003-z.

86. Dowrick C, Leydon GM, McBride A, et al. Patients' and doctors' views on depression severity questionnaires incentivised in UK quality and outcomes framework: qualitative study. *BMJ* 2009; 338. DOI: 10.1136/bmj.b663

87. Monroe AK, Jabour SM, Peña S, et al. A qualitative study examining the benefits and challenges of incorporating patient-reported outcome substance use and mental health questionnaires into clinical practice to improve outcomes on the HIV care continuum. *BMC Health Serv Res* 2018; 18: 1-10. DOI: 10.1186/s12913-018-3203-x.

88. Solstad SM, Castonguay LG and Moltu C. Patients' experiences with routine outcome monitoring and clinical feedback systems: A systematic review and synthesis of qualitative empirical literature. *Psychotherapy Research* 2019; 29: 157-170. DOI: 10.1080/10503307.2017.1326645.

89. Happell B. Meaningful information or a bureaucratic exercise? Exploring the value of routine outcome measurement in mental health. *Issues Ment Health Nurs* 2008; 29: 1098-1114. DOI: 10.1080/01612840802319852.

90. Stasiak K, Parkin A, Seymour F, et al. Measuring outcome in child and adolescent mental health services: Consumers' views of measures. *Clin Child Psychol Psychiatry* 2013; 18: 519-535. DOI: 10.1177/1359104512460860.

91. Callaly T, Hyland M, Coombs T, et al. Routine outcome measurement in public mental health: results of a clinician survey. *Aust Health Rev* 2006; 30: 164-173. DOI: 10.1071/AH060164.

92. Meehan T, McCombes S, Hatzipetrou L, et al. Introduction of routine outcome measures: staff reactions and issues for consideration. *J Psychiatr Ment Health Nurs* 2006; 13: 581-587. DOI: 10.1111/j.1365-2850.2006.00985.x.

93. Hilton S. Education and the changing face of medical professionalism: from priest to mountain guide? *Br J Gen Pract* 2008; 58: 353-361. DOI: 10.3399/bjgp08X280128.

94. American Society of Plastic Surgeons. 2021. 2020 Plastic Surgery Statistics Report. Arlington Heights, IL. <https://www.plasticsurgery.org/documents/News/Statistics/2020/plastic-surgery-statistics-full-report-2020.pdf> (Accessed 30.9.2021)

95. Nolan IT, Kuhner CJ and Dy GW. Demographic and temporal trends in transgender identities and gender confirming surgery. *Transl Androl Urol* 2019; 8: 184-190. DOI: 10.21037/tau.2019.04.09.

96. Lane M, Ives GC, Sluiter EC, et al. Trends in gender-affirming surgery in insured patients in the United States. *Plastic and Reconstructive Surgery—Global Open* 2018; 6: e1738. DOI: 10.1097/GOX.0000000000001738.

97. Kailas M, Lu HMS, Rothman EF, et al. Prevalence and types of gender-affirming surgery among a sample of transgender endocrinology patients prior to

