Oregon Health & Science University
School of Medicine

Scholarly Projects Final Report

Title *(Must match poster title; include key words in the title to improve electronic search capabilities.)*

Assessment of Clinical Outcomes in Transgender Orthopaedic Patients

Student Investigator's Name

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Date of Submission *(mm/dd/yyyy)*

Graduation Year

2026

Project Course *(Indicate whether the project was conducted in the Scholarly Projects Curriculum; Physician Scientist Experience; Combined Degree Program [MD/MPH, MD/PhD]; or other course.)*

Scholarly Project Curriculum

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Scholarly Project Final Report

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Project/Research Question

Do transgender and gender diverse patients have worse outcomes perioperatively compared to cisgender patients in orthopaedic surgery?

Type of Project *(Best description of your project; e.g., research study, quality improvement project, engineering project, etc.)*

Research study

Key words *(4-10 words describing key aspects of your project)*

Transgender orthopaedic patients, orthopaedic surgery, gender diverse patients, nonbinary patients, surgical outcomes

Meeting Presentations

If your project was presented at a meeting besides the OHSU Capstone, please provide the meeting(s) name, location, date, and presentation format below (poster vs. podium presentation or other).

None

Publications *(Abstract, article, other)*

If your project was published, please provide reference(s) below in JAMA style.

None

Submission to Archive

Final reports will be archived in a central library to benefit other students and colleagues. Describe any restrictions below (e.g., hold until publication of article on a specific date).

None

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Next Steps
What are possible next steps that would build upon the results of this project? Could any data or tools resulting from the project have the potential to be used to answer new research questions by future medical students?

Future research should include multicenter collaborations, collection of patient-reported outcomes, and longitudinal data to better understand functional recovery, satisfaction, and the influence of gender-affirming therapies on orthopaedic outcomes. Additionally, cohort studies with cisgendered comparison cohorts should be performed to better characterize and compare outcomes data.

Please follow the link below and complete the archival process for your Project in addition to submitting your final report.

https://ohsu.ca1.qualtrics.com/jfe/form/SV_3ls2z8V0goKiHZP

Student's Signature/Date *(Electronic signatures on this form are acceptable.)*
This report describes work that I conducted in the Scholarly Projects Curriculum or alternative academic program at the OHSU School of Medicine. By typing my signature below, I attest to its authenticity and originality and agree to submit it to the Archive.

Student's Full Name: Eden VanderHoek

Mentor's Approval *(Signature/date)*

3/18/2026

Scholarly Project Final Report

Report*: Information in the report should be consistent with the poster, but could include additional material. Insert text in the following sections targeting 1500-3000 words overall; include key figures and tables. Use Calibri 11-point font, single spaced and 1-inch margin; follow JAMA style conventions as detailed in the full instructions.*

Introduction *(≥250 words)*

In the United States, approximately 2.1 million adults identify as transgender, defined as gender identity that differs from one's sex assigned at birth (SAB).[1,2] As a variable, biological sex of individuals has been used broadly in medicine as an independent risk determinant and predictor for clinical outcomes.[3] In orthopaedic surgery, for example, sex-based differences have been well integrated into reporting of surgical outcomes; however, such studies overwhelmingly report on cisgender patient populations, and there remains a paucity of literature examining clinical outcomes that accompany transgender and gender diverse (TGD) identity when receiving orthopedic care.[4] For example, while orthopaedic sports surgeries such as ACL reconstruction are well-studied in cisgender populations, outcomes in TGD patients remain largely uncharacterized.[5–7] Given the rising number of TGD individuals requiring and seeking orthopaedic care, understanding perioperative outcomes in this population is critical in striving for equitable and evidence-based practice.

Despite the long-recognized existence of TGD individuals, the lack of research pertaining to these patients' healthcare outcomes presents a notable obstacle to making improvements in caring for this population. This fundamental gap in the literature limits data-driven counseling, shared decision-making and informed practice in a population experiencing substantial growth, with a resulting increase in demand for orthopaedic care. Addressing this care gap is a vital next step in identifying and mitigating potential inequities in healthcare delivery faced by TGD patients. In addition to healthcare equity data, understanding orthopaedic outcomes in TGD patients may also reveal potential orthopaedic implications related to exogenous gender-affirming therapies. Many TGD individuals are prescribed gender-affirming hormone therapies in the US primary care setting, which may impact musculoskeletal health.[8,9] Knowledge of bone health and post-operative implications in gender diverse individuals is important to ensuring proper counseling and care of these patients in the orthopaedic setting.

