CJIM | Original Research

The Association of Socioeconomic Factors with Treatment Following Sports Medicine Injuries

Serena Lian, MD[1], Adam Wegener, MD[1,2], Jessica Knapp, DO[1,2]

[1] University of North Carolina at Chapel Hill (UNC) School of Medicine, Chapel Hill, NC, USA

[2] Mountain Area Health Education Center (MAHEC), Asheville, North Carolina, USA

Background: Socioeconomic and demographic variables including insurance provider, sex, language, and race may influence evaluation or treatment of sports medicine injuries. The purpose of this study is to evaluate differences between demographic groups in receiving different interventions (referral to physical therapy, referral to orthopedics, or steroid injection) across an array of injuries.

Methods: The records of patients at a major primary care sports medicine clinic in North Carolina from 2018 to 2020 were retrospectively reviewed to determine whether the number of patients receiving each type of intervention—PT referral, orthopedic surgery referral, or steroid injection—differed based on insurance provider, sex, language, and race. Data were analyzed using Kruskal-Wallis, ANOVA, and chi-square tests.

Results: Analysis of 2127 clinic patients showed those who received none of the three interventions were significantly younger ($p<.001$), male ($p<.001$), and African American ($p<.05$), while White patients and Medicare patients ($p<.001$) were more likely to receive one of the treatments. Across all injuries, PT referral was the most common first-line treatment. Medicaid patients were significantly more likely to receive an orthopedic referral as a first-line intervention compared to private insurance and Medicare patients ($p<.001$). No significant differences in first-line treatment were found by sex, primary language, or race.

Conclusion: Providers tended to pursue conservative treatment first. Age, sex, race, language, and insurance status were found to have a significant association with the treatments prescribed. Notably, African American/Black patients were more likely to receive none of the interventions, and patients with Medicaid were more likely to be referred to orthopedics, a non-conservative treatment, as a first-line intervention.

Clinical Relevance: This study identified significant variation in the prescribed treatment for sports medicine injuries across different demographic groups.

DOI: 10.47265/cjim.v3i1.3685

Corresponding Author:
Serena Lian, MD, University of North Carolina at Chapel Hill (UNC) School of Medicine, Chapel Hill, NC, USA
(serena.lian37@gmail.com)

INTRODUCTION

Sports medicine clinics treat a variety of activity-related acute and chronic conditions. Common issues include traumatic injuries such as ligament tears and fractures, as well as insidious or metabolic conditions such as tendinopathy, female-athlete triad, or osteoarthritis.[1,2] Previous analyses of typical sports medicine clinics have estimated that between 92-96% of visits are centered around musculoskeletal complaints, largely in the lower extremities.[3,4]Despite the name, sports medicine conditions affect both athletes and non-athletes of a wide range of ages and activity levels, and can cause functional limitations that negatively impact overall quality of life.

Although there is a wide variation in musculoskeletal injuries, there are standard treatment modalities. For many injuries, there is no definitive intervention, often requiring individualized decision-making.[5–18,24]Three primary treatments frequently used to treat sports medicine conditions are physical therapy, such as for tendinopathy;

steroid injections, common in inflammatory conditions such as carpal tunnel syndrome and osteoarthritis; and orthopedic surgery, often in the setting of acute ligament tears or recalcitrant osteoarthritis.[5–21] Other conditions, such as mild ankle sprains and concussions, may be resolved with rest, pain medications, and home exercises. Most recommendations, across all injuries, advise pursuing conservative interventions first.[22–23] Certain underlying chronic health conditions, such as diabetes and obesity, can also impact treatment decisions, as obesity is a risk factor for surgery, and steroid injections can exacerbate hyperglycemia.[52–53]

Due to the broad range of treatment options, providers may propose interventions that vary significantly for each individual patient. Such flexibility may lead to disparate experiences and outcomes. An important focal point for the forward progress of the field of sports medicine in the United States is the promotion of health equity, which relies on pursuing and eliminating health disparities. The proposed definition of health disparity/inequity was clarified in the Annual Review of Public Health (2006) as a "difference in which a disadvantaged social group or groups (such as the poor, racial/ethnic minorities, women, or other groups who have persistently experienced social disadvantage or discrimination in the past) systematically experience worse health or greater health risks than the most advantaged social groups."[25]

Access to healthcare is influenced by a complex set of societal factors. However, insurance in particular is often a considerable obstacle in obtaining a sports medicine appointment, as reported in several studies in which patients with Medicaid were significantly more likely to be denied an appointment, or experienced greater delay times before their first evaluation following injury.[26–31] This finding held true even in states that had participated in the 2014 Medicaid expansion and in practices that served as "safety net" clinics.[29] Furthermore, there were differences in treatment found between race, sex, socioeconomic status, geographic location, and insurance groups,[9,32–38] with more advantaged groups receiving more treatments, whether surgery or physical therapy. Notably, one study reported that black, Medicaid-eligible females had 2.36 times greater odds of being prescribed "watchful waiting."[9] Race and insurance were also associated with disparate outcomes following treatment of various sports medicine conditions.[39–42]

It is apparent that socioeconomic factors, including insurance, sex, and race, affect equitable evaluation, treatment, and outcome of sports medicine injuries. The existing literature sheds light on health disparities in the treatment of specific injuries. To the authors' knowledge, no study has performed such analysis across all conditions presenting to primary care sports medicine. As certain interventions may be more costly, time-consuming, or effective than others, we aim to evaluate the association of socioeconomic factors with potential variation in treatment modalities (physical therapy, surgery, or steroid injection) across all different injuries, compared to the overall clinic population.

