



The Effect of Insurance Status and Race on Access to Care for Pediatric and Adolescent Patients With Anterior Cruciate Ligament Injury

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# The Effect of Insurance Status and Race on Access to Care for Pediatric and Adolescent Patients With Anterior Cruciate Ligament Injury

## Abstract

**BACKGROUND:** Anterior cruciate ligament injuries (ACL) of the knee are becoming increasingly common in the pediatric and adolescent population with the rise in organized sports participation. This injury can be devastating to a young athlete's ability to engage in physical activity as the knee is rendered unstable; leaving it susceptible to further degenerative changes. As a result, a delay in both the diagnosis and treatment of ACL injuries can lead to secondary joint damage in this highly active population. The purpose of this study was to analyze whether the insurance status and race of pediatric and adolescent patients with ACL injuries impacts the time from injury to diagnosis and treatment, and consequently secondary joint damage.

**MATERIALS AND METHODS:** This was a retrospective review of 170 consecutive patients at a tertiary care pediatric hospital treated by a single surgeon from 2011 to 2015 for ACL ruptures. The institution at which the patients were treated was a safety-net hospital that provides a significant level of care to low-income, uninsured, and vulnerable populations with no care preference given based on insurance status. Patients were stratified into public insurance and private insurance groups. Race was also considered. Ability to access care was compared between the groups in regards to time from injury to magnetic resonance imaging (MRI) exam (the gold standard for diagnosis of ACL injury) as well time from injury to surgical reconstruction. In addition, the presence of secondary injury (meniscal / chondral injury) that may have stemmed from treatment delay and continued activity with an unstable knee was compared between groups.

**RESULTS:** One hundred and two patients had public insurance and 68 patients had private insurance. Patients with private insurance received an MRI nearly 50% faster after their injury ( $p < 0.001$ , 19 days vs. 38 days). In addition, time from injury to ACL reconstruction was also faster ( $p < 0.001$ , 61 days vs. 96 days) for privately insured patients. An increased rate of meniscal tears and chondral injuries was not significantly seen in the public insurance group. Race did not impact timing to treatment or secondary injuries.

**CONCLUSIONS:** The results of this study demonstrated that time from injury to MRI diagnosis, and surgical treatment was significantly shorter in privately insured pediatric and adolescent patients even in a safety-net hospital setting. Clinicians must be cognizant of this disparity and develop means to ensure timely access to care.

## Keywords

pediatric ACL reconstruction; insurance status; access to care



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### **ABSTRACT**

**BACKGROUND:** Anterior cruciate ligament injuries (ACL) of the knee are becoming increasingly common in the pediatric and adolescent population with the rise in organized sports participation. This injury can be devastating to a young athlete's ability to engage in physical activity as the knee is rendered unstable; leaving it susceptible to further degenerative changes. As a result, a delay in both the diagnosis and treatment of ACL injuries can lead to secondary joint damage in this highly active population. The purpose of this study was to analyze whether the insurance status and race of pediatric and adolescent patients with ACL injuries impacts the time from injury to diagnosis and treatment, and consequently secondary joint damage.

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**CONCLUSIONS:** The results of this study demonstrated that time from injury to MRI diagnosis, and surgical treatment was significantly shorter in privately insured pediatric and adolescent patients even in a safety-net hospital setting. Clinicians must be cognizant of this disparity and develop means to ensure timely access to care.

**Keywords:** pediatric ACL reconstruction; insurance status; access to care

## INTRODUCTION

Anterior cruciate ligament (ACL) injuries are becoming increasingly prevalent in the pediatric age group (Frank et al., 2013) with the number of reconstructions nearly tripling in the last two decades (Mall et al., 2014 & Dodwell et al., 2014). Increased injury recognition, improved diagnostic techniques, and intensive, year-round athletic participation may all be factors that are driving this trend. Furthermore, multiple surgical techniques have been developed that allow for reconstruction in patients who are still skeletally immature (Frank et al., 2013), whereas non-operative treatment may have been elected in the past until skeletal maturity was reached.

ACL tears are often associated with other acute injuries as well as secondary injuries that result from an unstable knee both in the acute and chronic setting (Dumont et al., 2012). Whereas lateral meniscal tears occur more commonly at the time of acute injury, a chronically ACL deficient knee utilizes the posterior horn of the medial meniscus as the primary stabilizer to anterior translation of the tibia (Allen et al., 2000). Left untreated, an ACL deficient knee may develop degeneration of the medial meniscus as well as secondary chondral changes (Dumont et al., 2012). These secondary injuries, both acute and chronic, are well described in adults (De Roeck et al., 2003, Chhadia et al., 2011, Granan et al., 2009, Church et al. 2005, Warren et al., 1983) and in pediatric patients (Dumont et al., 2012, Millett et al., 2002, Vavken et al., 2010, Lawrence et al., 2011, Ralles et al., 2015, Newman et al., 2015, Anderson et al., 2015). The incidence of these secondary injuries increases with the amount of time the knee remains unstable (Millett et al., 2002, Lawrence et al., 2011, Ralles et al., 2015, Newman et al., 2015, Anderson et al., 2015). Thus, it is agreed that the surgical reconstruction of ACL tears in pediatric and adolescent patients should occur without significant delays to prevent secondary morbidity. Although there is much debate as to what amounts to timely access to care, it is clear that care access for pediatric and adolescent patients who are publically and/or non-insured can be challenging; particularly when race / ethnicity is considered as well (Newacheck et al., 1996).