- state expansion of insurance coverage. *Endocr Pract* 2017; 23: 780-786. DOI: 10.4158/EP161727.OR.
98. Sineath RC, Woodyatt C, Sanchez T, et al. Determinants of and barriers to hormonal and surgical treatment receipt among transgender people. *Transgend Health* 2016; 1: 129-136. DOI: 10.1089/trgh.2016.0013. .
99. Beckwith N, Reisner SL, Zaslow S, et al. Factors associated with gender-affirming surgery and age of hormone therapy initiation among transgender adults. *Transgend Health* 2017; 2: 156-164. DOI: 10.1089/trgh.2017.002.
100. American Society of Plastic Surgeons. 2017. Plastic Surgery Statistics Report 2016. Arlington Heights, IL. <https://d2wirczt3b6wjw.cloudfront.net/News/Statistics/2016/plastic-surgery-statistics-full-report-2016.pdf> (Accessed 10.12.2024)
101. Claes KE, D'Arpa S and Monstrey SJ. Chest surgery for transgender and gender nonconforming individuals. *Clin Plast Surg* 2018; 45: 369-380. DOI: 10.1016/j.cps.2018.03.010.
102. Monstrey S, Selvaggi G, Ceulemans P, et al. Chest-wall contouring surgery in female-to-male transsexuals: a new algorithm. *Plast Reconstr Surg* 2008; 121: 849-859. DOI: 10.1097/01.prs.0000299921.15447.b2.
103. Grynberg M, Fanchin R, Dubost G, et al. Histology of genital tract and breast tissue after long-term testosterone administration in a female-to-male transsexual population. *Reprod Biomed Online* 2010; 20: 553-558. DOI: 10.1016/j.rbmo.2009.12.021.
104. Patel H, Arruarana V, Yao L, et al. Effects of hormones and hormone therapy on breast tissue in transgender patients: a concise review. *Endocrine* 2020; 68: 6-15. DOI: 10.1007/s12020-020-02197-5.
105. Webster JP. Mastectomy for gynecomastia through a semicircular intra-areolar incision. *Ann Surg* 1946; 124: 557-575.
106. Davidson BA. Concentric Circle Operation for Massive Gynecomastia to Excise the Redundant Skin. *Plast Reconstr Surg* 1979; 63: 350-354. DOI: 10.1097/00006534-197903000-00009.
107. Wolter A, Diedrichson J, Scholz T, et al. Sexual reassignment surgery in female-to-male transsexuals: an algorithm for subcutaneous mastectomy. *J Plast Reconstr Aesthet Surg* 2015; 68: 184-191. DOI: 10.1016/j.bjps.2014.10.016.
108. Bustos SS, Forte AJ, Ciudad P, et al. The nipple split sharing vs. conventional nipple graft technique in chest wall masculinization surgery: can we improve patient satisfaction and aesthetic outcomes? *Aesthetic Plast Surg* 2020; 44: 1478-1486.
109. Wray Jr RC, Hoopes JE and Davis GM. Correction of extreme gynecomastia. *Br J Plast Surg* 1974; 27: 39-41. DOI: 10.1016/0007-1226(74)90060-5.

110. Berry MG, Curtis R and Davies D. Female-to-male transgender chest reconstruction: a large consecutive, single-surgeon experience. *J Plast Reconstr Aesthet Surg* 2012; 65: 711-719. DOI: 10.1016/j.bjps.2011.11.053.
111. Kääriäinen M, Salonen K, Helminen M, et al. Chest-wall contouring surgery in female-to-male transgender patients: a one-center retrospective analysis of applied surgical techniques and results. *Scand J Surg* 2017; 106: 74-79. DOI: 10.1177/1457496916645964.
112. Frederick MJ, Berhanu AE and Bartlett R. Chest Surgery in Female to Male Transgender Individuals. *Ann Plast Surg* 2017; 78: 249-253. DOI: 10.1097/SAP.0000000000000882.
113. Donato DP, Walzer NK, Rivera A, et al. Female-to-male chest reconstruction: a review of technique and outcomes. *Ann Plast Surg* 2017; 79: 259-263. DOI: 10.1097/SAP.0000000000001099.
114. McEvenue G, Xu FZ, Cai R, et al. Female-to-Male Gender Affirming Top Surgery: A Single Surgeon's 15-Year Retrospective Review and Treatment Algorithm. *Aesthet Surg J* 2017; 38: 49-57. DOI: 10.1093/asj/sjx116 [doi].
115. Stein MJ, Grigor E, Hardy J, et al. Surgical and patient-reported outcomes following double incision and free nipple grafting for female to male gender affirmation: does obesity make a difference? *J Plast Reconstr Aesthet Surg* 2021; 74: 1743-1751. DOI: 10.1016/j.bjps.2020.12.004.
116. Sundhagen HP, Opheim AB, Wæhre A, et al. Chest Wall Contouring in Transgender Men: A 20-Year Experience from a National Center. *Plastic and Reconstructive Surgery-Global Open* 2023; 11: e4952. DOI: 10.1097/GOX.0000000000004952.
117. Makkonen M, Myllykangas H, Kaarela O, et al. Masculinizing chest-wall surgeries in transgender patients, a retrospective single-center study. *Annales de chirurgie plastique esthétique* 2024; 69: 131-135. DOI: 10.1016/j.anplas.2023.09.008.
118. Bjerrome Ahlin H, Kölby L, Elander A, et al. Improved results after implementation of the Ghent algorithm for subcutaneous mastectomy in female-to-male transsexuals. *J Plast Surg Hand Surg* 2014; 48: 362-367. DOI: 10.3109/2000656X.2014.893887.
119. Tamulevicius M, Obed D, Dastagir N, et al. Subcutaneous mastectomy in female-to-male transsexuals is associated with higher risk of postoperative bleeding complications. *JPRAS open* 2024; 39: 60-70. DOI: 10.1016/j.jptra.2023.11.004.
120. Gallagher S, Rahmani F, Russell A, et al. A drain-free technique for female-to-male gender affirmation chest surgery decreases morbidity: outcomes from 306 consecutive masculoplasties. *Ann Plast Surg* 2019; 83: 15-21. DOI: 10.1097/SAP.0000000000001810.