METHODS

A retrospective chart review was completed for all visits from January 2018 through May 2020 at Mountain Area Health Education Center (MAHEC) Sports and Family Medicine Clinic, a major regional primary care center in North Carolina. Data was restricted to the past two years to minimize confounding by multiple injuries over time or recent changes in treatment recommendations. Of note, the time period included in this study was before the recent NC Medicaid expansion. 1953 interventions were recorded among 2127 patients. Demographic data was obtained for each subject: sex, age, race, primary language, insurance status, diabetes status, and BMI on initial encounter in the time window. No contact was made with any patients at any

point. The data was automatically pulled from a query of patient records performed by MAHEC librarians and transferred to a protected sheet in Microsoft Excel where data was de-identified. All study authors participated in cleaning and coding of the data.

Patient Characteristics and Treatments

Patients were grouped into intervention type—physical therapy referral, orthopedic surgery referral, or steroid injection—based on referral or procedure codes. Clinic patients who received none of the three treatments were categorized into a fourth group. Patients were separated by treatment in order to analyze demographics and trends within each treatment group as compared to the population represented by the overall clinic visit list. Within each intervention, patients were stratified by sex, race, primary language, and insurance. "Treatment" and "intervention" are used interchangeably.

Initial Treatment Choice

Many patients who received an intervention ultimately received more than one intervention, as determined by matched MRNs across data sheets. A second data log was created to identify patients' first-line treatment by grouping duplicate MRNs and sorting by date, then only retaining the first recorded encounter.

Coding

Variables were coded to stratify into the following categories as seen in Table 1 below. For all patients, insurance was coded into one of the five listed groups. Tricare was grouped with other employer-based private insurance. Diabetes mellitus (DM) status was determined with ICD-10 diagnosis codes for either insulin-dependent or non-insulin dependent DM. BMI categorizations were made according to numerically defined categories for underweight, normal, overweight, obese, and morbidly obese.

Statistical Analysis

The observed treatment rates were calculated as the proportion of patients across all variable factors receiving a physical therapy referral, orthopedic referral, steroid injection, or none of the above (referred to in this paper as a "no intervention" group). Total clinic data was used as a comparison. Kruskal-Wallis tests were used to compare median ages, while ANOVA was used for comparing means. Chi-squared analyses with applicable Bonferroni corrections were performed using SPSS Version 24 (IBM, Chicago, IL). Comparison groups within a demographic category were split into "most-advantaged" vs. "less-advantaged," e.g. English vs. non-English speakers, consistent with health equity research recommendations.[25] Significance was set at $p<.05$. "No Data" rows in the tables within the Results section were excluded from statistical analysis.

RESULTS

Difference in Demographics Among Patients Receiving Treatments

There were 2127 patients who underwent evaluation at MAHEC Sports and Medicine Clinic from January 2018 through May 2020. Of those 2127 patients, 1368 received an intervention (PT referral, orthopedic referral, or steroid injection), while 759 did not receive an intervention at all during the study period (Table 2). The median age of patients who received any intervention was found to be significantly higher than patients who received no intervention (55.3 vs. 40.6 years old, $p<.001$). There was a significant disparity in treatment utilization by sex, as males were

Table 1. Demographic categories used in data coding and analysis.

Sex	Race	Language	Insurance	DM	BMI
Male	White	English	Private	Yes	< 18.5
Female	Black	Spanish	Medicaid	No	18.5 ≤ x < 25
	Asian	Other	Medicare		25 ≤ x < 30
	Other	No Data	Charity Care		30 ≤ x < 40
	No Data		No data		x ≥ 40

statistically more likely to receive no intervention ($p<.001$). When examining race, there was also a significant difference; White patients were more likely to receive treatment and African American/Black patients were less likely to receive treatment ($p<.05$). Additionally, insurance showed a significant association with treatment utilization ($p<.001$), as Medicare patients were more likely to receive an intervention, while private and Medicaid patients were more likely to receive no intervention. Primary language did not significantly impact the likelihood of receiving an intervention.

Out of the 2127 patients seen in clinic during the study period, 1368 patients received treatment. Those patients were prescribed a total of 1953 interventions (Table 3). 1044 (53.5%) of those total interventions were physical therapy referrals, 330 (16.9%) were orthopedic referrals, and 579 (29.6%) were steroid injections. Females received relatively more total interventions, as 1362 treatments were given to female patients (69.7%) and 591 (30.3%) were given to male patients, compared to the clinic demographics of 66.6% female and 33.4% male patients ($p=.033$). There were 0.96 interventions prescribed per female patient compared to a mean of 0.83 treatments per male patient. White patients comprised 75.0% of the clinic population but received 79.3% of the total prescribed treatments ($p=.078$). Medicare patients made up 31.4% of the clinic population but received 834 (42.7%) of the total prescribed treatments ($p<.001$), receiving on average 1.25 interventions per person. These patients who tended to receive more interventions are illustrated in Figure 1 alongside groups that received fewer interventions (males and those with Medicaid or private insurance). There was no significant disparity by primary language.

Patterns in First-Line Treatment

There were 1368 patients who received at least one of the interventions (physical therapy referral, orthopedic referral, or steroid injection). Data on first-line treatment shows general provider tendency to pursue a conservative intervention (PT referral) first before injection or a referral to orthopedics. Of all the total interventions prescribed at the clinic during this study's time window, 16.9% were orthopedic referrals; however, only 11.6% of first-line interventions were orthopedic referrals, as shown in Table 4. Similarly, 29.6% of all total treatments were injections, but only 23.9% of first-line interventions were injections.