The purpose of this study was to analyze whether the insurance status of pediatric and adolescent patients with ACL injuries impacts the time from injury to both diagnosis and treatment, and as well as leads to a difference in the incidence of secondary meniscal and/or chondral injuries. This institution under consideration is a “safety net hospital,” which means that uninsured pediatric patients are automatically enrolled in a public insurance program and therefore should not be subjected to preferential treatment based on insurance status. To our knowledge, a study like this has not been performed at an institution that treats these injuries in a high-volume fashion, and is a safety-net hospital.

We hypothesized that pediatric and adolescent patients who were publicly insured would have longer waits from injury for both diagnosis and surgery, leading to an increased incidence of secondary injuries despite being treated in a safety-net setting.

## METHODS

The study was a retrospective review of a consecutive series of patients treated by a single surgeon at a tertiary care pediatric hospital from 2011 – 2015. IRB approval was obtained. Patients were included in the study if they had a diagnosis of a traumatic ACL tear confirmed via MRI imaging and underwent surgical intervention for their injury. Patients were excluded from the study if they were older than 18 years of age, did not have adequate documentation and/or recall of their date of traumatic injury, had congenital absence of their ACL, presented for revision surgery after being treated for their primary tear at another institution, or elected non operative treatment of their injury due to the fact that they had a partial tear of their ACL noted at the time of arthroscopy with less than 50% compromise of the native ACL with a negative intra-operative instability test.

Patient demographics including self-reported race (documented as white and non-white), date of the injury, insurance status (public or private), date of MRI imaging, and date of ACL reconstruction were recorded as continuous variables. As uninsured patients are automatically enrolled in public insurance programs upon beginning their care at this safety-net hospital, uninsured patients were not separated from the publicly insured. The presence of medial and/or lateral meniscus injuries as well as chondral injuries at the time of surgery were recorded as binary variables from the findings in the operative report. Additional procedures performed to address these secondary injuries, specifically meniscal repair and chondroplasty, were also recorded as binary variables. Follow up notes were reviewed to determine post-operative graft re-ruptures.

The Wilcoxon test for continuous variables was used to determine if there was a statistically significant difference in time from injury to diagnostic MRI, MRI to surgical reconstruction, and time from injury to surgical reconstruction between publicly and privately insured patients. An additional sub-group analysis analyzing race and time to MRI and surgery was performed as well as combined analysis of insurance status and race. Kaplan-Meier curves were generated for this data. The Fisher's exact test for dichotomous variables was also used to determine if there was a statistically significant difference in the presence of secondary injuries and treatment for these injuries between publicly vs. privately patients. P values less than or equal to 0.05 were considered statistically significant.

## RESULTS

One hundred ninety-four patients were identified from 2011 to 2015. Twenty were excluded due to incomplete medical records, and 4 patients were excluded, as operative reconstruction was not performed due to intra-operative findings of stability with a partially torn ACL. In the remaining 170 patients, the median age was 15.2 years (9-18 years) with 44% females. The median length of follow up was 316.5 days (14-1064 days). All injuries occurred during sports except for one car accident and one motorcycle accident.

102 patients had public insurance and 68 patients had private insurance (Table 1). 110 patients were white and 60 were non-white (Table 2). Subdivisions into payer and race are seen in Table 3. Patients with private insurance received an MRI 50% faster after their injury ( $p < 0.001$ , median 38 days vs. 19 days) (Table 1, Figure 1). There was difference in the time from MRI to ACL Reconstruction (Table 1). Time from injury to ACL reconstruction was also significant faster ( $p < 0.001$ , median 96 days vs. 61 days) for privately insured patients (Table 1, Figure 2). There

was no significant difference in access to care when patients were separated by race (Table 2, Figures 3-4).

There was a statistically significant difference in time to MRI and time to ACL reconstruction when patients were subdivided into payer and racial groups (Table 3, Figures 5-6). Yet, as noted above, the differences between payer groups were clinically significant however the differences between racial groups were not (Table 3, Figure 5-6).

