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# Greater Area Deprivation and Medicaid Insurance Status Adversely Affect Timing of Care and Rate of Re-Injury Following Anterior Cruciate Ligament Reconstruction

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# Disclosures

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# Background

- Lower socioeconomic status (SES) and public insurance are associated with barriers to care following ACL injury, including:
  - Lower likelihood to receive operative treatment
  - Longer delay from initial injury to surgery
  - Higher likelihood of concomitant pathology before undergoing ACLR
- Prior studies have relied on self-report of indicators of socioeconomic status and overlooked the influence of community deprivation on interactions with the healthcare system.

## The Effect of Socioeconomic Status on the Choice of Treatment for Patients With Cruciate Ligament Injuries in the Knee

### A Population-Based Cohort Study

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**Background:** The socioeconomic status (SES) of patients has been widely recognized as playing an important role in many health-related conditions, including orthopaedic conditions, in which a higher SES has been associated with a higher utilization of more advanced medical treatments such as drugs, diagnostics, and surgery. However, the association between SES and cruciate ligament surgery has not been thoroughly investigated.

**Purpose:** To evaluate the association between SES and choice of treatment in patients with a cruciate ligament injury.

**Study Design:** Cohort study; Level of evidence, 3.

**Methods:** All Swedish patients with a diagnosed cruciate ligament injury between 1987 and 2010 were identified from the Swedish National Patient Register (N = 98,349). The Longitudinal Integration Database for Health Insurance and Labor Market Studies (LISA) provided information on household income and highest achieved educational level, which were used as socioeconomic indices. The exposure was the SES of patients as determined by the household income and educational level, and the main outcome measure was treatment choice (surgical reconstruction vs nonoperative treatment). Poisson regression models estimated the association.

**Results:** A total of 52,566 patients were included in the study; of these, 20,660 (39%) were treated operatively. Patients in the highest quartile of household income had a significantly higher likelihood of undergoing surgery than those in the lowest quartile (relative risk [RR], 1.16; 95% CI, 1.11-1.20). Patients classified as highly educated had a significantly increased likelihood of being treated operatively compared with those with a low education (RR, 1.29; 95% CI, 1.19-1.39).

**Conclusion:** This study provides a population-based validation that having a higher SES as determined by the household income and/or level of education increases the likelihood of undergoing operative treatment after a cruciate ligament injury.

**Clinical Relevance:** All Swedish citizens are entitled by law to the same quality of health care; therefore, unmotivated differences in treatment between different socioeconomic groups are to be seen as a challenge. It is important to evaluate the specific mechanisms by which the patient's SES influences the decision of whether to treat a cruciate ligament injury operatively.

**Keywords:** knee ligaments; anterior cruciate ligament; epidemiology; statistics; socioeconomic status; economic and decision analysis


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# Background

- Area Deprivation Index (ADI) is a quantitative measure of social disadvantage
  - 17 measures of deprivation
  - Measured at Census block level
  - ADI has been shown to influence health outcomes independently of other common SES measures
  - Data is publicly available
  - Greater ADI indicates greater social deprivation
- Combined use of national ADI and insurance classification has been shown to predict the most variability in orthopedic patient-reported physical health

**Table 1. National ADI percentile factors and factor weights as described by Kind and Buckingham**

| Census Block Group Components | Factor Score Coefficients |
|---|---|
| Percent of the block group's population at least 25 years old with less than 9 years of education | 0.0849 |
| Percent at least 25 years old with greater than or equal to a high school diploma | -0.0970 |
| Percent of employed persons at least 16 years old in white-collar occupations | -0.0874 |
| Median family income | -0.0977 |
| Income Disparity | 0.0936 |
| Median home value | -0.0688 |
| Median gross rent | -0.0781 |
| Median monthly mortgage | -0.0770 |
| Home ownership rate | -0.0615 |
| Civilian unemployment rate of population at least 16 years old | 0.0806 |
| Percent of families below the poverty level | 0.0977 |
| Percent of population below 150% of the poverty threshold | 0.1037 |
| Percent of single-parent households with children less than 18 years old | 0.0719 |
| Percent of occupied housing units without a motor vehicle | 0.0694 |
| Percent of occupied housing units without a telephone | 0.0877 |
| Percent of occupied housing units without complete plumbing | 0.0510 |
| Percent of occupied housing units with more than one person per room | 0.0556 |

*Adapted from Singh GK, Am J Public Health, 2003*

**Purpose:** To investigate how ADI and insurance type affect timing of care and rate of re-injury following ACLR

**Hypothesis:** Greater national ADI percentile and Medicaid insurance status will be associated with delays in accessing orthopedic care and an increased risk of re-injury

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# Methods

- **Study Design:**
  - Retrospective Chart Review
  - 329 patients aged 12-40 years
  - Primary, unilateral ACLR with autograft between 2016-2019
- **Demographics:**
  - ADI obtained from Neighborhood Atlas (University of Wisconsin)
  - Patient insurance (Commercial vs Medicaid)
- **Outcomes of Interest:**
  - Time from injury to specialized care and to surgery
  - Second ACL injury, defined as graft failure or contralateral ACL injury
- **Plan of Analysis:**
  - ***Spearman's correlation coefficients (ρ):*** Relationship between national ADI percentile and care characteristics
  - ***Binary logistic regression:*** Association between patient and care characteristics, and second ACL injury