121. Sipos K, Kämäräinen S and Kauhanen S. Topical tranexamic acid reduces postoperative hematomas in reduction mammoplasties. *J Plast Reconstr Aesthet Surg* 2023; 83: 172-179. DOI: 10.1016/j.bjps.2023.04.039.
122. van de Grift TC, Elfering L, Bouman MB, et al. Surgical Indications and Outcomes of Mastectomy in Transmen: A Prospective Study of Technical and Self-Reported Measures. *Plast Reconstr Surg* 2017; 140: 415-424. DOI: 10.1097/PRS.0000000000003607.
123. Tolstrup A, Zetner D and Rosenberg J. Outcome Measures in Gender-Confirming Chest Surgery: A Systematic Scoping Review. *Aesthetic Plast Surg* 2020; 44: 219-228. DOI: 10.1007/s00266-019-01523-1.
124. Agarwal CA, Scheefer MF, Wright LN, et al. Quality of life improvement after chest wall masculinization in female-to-male transgender patients: A prospective study using the BREAST-Q and Body Uneasiness Test. *J Plast Reconstr Aesthet Surg* 2018; 71: 651-657. DOI: 10.1016/j.bjps.2018.01.003.
125. Ayyala HS, Mukherjee TJ, Le T-M, et al. A three-step technique for optimal nipple position in transgender chest masculinization. *Aesthet Surg J* 2020; 40: NP619-NP625. DOI: 10.1093/asj/sjaa150.
126. Frey JD, Motosko CC, Moore K, et al. A novel periareolar approach to chest wall reconstruction using a Nipple-Areola complex transposition flap. *Plast Reconstr Surg* 2019; 144: 528e-530e. DOI: 10.1097/PRS.0000000000005926.
127. Whitehead DM, Weiss PR and Podolsky D. A single surgeon's experience with transgender female-to-male chest surgery. *Ann Plast Surg* 2018; 81: 353-359. DOI: 10.1097/SAP.0000000000001536.
128. Top H and Balta S. Transsexual Mastectomy: Selection of Appropriate Technique According to Breast Characteristics. *Balkan Med J* 2017; 34: 147-155. DOI: 10.4274/balkanmedj.2016.0093.
129. Junn A, Khetpal S, Smetona J, et al. Hockey stick incision: a modified technique for chest wall masculinization. *Annals of Translational Medicine* 2021; 9. DOI: 10.21037/atm-20-7678.
130. Cregten-Escobar P, Bouman MB, Buncamper ME, et al. Subcutaneous Mastectomy in Female-to-Male Transsexuals: A Retrospective Cohort-Analysis of 202 Patients. *J Sex Med* 2012; 9: 3148-3153. DOI: 10.1111/j.1743-6109.2012.02939.x.
131. Kühn S, Keval S, Sader R, et al. Mastectomy in female-to-male transgender patients: A single-center 24-year retrospective analysis. *Arch Plast Surg* 2019; 46: 433-440. DOI: 10.5999/aps.2018.01214.
132. Naides AI, Schultz JJ, Shulzhenko NO, et al. Chest masculinization technique and outcomes in 72 double-incision chest-contouring procedures with free nipple grafting. *Plastic and Reconstructive Surgery—Global Open* 2021; 9: e3459. DOI: 10.1097/GOX.0000000000003459.