Lateral meniscus tears were more likely ( $p=0.034$ ) to require repair in publically insured patients (30% in publically insured vs. 6.7% in privately insured, Table 1). There were no significant differences in secondary injuries, treatments or complications when looking based on race (Table 2). When subdividing patients into insurance and racial groups, chondral injuries were significantly less likely in privately insured, non-white patients ( $p=0.047$ ) (Table 3).

Table 1: Data Stratified by Insurance Type			
Patient Characteristics			
	Privately Insured	Publicly Insured	p Value
N	68	102	
Median Age (range)	14.5 (13,16)	16 (15,17)	< 0.001
Males (%)	30 (44.1)	65 (63.7)	0.018
Females (%)	38 (55.9)	37 (36.3)	
Median Follow Up Times (days)			
	Privately Insured	Publicly Insured	p Value
Length of Follow Up	301.5	326.5	0.488
Time from Injury to MRI	19	37.5	< 0.001
Time from MRI to ACL Recon	43	46	0.152
Time from Injury to ACL Recon	61	96	< 0.001
Arthroscopic Findings and Treatments			
	Privately Insured	Publicly Insured	p Value
N	68	102	
Lateral Meniscus Injury (%)	31 (45.6)	40 (39.6)	0.539
Medial Meniscus Injury (%)	3 (4.4)	13 (12.9)	0.115
Chondral Injury (%)	10 (14.7)	27 (26.7)	0.096
Lateral Meniscus Repair (%)	2 (6.7)	12 (30)	0.034
Medial Meniscus Repair (%)	2 (66.7)	9 (60)	1
Chondroplasty (%)	6 (8.8)	10 (9.9)	1
Complications (%)	13 (19.1)	19 (18.6)	1

Table 1: Patient Characteristics, Median Follow Up Times (in days) and Arthroscopic Findings/Treatments based on insurance type.



