

# Impact of Socioeconomic Factors on Time to Surgery for Distal Radius Fractures

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**Background:** Delay in care secondary to socioeconomic status (SES) and demographic factors represents an area for potential improvement. Reducing time to surgery in distal radius fracture (DRF) fixation may improve outcomes while reducing cost. The purpose of this study is to investigate the effect of SES on time to surgery in our study population.

**Methods:** Patients undergoing outpatient DRF surgery within an academic health-care system during a 4-year period were reviewed. Time to surgery and demographic factors were analyzed. The US Census Bureau was used to determine median household income (MHI) for a patient's ZIP code; patients were stratified into three groups based on MHI.

**Results:** A total of 413 patients met inclusion criteria. SES (14.7 d in the low-SES group, 14.0 d in the mid-SES group, and 11.1 d in the high-SES group,  $P = 0.00063$ ), insurance (11.7 d for insured versus 16.3 d for Medicaid/uninsured,  $P < 0.0001$ ), race (non-White group: 15.2 d versus White group: 10.9 d,  $P < 0.0001$ ), and treatment facility (16.2 d at county hospital versus 10.9 d at university hospital,  $P < 0.0001$ ) were associated with time to surgery in univariate analysis. Multivariate analysis found that only treatment facility was associated with time to surgery.

**Conclusions:** Non-White, uninsured/Medicaid individuals residing in low-SES areas may be more likely to receive care at a safety-net facility and are at greatest risk for delay in time to surgery. Measures aimed to reduce barriers to care, increase healthcare coverage, and improve patient education should be initiated to mitigate these disparities. (*Plast Reconstr Surg Glob Open* 2024; 12:e5838; doi: 10.1097/GOX.0000000000005838; Published online 30 May 2024.)

## INTRODUCTION

Distal radius fractures (DRFs) are among the most common upper extremity injuries sustained, with yearly prevalence rates as high as 16.2 per 10,000 persons.<sup>1</sup> The distribution of DRF is bimodal, with increased prevalence seen in young adults and older adults.<sup>2</sup> The treatment and long-term outcomes after DRF depend on numerous patient and surgeon specific factors.<sup>3-6</sup> Outside of traditional patient risk factors (age, smoking status, diabetes, etc), studies have begun to evaluate socioeconomic factors and how they impact long-term outcomes after DRF. Low socioeconomic status (SES), often termed social deprivation, has been shown to increase the risk of DRF.<sup>7-9</sup> Patients with social

deprivation may have less patient engagement and detrimental psychosocial factors that contribute to worse outcomes after DRF.<sup>10</sup> It has been shown that satisfactory outcomes after DRF are dependent on proper patient engagement in the acute rehabilitation setting and for long-term rehabilitation.<sup>11</sup> Additionally, socially deprived patients may take longer to receive surgery and may be less likely overall to receive surgery than affluent, socially enriched patients.<sup>12,13</sup> Low SES has been a factor associated with poor outcomes after DRF,<sup>2</sup> and these patients may be at greater risk for numerous obstacles after DRF, including self-reported disability and pain, which portend longer sick leave after DRF.<sup>14</sup> The goal of this study was to evaluate the effect of socioeconomic factors, including MHI, treatment facility (county versus university), insurance status (Medicaid/uninsured versus insured), and race (non-White versus White) on time to surgery after DRF. It was hypothesized that lower SES would be associated with increased time to surgery.

## METHODS

Institutional review board approval was obtained before study initiation. Consecutive patients from January 2017

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to June 2021 who underwent outpatient fixation of DRF within a large multisite academic healthcare system were retrospectively reviewed. Treatment facilities included a large county-level one trauma facility (16 inpatient operating rooms and three fellowship trained hand surgeons) and a university health system with two large tertiary care hospitals and two ambulatory surgery centers (six outpatient operating rooms and five fellowship trained hand surgeons). Patients were excluded if they had inpatient surgery, or if they had surgery more than 45 days after the original injury date because this would be considered a corrective osteotomy in the authors' practice. Time from injury to surgery (d) was recorded for each patient. The US Census Bureau was used to determine median household income (MHI) for a patient's five digit ZIP code.

Demographic variables including patient sex, race, and insurance status were collected and analyzed. Treatment facility (county versus university hospital) was documented for comparison. Data analysis was performed with IBM SPSS 27.0 (SPSS, Inc, Chicago, Ill.). A two-tailed Student *t* test was used to compare means. A chi-square test or Fisher exact test (when appropriate) was used to compare categorical variables. Alpha was set to 0.05. A one-way ANOVA test was used to compare the three SES groupings.