Differences in First-Line Treatment between Demographic Groups

Table 5 shows the breakdown of patients' first-line treatment into separate categories based on patient characteristics. The median ages of those referred to orthopedics and PT as a first-line intervention were younger than that of the injection group (54 vs. 59 years old, $p<.001$). Significant differences in first-line treatment were also found based on insurance type ($p<.001$), as patients with Medicaid were significantly more likely to be referred to orthopedic surgery as a primary intervention, and less likely to receive an injection. Sex, race,

Table 2. Demographics of patients in clinic

	Total Clinic Patients (n=2127)		Any Treatment (n=1368)		No Treatment (n=759)		P value
Age (years ± SD)	50.3 ± 21		55.3 ± 19.4		40.6 ± 21.2		**<.001**
Sex							**<.001**
Female	1417	66.6%	951	69.5%	466	61.4%	
Male	710	33.4%	417	30.5%	293	38.6%	
Race							**.0497**
White	1595	75.0%	1071	78.3%	524	69.0%	
Black	171	8.0%	98	7.2%	73	9.6%	
Asian	16	0.8%	9	0.7%	7	0.9%	
Other	41	1.9%	25	1.8%	16	2.1%	
No Data	304	14.3%	165	12.1%	139	18.3%	
Language							.215
English	1986	93.4%	1288	94.2%	698	92.0%	
Spanish	73	3.4%	42	3.1%	31	4.1%	
Other	11	0.5%	9	0.7%	2	0.3%	
No Data	57	2.7%	29	2.1%	28	3.7%	
Insurance							**<.001**
Private	984	46.3%	579	42.3%	405	53.4%	
Medicaid	366	17.2%	206	15.1%	160	21.1%	
Medicare	668	31.4%	529	38.7%	139	18.3%	
Charity Care	8	0.4%	4	0.3%	4	0.5%	
No Data	101	4.7%	50	3.7%	51	6.7%	

diabetes status, and BMI had no statistically significant association with first-line intervention.

Italicized text was excluded (No Data) or combined (race, language) into a subcategory for chi-square analysis.

Further analysis was performed on the association between primary insurance type and first-line treatment. Unlike privately insured and Medicare patients, those with Medicaid were disproportionately referred to orthopedics first—18.4% of Medicaid patients received a first-line orthopedic referral, compared to 9.5% of patients with private insurance and 11.5% of those with Medicare (p<.001). Those who were privately insured were more likely to receive steroid injections first. When stratifying patients with private insurance to include only those age <65, the association between insurance type and first-line intervention still significant (p<.001). As shown in Figure 2, all three insurance types received PT as the most common first-line intervention, but when looking at orthopedic referrals, Medicaid patients had disproportionately more than the other insurance groups.

The difference in first-line treatment between race and language groups is shown in Figure 3. As in the insurance analysis, most patients were referred to PT before other treatments. While 65% of English speakers were referred to PT first, only 58.8% of non-English speakers received the same initial recommendation. A higher proportion (19.6%) of non-English speakers was referred to orthopedic surgery as a primary intervention compared to 11.3% of English speakers. However, this difference was not significant (p=.188). There was no statistically significant difference in initial intervention for White vs. non-White patients (p=.406).

Table 3. Total Interventions Prescribed in MAHEC Sports Clinic.

	Total Treatments (n=1953)		Clinic Population (n=2127)		P value
Sex					**.033**
Female	1362	69.7%	1417	66.6%	
Male	591	30.3%	710	33.4%	
Race					.078
White	1549	79.3%	1595	75.0%	
Black	145	7.4%	171	8.0%	
Asian	11	0.6%	16	0.8%	
Other	28	1.4%	41	1.9%	
No Data	220	11.3%	304	14.3%	
Language					.655
English	1846	94.5%	1986	93.4%	
Spanish	58	3.0%	73	3.4%	
Other	9	0.5%	11	0.5%	
No Data	40	2.0%	57	2.7%	
Insurance					**<.001**
Private	786	40.2%	984	46.3%	
Medicaid	268	13.7%	366	17.2%	
Medicare	834	42.7%	668	31.4%	
Charity Care	4	0.2%	8	0.4%	
No Data	61	3.1%	101	4.7%	