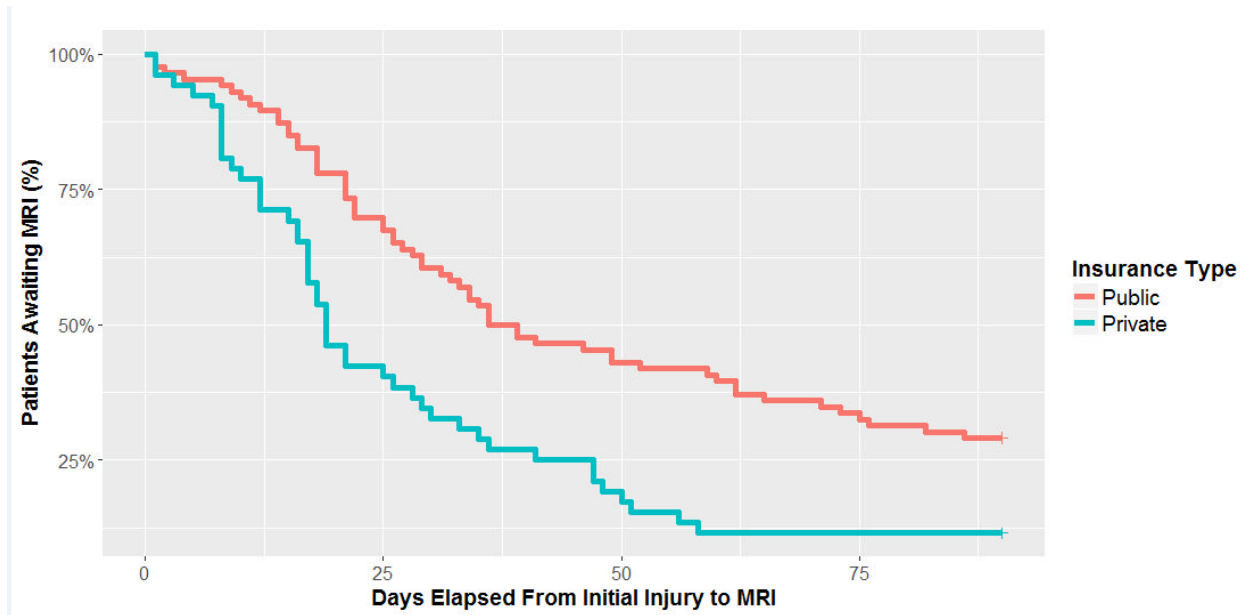


Figure 1. Time from Injury to MRI Stratified by Insurance Type

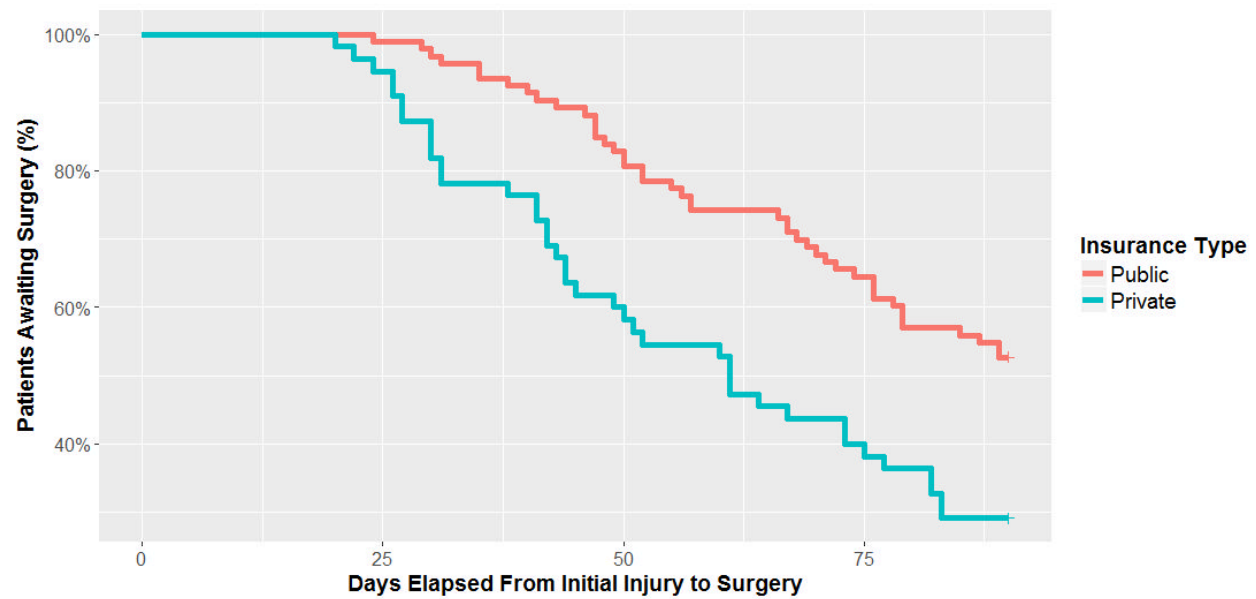


Figure 2. Time from Injury to Surgery Stratified by Insurance Type

Table 2: Data Stratified by Race			
Patient Characteristics			
	White	Non-White	p Value
N	110	60	
Median Age (range)	16 (14,17)	15 (13,16)	0.014
Males (%)	67 (60.9)	28 (46.7)	0.104
Females (%)	43 (39.1)	32 (53.3)	
Median Follow Up Times (days)			
	White	Non-White	p Value
Length of Follow Up	361.5	297	0.235
Time from Injury to MRI	34	26	0.183
Time from MRI to ACL Recon	41	48	0.232
Time from Injury to ACL Recon	83	76	0.156
Arthroscopic Findings and Treatments			
	White	Non-White	p Value
N	110	60	
Lateral Meniscus Injury (%)	48 (44)	23 (38.3)	0.578
Medial Meniscus Injury (%)	10 (9.2)	6 (10)	1
Chondral Injury (%)	29 (26.6)	8 (13.3)	0.072
Lateral Meniscus Repair (%)	11 (23.4)	3 (13)	0.721
Medial Meniscus Repair (%)	9 (75)	2 (33.3)	0.305
Chondroplasty (%)	13 (11.9)	3 (5)	0.231
Complications (%)	22 (20)	10 (16.7)	0.744

Table 2: Patient Characteristics, Median Follow Up Times (in days) and Arthroscopic Findings/Treatments based on patient race.



