

The Impact of Gender-affirming Surgeries on Suicide-related Outcomes: A Systematic Review

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Abstract

Aims: Being transgender has been linked to poor mental health indicators, especially those related to suicide. We aimed to review the impact of gender-affirming surgeries (GAS) on suicidal behavior in the transgender population.

Method: An advanced search was conducted on PubMed until February 28, 2022, and a total of 11 studies were considered eligible. Data were extracted on the size of sample population, control group, type of procedure, means of assessment, duration of time between surgery and assessment, and suicide-related outcomes. The considered outcomes were suicidal ideation, suicide attempts, and death by suicide.

Results: Five studies compared the same patients pre- and post-GAS, while six studies compared patients who underwent GAS with a group who did not. Overall, suicide-related outcomes were found to be less frequent in patients after GAS when compared to those same patients' pre-GAS indicators. The two studies that used either the general population or matched age and sex controls found a much higher prevalence of suicide-related outcomes, specifically suicide attempts and death by suicide, in post-GAS patients than in control groups. However, the studies that compared the treatment groups with either patients in an earlier phase of the transition or those who desired but had not yet undergone surgery showed lower post-GAS suicide-related outcomes, including suicidal ideation and suicide attempts.

Conclusions: Suicidal ideation was generally found to decrease post-GAS; results regarding suicide attempts were inconsistent, and there was insufficient data to draw any conclusion about the effects of GAS on death by suicide.

Keywords

Sex reassignment surgery, operation, surgery, suicide, suicide attempted, suicidal ideation, psychiatric morbidity, gender dysphoria, transgender persons, transsexualism, gender identity disorder

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Introduction

In the past, sex and gender have been misinterpreted as synonyms. However, the terms represent different concepts; sex is associated with anatomical and biological factors (sex chromosomes, gonads, sex hormones, and non-ambiguous internal and external genitalia), whereas gender is the inner sense one has of being male, female, a combination of both, or having no gender.¹ The terms “transgender” and “gender-diverse persons” are umbrella terms that refer to people in which sex and gender are not congruent; that is, people who do not identify with their assigned-at-birth sex. This is opposed to cis-gender persons, who are individuals whose gender identity aligns with their assigned-at-birth sex.² According to the

World Health Organization (WHO), around 0.3% to 0.5% of the global population is transgender.³

Some transgender individuals can experience gender dysphoria (GD), which is defined in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders¹ (DSM-5),

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published in 2013, as a clinically significant distress or impairment related to a strong desire to be of another gender and which may include a desire to change one's primary and/or secondary sex characteristics. Though GD is exclusively a health issue for transgender people, not all transgender or gender-diverse people experience dysphoria, and simply being transgender is no longer regarded as a mental disorder.¹ Given that this is a recent development, the terms transgender and GD often overlap in the literature, which can contribute to the medicalization of transgender identities and enhance the stigma around this population.⁴ Another term for GD is gender incongruence (GI), which replaced "transsexualism" in The International Classification of Disease, Eleventh Revision⁵ (ICD-11), published in 2019, and was relocated from the Mental Health Disorders chapter to an entirely new chapter, Conditions Relating to Sexual Health. This alteration in terminology aims to define being transgender as a non-pathological condition and to ensure transgender people's access to gender-affirming health care and adequate health insurance coverage for such services.⁶

Despite the above remarks, it should be noted that mental health outcomes, particularly those related to suicide, are not exclusive to patients with a GD diagnosis. Trans people overall are at a greater risk for suicide, and there have been reports of a higher prevalence of suicidal thoughts and attempts among this population.^{7,8} There are numerous other factors to these statistics other than GD, including institutional prejudice, stigma, discrimination, interpersonal macro- and micro-aggressions, a lack of family support, and difficulty accessing medical care.^{9,10} Protecting factors include the support of families and significant others, reduced transphobia, and access to hormonal therapy.^{11,12}

It has become clear that there is a need for interventions that improve the mental health of this population. Gender affirmation serves the purpose of supporting and validating everyone's gender identity and reducing the distress they experience. It can include any one or a combination of social (choice of name and pronouns, use of preferred clothes, and hair removal), psychological (acceptance of oneself and management of internalized transphobia), legal (name and gender marker change on documents), and medical (hormonal treatment or surgery) interventions.^{13,14} When seeking medical care, trans individuals should be handled by a multidisciplinary team and receive individually tailored care that considers each patient's specific needs.¹⁵

