Effect of socioeconomic disparities on adolescent idiopathic scoliosis outcomes

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INTRODUCTION:

Sex, race, and ethnicity have been shown to play a role in outcomes for various orthopedic conditions. Previous studies have investigated the relationship between socioeconomic disparities and Adolescent Idiopathic Scoliosis (AIS). As far as we are aware, not much is described about the surgical outcomes in these patients. In this study, we look at a single institution to assess whether race, ethnicity, and socioeconomic status (as represented by the Childhood Opportunity Index (COI), Social Deprivation Index (SDI), and insurance) correlate with initial Cobb angle, delay to surgery, trial of conservative treatment, and surgical outcomes.

METHODS:

We retrospectively evaluated patients who underwent surgery for idiopathic scoliosis at a single pediatric deformity center between 2015 to 2020. Only patients aged 11 to 18 years with idiopathic scoliosis were included. Basic demographics including age, gender, ethnicity, race, and payer category were obtained. Primary outcomes were initial Cobb angle magnitude and Cobb angle magnitude at time of surgery. COI and SDI using aggregated Zip Code Tabulation Area (ZCTA) were also obtained. COI measures neighborhood resources for children and covers three domains: education, health and environment, and social and economic. Higher COI indicates greater neighborhood resources. SDI measures levels of disadvantage based off of seven demographic characteristics, with higher SDI indicating higher deprivation. Secondary outcomes were proportion of children who were braced before surgery, time from initial presentation to surgery, and percentage of curve correction after surgery. Chi square tests were performed for categorical data, while independent t-test and one-way analysis of variance (ANOVA) were performed for continuous data, with significance set at 0.05.

RESULTS:

Between 2015-2020, 249 patients met study criteria and were included. Mean age was 14.3 years, with 80.7% females. Among the patients, 25.3% were Hispanic, while 69.1% were Non-Hispanic. Race was distributed as follows: 69.1% White, 7.6% Black, and 8.4% Asian. When comparing gender, females underwent surgery at a younger age than males (14.1 vs. 15.5 years, $p<0.001$). There were no other additional differences. When comparing ethnicity, percentage of curve correction was lower among Hispanics (70.1 vs 73.8%, $p=0.047$), and state-normed COI was lower 42.1 vs 49.3, $p=0.046$) while SDI was higher (69.7 vs 59.7, $p=0.008$) among Hispanics. There were no other differences in curve severity at presentation or surgical outcomes. There were no differences in severity at presentation or outcomes with regards to race. When comparing payor type, those with state-funded insurance were noted to have lower COI (41.0 vs. 53.5 $p < 0.001$) and higher SDI (69.1 vs. 55.9, $p < 0.001$) when compared to those with private insurance. No other significant differences were found. There were weak correlations between state-normed COI and SDI and initial curve magnitude ($r=0.1$ for both parameters).

DISCUSSION AND CONCLUSION:

Childhood Opportunity Index and Social Deprivation Index correlate with ethnicity and insurance status. However, there were no significant differences found in our study population as it relates to the correlation of race and socioeconomic status with disease severity and outcomes. While the percentage of curve correction was statistically significant in Hispanics vs. non-Hispanics as well as the older age at surgery in privately insured patients, this did not represent a clinically significant difference. Our findings of female patients being operated on earlier than males would be consistent with the delayed maturity of the adolescent male. This institution traditionally caters to an underserved population and may be missing a large part of the insured and more advantaged populations. As evidenced by our lower mean COI and higher mean SDI, our population had a greater socioeconomic disadvantage than the general population for California. This could be improved by adding multi-center studies across the state and the nation so as to gather a wider population and by adding the nonsurgical patients as we could capture a cohort of patients that had early intervention and potentially effective bracing as a treatment measure. Ethnicity and insurance status are shown to correlate with opportunity and deprivation, however, the relationship on clinical outcomes in scoliosis surgery still need further clarification.

Table 2. Ethnicity

	Hispanic	Non-Hispanic	
Age at surgery	14.1 ± 1.8 years	14.4 ± 1.9 years	P= 0.344
Initial curve	53.7 ± 16.8 degrees	52.1 ± 14.6 degrees	P= 0.498
Curve at surgery	63.0 ±13.8 degrees	61.1 ± 12.3 degrees	P= 0.299
% braced prior to surgery	33.3%	30.8%	P= 0.713
Time from presentation to surgery	434.3 ± 463.4 days	473.3 ± 524.7 days	P=0.603
Percentage curve correction	70.1 ± 13.2%	73.8 ± 12.0%	0.047
COI	42.1 ± 23.7	49 ± 24.0	P= 0.046
SDI	69.7 ± 22.3	59.7 ± 25.4	P=0.008

Table 1. Gender

	Male	Female	
Age at surgery	15.5 years	14.1 years	P<0.001
Initial curve	49.6 degrees	53.0 degrees	P=0.182
Curve at surgery	63.0 degrees	60.8 degrees	P=0.296
% braced prior to surgery	38.7%	30.3%	P=0.285
Time from presentation to surgery	473 days	434 days	P=0.759
Percentage curve correction	72.6%	72.9%	P=0.885
COI	47.0	48.0	P=0.807
SDI	62.2	61.8	P=0.924

Table 4. Payor Type

	Private	State-funded	
Age at surgery	14.6 ± 1.8 years	13.9 ± 2.0 years	P= 0.011
Initial curve	50.3 ± 15.2 degrees	53.9 ± 14.5 degrees	P= 0.063
Curve at surgery	59.6 ± 11.0 degrees	62.4 ± 13.8 degrees	P= 0.087
% braced prior to surgery	33.9%	30.9%	P= 0.629
Time from presentation to surgery	454.9 ± 487.4 days	485.3 ± 515.6 days	P=0.643
Percentage curve correction	74.1 ± 12.8 %	72.2 ± 11.3%	P=0.226
COI	53.5 ± 24.6	41.0 ± 23.0	P < 0.001
SDI	55.9 ± 25.3	69.1 ± 23.0	P < 0.001

Table 3. Race

	White	Black	Asian	
Age at surgery	14.3 ± 1.9 years	13.9 ± 2.0 years	15.1 years ± 1.9	P= 0.089
Initial curve	51.4 ± 15.4 degrees	52.2 ± 17.6 degrees	56.0 ± 13.3 degrees	P= 0.433
Curve at surgery	61.0 ± 13.2 degrees	61.3 ± 11.8 degrees	62.7 ± 10.5	P= 0.858
% braced prior to surgery	33.1%	36.8%	33.3%	P= 0.949
Time from presentation to surgery	487.5 ± 538.94 days	407.5 ± 408.7 days	473.5 ± 479.5 days	P=0.818
Percentage curve correction	72.9 ± 12.5%	76.6 ± 12.6%	73.2 ± 10.3%	P=0.467
COI	49.0 ± 22.9	46.1 ± 28.6	43.3 ± 34.2	P= 0.565
SDI	60.4 ± 24.1	63.6 ± 27.9	67.0 ± 29.9	P=0.484