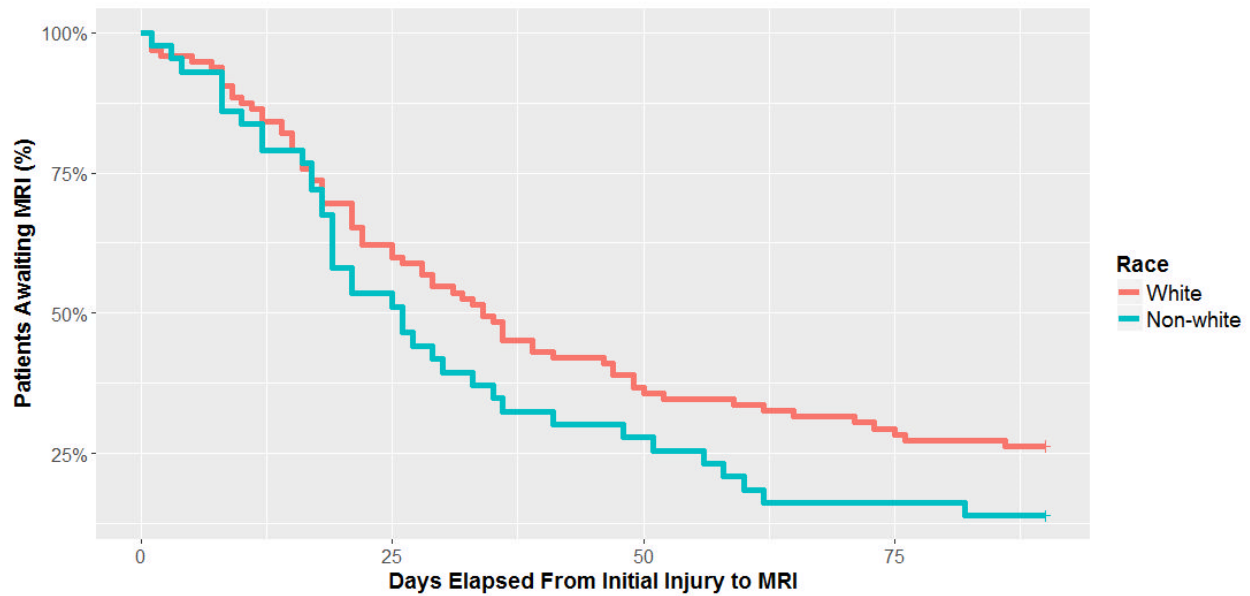


Figure 3. Time from Injury to MRI Stratified Based on Race

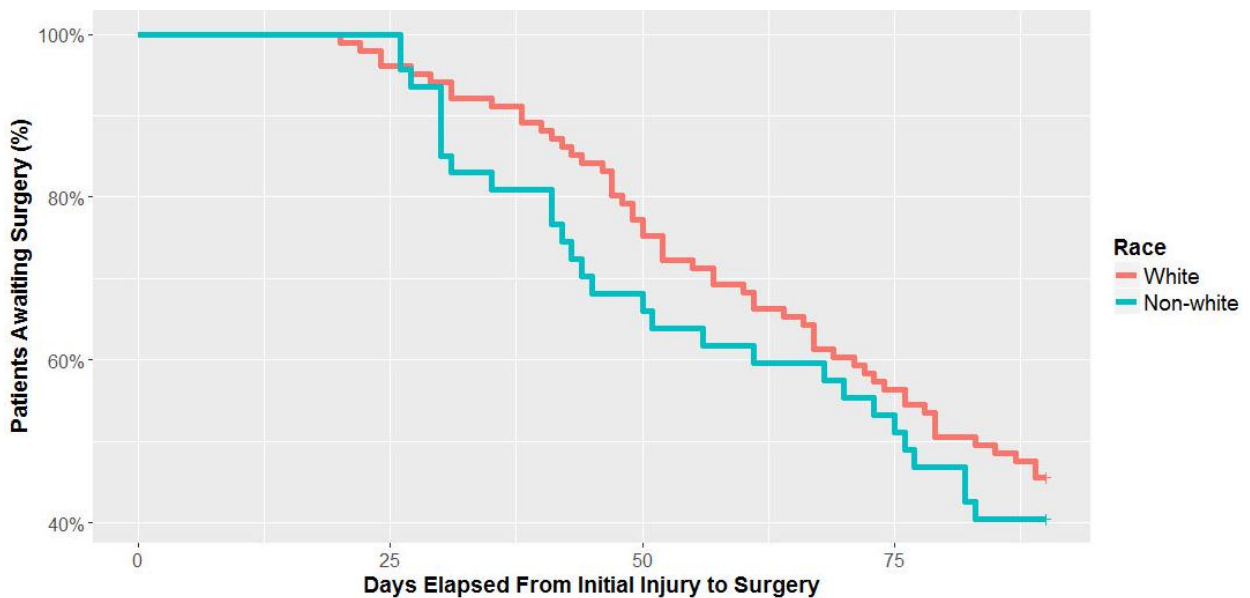


Figure 4. Time from Injury to Surgery Stratified Based on Race

Table 3: Data Stratified by Insurance Type and Race					
Patient Characteristics					
	Privately Insured + White	Privately Insured + Non-White	Publicly Insured + White	Publicly Insured + Non-White	p Value
N	30	38	80	22	
Median Age (range)	15 (14,16)	14 (12.2,16)	16 (15,17)	16 (15,17)	< 0.001
Males (%)	16 (53.3)	14 (36.8)	51 (63.7)	14 (63.6)	0.042
Females (%)	14 (46.7)	24 (63.2)	29 (36.2)	8 (36.4)	
Median Follow Up Times (days)					
	Privately Insured + White	Privately Insured + Non-White	Publicly Insured + White	Publicly Insured + Non-White	p Value
Length of Follow Up	378.5	282.5	326.5	330	0.51
Time from Injury to MRI	17	19	46	29	0.001
Time from Injury to ACL Recon	61	67	94.5	103	0.003
Arthroscopic Findings and Treatments					
	Privately Insured + White	Privately Insured + Non-White	Publicly Insured + White	Publicly Insured + Non-White	p Value
N	30	38	80	22	
Lateral Meniscus Injury (%)	17 (56.7)	14 (36.8)	31 (39.2)	9 (40.9)	0.345
Medial Meniscus Injury (%)	1 (3.3)	2 (5.3)	9 (11.4)	4 (18.2)	0.248
Chondral Injury (%)	8 (26.7)	2 (5.3)	21 (26.6)	6 (27.3)	0.047
Lateral Meniscus Repair (%)	1 (6.2)	1 (7.1)	10 (32.2)	2 (22.2)	0.347
Medial Meniscus Repair (%)	1 (100)	1 (50)	8 (72.7)	1 (25)	0.609
Chondroplasty (%)	5 (16.7)	1 (2.6)	8 (10.1)	2 (9.1)	0.257
Complications (%)	7 (23.3)	6 (15.8)	15 (18.8)	4 (18.2)	0.889

Table 3: Patient Characteristics, Median Follow Up Times (in days) and Arthroscopic Findings/Treatments based on insurance type and patient race.