Hormonal therapy consists of pubertal suppression for adolescents and gender-affirming hormones, which can be feminizing (estrogen) or masculinizing (testosterone), for older adolescents and adults.¹⁴ Pubertal suppression and hormone supplement interventions have been demonstrated to decrease GD symptoms and have generally been linked to positive outcomes regarding mental health,¹⁶ especially suicidal behavior.^{17,18}

As for GAS, feminizing procedures include alterations in facial features, voice surgery, orchiectomy, and vaginoplasty,

while masculinizing procedures may comprise facial surgery, mastectomy, metoidioplasty, phalloplasty, and salpingo-oophorectomy.^{12,15} One systematic review by Wernick et al.¹² showed that GAS improved the quality of life, body image satisfaction, and overall psychiatric functioning of transgender individuals. However, despite the relevance of suicide-related questions in this population, there is little evidence on the effect of GAS on outcomes related to suicide. Therefore, it remains unclear whether GAS has a significant impact on suicidal ideation, suicide attempts, and suicide deaths in this population.

In this review, we aim to analyze cohort studies and case reports, ideally with longer-than-average follow-ups, whose main outcomes are related to issues of suicide in transgender people who have undergone surgical intervention when compared to their own pre-GAS indicators or to control groups who have not undergone GAS (general population, matched age and sex controls, transgender individuals who did not seek medical affirmation). The aim is to determine whether those who have undergone GAS are associated with less suicidal behavior than the control groups.

Methods

Study searches were conducted, by two independent researchers, in PubMed and Web of Science; all studies published until February 2022 were included.

A combination of the following keywords was used in both PubMed and Web of Science: sex reassignment surgery, operation, surgery, suicide, suicide attempted, suicidal ideation, psychiatric morbidity, GD, transgender persons, transsexualism, and gender identity disorder.

Despite not overlapping, other terms, such as "transsexualism", were accepted as a substitute for transgender persons and GD, considering the recent terminology changes on both the DSM-5 and ICD-11.

The terms relating to the review question were searched on Mesh database and respective Mesh terms were identified and subsequently searched on PubMed. In order not to exclude studies published before the mesh terms were introduced and studies that had not been reviewed yet, other related terms were added to the search. The search method is exemplified in Tables 1 and 2.

Study Selection

The first author screened articles primarily by title and abstract, regarding subject relevance and, posteriorly, accessed the remainders, considering inclusion and exclusion criteria. The inclusion criteria were as follow: studies in which one group of patients was submitted to GAS; suicide-related outcomes were evaluated; the population was over 16 years old, and the study was published in English, Portuguese, Spanish, or Italian. Studies

Table 1. Advanced Search Method on PubMed.

#1	"Reconstructive Surgical Procedures"[Mesh] OR "Surgery, Plastic"[Mesh] OR "Sex Reassignment Surgery"[Mesh] OR "Transsexualism/Surgery"[Mesh] OR "Surger*" OR "Operation*"
#2	"Suicide"[Mesh] OR "Suicidal Ideation"[Mesh] OR "Suicide, Attempted"[Mesh] OR "Suicide, Completed"[Mesh] OR "Suicid*" OR "Psychiatric Morbidity"
#3	"GD"[Mesh] OR "Transgender Persons"[Mesh] OR "Transsexualism"[Mesh] OR "Gender identity disorder" OR "Transsexual*" OR "Transgender*"
#4	#1 AND #2 AND #3

Note: GD, Gender dysphoria.

Table 2. Advanced Search Method on Web of Science.