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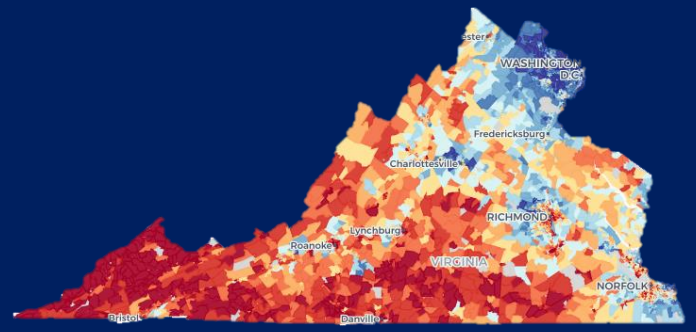


https://www.neighborhoodatlas.medicine.wisc.edu/

# Results

- 329 total patients
- Demographics
  - Average age: 22.6
  - 44.1% Female, 55.9% Male
  - 45.6% White, 54.45% non-White
  - Average national ADI percentile: 11
- Access to Care
  - Mean time from injury to specialized care: 8 Days
  - Mean time from injury to surgery: 46 Days
- Graft source
  - 52.5% Bone-Patellar Tendon-Bone Autograft
  - 37.8% Hamstring Autograft
  - 6.8% Quadriceps Autograft
- Insurance type
  - 13.7% Medicaid
  - 86.3% Commercial

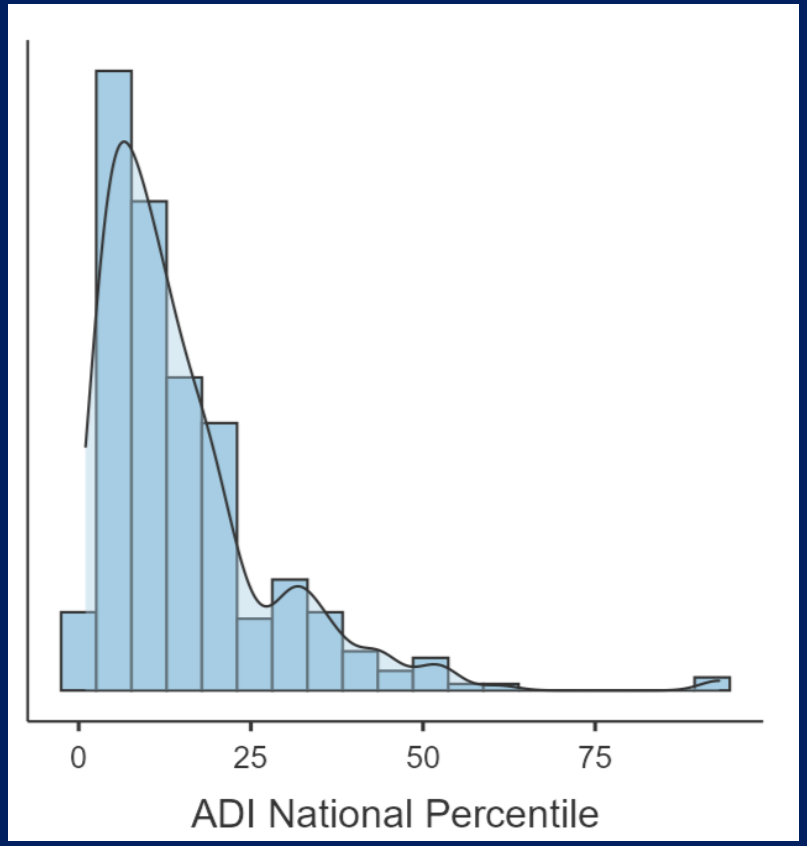


Figure 1. Distribution of National ADI percentile among the sample

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# Results

- Greater national ADI percentile is associated with:
  - Longer time from injury to specialized care (rho = 0.150, p = 0.007)
  - Longer time from injury to surgery (rho = 0.195, p < 0.001)
- Medicaid insurance is associated with:
  - 3 times greater odds of experiencing a second ACL injury
- 9.4% of patients experienced a second ACL injury

**Table 2. Binary logistic regression model predicting second ACL injury.**

| | β Value | Odds Ratio (95% CI) | P Value |
|---|---|---|---|
| Intercept | -1.994 | 0.136 (0.027, 0.682 | 0.015 |
| Biologic sex | | | |
| Male - Female | 0.418 | 1.518 (0.654, 3.527) | 0.332 |
| Age | -0.037 | 0.964 (0.899, 1.033) | 0.298 |
| Graft source | | | |
| BPTB – HS autograft | -0.755 | 0.470 (0.173, 1.278) | 0.139 |
| BPTB – QT autograft | 0.069 | 1.071 (0.273, 4.202) | 0.922 |
| Days from injury to specialized care | -0.002 | 0.998 (0.995, 1.002) | 0.342 |
| Days from specialized care to surgery | 0.002 | 1.002 (1.000, 1.005) | 0.051 |
| National Area Deprivation Index | 0.017 | 1.017 (0.991, 1.043) | 0.208 |
| Insurance type | | | |
| Commercial - Medicaid | 1.124 | 3.076 (1.165, 8.117) | 0.023 |

# Discussion

- Longer delays to treatment are associated with greater risk for concomitant pathology
- Greater ADI is associated with longer delays to treatment
- Medicaid insurance is associated with higher odds of re-injury, but ADI is not

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# Conclusion

- Lower socioeconomic status adversely affects timing of care and re-injury rates following an ACL injury.
- Patients with a greater national ADI percentage took significantly longer to reach specialized care and obtain surgery following ACL injury.
- Patients utilizing Medicaid insurance were more likely to sustain a re-injury following ACLR.

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