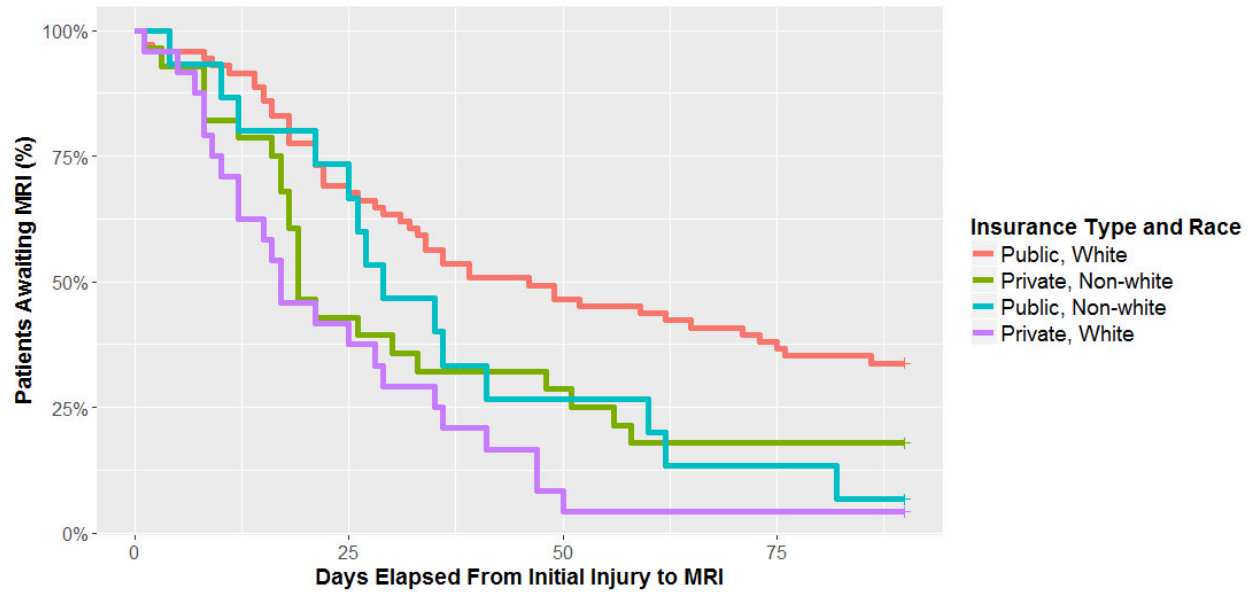


Figure 5. Time from Injury to MRI Stratified Based on Insurance and Race

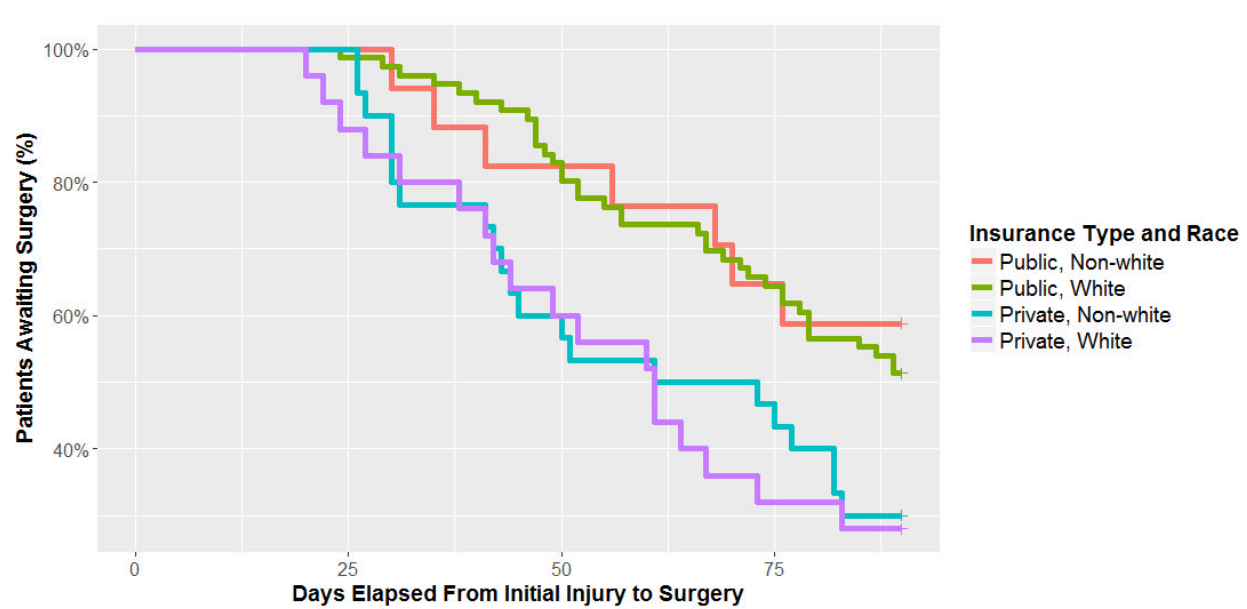


Figure 6. Time from Injury to Surgery Stratified Based on Insurance and Race

## DISCUSSION

Our results demonstrate that significant delays occur in regards to timing of care for pediatric and adolescent patients with ACL tears with public insurance. Non-privately insured patients experience a nearly 50% longer time to obtain both an MRI and receive treatment in the form of ACL reconstruction irrespective of race.

From a clinical standpoint, delayed access to care can lead to secondary damage from an unstable knee. Although our study was unable to demonstrate any association with insurance status and the incidence of lateral meniscal tears seen during arthroscopic ACL reconstruction, when tears were present publically insured patients were more likely to have repairs rather than debridement. This may indicate a greater degree of tear severity in these patients due to continued injury while awaiting intervention. Furthermore, other markers of secondary injury such as the presence of medial meniscal and chondral injuries also demonstrated a trend towards being higher in publicly insured patients. The lack of statistical significance may be attributable to the low numbers of these secondary injuries found in these patients, leaving this variable underpowered. Though no conclusions can be drawn from this data, the trend may indicate what has been demonstrated in prior studies (Dumont et al., 2012, De Roeck et al., 2033, Chhadia et al., 2011, Granan et al., 2009, Church et al., 2005, Millett et al., 2002, Lawrence et al., 2011, Ralles et al., 2015, Newman et al., 2015, Anderson et al., 2011) that delays in stabilization of a ACL deficient knee may lead to secondary injuries to the cartilage and the meniscus. Further, multi-center analysis may demonstrate this trend.