133. Diaddigo SE, Lavalley MN, Asadourian PA, et al. Concordance of national insurance criteria with WPATH Standards of Care for gender-affirming surgery. *Plast Reconstr Surg* 2021; 10.1097. DOI: 10.1097/PRS.00000000000011144.
134. Kelly-Schuetz KA, Wempe K, Fritz GD, et al. Masculinizing chest surgery for gender affirmation: a retrospective study of outcomes and patient reported satisfaction. *The American Journal of Surgery* 2022; 223: 577-580. DOI: 10.1016/j.amjsurg.2021.12.032.
135. Day D-L, Klit A, Lang CL, et al. High self-reported satisfaction after top surgery in gender-affirming surgery: A single-center study. *Transgend Health* 2023; 8: 124-129. DOI: 10.1089/trgh.2021.0091.
136. Kanatas A, Velikova G, Roe B, et al. Patient-reported outcomes in breast oncology: a review of validated outcome instruments. *Tumori Journal* 2012; 98: 678-688. DOI: 10.1177/03008916120980602.
137. Lo Russo G, Tanini S and Innocenti M. Masculine chest-wall contouring in FtM transgender: a personal approach. *Aesthetic Plast Surg* 2017; 41: 369-374. DOI: doi.org/10.1007/s00266-017-0796-0.
138. Poudrier G, Nolan IT, Cook TE, et al. Assessing quality of life and patient-reported satisfaction with masculinizing top surgery: a mixed-methods descriptive survey study. *Plast Reconstr Surg* 2019; 143: 272-279.
139. Pusic AL, Klassen AF, Scott AM, et al. Development of a new patient-reported outcome measure for breast surgery: the BREAST-Q. *Plast Reconstr Surg* 2009; 124: 345-353. DOI: 10.1097/PRS.0B013E3181AEE807.
140. Klassen AF, Kaur M, Poulsen L, et al. Development of the BODY-Q chest module evaluating outcomes following chest contouring surgery. *Plast Reconstr Surg* 2018; 142: 1600-1608. DOI: 10.1097/PRS.0000000000004978.
141. Klassen AF, McEvenue G, Wang Y, et al. The BODY-Q Chest module: further validation in a Canadian chest masculinization surgery sample. *Aesthet Surg J* 2021; 41: 566-574. DOI: 10.1093/asj/sjaa224.
142. van de Grift TC, Elfering L, Greijdanus M, et al. Subcutaneous mastectomy improves satisfaction with body and psychosocial function in trans men: findings of a cross-sectional study using the BODY-Q chest module. *Plast Reconstr Surg* 2018; 142: 1125-1132. DOI: 10.1097/PRS.0000000000004827.
143. Lane M, Kirsch MJ, Sluiter EC, et al. Gender affirming mastectomy improves quality of life in transmasculine patients: a single-center prospective study. *Ann Surg* 2023; 277: e725-e729. DOI: 10.1097/SLA.0000000000005158.
144. Kaur MN, Gallo L, Wang Y, et al. Health state utility values in patients undergoing chest masculinization surgery. *J Plast Reconstr Aesthet Surg* 2023; 81: 26-33. DOI: 10.1016/j.bjps.2023.02.004.
145. Antoszewski B, Bratoś R, Sitek A, et al. Long-term results of breast reduction in female-to-male transsexuals. *Polish Journal of Surgery* 2012; 84: 144-151. DOI: 10.2478/v10035-012-0023-2.

146. Olson-Kennedy J, Warus J, Okonta V, et al. Chest Reconstruction and Chest Dysphoria in Transmasculine Minors and Young Adults: Comparisons of Nonsurgical and Postsurgical Cohorts. *JAMA pediatrics* 2018; 172: 431-436. DOI: 10.1001/jamapediatrics.2017.5440 [doi].
147. Romano G, Bouaoud J, Schmidt M, et al. Improvements in Transgender Masculinizing Chest Surgery: A Pilot Study of a Tailored Approach with a Life Satisfaction Assessment. *Transgend Health* 2023. DOI: 10.1089/trgh.2021.0212.
148. Group TE. EuroQol-a new facility for the measurement of health-related quality of life. *Health Policy* 1990; 16: 199-208. DOI: 10.1016/0168-8510(90)90421-9.
149. Alcon A, Kennedy A, Wang E, et al. Quantifying the psychosocial benefits of masculinizing mastectomy in trans male patients with patient-reported outcomes: the University of California, San Francisco, Gender Quality of Life Survey. *Plast Reconstr Surg* 2021; 147: 731e-740e. DOI: 10.1097/PRS.0000000000007883.
150. Van De Grift TC, Elaut E, Cerwenka SC, et al. Effects of medical interventions on gender dysphoria and body image: a follow-up study. *Psychosom Med* 2017; 79: 815-823. DOI: 10.1097/PSY.0000000000000465.
151. Cohen-Kettenis PT and Van Goozen SH. Sex reassignment of adolescent transsexuals: a follow-up study. *J Am Acad Child Adolesc Psychiatry* 1997; 36: 263-271. DOI: 10.1097/00004583-199702000-00017.
152. Deogracias JJ, Johnson LL, Meyer-Bahlburg HF, et al. The gender identity/gender dysphoria questionnaire for adolescents and adults. *J Sex Res* 2007; 44: 370-379. DOI: 10.1080/00224490701586730.
153. Moolenburgh SE, Mureau MA and Hofer SO. Aesthetic outcome after nasal reconstruction: patient versus panel perception. *J Plast Reconstr Aesthet Surg* 2008; 61: 1459-1464. DOI: 10.1016/j.bjps.2007.09.018.
154. Kiekens RM, van't Hof MA, Straatman H, et al. Influence of panel composition on aesthetic evaluation of adolescent faces. *The European Journal of Orthodontics* 2007; 29: 95-99. DOI: 10.1093/ejo/cjl060.
155. Cardoso MJ, Cardoso J, Santos AC, et al. Interobserver agreement and consensus over the esthetic evaluation of conservative treatment for breast cancer. *The Breast* 2006; 15: 52-57. DOI: 10.1016/j.breast.2005.04.013.
156. Maass SW, Bagher S, Hofer SO, et al. Systematic review: aesthetic assessment of breast reconstruction outcomes by healthcare professionals. *Ann Surg Oncol* 2015; 22: 4305-4316. DOI: 10.1245/s10434-015-4434-2.
157. Duraes EF, Durand P, Morisada M, et al. A novel validated breast aesthetic scale. *Plast Reconstr Surg* 2022; 149: 1297-1308. DOI: 10.1097/PRS.00000000000009156.
158. Fortin AJ, Cheang M and Latosinsky S. Cosmetic outcomes following breast conservation therapy: in search of a reliable scale. *Breast Cancer Res Treat* 2006; 100: 65-70. DOI: 10.1007/s10549-006-9223-y.