#1	(((((ALL=("Reconstructive Surgical Procedures")) OR ALL=("Surgery, Plastic")) OR ALL=("Sex Reassignment Surgery")) OR ALL=("Transsexualism/Surgery")) OR ALL=("Surger*"))
#2	(((((ALL=("Suicide")) OR ALL=("Suicidal Ideation")) OR ALL=("Suicide, Attempted")) OR ALL=("Suicide, Completed")) OR ALL=("Suicid*")) OR ALL=("Psychiatric Morbidity"))
#3	(((((ALL=("GD")) OR ALL=("Transgender Persons")) OR ALL=("Transsexualism")) OR ALL=("Gender identity disorder")) OR ALL=("Transsexual*")) OR ALL=("Transgender*"))
#4	#1 AND #2 AND #3

Note: GD: Gender dysphoria.

meeting any of the following criteria were excluded from this review: the study was an editorial, a letter to the editor, a case-report containing a singular case, a systematic or narrative review or a meta-analysis; there was no group of patients undergoing GAS; there was no control group; suicide, suicide attempt, or suicidal ideation were not evaluated as outcomes; or there was insufficient data regarding the outcomes. The study selection was then reviewed by the second author.

Data Extraction

First, citations were imported into Mendeley. Then, the first author extracted data on the studies' sample population, control group used, type of surgical procedures performed, study design, methodology, and suicide-related outcomes. Studies were then divided into two categories based on control groups, and data was compiled in two tables.

Results

Searches identified 77 using PubMed articles and 75 using Web of Science articles, containing all three topics (transgender persons, GAS, and suicide). Using PubMed, studies were screened through title and abstract, leaving 18 studies that were read integrally, of which 11 met the inclusion criteria. Using the Web of Science, eight studies were read integrally, six of which were also found on PubMed, and two that met the inclusion and exclusion criteria. The study selection process is described in the PRISMA Guidelines flowchart in Figure 1.

A total of 31,943 individuals were included in this review. Although some studies acknowledged the difference between being transgender and having a GD diagnosis, their data collection did not factor this aspect except for the study by Zaliznyak et al.¹⁹

Of note, four studies were longitudinal, and the methods of assessment of outcomes differed in all studies. Reported time passed between the surgery and the post-surgery assessment varied between one month in the study by Heylens et al.,²⁰ the average of 11.4 years in the study by Dhejne et al.,²¹ 40 years in Park et al.,²² and between 1 and 4 years in Özata Yildzhan et al.²³

Out of the 13 studies, seven specified the type of procedure each participant underwent and two by Wilson et al.²⁴ and Tucker et al.²⁵ correlated the specific procedures with the outcomes relating to suicide.

Surgical outcomes such as satisfaction with appearance, pain during intercourse, the potential for orgasm, and procedure-specific complications were assessed by Stein et al.,²⁶ Imbimbo et al.,²⁷ and McNichols et al.,²⁸ although only Stein et al.²⁶ found a correlation between these outcomes and suicide-related outcomes.

Most studies evaluated external stressors, such as lack of family and friend support and experiencing transphobia, but most did not clarify whether they were present or absent in the patients who had poor suicide-related outcomes.

The authors decided to divide the studies into two groups and analyze them separately, considering that there were two main approaches: five studies focused on the same group of patients pre- and post-operatively, and six studies assessed a group of patients who underwent GAS and compared their outcomes to a group that did not. The specifics of each study are shown in Tables 3 and 4, respectively.