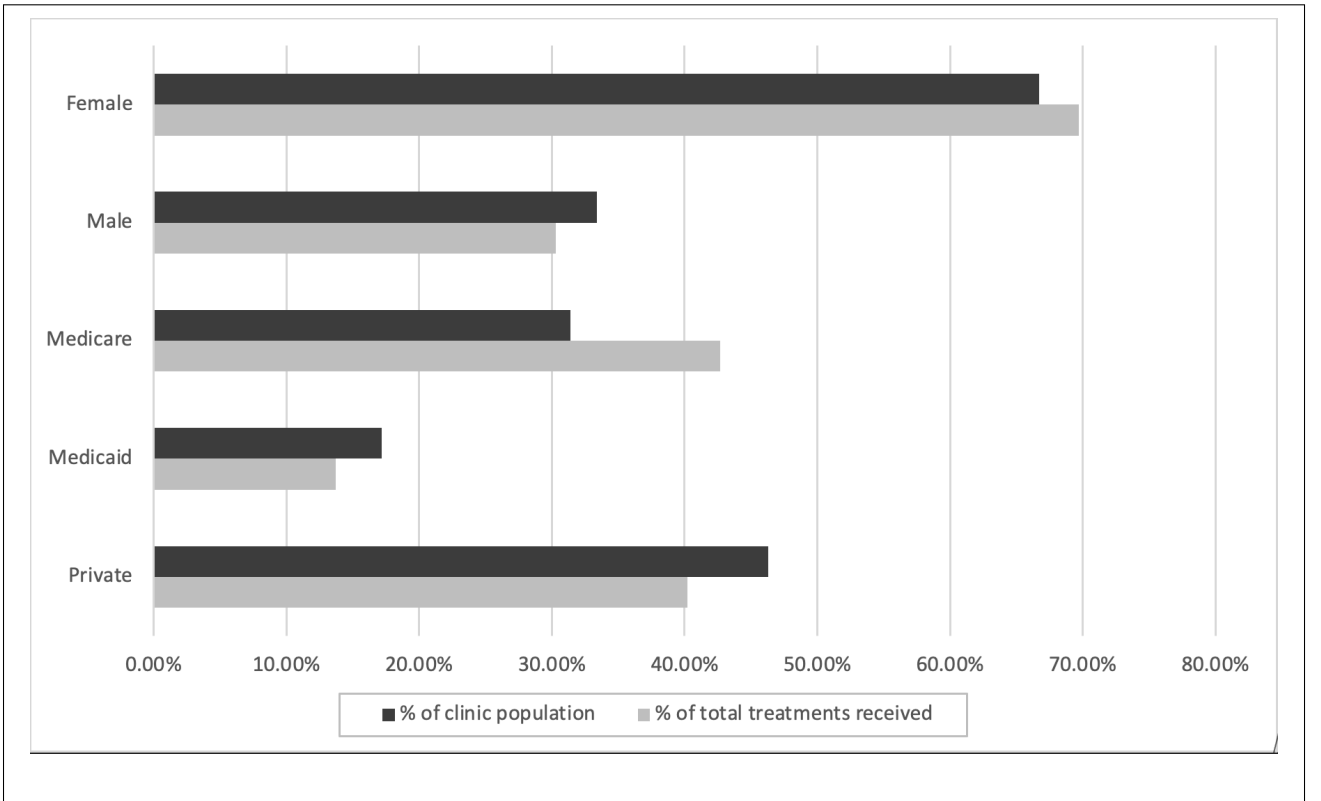

Figure 1. Patient groups who were prescribed disproportionately more or fewer total interventions. All groups are statistically significant.

Table 4. First-line treatments vs. total treatments. PT was more likely to be prescribed as first-line; referral to orthopedics and steroid injections were less likely to be first-line.

	PT		Ortho		Injection		Total No. of Treatments
Total Treatments	1044	53.5%	330	16.9%	579	29.6%	1953
First-line	882	64.5%	159	11.6%	327	23.9%	1368

Table 5. First-line Interventions.

	PT (n=882)		Ortho (n=159)		Injection (n=327)		Total	P value
Age (y)	54 [37,69]		54 [35,67]		59 [47,70]		56 [39,69]	**<.001**
Sex								.081
Female	631	66.4%	107	11.3%	213	22.4%	951	
Male	251	60.2%	52	12.5%	114	27.3%	417	
Race								.406
White	696	65.0%	118	11.0%	257	24.0%	1071	
Non-White	86	65.2%	19	14.4%	27	20.5%	132	
Black	*69*	*70.4%*	*14*	*14.3%*	*15*	*15.3%*	*98*	
Asian	*5*	*55.6%*	*1*	*11.1%*	*3*	*33.3%*	*9*	
Other	*12*	*48.0%*	*4*	*16.0%*	*9*	*36.0%*	*25*	
No Data	*100*	*60.6%*	*22*	*13.3%*	*43*	*26.1%*	*165*	
Language								.188
English	837	65.0%	145	11.3%	306	23.8%	1288	
Non-English	30	58.8%	10	19.6%	11	21.6%	51	
Spanish	*26*	*61.9%*	*8*	*19.0%*	*8*	*19.0%*	*42*	
Other	*4*	*44.4%*	*2*	*22.2%*	*3*	*33.3%*	*9*	
No Data	*15*	*51.7%*	*4*	*13.8%*	*10*	*34.5%*	*29*	
Insurance								<.001
Private	368	63.4%	55	9.5%	157	27.1%	580	
Medicaid	139	67.5%	38	18.4%	29	14.1%	206	
Medicare	345	65.2%	61	11.5%	123	23.3%	529	
Charity Care	*2*	*66.7%*	*0*	*0.0%*	*1*	*33.3%*	*3*	
No Data	*28*	*56.0%*	*5*	*10.0%*	*17*	*34.0%*	*50*	
DM								.878
Yes	112	65.1%	18	10.5%	42	24.4%	172	
No	770	64.4%	141	11.8%	285	23.8%	1196	
% with DM	12.7%		11.3%		12.8%			
Avg. BMI (kg/m2)	34.7		29.8		31			.740

Non-italicized text indicates subgroups used for chi-square analysis. Italicized text was excluded (No Data) or combined (race, language) into a subcategory for chi-square analysis.