The importance of preventing secondary meniscal and chondral damages from an ACL deficient knee is critical and strategies must be developed to decrease this from occurring. The time from injury to treatment is directly correlated with secondary damage to the cartilage of the knee and the medial meniscus (Ralles et al. 2015, Millett et al., 2011, Lawrence et al., 2011, Newman et al., 2015). To achieve more granularity in this timing, Anderson et al classified repairs into acute (<6 weeks after injury), subacute (6-12 weeks) and chronic (>12 weeks) and found worsening damage of both the cartilage and meniscus with increased time (Anderson et al., 2015). This data is critical as our publically insured patients were obtaining ACL reconstruction at a mean of 96 days from the time of injury.

Unfortunately, this trend for care disparity based on insurance status is not specific to ACL injuries. The difference in access to care for privately versus publicly incurred patients has been demonstrated globally in the orthopedic (Draeger et al., 2014, Calfee et al., 2012, Pierce et al., 2012, Dodwell et al., 2014) and medical literature (DeVoe et al., 2007, Asplin et al., 2005, Skinner et al., 2007). Barage et al. in South Florida reported on 80 patients with ACL injuries and found that the time from injury to diagnosis was 14 days for privately insured, 56 days for the publicly insured, and 121 days for the uninsured (Barage et al., 2012). This study took place in a university based sports medicine group, was not limited to pediatrics or a single surgeon, did not comment on the time until surgery, and did not examine the presence of secondary meniscal / chondral injuries. Our results parallel this study by demonstrating that much of the delay between publicly and privately insured patients comes from a delay in MRI diagnosis, which then translates to a delay in surgery. Our analysis indicates that the time from MRI imaging to surgery did not significantly differ between groups in our study.

