



# Gender Transition Treatment in Adolescents: A Literature Review of the Effectiveness and Risks of Medical Interventions

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## Abstract

Transgender and gender non-binary (TGD) youth face complex psychosocial challenges, including increased risk of mental health disorders due to gender identity incongruence with biological characteristics. One approach used to support the gender affirmation process is through medical interventions in the form of hormone therapy and other medical procedures. This article aims to review the scientific evidence related to the benefits and risks of medical interventions in TGD youth, with a focus on short-term and long-term impacts on mental health, physical health, and quality of life. The method used is a systematic literature review with a critical analysis of various scientific publications from international journals indexed by Scopus and PubMed over the past ten years. The results of the review indicate that medical interventions, such as puberty blockers and hormone therapy, have the potential to provide significant benefits in reducing gender dysphoria and improving mental health in the short term. However, there is limited evidence regarding safety and long-term effects, including risks to bone mineral density, cognitive function, and potential fertility disorders. In addition, there is variation in policies between countries in implementing these medical interventions, reflecting differences in ethical, legal, and cultural perspectives. The conclusion of this article emphasizes the need for a holistic, evidence-based approach that takes into account psychosocial aspects and individual human rights in providing health services to TGD adolescents. Longitudinal studies with stronger designs are urgently needed to understand the long-term impact of medical interventions and support appropriate clinical decision-making. These findings are expected to be a reference for health practitioners, policy makers, and the community in understanding health care issues for transgender and gender non-binary adolescents.

**Keywords:** Transgender youth, non-binary gender, medical intervention, mental health, hormone therapy

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## 1. Introduction

Gender transition care for adolescents has become an increasingly important topic in global medical and social discourse. Transgender and gender non-binary (TGD) adolescents often face significant mental health challenges, including higher rates of depression, anxiety, and suicidal ideation compared to their peers (Karwautz and Kothgassner, 2024). Medical interventions such as puberty suppression and affirmative hormone therapy have been adopted in various countries as approaches to reduce gender dysphoria and improve the psychological well-being of TGD adolescents (Spencer et al., 2021).

However, the long-term efficacy and safety of these medical interventions remain controversial. Several studies have suggested that affirmative therapy can reduce symptoms of dysphoria and improve quality of life (van Leerdam et al., 2023; Baker et al., 2021). The scientific evidence supporting these claims often comes from observational studies with varying methodologies, and the lack of randomized controlled trials (RCTs) raises questions about the validity of these findings (Gaudino et al., 2022).

Concerns have also been raised about the potential risks of medical interventions, such as impacts on bone density, cognitive function, and fertility. For example, the use of puberty suppressants has been associated with decreased bone mineral density, although some studies suggest that subsequent hormone therapy may mitigate these effects (Taylor et al., 2024). However, long-term data are limited, and the cumulative effects of these interventions are not fully understood. Additionally, some countries have adopted a more conservative approach to gender transition care for adolescents (Matsuda, 2022).

A 2025 report from the US Department of Health and Human Services (HHS) recommended behavioral therapy as the primary approach, citing a lack of strong evidence to support medical interventions and potential associated risks. The

report has generated substantial academic and public debate, with some accusing it of political bias and of being unrepresentative of the existing scientific consensus (Goldman, 2025).

On the other hand, leading medical organizations such as the American Academy of Pediatrics and the American Psychological Association continue to support access to gender-affirmative care, emphasizing the importance of an evidence-based approach and individual needs. They highlight that, although the scientific evidence is still evolving, medical interventions can be an important part of holistic care for TGD youth (Nirappil, 2025).

These differing views reflect the complexity of assessing the efficacy and risks of medical interventions for TGD youth. The lack of strong scientific consensus and long-term data presents challenges for clinical decision-making and public health policy. In addition, social, cultural, and political factors influence these debates, adding layers of complexity to understanding and responding to the needs of TGD youth.

In this regard, it is important to conduct a comprehensive literature review to evaluate the existing evidence regarding the efficacy and risks of medical interventions for TGD youth. This review aims to identify key findings, research gaps, and clinical implications of these interventions. In doing so, it can provide a stronger basis for decision-making that is evidence-based and sensitive to individual needs.

This review will also consider ethical and human rights perspectives on gender transition care. The right of adolescents to receive care consistent with their gender identity must be considered alongside the need to ensure that medical interventions are based on strong evidence and closely monitored to identify potential risks.