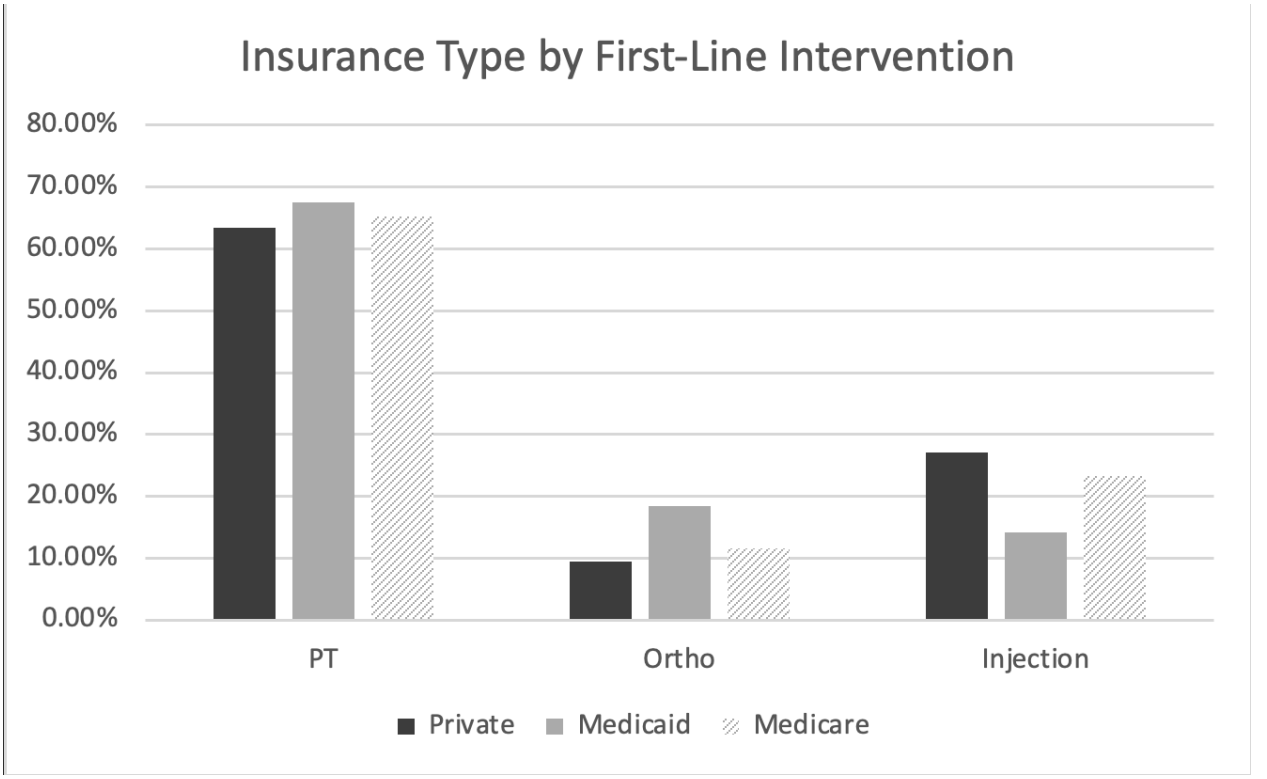

Figure 2. Rates of each first-line intervention vs. type of insurance.

DISCUSSION

Consistent with other studies on disparities in specific musculoskeletal injuries, the findings from this study demonstrate variation in the treatment of patients of all sports medicine conditions across demographic categories. The results increase our understanding of tendencies in the prescription of initial interventions following injury and highlight an association between patient characteristics and the first-line intervention received.

Demographic characteristics showed statistically significant association with initial or total treatment decisions. Some variation in intervention between different demographic groups may be medically warranted; for example, young and athletic patients may have a higher proportion of injuries such as mild ankle sprains, which may be treated at home. The sex difference could be explained by a greater proportion of male patients who participate in sports that have a high rate of conditions that cannot be treated by surgery, injection, or physical therapy (such as concussions in American football). But the disparities found in this study could also suggest the possibility that non-medical factors may play some role in affecting the treatments utilized by patients. Our study found racial differences between the no-treatment and any-treatment groups, similar to the findings by Chapman et al. [9] Nature of injury alone is unlikely to explain the racial disparity, as we have little reason to believe that different racial groups are presenting with significantly different injuries. The cause, then, of such a disparity in treatment is unknown and likely complex.

The disease burden from sports medicine injuries is high—affecting people of all ages, restricting movement, and leading to later complications—thus emphasizing the need for appropriate and timely intervention.[43] Our analyses revealed that,

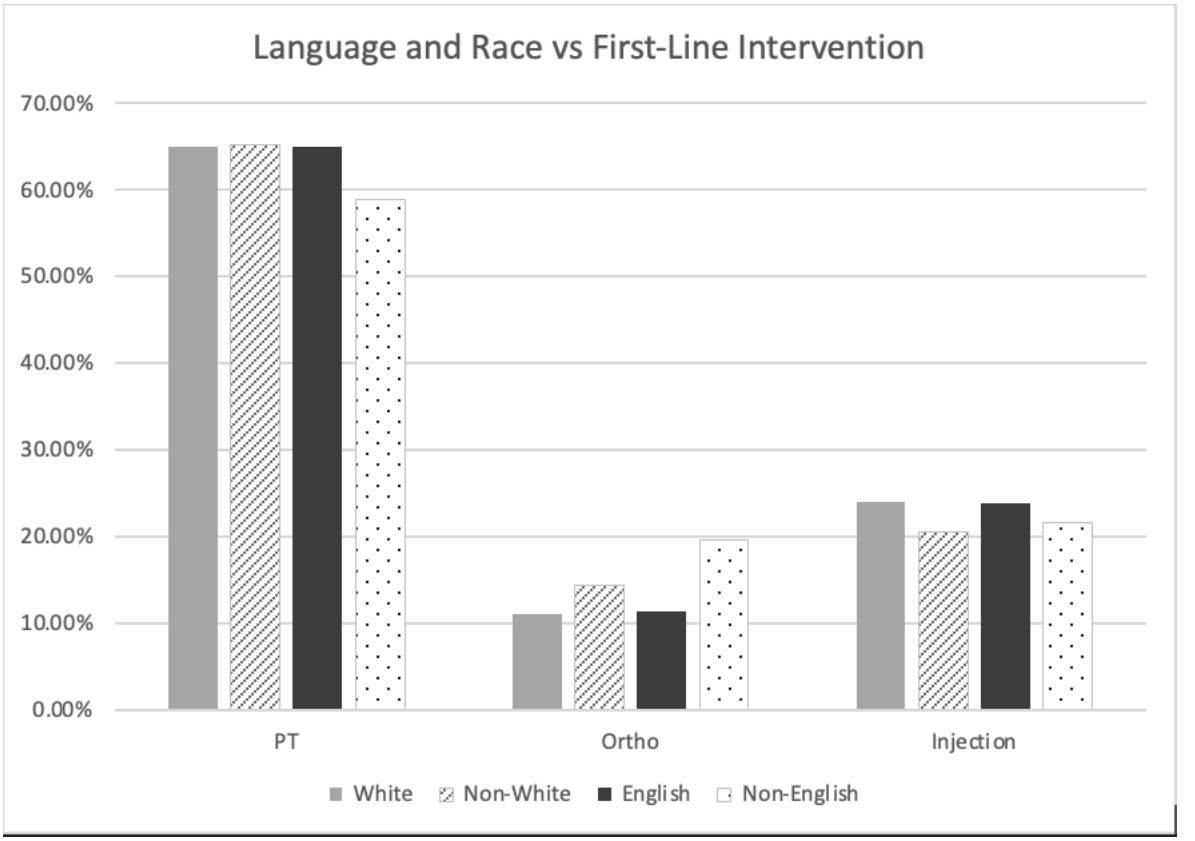

Figure 3. Rates of each first-line intervention vs. race and primary language.