When analyzing for race, no significant difference in secondary injuries, treatments or complications was found in our study. This supports the earlier finding that there was no delay in treatment due to race; insurance status was the more important determinant of access to care. The fact that racial difference had no impact on the follow up times and the subsequent secondary injuries in pediatric patients with ACL injuries is encouraging given the prior literature which indicates a different trend in the treatment of non-white patients (Newacheck et al., 1996). Specifically, in orthopaedic literature, there are numerous examples of decreased access to care for non-white racial groups (Zavatsky et al., 2015, Dodwell et al., 2015). Even when specifically

examining ACL reconstructions, white patients have higher odds of ACL reconstruction after ACL tear than non-white patients in all age groups (Collins et al., 2013). Given that our study took place at a single safety-net institution located in a racially diverse community, it may be difficult to generalize these results. Perhaps, this reflects the ability of safety-net hospitals to protect for race-based discrimination, their location in diverse areas, or lack of implicit bias among clinicians. Repeating this study in other socio-economic and geographic areas would be telling.

It is important to understand the context in which our treatment delays were occurring even with multiple safety mechanisms in place. California residents with limited resources obtain health care benefits through a number of publicly funded programs. A systematic review of specialty care for pediatric patients demonstrated that access to care was improved for publicly insured children relative to the uninsured (Skinner et al., 2007). Medi-Cal is California's Medicaid health care program and all pediatric patients (under age 21) are eligible ([www.mybenefitscalwin.org](http://www.mybenefitscalwin.org); 2016). Those patients who are not eligible due to undocumented status are eligible for health insurance through one of 10 county based Healthy Kids programs, which contract with local Medi-Cal managed care plans to provide medical services to enrollees (Lewit 2016). These health plans are designed to provide not only emergency care for pediatric patients but also facilitate routine care. Despite the preexisting resources available to patients at the institution of study, the delays in care are still very evident.

We also postulate that the delays in care will be magnified in other health care environments where public insurance is not accepted, appointments are preferentially given to privately insured patients, and clinicians may not be comfortable in treating skeletally immature patients with ACL injuries. Therefore, our incidence of secondary meniscal and chondral injuries in the publically insured cohort may actually be significantly less than what may be occurring in the general population.

It is also important to note that our institution is a safety-net hospital: it does not differentiate access to appointments (clinic, MRI, surgery) based on insurance status (i.e. private insurance patients are not given preferential appointments). The practice also has a pediatric orthopedic sports medicine specialist who is comfortable in treating ACL injuries in this population. And yet, significant delays were still observed between these cohorts. Consideration must be given to what exactly led to these delays. It is probable that authorizations for imaging or surgical procedures may have been the root of the delay. However, it is also plausible that these delays in obtaining treatment may arise from patients and patients' families. Obviously, the causation cannot be determined, but we speculate there may be a contribution from other socioeconomic situations that uninsured and publically insured families face: patient belief in non-traditional treatments, trust for the health care system, inability to navigate the complex healthcare system, the ability to take time off of work to make appointments, and travel logistics such as access to public transportation. Further qualitative studies need to be undertaken if we are to determine the true cause of these diagnostic and treatment delays.

One of the strengths of this study is that it was a single surgeon study that took place in a single institution with consecutive patients having the same diagnosis over several years. This controlled for differences in scheduling practices, variation in surgical indications and practices, and documentation of findings in operative reports. The study also had sufficient numbers of patients in both groups, which made the statistical analysis of the data sounder.

The weaknesses of this study lies in the fact that it is difficult to generalize to hospital systems outside of the institution studied, where financial systems are not in place to ensure access



to care for publically insured patient as well as clinicians who are not trained in performing skeletally immature ACL reconstructions. Therefore, our study may actually be under-estimating the “true” delays in access to care and secondary injury in these patients. This study did not control for age and gender, which were significantly different when testing differences in payer and race. There is no difference in the scheduling of appointments based on these variables. The age differences were within one year and not clinically significant. There is also no evidence demonstrating a difference in secondary injuries based on age or gender, so we believe that this did not contribute to the conclusions from this study. Another weakness lies in the lack of granularity when reporting the size / severity of the secondary chondral and meniscal tears, as the operative reports did not provide dimensions and staging data.

## CONCLUSION

In the current health care environment where more and more attention is being given to not only health care costs but also access to care, the results of this study should give pause to pediatric and sports orthopedists. The safety net hospital adequately provided access to care for patients of white and non-white races. However, insurance status does impact access to care, as seen by the increased in time to MRI and time to ACL reconstruction for publically insured patients. Though this was a single center study, we recommend that clinicians examine their own practice pathways to ensure such delays are minimized and stay vigilant when treating patients in an area where public insurance may impede timely treatments of operative conditions.

## ACKNOWLEDGEMENTS

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