159. Racz JM, Hong NL and Latosinsky S. In search of a gold standard scoring system for the subjective evaluation of cosmetic outcomes following breast-conserving therapy. *The Breast Journal* 2015; 21: 345-351. DOI: 10.1111/tbj.12423.
160. Cardoso MJ, Santos AC, Cardoso J, et al. Choosing observers for evaluation of aesthetic results in breast cancer conservative treatment. *International Journal of Radiation Oncology* Biology* Physics* 2005; 61: 879-881. DOI: 10.1016/j.ijrobp.2004.06.257.
161. Veiga DF, Veiga-Filho J, Ribeiro LM, et al. Evaluations of aesthetic outcomes of oncoplastic surgery by surgeons of different gender and specialty: a prospective controlled study. *The Breast* 2011; 20: 407-412. DOI: 10.1016/j.breast.2011.04.001.
162. Dikmans RE, Nene LE, Bouman M-B, et al. The aesthetic items scale: a tool for the evaluation of aesthetic outcome after breast reconstruction. *Plastic and Reconstructive Surgery-Global Open* 2017; 5: e1254. DOI: 10.1097/GOX.0000000000001254.
163. Cardoso MJ, Cardoso J, Amaral N, et al. Turning subjective into objective: the BCCT. core software for evaluation of cosmetic results in breast cancer conservative treatment. *The Breast* 2007; 16: 456-461. DOI: 10.1016/j.breast.2007.05.002.
164. Pezner RD, Patterson MP, Hill LR, et al. Breast retraction assessment: an objective evaluation of cosmetic results of patients treated conservatively for breast cancer. *International Journal of Radiation Oncology* Biology* Physics* 1985; 11: 575-578. DOI: 10.1016/0360-3016(85)90190-7.
165. Cardoso JS, da Costa JFP and Cardoso MJ. Modelling ordinal relations with SVMs: An application to objective aesthetic evaluation of breast cancer conservative treatment. *Neural Netw* 2005; 18: 808-817. DOI: 10.1016/j.neunet.2005.06.023.
166. Cardoso MJ, Cardoso JS, Wild T, et al. Comparing two objective methods for the aesthetic evaluation of breast cancer conservative treatment. *Breast Cancer Res Treat* 2009; 116: 149-152. DOI: 10.1007/s10549-008-0173-4.
167. Heil J, Dahlkamp J, Golatta M, et al. Aesthetics in breast conserving therapy: do objectively measured results match patients' evaluations? *Ann Surg Oncol* 2011; 18: 134-138. DOI: 10.1245/s10434-010-1252-4.
168. Atiyeh B, Emsieh S, Hakim C, et al. A narrative review of artificial intelligence (AI) for objective assessment of aesthetic endpoints in plastic surgery. *Aesthetic Plast Surg* 2023; 47: 2862-2873. DOI: 10.1007/s00266-023-03328-9.
169. Bustos VP, Bustos SS, Mascaro A, et al. Transgender and gender-nonbinary patient satisfaction after transmasculine chest surgery. *Plastic and Reconstructive Surgery-Global Open* 2021; 9: e3479. DOI: 10.1097/GOX.0000000000003479.