in line with recommendation across nearly all sports medicine conditions, conservative treatments were generally prescribed first. The lower proportion of patients receiving a first-line orthopedic surgery referral, compared to total, suggests that surgery was usually offered as a possibility to patients, but only after more conservative interventions. Our results showed disproportionately more patients with Medicaid—considered a less advantaged characteristic—were referred to orthopedics first, compared to the most advantaged groups (private insurance, Medicare). In addition, there was a non-significant trend of non-English speakers receiving more first-line orthopedic referrals compared to English speakers. The interpretation of this data may be complicated from a multifactorial effect; it is nearly impossible to determine which of the socioeconomic factors plays the primary role in the observed treatment variation.

Treatment decisions may have been impacted by either insurance status itself, or the cost or time requirement of intervention. Physical therapy has been accepted as a safe, effective, and ultimately cost-saving intervention[44–45] but requires several visits. For patients with limited resources or transportation, placing a referral to orthopedic surgery immediately rather than attempting physical therapy first could be a cost- and time-saving measure. A previous randomized control trial showed that low socioeconomic status was associated with poorer exercise adherence following meniscus tear.[46] However, in our study, Medicaid patients received the same proportion of first-line PT referrals as other insurance groups.

North Carolina, at the time of this study, was one

of the states that had opted not to participate in the Medicaid expansion, which would have increased healthcare coverage for an estimated 500,000 people.[47] The combination of the NC Medicaid coverage policy limit on office visits, coupled with the fact that many practices do not accept Medicaid,[30,48] likely places restrictions on patients seeking evaluation for sports medicine injuries.[49] Medicaid coverage for orthopedic surgery, on the other hand, nearly matches that of NC Medicare.[50] Patients with Medicaid typically have lower socioeconomic status than privately insured patients, which further adds a layer of complication in obtaining timely healthcare access. Regarding the higher rate of orthopedic referrals, it could be that less-advantaged groups in our study delayed visiting a physician until the injury had progressed to the point of needing surgery. This study also lacked a significant population of uninsured or Charity Care patients; further expansion of our analysis to free or sliding-scale model clinics would help broaden our understanding of the disparities in treating patients without insurance.

Primary insurance type accounted for a significant amount of the treatment variation in this study's patient population, but any meaningful improvement would rely on widespread policy change, as such disparities could likely be seen in other primary care centers with high proportions of uninsured or publicly insured patients. Patients' primary language also shows a slight, non-significant trend in the observed treatment variation, and may correlate somewhat with race or insurance, but the direction of the effect is undetermined. Providers must be aware of these patterns in order to contribute to positive change going forward.

The two other patient characteristics analyzed—diabetes and BMI—had no significant impact on treatment decisions. However, it is interesting to note that diabetic patients received the same percent of steroid injections as non-diabetics, despite research showing that steroid injections lead to unpredictable spikes in blood glucose levels.[51] Likewise, the average BMI for those with a first-line orthopedic referral was the same as that of patients receiving PT and injection first, despite obesity being a risk factor in surgery.[52]

One of this study's main strengths lies in its broad overview of socioeconomic disparities, examining all clinic patients across all sports medicine conditions in order to reduce the influence of specific treatment trends and recommendations for individual injuries. It therefore allows for the primary focus to be on disparities in treatment, an aspect of care reliant on provider and patient decision-making. Such decision-making is influenced by many diverse variables, from medical condition to socioeconomic factors such as insurance type, patient resources, and personal preferences.

Limitations must be considered when interpreting study findings, however. Within this study, it is nearly impossible to determine causality, and findings can only be reported as an association between socioeconomic factors and observed treatment variation. The recorded first-line treatment for a small number of patients may not have been their true first-line, especially for those with a first office visit before January 2018 and/or those with multiple injuries; however, this is unlikely to affect any specific demographic category. The data reflects only the prescribed intervention, which may not represent actual utilization of treatment. The study was also unable to assess outcomes, so no conclusions can be drawn about the eventual impact of treatment variation on health disparities. The clinic population, and the surrounding region of North Carolina, are socioeconomically diverse but have limited racial diversity,[53] leading to the small size of certain patient subgroups. A larger data collection project with more sports medicine clinics in other areas of the country may help to describe national patterns of socioeconomic-based treatment disparities.

In conclusion, the variance in interventions received by patients in a sports medicine clinic was found to correlate with certain socioeconomic factors. Age, sex, insurance, and race were found to have a significant association with receiving

no treatment, while Medicaid patients were referred to orthopedics as a first-line intervention at a significantly higher rate. Further analysis, discussion, and systemic changes are necessary to reduce controllable and undesirable variance in the treatment of sports medicine conditions and promote greater health equity.

ARTICLE INFORMATION

Accepted for Publication: September 08 2023.

Published Online: September 22 2023.

DOI: 10.47265/cjim.v3i1.3685

Cite this article: Lian Serena, Wegener Adam, Knapp Jessica. **The Association of Socioeconomic Factors with Treatment Following Sports Medicine Injuries**. Carolina Journal of Interdisciplinary Medicine (CJIM) 2023;3(1):25-37.

Conflict of Interest Disclosures: None

Acknowledgements: The authors thank the following individuals: (1) Dan Davis, Health Information Specialist at MAHEC, for his assistance with data acquisition and (2) Wendy Nuzzo, M.S., data analyst at MAHEC, for her guidance in conducting statistical analysis.

Funding/Support: No external funding was obtained by the authors.