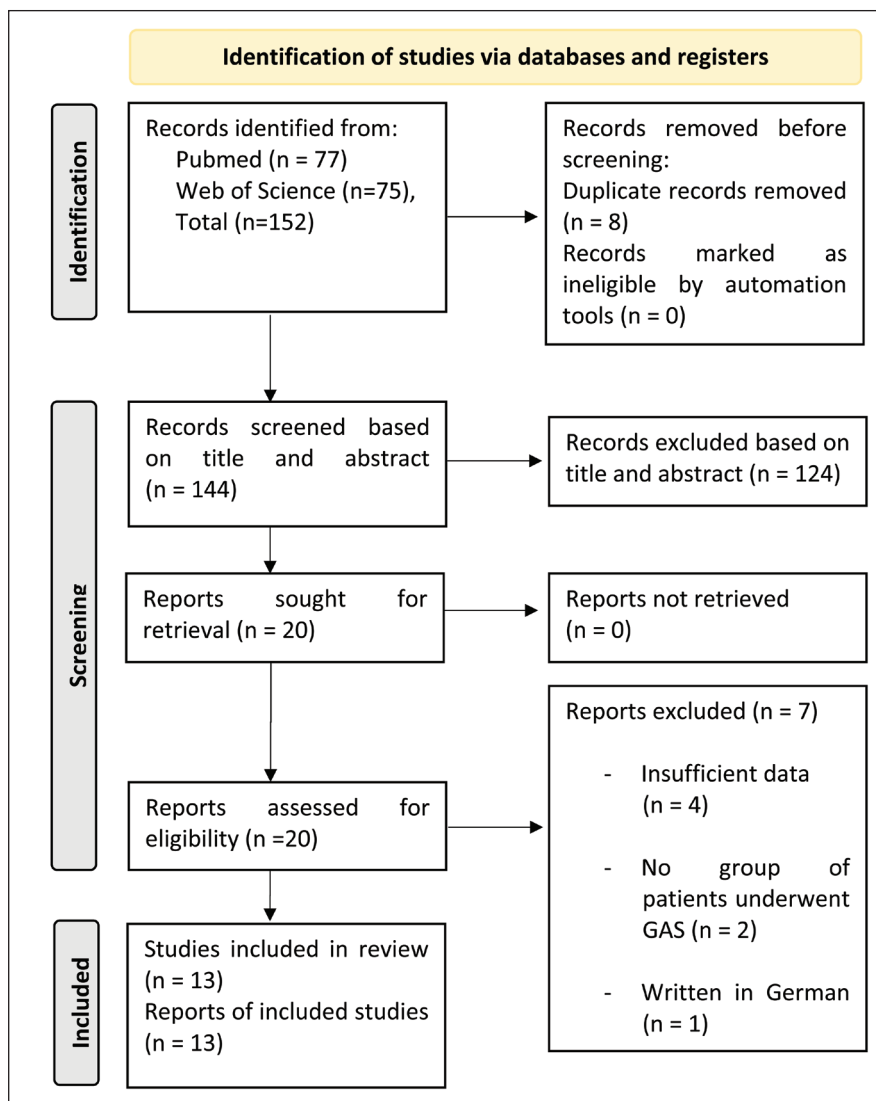


Figure 1. PRISMA Guidelines Flowchart.

Studies in which the Same Patients were Evaluated Pre- and Post-Operatively

The sample population ranged from 10 to 246 transgender persons per study, with a total of 584 subjects. The study by Zaliznyak et al.¹⁹ included exclusively patients with a GD diagnosis.

Suicidal ideation was assessed in four studies and found to be decreased post-GAS in two studies. Stein et al.²⁶ showed a decrease from 32% pre-GAS to 9% post-GAS and described the presence of positive external factors, such as a supportive partner, as an adjuvant to surgery in producing the results. However, support from friends and family was not found to be correlated. The authors also reported that the patients who maintained suicidal thoughts belonged to the group of patients who suffered post-op complications. McNichols et al.²⁸ found a decline from 27% pre-GAS to 14% post-GAS, reporting satisfaction with surgery-related outcomes as an

important co-factor. In the study by Imbimbo et al.,²⁷ suicidal ideation was assessed pre-operatively with half of the patients reporting its presence, but it was not assessed post-operatively. Heylens et al.²⁰ reported the presence of suicidal thoughts in 16.7% of patients post-operatively but did not measure it pre-operatively.

Suicide attempts were assessed in four studies and found to have decreased in two: Imbimbo et al.²⁷ showed a decrease from 7% pre-GAS to 2% post-GAS, which was credited to the successful surgical outcomes, and Zaliznyak et al.¹⁹ from 30% pre-GAS to 0% post-GAS, although 12% maintained suicidal ideation. One study by Heylens et al.²⁰ detected no statistically relevant decrease. McNichols et al.²⁸ reported that 27% of patients had a history of suicide attempts prior to GAS but did not state the percentage of patients who reported suicide attempts post-operatively.

Death by suicide was only considered the main outcome in Stein et al.²⁶ case report, which registered zero suicide post-GAS.

Table 3. Studies in Which the Same Patients were Evaluated Pre- and Post-Operatively.