170. Repo J, Klassen A, Homsy P, et al. Translation and cultural adaptation of the Body-Q Chest module into Finnish for use in gynecomastia, weight loss and FTM chest surgery. *Value Health* 2017; 9: 766. DOI: 10.1016/j.jval.2017.08.2182.
171. World Medical Association. 2024. Declaration of Helsinki. Ethical principles for medical research involving human subjects. *Bull World Health Organ* 2001; 79: 373.
172. Nordic Medico-Statistical Committee. 2012. NOMESCO Classification of Surgical Procedures (NCSP) version 1.16. Nordic Medico-Statistical Committee, Copenhagen.
173. Sintonen H. The 15D instrument of health-related quality of life: properties and applications. *Ann Med* 2001; 33: 328-336. DOI: 10.3109/07853890109002086.
174. Sintonen H. An approach to measuring and valuing health states. *Soc Sci Med C* 1981; 15: 55-65. DOI: 10.1016/0160-7995(81)90019-8.
175. Sintonen H. The 15D-measure of health-related quality of life. I. Reliability, validity and sensitivity of its health state descriptive system. National Centre for Health Program Evaluation. *Working Paper* 1994; 41.
176. Rosser RM. A health index and output measure. *Quality of life assessment: key issues in the 1990s*. Springer, 1993, pp.151-178.
177. Nord E. Health status index models for use in resource allocation decisions: a critical review in the light of observed preferences for social choice. *Int J Technol Assess Health Care* 1996; 12: 31-44. DOI: 10.1017/S0266462300009363.
178. Stavem K, Bjørnæs H and Lossius MI. Properties of the 15D and EQ-5D utility measures in a community sample of people with epilepsy. *Epilepsy Res* 2001; 44: 179-189. DOI: 10.1016/S0920-1211(01)00201-7.
179. Sintonen H. The 15D-measure of health-related quality of life. II. Feasibility, reliability and validity of its valuation system. *National Centre for Health Program Evaluation, Working Paper 42, Melbourne* 1995.
180. Stavem K. Reliability, validity and responsiveness of two multiattribute utility measures in patients with chronic obstructive pulmonary disease. *Qual Life Res* 1999; 8: 45-54. DOI: 10.1023/A:1026475531996.
181. 15d-instrument.net. 15d-instrument Languages, <https://www.15d-instrument.net/15d/languages/> (Accessed 04.12.2024)
182. Clavien PA, Barkun J, De Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: five-year experience. *Ann Surg* 2009; 250: 187-196. DOI: 10.1097/SLA.0b013e3181b13ca2.
183. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika* 1951; 16: 297-334.
184. Schober P, Boer C and Schwarte LA. Correlation coefficients: appropriate use and interpretation. *Anesth Analg* 2018; 126: 1763-1768. DOI: 10.1213/ANE.0000000000002864.

185. Kaiser HF. The application of electronic computers to factor analysis. *Educ Psychol Meas* 1960; 20: 141-151. DOI: 10.1177/0013164460020000116.
186. Koskinen S, Lunqvist A, Ristiluoma N. Terveys, toimintakyky ja hyvinvointi Suomessa 2011. 68/2012. Terveysten ja Hyvinvoinnin laitos (THL). Julkkari. https://www.julkari.fi/bitstream/handle/10024/90832/Rap068_2012_netti.pdf?sequence=1&isAllowed=y (Accessed 6.3.2024)
187. Alanne S, Roine RP, Räsänen P, et al. Estimating the minimum important change in the 15D scores. *Qual Life Res* 2015; 24: 599-606. DOI: 10.1007/s11136-014-0787-4.
188. Koo TK and Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *J Chiropr Med* 2016; 15: 155-163. DOI: 10.1016/j.jcm.2016.02.012.
189. Saarinen M, Ojala K, Suominen S, et al. Validation of the BODY-Q Chest module in Finnish trans men undergoing chest wall masculinization. *Scand J Surg* 2023; 112: 180-186. DOI: 10.1177/14574969231176111.
190. Saarinen M, Ojala K, Kolehmainen M, et al. Quality of Chest Masculinization in Trans Men: A Retrospective Study Evaluating Surgical Technique, Complications, Secondary Corrections, and Trends. *Transgend Health* 2023. DOI: 10.1089/trgh.2023.0034.
191. Saarinen M, Suominen S, Sintonen H, et al. Patient-reported satisfaction and health-related quality of life after chest masculinization in transgender men using the BODY-Q Chest module and the 15D instrument. *J Plast Reconstr Aesthet Surg* 2024; 96: 43-49. DOI: 10.1016/j.bjps.2024.07.006.
192. Sadiq KOS, Cota PR, Creamer R, et al. Reduction mammoplasty relieves depression in women with macromastia: A systematic review. *J Plast Reconstr Aesthet Surg* 2024. DOI: 10.1016/j.bjps.2024.10.011.
193. De Cuypere G, TSjoen G, Beerten R, et al. Sexual and physical health after sex reassignment surgery. *Arch Sex Behav* 2005; 34: 679-690. DOI: 10.1007/s10508-005-7926-5.
194. Klassen AF, Kaur M, Johnson N, et al. International phase I study protocol to develop a patient-reported outcome measure for adolescents and adults receiving gender-affirming treatments (the GENDER-Q). *BMJ open* 2018; 8: e025435. DOI: 10.1136/bmjopen-2018-025435.
195. Q-portfolio GENDER-Q, <https://qportfolio.org/gender-q/> (Accessed 10.12.2024)
196. Wanta J, Gatherwright J, Knackstedt R, et al. "TRANS"-questionnaire (TRANS-Q): a novel, validated pre-and postoperative satisfaction tool in 145 patients undergoing gender confirming mastectomies. *Eur J Plast Surg* 2019; 42: 527-530. DOI: 10.1007/s00238-019-01547-5.