Ethics Approval and Consent to Participate: The Institutional Review Board deemed this study protocol to be exempt from review (IRB Reference No. 20-12-2001, NF).

AUTHOR BIOGRAPHY

Serena Lian S. Lian, MD, is a resident physician at Inova Fairfax Hospital and a recent graduate of UNC School of Medicine.

Adam Wegener A. Wegener, MD, is a resident physician at New Hanover Regional Medical Center and a recent graduate of UNC School of Medicine.

Jessica Knapp J. Knapp, DO, is an Assistant Professor at UNC Chapel Hill School of Medicine and the Sports Medicine Fellowship Director at MAHEC.

REFERENCES

1. Orthopedic Services ; 2020,. https://mahec.net/patient-information/family-health/sports-medicine/our-services

2. Sports Medicine and Injury Care ; 2020,. https://atriumhealth.org/medical-services/specialty-care/orthopedic-care/sports-medicine

3. Butcher JD, Zukowski CW, Brannen SJ, et al. Patient profile, referral sources, and consultant utilization in a primary care sports medicine clinic. *J Fam Pract*. 1996;43(6):8969703–8969703.

4. Kannus P, Aho H, Järvinen M, et al. Computerized recording of visits to an outpatient sports clinic. *Am J Sports Med*. 1987;15(1):79–85.

5. Graaf VAVD, Wolterbeek N, Mutsaerts EL, et al. Arthroscopic Partial Meniscectomy or Conservative Treatment for Nonobstructive Meniscal Tears: A Systematic Review and Meta-analysis of Randomized Controlled Trials. *Arthroscopy*. 2016;32(9):27474105–27474105.

6. Apaul M, Davies LJ, Hopewell S, et al. Surgical versus conservative interventions for treating anterior cruciate ligament injuries. *Cochrane Database of Systematic Reviews*. 2016;.

7. Krause M, Freudenthaler F, Frosch KH, et al. Operative Versus Conservative Treatment of Anterior Cruciate Ligament Rupture. *Dtsch Arztebl Int*. 2018;115:855–862.

8. Toliopoulos P, Desmeules F, Boudreault J, et al. Efficacy of surgery for rotator cuff tendinopathy: a systematic review. *Clin Rheumatol*. 2014;33(10):24682606–24682606.

9. Chapman CG, Floyd SB, Thigpen CA, et al. PMCID ; 2018,.

10. Vasta S, Papalia R, Albo E, et al. Top orthopedic sports medicine procedures. *J Orthop Surg Res*. 2018;13(1):190–190.

11. Desjardins-Charbonneau A, Roy JS, Dionne CE, et al. The efficacy of manual therapy for rotator cuff tendinopathy: a systematic review and meta-analysis. *J Orthop Sports Phys Ther*. 2015;45(5):25808530–25808530.

12. Desjardins-Charbonneau A, Roy JS, Dionne CE, et al. *Int J Sports Phys Ther*. 2015;10(4):4527190–4527190.

13. Desmeules F, Boudreault J, Roy JS, et al. The efficacy of therapeutic ultrasound for rotator cuff tendinopathy: A systematic review and meta-analysis. *Phys Ther Sport*. 2014;16(3):25824429–25824429.

14. Desmeules F, Boudreault J, Roy JS, et al. Efficacy of transcutaneous electrical nerve stimulation for rotator cuff tendinopathy: a systematic review. *Physiotherapy*. 2015;102(1):26619821–26619821.

15. ESSKA Meniscus Consensus Project. ESSKA Meniscus Consensus Project: Degenerative meniscus lesions ; 2016,. https://cdn.ymaws.com/www.esska.org/resource/resmgr/Docs/2016-meniscus-consensus-proj.pdf

16. Huisstede BM, Brink JVD, Randsdorp MS, et al. Effectiveness of Surgical and Postsurgical Interventions for Carpal Tunnel Syndrome-A Systematic Review. *Arch Phys Med Rehabil*. 2017;99(8).

17. Fransen M, Mcconnell S, Harmer AR, et al. Exercise for osteoarthritis of the knee. *Cochrane Database of Systematic Reviews*. 2015;.

18. Ackermann PW, Renström P. *Tendinopathy in Sport Sports Health*. 2012;4(3):193–201.

19. Dunn KL, Lam KC, Mcleod V, et al. Early Operative Versus Delayed or Nonoperative Treatment of Anterior Cruciate Ligament Injuries in Pediatric Patients. *J Athl Train*. 2016;51(5):5013703–5013703.

20. Kaikkonen A, Kannus P, Järvinen M. Surgery versus functional treatment in ankle ligament tears. A prospective study. *Clin Orthop Relat Res*. 1996;(326):194–202.

21. Edwards SL, Lee JA, Bell JE, et al. Nonoperative treatment of superior labrum anterior posterior tears: improvements in pain, function, and quality of life. *Am J Sports Med*. 2010;38(7):20522835–20522835.

22. Mccrory P, Meeuwisse W, Dvorak J. Consensus statement on concussion in sport-the 5th international conference on concussion in sport. *British Journal of Sports Medicine*. 2016;51:838–847.

23. Sprained Ankle ; 2016,. https://orthoinfo.aaos.org/en/diseases--conditions/sprained-ankle/

24. Pappou IP, Schmidt CC, Jarrett CD, et al. AAOS Appropriate Use Criteria: Optimizing the Management of Full-Thickness Rotator Cuff Tears. *Journal of the American Academy of Orthopaedic Surgeons*. 2013;21(12):772–775.

25. Braveman P. HEALTH DISPARITIES AND HEALTH EQUITY: Concepts and Measurement. *Annual Review of Public Health*. 2006;27(1):167–194.

26. Draeger RW, Patterson BM, Olsson EC, et al. The influence of patient insurance status on access to outpatient orthopedic care for flexor tendon lacerations. *J Hand Surg Am*. 2014;39(3):527–560.