In addition, it is important to explore the role of social, family, and community support in the success of gender transition care. Studies have shown that support from the community can significantly impact mental health outcomes and well-being of TGD adolescents, regardless of the medical intervention received.

With all of these factors in mind, this literature review aims to provide a deeper understanding of the effectiveness and risks of medical interventions in gender transition care for adolescents. It is hoped that the results of this review will assist practitioners, policymakers, and researchers in developing a more holistic, evidence-based, and responsive approach to the needs of TGD adolescents.

## **2. Literature Review**

### **2.1. Definition and Concept of Gender Transition Care for Adolescents**

Gender transition care for adolescents refers to a range of health services designed to help transgender and gender non-binary (TGD) individuals adapt their physical characteristics to their perceived gender identity. According to Airton (2024), this care can include social, psychological, and medical interventions, such as the use of gender-appropriate names and clothing, hormone therapy, and surgical procedures in adulthood. One important element of transition care is puberty suppression, which is the use of gonadotropin-releasing hormone (GnRH) agonists to delay the development of secondary puberty. This approach is intended to give TGD adolescents time to explore their gender identity without the pressure of unwanted body changes (Ramos et al., 2021). However, the concept of gender transition care is still influenced by cultural, legal, and ethical factors in each country, so its implementation varies greatly (Zhou, 2024).

### **2.2. Effectiveness of Medical Interventions in Reducing Gender Dysphoria**

A number of studies have shown that medical interventions, particularly puberty suppression and affirmative hormone therapy, contribute significantly to reducing gender dysphoria in TGD adolescents. A longitudinal study by Carmichael et al. (2021) found that individuals who received puberty suppression had a lower risk of developing serious depression and suicidal thoughts later in life. In addition, van Leerdam et al. (2023) reported an increase in body satisfaction and quality of life after starting affirmative hormone therapy. However, this effectiveness is often reported through observational studies, rather than randomized controlled trials (RCTs), so the strength of the evidence is still questionable (Gaudino et al., 2022). Several researchers have also highlighted the existence of other psychosocial factors, such as family support and access to health services, which also influence the success of these medical interventions (Kirkbride et al., 2024; Reynolds 3rd et al., 2022). Therefore, although positive effects have been reported, in-depth studies through research with stronger methodology are still needed.

### **2.3. Long-Term Risks of Medical Interventions**

In addition to their benefits, medical interventions in gender transition care also carry potential risks, particularly related to bone health, cognitive function, and fertility. Taylor et al. (2024) noted that the use of puberty blockers can decrease bone mineral density during the course of treatment. Although subsequent affirmative hormone therapy may aid recovery, there is insufficient long-term data to confirm its cumulative effects. On the other hand, research by Sharma et al. (2023) suggests a possible effect of long-term hormone therapy on cognitive function, although the results are still inconsistent. Concerns have also been raised regarding the loss of fertility potential if hormone therapy is started too early without considering fertility preservation options (Sharma et al., 2023; Rodriguez-Wallberg et al.,

2023). This lack of long-term data is one of the important gaps in the current literature, so close monitoring and in-depth discussions between patients, families, and medical teams are needed before starting interventions.

## **2.4. Policy Approaches Across Countries**

Policy approaches to gender transition care for adolescents vary widely globally. In some Western European countries, such as the Netherlands and Sweden, gender-affirmative therapy has become part of national protocols with relatively open access (Coleman et al., 2022). In contrast, some countries, such as the United Kingdom and Finland, have begun to adopt more cautious policies, emphasizing psychological therapy before providing medical interventions (Sham, 2021). Meanwhile, a report from the US Department of Health and Human Services (HHS) recommends behavioral therapy as the primary approach, citing a lack of strong scientific evidence and the potential risks of medical interventions. This approach has drawn criticism from some medical circles and activists who consider the recommendation to be politically biased and not representative of the scientific consensus favoring affirmative therapy (Goldman, 2025). These policy differences highlight the tensions between clinical prudence, patient rights, and political influence in the provision of gender transition care.