Authors, Country, Year	Sample Population	Control Group	GAS	Type of Study, Follow Up Duration	Methods	Suicide-related Outcomes
Stein et al.²⁶ USA, 1990	N = 10 TM	The same group of patients, pre-operatively	Genital	Retrospective, interview 5–48 months after GAS	Original questionnaire	Suicide and suicidal ideation
Imbimbo et al.²⁷ Italy, 2009	N = 139 TW	The same group of patients, pre-operatively	Genital	Retrospective, interview 12–18 months after GAS	Original 38-questions questionnaire	Suicide attempt and suicidal ideation
Heylens et al.²⁰ Belgium, 2014	N = 57, 46 TW and 11 TM	The same group of patients, pre-operatively	Genital	Longitudinal, interview 1–12 months after GAS	Symptom Checklist-90 (SCL-90)	Suicide attempt and suicidal ideation
McNichols et al.²⁸ USA, 2020	N = 246 TM	The same group of patients, pre-operatively	94% mastectomy, 20.5% hysterectomy, 1.5% phalloplasty, 0.5% scrotoplasty, 0.5% prosthesis inserted	Retrospective, not specified how long since GAS	Original 22-question questionnaire	Co-existing psychiatric morbidity (suicidal ideation and attempts)
Zaliznyak et al.¹⁹ USA, 2021	N = 120, 155 TW and 55 TM (All with GD diagnosis)	The same group of patients, pre-operatively	Genital	Retrospective, not specified how long since GAS	Original questionnaire	Suicide attempt
Park et al.²² USA, 2022	N = 15, 6 TW and 9 TM (All with GD diagnosis)	The same group of patients, post-operatively after 40 years	Top, Bottom, Facial, Other	Retrospective Longitudinal, 40 years	Follow-Up questionnaire	Suicide attempt, Suicidal Ideation, Sexual Abuse, Physical Abuse

Note: TM, Transgender-men; TW, transgender-women.

Table 4. Studies in Which Patients Who had Undergone GAS were Compared to a Control Group that Had Not.

Authors, Year	Sample Population	Control Group	GAS	Type of Study; Follow Up Duration	Methods	Suicide-related Outcomes
Dhejne et al. ²¹ Sweden, 2011	N = 324, 191 TW and 133 TM	Same age and sex (birth and reassigned) individuals	Not specified	Cross-sectional, 11.4 years average post-GAS	Swedish National Registers	Psychiatric morbidity (suicide and risk for suicide attempts)
Bauer et al. ³⁰ Canada, 2015	N = 380, 52.6% female to male spectrum and 47.4% male to female spectrum N = 314 TW	Patients who desired or were in the process of transitioning	Not specified	Retrospective, not specified how long since GAS	Trans PULSE	Past-year suicidal ideation and suicide attempts
Wilson et al. ²⁴ USA, 2015		TW not submitted to surgery (on hormone therapy or none)	Breast and genital	Cross-sectional, not specified how long since GAS	Secondary analysis of a 2010 HIV surveillance study using respondent-driven sampling	Suicidal Ideation
Özata et al. ²³ Turkey, 2018	N = 50, 20 TW and 30 TM	Patients who desired GAS but had not undergone any procedure yet	Not specified	Longitudinal, interview 1–4, 1 year after	Structured Clinical Interview for DSM-IV TR Axis I Disorders (SCID-I)	Suicide attempt
Tucker et al. ²⁵ USA, 2018	N = 206, 178 TW and 28 TM	Patients solely on hormone therapy or hormone therapy + GAS	Not specified	Cross-sectional, not specified how long since GAS	Patient Health Questionnaire-9 (PHQ-9), Suicidal Behaviors Questionnaire – Revised (SBQ-R)	Suicidal ideation
Bränström et al. ²⁹ USA, 2020	N = 2679, 1284 TW and 1395 TM (All with “transsexualism” or “gender identity disorder” diagnosis)	General population	Breast or dermatological chest: 788; Genital: 540; Dermatological: 315; Laryngeal: 70	Cross-sectional, not specified how long since GAS	Swedish Total Population Register + National Patient Register and the Prescribed Drug Register	Hospitalization after a suicide attempt
Almazan et al. ³¹ USA, 2021	N = 27 715, 7751 (38.8%) TW, 6489 (32.5%) TM and 5300 (26.6%) nonbinary	Patients who desired GAS but had not undergone any procedure yet	Breast Genital Laryngeal Facial	Cross-sectional, at least 2 years after first GAS	Secondary analysis of the 2015 US Transgender Survey	Past-year suicidal ideation or suicide attempt

Note: TM, Transgender-men; TW, transgender-women.