This study seeks to provide data that will allow for more appropriate and equitable orthopedic care for the transgender population. The purpose of this study was to investigate outcomes of transgender and gender-diverse orthopaedic patients who received orthopaedic sports surgery at a single institution. Secondarily, this project aimed to provide descriptive statistics of a gender-diverse patient cohort to provide baseline inference into the quality of care received by these individuals.

Methods *(≥250 words)*

Following institutional review board approval, a retrospective review of electronic medical records (EMR) was conducted at a single tertiary care academic medical center to identify TGD patients who underwent orthopaedic sports surgery between January 1, 2010, and December 31, 2023. Eligible patients were adults aged 18 years or older at the time of surgery. For this study, "transgender and gender diverse" individuals were defined as those identifying as either transgender (transwoman or transman) or nonbinary. Gender

data was determined based upon EMR documentation, including clinician chart notation and structured EMR fields documenting gender identity and sex assigned at birth (SAB).

Once eligible patients were identified, demographic and clinical data were extracted to characterize the study population and evaluate perioperative orthopaedic outcomes. Demographic variables included age at the time of surgery, gender identity, and SAB. Medical comorbidities were also recorded. Information related to gender-affirming care was collected when available, including history of gender-affirming hormone therapy and prior gender-affirming surgical procedures. Surgical and perioperative variables were collected to describe orthopaedic presentations and management. These included surgical diagnosis, procedure type, and American Society of Anesthesiologists (ASA) physical status classification. Additional healthcare utilization variables related to the orthopaedic condition were recorded, including referral timeline and aspects of perioperative care.

Descriptive statistics were used to summarize demographic characteristics, surgical variables, and perioperative outcomes within the TGD cohort. Given the exploratory nature of this study and the limited number of eligible patients, the analysis was designed to descriptively characterize perioperative outcomes rather than perform comparative statistical testing.

Results *(≥500 words)*

A total cohort of 393 patients was initially queried from the electronic medical record (EMR) using documentation related to transgender or gender-diverse identity among orthopaedic patients seen between 2010 and 2023. Following this query, manual EMR review was performed by the research team to confirm gender identity through chart documentation, including clinician notes and structured EMR fields documenting gender identity and sex assigned at birth (SAB). After this review process, 121 patients were determined to be cisgender and were therefore excluded from further analysis. The remaining cohort consisted of 272 patients with confirmed transgender or gender-diverse identities who were evaluated by orthopaedic services during the study period, 70 of which underwent orthopaedic surgery. Among these individuals, 24 patients were treated within the orthopaedic sports medicine division, while the remaining surgical patients were managed by other orthopaedic subspecialties including trauma (13 patients), joints (8), foot and ankle (5), hand and upper extremity (9), spine (7) and oncology (4) and were thus excluded from analysis.

Within the orthopaedic sports cohort, 24 gender-diverse patients undergoing a total of 29 orthopaedic sports procedures were identified. Among these patients, 33.3% identified as transmen, 8.3% as transwomen, and 58.3% as nonbinary (Figure 1). In terms of sex assigned at birth, 79.2% of patients were assigned female at birth (AFAB) and 20.8% were assigned male at birth (AMAB). The mean age at the time of surgery was 29.5 years, with a range from 18 to 40 years. Based on American Society of Anesthesiologists (ASA) physical status classification, 37.9% of patients were categorized as ASA class I and 62.1% were categorized as ASA class II.

Medical comorbidities were present in a subset of the cohort. The most commonly documented comorbidity category was psychiatric illness, identified in 25% of patients. Pulmonary comorbidities were observed in 16.7% of patients, while endocrine conditions were present in 12.5%. Less frequently reported conditions included myocardial disease and vascular disease, each occurring in 4.2% of the cohort. These comorbidities were recorded based on existing diagnoses documented in the EMR at the time of surgical

evaluation.