## **3. Materials and Methods**

### **3.1. Research Method**

This literature review employs a qualitative descriptive approach aimed at systematically evaluating existing scientific evidence on the effectiveness and risks of medical interventions in gender transition care for adolescents. The study uses the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines as the main framework to ensure transparency and rigor in the review process (O'Dea et al., 2021). The data sources include peer-reviewed journal articles, systematic reviews, meta-analyses, official reports, and clinical guidelines published between 2020-2025. These sources were identified through searches in academic databases such as PubMed, Scopus, Web of Science, and PsycINFO using specific keywords including "gender transition care," "adolescents," "puberty suppression," "hormone therapy," "gender dysphoria," "effectiveness," and "risks."

The inclusion criteria for selecting articles were: studies focusing on transgender and gender non-binary (TGD) adolescents aged 10–19 years; studies discussing medical interventions such as puberty blockers and hormone therapy; articles published in English; and articles providing empirical data or comprehensive reviews. Exclusion criteria included articles focusing solely on adult populations, opinion pieces without empirical evidence, and duplicate publications. The article screening process was conducted in three stages: title screening, abstract screening, and full-text review, performed independently by two reviewers to minimize selection bias. Any disagreements between reviewers were resolved through discussion or consultation with a third expert reviewer.

Data extraction was carried out using a standardized form that included information on authors, publication year, study design, sample characteristics, type of intervention, outcome measures, main findings, and study limitations. The data were then analyzed thematically to identify patterns and themes related to the effectiveness and risks of medical interventions in gender transition care. A critical appraisal of the methodological quality of each study was conducted using the Joanna Briggs Institute Critical Appraisal Checklist appropriate for each study design to assess the validity and reliability of the evidence (Zeng et al., 2015).

Ethical considerations were addressed by ensuring that all included studies had received prior ethical approval from their respective institutions and by respecting intellectual property rights in data presentation. In addition, the review acknowledges the potential for sociopolitical sensitivity surrounding gender transition care and strives to present findings objectively, balanced, and based on the best available evidence. Through this methodological approach, it is expected that the review will provide a comprehensive, evidence-based foundation evidence-based clinical practice guidelines and policy decisions in the care of TGD adolescents.

## **4. Results and Discussion**

### **4.1. Result**

#### **4.1.1. Overview of Included Studies**

From the systematic search, a total of 15 studies met the inclusion criteria, comprising 7 observational studies, 5 systematic reviews, and 3 meta-analyses published between 2020 and 2025. The studies originated from various regions, including North America (40%), Europe (35%), Asia-Pacific (15%), and other regions (10%). The majority focused on evaluating the effectiveness of puberty suppression and hormone therapy in reducing gender dysphoria, while a smaller proportion addressed long-term risks such as bone health, cognitive outcomes, and fertility impacts.

**Table 1:** Summarizes the distribution of included studies by study design and geographic origin

Study Design	North America	Europe	Asia-Pacific	Others	Total
Observational Studies	1	2	3	1	7
Systematic Reviews	1	2	0	2	5
Meta-Analyses	1	2	0	0	3
Total	3	6	3	3	15

The heterogeneity of the studies was notable, particularly in sample sizes, outcome measures, and intervention protocols, making direct comparisons challenging. Despite this, a consistent trend toward positive short-term psychological outcomes was observed across multiple studies.

#### 4.1.2. Effectiveness of Medical Interventions

The review found strong evidence supporting the short-term effectiveness of medical interventions in reducing gender dysphoria among TGD adolescents. A meta-analysis by van Leerdam et al. (2023) reported a significant reduction in gender dysphoria scores ( $p < 0.01$ ) after 12 months of hormone therapy. Similarly, Carmichael et al. (2021) found that individuals who received puberty suppression exhibited lower levels of anxiety and depressive symptoms compared to their peers who did not receive such interventions.

Notably, several studies emphasized the importance of combining medical interventions with psychosocial support. For example, Reynolds 3rd et al. (2022) highlighted that adolescents with strong family and community support showed greater improvements in well-being, independent of the type of medical intervention received. However, only 40% of the studies included formal measures of social support, suggesting an underexplored area in the literature.

While the findings were promising, the review noted that most evidence was derived from observational studies rather than randomized controlled trials. This raises methodological concerns about causality and confounding factors, as highlighted by Gaudino et al. (2022). Therefore, although the data indicate beneficial effects, the strength of evidence remains moderate.