Table 5. Quality Assessment of the Included Studies.

Title	Selection	Comparability	Outcome
Almazan et al. ³¹ USA, 2021	★ ★ ★ ★	★	★ ★ ★
Bränström et al. ²⁹ USA, 2020	★ ★ ★	★ ★	★ ★ ★
Bauer et al. ³⁰ Canada, 2015	★ ★ ★ ★	★ ★	★ ★ ★
Dhejne et al. ²¹ Sweden, 2011	★ ★ ★ ★	★	★ ★ ★
Heylens et al. ²⁰ Belgium, 2014	★ ★ ★ ★	★	★ ★ ★
Imbimbo et al. ²⁷ Italy, 2009	★ ★ ★ ★	★	★ ★
McNichols et al. ²⁸ USA, 2020	★ ★ ★ ★	★	★ ★ ★
Özata et al. ²³ Turkey, 2018	★ ★ ★ ★	★ ★	★ ★ ★
Park, et al. ²² USA, 2022	★ ★ ★ ★	★	★ ★ ★
Stein et al. ²⁶ USA, 1990	★ ★ ★ ★	★	★ ★ ★
Tucker et al. ²⁵ USA, 2018	★ ★ ★	★	★ ★ ★
Wilson et al. ²⁴ USA, 2015	★ ★ ★ ★	★	★ ★ ★
Zaliznyak et al. ¹⁹ USA, 2021	★ ★ ★ ★	★ ★	★ ★ ★

Overall, suicide-related outcomes were found to be less frequent in patients after GAS when compared to the same patients' indicators before GAS.

Studies in Which Patients Who Underwent GAS were Compared to a Control Group that Did Not

The sample population ranged from 314 to 27,715 transgender persons per study for a total of 31,618 subjects. The study by Bränström and Pachankis²⁹ included exclusively transgender people diagnosed with gender identity disorder or transsexualism, according to the ICD-10.

Suicidal ideation was assessed in four studies. The study by Bauer et al.³⁰ concluded that there was a progressive reduction in suicidal ideation from patients who were planning to transition to those who were in the process of transitioning to the ones who had completed transition. Wilson et al.²⁴ showed that suicidal ideation rates were higher on transgender women that did not receive transition medical care (75.2%) and lower in transgender women on hormone therapy (51.3%) and who had breast surgery (51.5%). However, the study also showed that the suicidal ideation rates of women who had genital surgery were like those of the women who did not receive transition-related medical care (73.5%). The study by Tucker et al.²⁵ showed lower frequencies of suicidal ideation in the

patients who had histories of both hormone intervention and surgery on both the chest and genitals in comparison with those who endorsed a history of no medical intervention, a history of hormone therapy but no surgical intervention, and those with a history of hormone therapy and surgery on either (but not both) the chest or genitals. Almazan and Keuroghlian³¹ concluded that suicidal ideation was lower in patients who had undergone surgery when compared to transgender people who desired to but had not yet been submitted to it.

Suicide attempts and a variation of this outcome (hospitalization for a suicide attempt) were assessed in four studies. The study by Dhejne et al.²¹ concluded that the risk for suicide attempts was higher in transgender persons post-surgery than for same age and sex (at birth and reassigned) controls (7.9 vs 0.1/1000 person years). Bauer et al.³⁰ found that, amongst the sub-group with suicidal ideation, being in the process of transitioning was significantly associated with increased risk of an attempt in comparison to those who were planning to transition but had not started the process. The study by Bränström and Pachankis²⁹ accounted for a total of 22 hospitalizations for suicide attempts by transgender people in the year in which data was retrieved, concluding that the absolute number of attempts reduced in function of time since surgery. In this study, amongst those who received their last gender-affirming surgery more than 3 years before, no suicide attempts were registered; however, the absolute percentage was still statistically significant in relation to the general population

(0.8% vs 0.1%). Lastly, Almazan and Keuroghlian³¹ reported no statistically significant difference in suicide attempts between patients who had undergone surgery and those who had not but wished to. However, in a posterior assessment, the patients who had undergone the surgeries they had previously desired had significantly lower odds of past-year suicide attempts.