Across the 29 surgical procedures performed in this cohort, anterior cruciate ligament (ACL)-related injuries represented the most common operative indication, accounting for 37.9% of surgeries. Hip pathology, including femoroacetabular impingement and acetabular labral tears, represented the second most common indication and accounted for 24.1% of procedures. Additional indications included shoulder instability (10.3%), patellar instability (10.3%), and isolated meniscal injuries (6.9%) (Figure 2). Other procedures were performed less frequently and reflected the diversity of sports-related orthopaedic conditions treated during the study period.

At the time of surgery, 40% of patients were actively prescribed gender-affirming testosterone therapy. No patients in the cohort were documented as receiving estrogen therapy at the time of their orthopaedic procedure. Information regarding gender-affirming hormone therapy was obtained from medication lists and endocrinology documentation within the EMR.

Among the 29 surgeries performed, intraoperative complications were identified in two cases (6.9%). These complications included one instance of intraoperative breakage of a suture anchor within the patellar bone during fixation and one case of breach of the lateral cortical wall of the femur during drilling. Both complications were recognized intraoperatively and managed at the time of surgery. No postoperative complications were documented within 90 days following surgery for any patient in the cohort.

Measures of postoperative care and follow-up were also evaluated. The mean hospital length of stay was 0.31 days, with a range from 0.15 to 1.2 days. Patients attended an average of 3.8 postoperative follow-up visits. The mean duration of follow-up was 256.5 days, with follow-up ranging from 13 to 871 days following surgery.

Given the heterogeneity in operative indications and surgical procedures performed within this cohort, limitations existed which precluded comparison with a cisgendered control cohort. Additionally, the overall number of perioperative complications observed in this cohort was low, resulting in a limited number of events and restricting the ability to perform meaningful comparative statistical analyses.

Discussion *(≥500 words)*

This study presents one of the first known characterizations of orthopaedic sports surgery outcomes in transgender and gender-diverse (TGD) patients. In this single-institution review, patients represented a wide spectrum of gender identities, with the majority identifying as nonbinary and most being assigned female at birth. The most common indication for surgery was ACL-related injury, but notable proportions of patients were also treated for hip pathology and shoulder instability. Follow-up duration was variable but adequate for early outcome monitoring, with a mean of over 250 days. At present, all sports-related surgeries in orthopaedics have limited literature with data specific to the TGD population.

Importantly, this cohort demonstrated low complication rates, with only two intraoperative events and no postoperative complications observed. These findings suggest that gender-diverse patients undergoing sports-related procedures can achieve safe surgical outcomes comparable to the general population, though statistical power was limited in this small heterogenous cohort, and matched cisgender

comparisons were not made in this descriptive study. To-date, no robust comparative studies exist to inform practice changes or guidance for care of the transgender patient in orthopaedics, though multiple prior articles have elicited calls to action on this literature gap.[5,6,10,11]

The comorbidity profile of this cohort warrants attention, particularly the high prevalence of psychiatric conditions (25%), which is consistent with broader public health data on mental health disparities among transgender individuals, additionally within transgender patients accessing orthopaedic care.[12,13] Additionally, 40% of patients were prescribed testosterone therapy at the time of surgery, with no patients receiving estrogen therapy. While hormone therapy is not known to independently increase surgical risk in musculoskeletal procedures, future research should explore potential interactions with tissue healing, bone density, and perioperative considerations as they relate to gender transition and sports outcomes relating to gender identity.[14,15] One narrative review by Hayes-Lattin et al described various investigations reporting on gender-affirming hormone therapy (GAHT) and considerations for sports medicine care in TGD patients, reporting that GAHT may increase fracture risk, but may also be beneficial for bone mineral density in transwomen.[14] Though we cannot draw meaningful associations from this investigation about outcomes risk as it relates to gender diverse identity or prescribed hormone therapy, the rising use of exogenous gender-affirming therapies raises important questions about how these may influence bone quality, outcomes or complication risk in orthopaedic surgery.