27. Froelich JM, Beck R, Novicoff WM, et al. Effect of health insurance type on access to care. *Orthopedics*. 2013;36(10):24093703–24093703.

28. Williams AA, Mancini NS, Solomito MJ, et al. Chondral Injuries and Irreparable Meniscal Tears Among Adolescents With Anterior Cruciate Ligament or Meniscal Tears Are More Common in Patients With Public Insurance. *Am J Sports Med*. 2017;45(9):28530851–28530851.

29. Wiznia DH, Nwachuku E, Roth A, et al. The Influence of Medical Insurance on Patient Access to Orthopaedic Surgery Sports Medicine Appointments Under the Affordable Care Act. *Orthop J Sports Med*. 2017;5(7):5528187–5528187.

30. Rogers MJ, Penvose I, Curry EJ, et al. Medicaid Health Insurance Status Limits Patient Accessibility to Rehabilitation Services Following ACL Reconstruction Surgery. *Orthop J Sports Med*. 2018;6(4):5888828–5888828.

31. Patterson BM, Spang JT, Draeger RW, et al. Access to outpatient care for adult rotator cuff patients with private insurance versus Medicaid in North Carolina. *J Shoulder Elbow Surg*. 2013;22(12):24135415–24135415.

32. Gundle KR, Mcglaston TJ, Ramappa AJ. Effect of insurance status on the rate of surgery following a meniscal tear. *J Bone Joint Surg Am*. 2010;92(14):20962196–20962196.

33. Suchman KI, Behery OA, Mai DH, et al. The Demographic and Geographic Trends of Meniscal Procedures in New York State: An Analysis of 649,470 Patients Over 13 years. *J Bone Joint Surg Am*. 2018;100(18):1581–1588.

34. Schairer WW, Nwachukwu BU, Lyman S, et al. Race and Insurance Status Are Associated With Surgical Management of Isolated Meniscus Tears. *Arthroscopy*. 2018;34(9):2677–2682.

35. Montgomery SR, Zhang A, Ngo SS, et al. Cross-sectional analysis of trends in meniscectomy and meniscus repair. *Orthopedics*. 2013;36(8):1007–1020.

36. Wagner ER, Solberg MJ, Higgins LD. The Utilization of Formal Physical Therapy After Shoulder Arthroplasty. *J Orthop Sports Phys Ther*. 2018;48(11):29739303–29739303.

37. Navarro RA, Prentice HA, Inacio M, et al. The Association Between Race/Ethnicity and Revision Following ACL Reconstruction in a Universally Insured Cohort. *J Bone Joint Surg Am*. 2019;101(17):31483397–31483397.

38. Collins JE, Katz JN, Donnell-Fink LA, et al. Cumulative incidence of ACL reconstruction after ACL injury in adults: role of age, sex, and race. *Am J Sports Med*. 2009;41(3):3896975–3896975.

39. Li L, Bokshan SL, Mehta SR, et al. Disparities in Cost and Access by Caseload for Arthroscopic Rotator Cuff Repair: An Analysis of 18,616 Cases. *Orthopaedic Journal of Sports Medicine*. 2019;.

40. Patel AR, Sarkisova N, Smith R, et al. ; 2019,.

41. Bram JT, Talathi NS, Patel NM, et al. How Do Race and Insurance Status Affect the Care of Pediatric Anterior Cruciate Ligament Injuries? *Clin J Sport Med*. 2020;30(6):201–206.

42. Li X, Veltre DR, Cusano A, et al. Insurance status affects postoperative morbidity and complication rate after shoulder arthroplasty. *Journal of Shoulder and Elbow Surgery*. 2017;26(8):1423–1431.

43. Issa K, Pierce CM, Pierce TP, et al. Total Shoulder Arthroplasty Demographics, Incidence, and Complications-A Nationwide Inpatient Sample Database Study. *Surg Technol Int*. 2016;29:27608744–27608744.

44. Drawer S, Fuller CW. Propensity for osteoarthritis and lower limb joint pain in retired professional soccer players. *British Journal of Sports Medicine*. 2001;35:402–408.

45. Frogner BK, Harwood K, Andrilla C, et al. Physical Therapy as the First Point of Care to Treat Low Back Pain: An Instrumental Variables Approach to Estimate Impact on Opioid Prescription, Health Care Utilization, and Costs. *Health Serv Res*. 2018;53(6):6232429–6232429.

46. Tuakli-Wosornu YA, Selzer F, Losina E, et al. Predictors of Exercise Adherence in Patients With Meniscal Tear and Osteoarthritis. *Arch Phys Med Rehabil*. 2016;97(11):5083166–5083166.

47. Foundation JL ; 2020,. https://www.johnlocke.org/policy-position/medicaid-expansion/

48. Medicaid and Health Choice Clinical Coverage Policy No: 10A ; 2020,. https://files.nc.gov/ncdma/documents/files/10A_10.pdf

49. Kim CY, Wiznia DH, Hsiang WR, et al. The Effect of Insurance Type on Patient Access to Knee Arthroplasty and Revision under the Affordable Care Act. *J Arthroplasty*. 2015;30(9):25891434–25891434.

50. Lalezari RM, Pozen A, Dy CJ. State Variation in Medicaid Reimbursements for Orthopaedic Surgery. *The Journal of Bone and Joint Surgery*. 2018;100(3):236–242.

51. Kallock E, Neher JO, St, et al. Do intra-articular steroid injections affect glycemic control in patients with diabetes? *PMID 21135928*. 2010;p. 59–59.

52. Obalum DC, Fiberesima F, Eyesan SU, et al. A review of obesity and orthopaedic surgery: The critical issues. *The Nigerian Postgraduate Medical Journal*. 2012;19(3):23064175–23064175.

53. Quickfacts - Asheville City, North Carolina ; 2019,. https://www.census.gov/quickfacts/ashevillecitynorthcarolina