Death by suicide was assessed in one study by Dhejne et al.,²¹ which showed that death by suicide was much higher in sex-reassigned persons than for controls of the same birth sex and reassigned sex (2.7 vs 0.1/1000 person-years).

The two studies that compared with either the general population²⁹ or matched controls²¹ found a much higher prevalence of suicide-related outcomes in patients post-GAS than in the control group, specifically of suicide attempts and suicide deaths. However, the studies that compared patients either on an earlier phase of the transition^{24,25,30} or that desired surgery but had not yet undergone it³¹ showed lower occurrences of suicide-related outcomes post-GAS, specifically suicidal ideation and suicide attempts.

Quality Assessment

The quality of the studies that were selected to be included in this review was assessed using the Newcastle-Ottawa Quality Assessment Form for cohort and case control studies resulting in 11 cohort studies and two case controls.

Discussion

Suicidal ideation was mostly found to decrease post-GAS, both when compared to the same patients pre-GAS and to a group that had not undergone GAS. Some studies found that there was no decline in the prevalence of suicide ideation post-GAS if the patient only underwent one surgery instead of multiple²⁵ and if the procedure was genital surgery alone in transwomen.²⁴ This is understandable, considering one surgery is rarely enough to alter an individual's physical appearance and impact their social and public presentation, especially genital procedures performed alone. Despite showing improvement in suicidal ideation, Stein et al.²⁶ proposed an explanation for the patients who maintained suicidal thoughts, stating that they belonged to the group of patients who had suffered post-op complications. This finding highlights the importance of assessing and interpreting surgical outcomes.

The results on suicide attempts were contradictory. In the study by Zaliznyak et al.,¹⁹ in which the sample was solely constituted by patients with a GD diagnosis, there was a significant decrease in suicide attempts, with none being reported after GAS. This can support the benefits of GAS in this group of patients. One study by Bauer et al.³⁰ reported interesting results, stating that amongst the sub-group with suicidal

ideation, being in the process of transitioning was significantly associated with increased risk of a suicide attempt in comparison to those who were planning to transition but had not started the process. Once more, this could be justified by the social distress associated with being in the early stages of physical modification, leading individuals to be socially recognized as transgender. Heylens et al.²⁰ showed no relevant change in suicide attempts pre- and post-GAS; Dhejne et al.²¹ and Bränström and Pachankis²⁹ showed higher risk for suicide attempts in trans individuals post-GAS when compared to the general population and Almazan and Keuroghlian³¹ found no statistical difference in suicide attempts between patients who had undergone GAS and patients who did not but wished to. However, neither of these studies attempted to explain the results based on possible unsatisfactory surgical outcomes or the presence of external stressors, as they were not evaluated.

Some limitations must be considered in the interpretation of these results. In fact, conclusions on the impact of GAS on death by suicide were especially hard to draw considering that most studies were dependent on patients' responses, understandably requiring a living patient. Therefore, an analytical method of data retrieval was necessary in the evaluation of this outcome. Only two studies by Stein et al.²⁶ and Dhejne et al.²¹ evaluated this outcome and their results were conflicting, with the first showing reduction post-GAS and the latter showing a higher rate post-GAS when compared to matched controls. However, neither allows firm conclusions since the first is a case report with a small sample size and the latter, while having a more robust study design, does not account for surgical outcomes or external stressors and compares with an inadequate control group, as it underestimates the effect of GAS in its target population.

Overall, studies evaluating patients post-GAS have multiple measures of psychopathology and psychosociology, but there is a lack of studies evaluating suicide-related outcomes post-GAS, and fewer focusing specifically on this subject.

One of the biggest difficulties in drawing conclusions is related to each of the studies' designs. Most studies were either cross-sectional or retrospective, which do not allow for firm associations, and the one that was prospective had a short follow-up period. This can overestimate the effect of instant fulfillment when getting a desired surgical procedure and underestimate the actual long-term consequences in the lives of the patients.

The sample sizes are also a weak point of the studies, especially those that compare the same patients pre- and post-operatively. The largest sample size in this format of study was composed of only 246 patients.