Limitations of this study include the small sample size and low number of perioperative complication events, which limited statistical power and precluded robust comparative analyses. The heterogeneity of operative indications and procedures further restricted procedure-specific evaluation. As a single-institution retrospective review, this study is also subject to limitations inherent to retrospective data collection, including potential inaccuracies or incomplete documentation within the electronic medical record. Identification of gender-diverse patients relied on available chart documentation and structured EMR fields for gender identity and sex assigned at birth, which may not capture all individuals who identify as transgender or gender diverse and may introduce misclassification bias.

This study establishes a baseline for further efforts toward outcome investigations in this population. As more gender-diverse individuals seek orthopaedic care, it is critical that orthopaedic literature begin to describe operative outcome measures in these individuals to establish knowledge of potential operative risk associations. This study serves as an important step toward characterizing outcomes in this understudied population and bringing equity to a body of literature currently limited in investigation of gender diverse individuals. Future research should include multicenter collaborations, collection of patient-reported outcomes, and longitudinal data to better understand functional recovery, satisfaction, and the influence of gender-affirming therapies on orthopaedic outcomes. Additionally, cohort studies with cisgendered comparison cohorts should be performed to better characterize and compare outcomes data.

Conclusions *(2-3 summary sentences)*

In conclusion, a small cohort of transgender and gender diverse patients at a single tertiary care center demonstrate reassuring outcomes in the orthopaedic perioperative setting. The present sample though lack statistical power and homogeneity for comparative analysis. Larger, multi-institutional comparative studies are needed to better understand outcomes and guide evidence-based care in this population.

Tables and Figures:

Figure 1: Gender Identity Breakdown of Gender Diverse Cohort

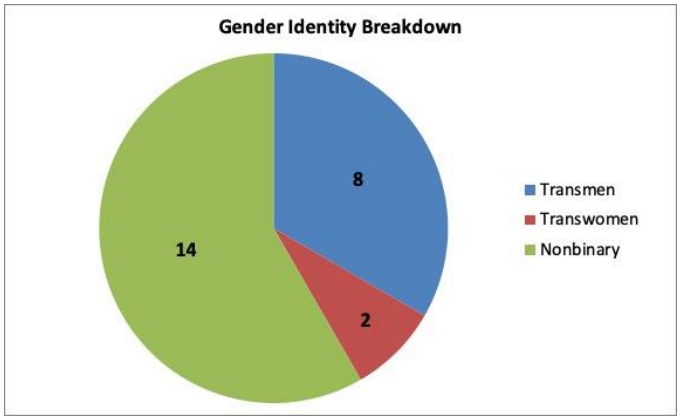
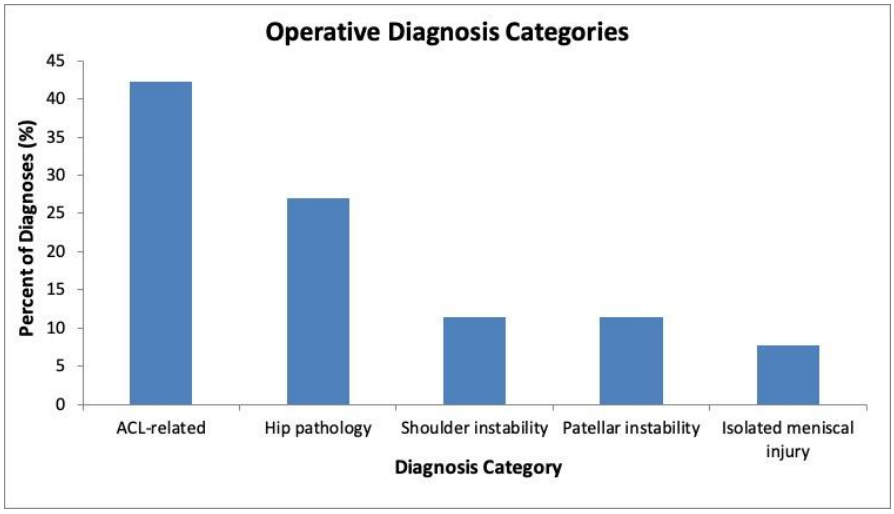