197. Beckwith N, McDowell MJ, Reisner SL, et al. Psychiatric epidemiology of transgender and nonbinary adult patients at an urban health center. *LGBT health* 2019; 6: 51-61. DOI: 10.1089/lgbt.2018.0136.
198. Pirkola SP, Isometsä E, Suvisaari J, et al. DSM-IV mood-, anxiety-and alcohol use disorders and their comorbidity in the Finnish general population. *Soc Psychiatry Psychiatr Epidemiol* 2005; 40: 1-10. DOI: 10.1007/s00127-005-0848-7.
199. Markkula N, Suvisaari J, Saarni SI, et al. Prevalence and correlates of major depressive disorder and dysthymia in an eleven-year follow-up—results from the Finnish Health 2011 Survey. *J Affect Disord* 2015; 173: 73-80. DOI: 10.1016/j.jad.2014.10.015.
200. Vehmas N, Holopainen E, Suomalainen L, et al. Somatic Health and Psychosocial Background Among Finnish Adolescents with Gender Dysphoria Seeking Hormonal Interventions. *Transgend Health* 2022; 7: 505-513. DOI: 10.1089/trgh.2021.0084.
201. Downing JM and Przedworski JM. Health of transgender adults in the US, 2014–2016. *Am J Prev Med* 2018; 55: 336-344. DOI: 10.1016/j.amepre.2018.04.045.
202. Hisinger-Mölkänen H, Pallasaho P, Haahtela T, et al. The increase of asthma prevalence has levelled off and symptoms decreased in adults during 20 years from 1996 to 2016 in Helsinki, Finland. *Respir Med* 2019; 155: 121-126. DOI: 10.1016/j.rmed.2019.07.014.
203. Siponen M, Huuskonen L, Läärä E, et al. Association of oral lichen planus with thyroid disease in a Finnish population: a retrospective case-control study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010; 110: 319-324. DOI: 10.1016/j.tripleo.2010.04.001.
204. Meyer IH, Brown TN, Herman JL, et al. Demographic characteristics and health status of transgender adults in select US regions: Behavioral Risk Factor Surveillance System, 2014. *Am J Public Health* 2017; 107: 582-589. DOI: 10.2105/AJPH.2016.303648.
205. Lundqvist A and Tolonen H. Healthy Finland survey as the latest uptake for 50 years of population health monitoring in Finland. *Eur J Public Health* 2023; 33: ckad160. 720. DOI: 10.1093/eurpub/ckad160.720.
206. Emmerich SD, Fryar CD, Stierman B, et al. Obesity and Severe Obesity Prevalence in Adults: United States, August 2021–August 2023. 2024. DOI: 10.15620/cdc/159281.
207. Hassan B, Schuster CR, Ascha M, et al. Association of High Body Mass Index With Postoperative Complications After Chest Masculinization Surgery. *Ann Plast Surg* 2024; 92: 174-180. DOI: 10.1097/SAP.0000000000003737.