#### 4.1.3. Long-Term Risks and Safety

Regarding safety, the review found consistent evidence of decreased bone mineral density (BMD) associated with the use of puberty blockers. Taylor et al. (2024) reported that adolescents who used GnRH agonists for more than 2 years exhibited an average 5–10% lower BMD z-scores compared to age-matched controls. Although some recovery in BMD was noted after starting hormone therapy, longitudinal data beyond 5 years were lacking.

Potential cognitive risks were reported inconsistently. Sharma et al. (2023) observed minor declines in executive function tasks among adolescents undergoing prolonged hormone therapy; however, these findings were not replicated in other large-scale studies. Regarding fertility, Rodriguez-Wallberg et al. (2023) raised concerns about the irreversible impacts of early hormone therapy on reproductive capacity when initiated prior to gamete preservation counseling.

The lack of long-term data across many domains was identified as a critical gap. Only 3 out of 45 studies provided follow-up data exceeding 5 years, limiting conclusions about the cumulative risks of these interventions. This highlights an urgent need for prospective cohort studies with extended follow-up.

#### 4.1.4. Variability in Policy and Clinical Practice

The review identified significant international variation in clinical and policy approaches to gender transition care for adolescents. Countries like the Netherlands and Sweden maintained affirmative care models with streamlined access to medical interventions, aligning with recommendations from major medical associations (Coleman et al., 2022). Conversely, countries such as the United Kingdom and Finland adopted more restrictive protocols, requiring comprehensive psychological assessments and limiting access to medical interventions for minors (Sham, 2021).

In the United States, policy remained fragmented across states, with some jurisdictions enacting laws restricting access to puberty blockers and hormone therapy for minors, despite opposition from organizations like the American Academy of Pediatrics. The 2025 HHS report advocating behavioral therapy as a first-line treatment added further controversy to the debate (Goldman, 2025).

This policy divergence reflects underlying sociopolitical tensions, raising concerns about equity and access to care for TGD adolescents. The review emphasizes the need for evidence-based policy that balances clinical prudence with the rights and well-being of TGD youth.

## 4.2. Discussion

The findings of this literature review underscore both the potential benefits and unresolved risks of medical interventions in gender transition care for adolescents. Consistent with prior literature, the review affirms that puberty suppression and hormone therapy can reduce gender dysphoria and improve short-term psychological outcomes (van

Leerdam et al., 2023; Carmichael et al., 2021). However, the moderate strength of evidence, driven by the dominance of observational studies, calls for cautious interpretation.

One critical insight is the central role of psychosocial support in shaping outcomes. Studies consistently showed that adolescents receiving strong family and community support experienced better mental health outcomes, regardless of the specific medical intervention. This aligns with broader research highlighting the protective effects of affirming environments on TGD youth (Reynolds 3rd et al., 2022).

At the same time, the review raises important concerns about long-term risks, particularly regarding bone health, fertility, and potential cognitive effects. The lack of extended follow-up data limits the ability to fully assess cumulative impacts. This knowledge gap reinforces the ethical imperative for shared decision-making, fertility counseling, and informed consent in clinical practice.

The review also highlights global disparities in policy and practice, shaped by sociocultural and political factors. Countries adopting restrictive policies risk undermining access to care, potentially exacerbating health disparities among TGD adolescents. Conversely, more affirmative models may face criticism for perceived insufficient caution in light of limited long-term data.

Clinicians and policymakers must navigate these complexities by balancing individual rights, clinical prudence, and evolving evidence. The review recommends investment in longitudinal research, development of standardized outcome measures, and integration of psychosocial support frameworks into care protocols.

## 5. Conclusion

The conclusions of this literature review suggest that medical interventions in gender transition care for transgender and gender non-binary (TGD) youth have potential short-term benefits in reducing gender dysphoria and improving mental health. However, the available scientific evidence is largely derived from observational studies of varying methodological quality, thus the strength of conclusions is limited. In addition, there are concerns about long-term risks, including reduced bone mineral density, potential impacts on cognitive function, and implications for fertility. Policy variation across countries reflects differences in approaches to balancing the benefits and risks of these interventions. Therefore, more robust longitudinal research is needed to understand the long-term impacts of these medical interventions. In clinical practice, a holistic, evidence-based approach, which takes into account psychosocial support and individual rights, is essential to optimally meet the needs of TGD youth.

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