Figure 2: Diagnostic Indications for Sports Surgery in Patient Cohort



References *(JAMA style format)*

1. thisisloyal.com L|. How Many Adults and Youth Identify as Transgender in the United States? Williams Institute. Accessed March 9, 2026. https://williamsinstitute.law.ucla.edu/publications/trans-adults-united-states/

2. Sequeira GM, Dayton K. Transgender and Gender-Diverse Youth. *JAMA Pediatr*. 2021;175(7):756. doi:10.1001/jamapediatrics.2021.1014

3. Sex as a Biological Variable. October 17, 2025. Accessed March 9, 2026.

http://orwh.od.nih.gov/sex-as-biological-variable

4. Lee C, Ezell K, Dunford B, et al. Health Inequities in Orthopaedic Trauma Surgery in the United States: A Scoping Review. *J Am Acad Orthop Surg*. 2023;31(9):e489-e503. doi:10.5435/JAAOS-D-22-00710

5. Ramsey DC, Lawson MM, Stuart A, Sodders E, Working ZM. Orthopaedic Care of the Transgender Patient. *J Bone Joint Surg Am*. 2021;103(3):274-281. doi:10.2106/JBJS.20.00628

6. Jacobson AR, Goodrich E, Feroe AG, Rahman A. Considerations in Care of the Transgender Orthopedic Patient. *Curr Rev Musculoskelet Med*. 2025;18(11):536-546. doi:10.1007/s12178-025-09984-5

7. Mok AC, Fancher AJ, Vopat ML, et al. Sex-Specific Outcomes After Anterior Cruciate Ligament Reconstruction: A Systematic Review and Meta-analysis. *Orthop J Sports Med*. 2022;10(2):23259671221076883. doi:10.1177/23259671221076883

8. Reisner SL, Pletta DR, Mayer KH, et al. HIV seropositivity and viral non-suppression in transgender, non-binary, and gender-diverse people in primary care receiving gender-affirming hormone therapy in the USA between 2013 and 2019 (LEGACY): an observational, longitudinal, cohort study. *Lancet HIV*. 2025;12(4):e283-e292. doi:10.1016/S2352-3018(25)00004-9

9. Castelijn JM, Huisman B, Steensma TD, et al. Prevalence of gender-affirming hormone therapy in non-binary and genderqueer individuals, a systematic review and meta-analysis. *Endocrine*. 2025;90(2):420-426. doi:10.1007/s12020-025-04381-x

10. Harper KD, Maiorino E. Total Joint Arthroplasties in Transgender Patients: Unique Considerations for an Emerging Patient Population. *J Am Acad Orthop Surg*. 2022;30(13):607-612. doi:10.5435/JAAOS-D-21-00914

11. Graves L, Lukert BP. The Role of Sex and Gender in Transgender Bone and Other Musculoskeletal Health. *J Bone Joint Surg Am*. 2024;106(16):1507-1511. doi:10.2106/JBJS.24.00119

12. VanderHoek E, Yoo J, Zusman N. Gender Dysphoria and Scoliosis: Pediatric Orthopedists Are Very Much Members of the Healthcare Team. *J Pediatr Orthop Soc N Am*. 2024;0(0). doi:10.1016/j.jposna.2024.100119

13. Wang YC, Hoatson T, Stamoulis C, et al. Psychological Distress and Suicidality Among Transgender Young Adults in the United States. *J Adolesc Health Off Publ Soc Adolesc Med*. 2024;74(6):1095-1105. doi:10.1016/j.jadohealth.2023.11.004

14. Hayes-Lattin M, Krivicich LM, Bragg JT, Rogerson A, Salzler MJ. Considerations for the care of transgender patients in orthopaedics and sports medicine: a narrative review. *Br J Sports Med*. 2024;58(18):1075-1082. doi:10.1136/bjsports-2023-107703

15. Boskey ER, Taghinia AH, Ganor O. Association of Surgical Risk With Exogenous Hormone Use in Transgender Patients: A Systematic Review. *JAMA Surg*. 2019;154(2):159-169.

doi:10.1001/jamasurg.2018.4598