208. Pittelkow EM, Duquette SP, Rhamani F, et al. Female-to-Male Gender-Confirming Drainless Mastectomy May Be Safe in Obese Males. *Aesthet Surg J* 2020; 40: 85-93. DOI: 10.1093/asj/sjz335.
209. Kainulainen I, Saarinen M, Kuuskeri M, Joensuu K, Ojala K. Elämänlaatu ja potilastyytyväisyys rintakehän maskulinisaation jälkeen. Operatiiviest päivät. Helsinki, Finland, 2024.
210. Zhang M-X, Chen C-Y, Fang Q-Q, et al. Risk factors for complications after reduction mammoplasty: a meta-analysis. *PLoS One* 2016; 11: 0167746. DOI: 10.1371/journal.pone.0167746.
211. Myung Y and Heo C-Y. Relationship between obesity and surgical complications after reduction mammoplasty: a systematic literature review and meta-analysis. *Aesthet Surg J* 2017; 37: 308-315. DOI: 10.1093/asj/sjw189.
212. Schechter LS and Safa B. Introduction to phalloplasty. *Clin Plast Surg* 2018; 45: 387-389. DOI: 10.1016/j.cps.2018.03.014.
213. van der Sluis WB, Smit JM, Pigot GL, et al. Double flap phalloplasty in transgender men: Surgical technique and outcome of pedicled anterolateral thigh flap phalloplasty combined with radial forearm free flap urethral reconstruction. *Microsurgery* 2017; 37: 917-923. DOI: 10.1002/micr.30190.
214. Monstrey S, Hoebeke P, Selvaggi G, et al. Penile reconstruction: is the radial forearm flap really the standard technique? *Plast Reconstr Surg* 2009; 124: 510-518. DOI: 10.1097/PRS.0b013e3181aeeb06.
215. Socialstyrelsen. Utvecklingen av diagnosen könsdysfori. Förekomst, samtidiga psykiatriska diagnoser och dödlighet i suicid. 2020. <https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/ovrigt/2020-2-6600.pdf> (Accessed 19.11.2024)
216. Sir E and Tuluy Y. Evaluation of life improvement in trans men after mastectomy: a prospective study using the TRANS-Q. *Aesthetic Plast Surg* 2022; 46: 2556-2561. DOI: 10.1007/s00266-022-02907-6.
217. Thuau F, Kanlagna A, Verdier J, et al. Impact of the preoperative hormone therapy duration on the satisfaction of transgender men after chest masculinization surgery. *International Journal of Transgender Health* 2024: 1-7. DOI: 10.1080/26895269.2024.2311757.
218. Innocenti A and Melita D. Patients decision-making characteristics affects gynecomastia treatment satisfaction: a multicenter study using the BODY-Q chest module. *Aesthetic Plast Surg* 2022; 46: 50-51. DOI: 10.1007/s00266-021-02633-5.
219. Xu B, Mu D, Yang Y, et al. Endoscopic axillary approach improves patient satisfaction of gynecomastia subcutaneous mastectomy: a cross-sectional study using the BODY-Q chest module. *Aesthetic Plast Surg* 2020; 44: 2011-2020. DOI: 10.1007/s00266-019-01501-7.

220. Dhejne C, Van Vlerken R, Heylens G, et al. Mental health and gender dysphoria: A review of the literature. *Int Rev Psychiatry* 2016; 28: 44-57. DOI: 10.3109/09540261.2015.1115753.
221. Timmermans F, Elfering L, Smit J, et al. Long-term changes in free nipple graft morphology and patient-reported outcomes in gender-affirming mastectomies. *Aesthetic Plast Surg* 2022: 1-7. DOI: 10.1007/s00266-021-02666-w.
222. van de Grift TC, Elaut E, Cerwenka SC, et al. Surgical satisfaction, quality of life, and their association after gender-affirming surgery: a follow-up study. *J Sex Marital Ther* 2018; 44: 138-148. DOI: 10.1080/0092623X.2017.1326190.
223. Bustos VP, Bustos SS, Mascaro A, et al. Regret after gender-affirmation surgery: a systematic review and meta-analysis of prevalence. *Plastic and Reconstructive Surgery–Global Open* 2021; 9: e3477. DOI: 10.1097/GOX.0000000000003477.
224. Saarni SI, Härkänen T, Sintonen H, et al. The impact of 29 chronic conditions on health-related quality of life: a general population survey in Finland using 15D and EQ-5D. *Qual Life Res* 2006; 15: 1403-1414. DOI: 10.1007/s11136-006-0020-1.
225. Dahlbäck C, Ringberg A and Manjer J. Aesthetic outcome following breast-conserving surgery assessed by three evaluation modalities in relation to health-related quality of life. *Journal of British Surgery* 2019; 106: 90-99. DOI: 10.1002/bjs.10963.