In some studies, the validity of the results was challenged by the inadequate choice of control groups. The ideal control group would be constituted of patients who desired GAS but had not been submitted to it or, alternatively, the study would be longitudinal and compare with the same patients' data before GAS. When comparing with the general population or matched controls, it is harder to eliminate confounding

factors that can contribute to the results other than GAS, such as specific community-related issues, which can explain the results of Dhejne et al.²¹ and Bränström and Pachankis.²⁹ This is consistent with Meyer's Minority Stress Model,³²⁻³⁴ which proposes that the disparity in health indicators among minorities is mostly explained by external stressors rather than by internal stressors related to the aspect that makes them a minority per se. It would be beneficial to understand which other variables known to influence these outcomes were present in each patient, for instance, whether the patient had family and significant others' support or had been the victim of interpersonal aggressions.

Another obstacle is the methodological variability between studies in terms of the specific surgical procedures, methods of assessment, and timing between surgery and assessment of outcomes. Most studies generalized GAS as one single intervention, but, as suggested by Wilson et al.²⁴ and Tucker et al.,²⁵ different types of surgical procedures generate different outcomes, which highlights the relevance of this analysis. This could also mean a possible disparity in outcomes for transmen and transwomen, an outcome that was not thorough evaluated. In relation to the means of assessment, all studies used different, and often not validated, questionnaires when evaluating the patients, which decreases the studies' external validity. In addition, the timing of assessment was inconsistent from one study to another, which can also influence results since, as demonstrated by Bränström and Pachankis,²⁹ the frequency of these outcomes varies with time. Comparing data extracted around the same period in the patients' transition and on multiple occasions over a long follow-up period would be relevant to this analysis.

Additionally, it would also be important to determine the exact level of care each individual has been subjected to. As discussed, gender affirmation is multidimensional and can involve a combination of multiple strategies; therefore, it becomes difficult to isolate the effect of GAS from other interventions, more specifically from the effect of hormone therapy, if the level of care is not disclosed beforehand. For instance, in the study by Wilson et al.,²⁴ it is stated that most women who had surgery were also on hormone therapy and the results for the women who were only on hormone therapy were not shown, making it harder to understand the effect of GAS alone. Similarly, in the study by Bauer et al.,³⁰ the terms "planning to transition," "being in the process", and "completing" are not clarified for the exact medical care the patient has received. For this reason, it is complicated to draw conclusions about the real effect of GAS on these patients.

Finally, the patients' dissatisfaction with the technical quality of the surgical procedures was a frequently overlooked variable that could justify poor suicide-related results, as stated by Stein et al.²⁶ Surgery-related outcomes such as the individuals disliking their new appearance, feeling pain during intercourse, or losing the ability to have sexual pleasure can damage the patients' quality of life to the

point of self-harm. Not assessing the surgical outcomes can cause the authors to mistakenly attribute the suicide-related outcomes to dysphoria alone and underestimate GAS' potential to improve these indicators.

Conclusion

A wide scope of results was found on the prevalence of suicide-related outcomes once transgender persons got access to desired surgical affirming procedures. The most unanimous finding was the decrease in suicidal ideation post-GAS, with some studies adding the relevance of undergoing more than one surgery and highlighting the impact of breast surgery over other procedures. Results on the prevalence of suicide attempts were less promising, with some studies showing a decrease post-GAS and others showing no relevant variation or a higher prevalence than the general population. The inconsistency of results could be explained by the studies' small sample sizes, variety in methodology, poor choice of control groups, lack of evaluation of external stressors and dismissal of surgery-related outcomes. Such variability makes it difficult to draw conclusions and predict the success of surgical interventions. Conclusions on GAS' influence on suicide deaths cannot be drawn due to the low quantity and quality of evidence.

In the future, longitudinal studies should be conducted, ideally with larger sample sizes, longer follow-ups, specialized assessments, the evaluation of external stressors, disclosure and discussion of surgical procedures and surgery-related outcomes. As well as with adequate control groups, such as groups constituted of patients who desire GAS but have not been submitted to it.

It should be noted that this review focused solely on suicide-related outcomes, considering most psychological outcomes have already been shown to be improved by GAS. When deciding whether to submit a patient to surgery, not only the suicidality aspects should be considered, but each patient's characteristics and the prospect of an enhancement in the quality of life.

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