### RESULTS

A total of 413 patients met inclusion criteria. Two hundred fifty-seven patients were treated within the university health system, whereas 185 patients were treated within the county system. SD of time to surgery in the university health system was  $10.9 \pm 22.3$  and  $16.2 \pm 13.7$  days in the county system. Patients were mostly women (63.2%) and identified as either White (42.6%), Black (38.8%), Hispanic (5.0%), Asian (3.1%), or declined (9.6%). Patients' insurance status included private insurance (47.9%), Medicare (12.2%), Medicaid (9.0%), or uninsured (30.9%). MHI ranged from \$20,908 to \$194,272. There were 98 patients within the low MHI group (\$0–\$49,999), 165 patients in the mid-MHI group (\$50,000–\$74,999), and 150 patients in the high MHI group (\$75,000+). Patient demographics

**Table 1. Demographic Factors by Treatment Facility**

	County Hospital	University System	
Total No. patients	185 (48.9%)	257 (58.1%)	
Sex			
Male	98 (52.97%)	67 (26.07%)	<i>P</i> < 0.00001
Female	87 (47.03%)	190 (73.93%)	
Race			<i>P</i> < 0.00001
Black	126 (68.10%)	53 (20.62%)	
White	30 (16.21%)	178 (69.26%)	
Hispanic	17 (9.19%)	6 (2.33%)	
Other	10 (5.41%)	19 (7.39%)	
Age, y (mean)	41.77	53.46	<i>P</i> < 0.00001
Insurance type			<i>P</i> < 0.00001
Private	38 (20.54%)	165 (64.20%)	
Medicare	14 (7.57%)	38 (14.79%)	
Medicaid	19 (10.27%)	27 (10.50%)	
Worker's comp	4 (2.16%)	0 (0%)	
Uninsured	108 (58.38%)	21 (8.17%)	

### Takeaways

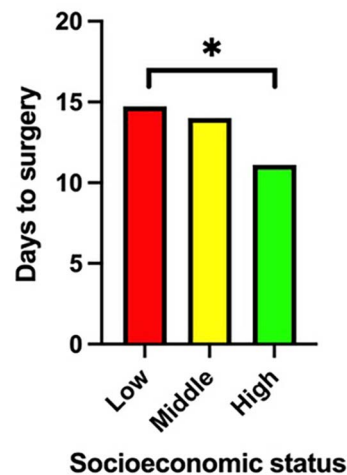
**Question:** What factors influence the time to surgery for distal radius fractures (DRFs), and how do socioeconomic status, insurance, race, and treatment facility affect this timing?

**Findings:** Lower socioeconomic status, lack of insurance or Medicaid coverage, and non-White race were all associated with longer delays in surgery for DRF. Treatment facility had the most significant impact on time to surgery, with county hospitals experiencing longer delays compared with university hospitals. Multivariate analysis revealed that only treatment facility was consistently associated with time to surgery.

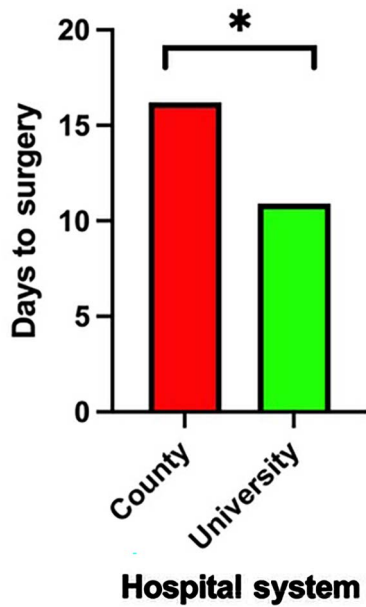
**Meaning:** This study highlights the significant impact of socioeconomic factors and treatment facility on the timing of surgery for DRF, underscoring the need for efforts to reduce barriers to care and improve healthcare access for at-risk patient populations to mitigate these disparities.

by treatment facility can be seen in Table 1. Thirteen patients were excluded from the university health system, whereas five patients were excluded from the county system.

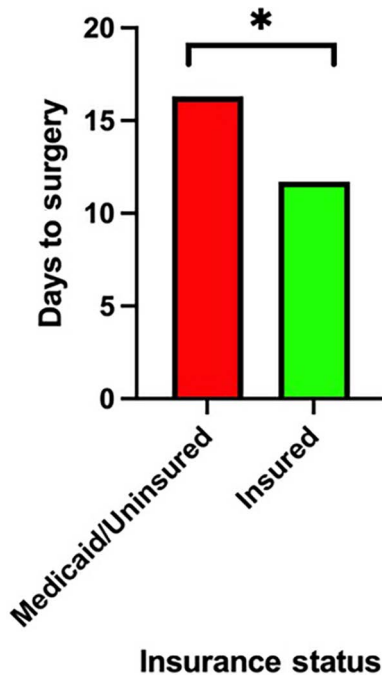
Bivariate analysis was first performed. SES was found to be significantly associated with time to surgery (14.7 d in low-SES group, 14.0 d in mid-SES group, and 11.1 d in high-SES group, *P* = 0.00063) (Fig. 1). Time to surgery within the county hospital system was found to be significantly longer than in the university system (16.2 versus 10.9 d, *P* < 0.0001) (Fig. 2). Insurance status was found to be an additional factor contributing to increased time to surgery: 11.7 days for insured versus 16.3 days for Medicaid/uninsured (*P* < 0.0001) (Fig. 3). Self-identified race was found to be significantly associated with time to surgery (non-White group: 15.2 d versus White group: 10.9 d, *P* < 0.0001) (Fig. 4). Subgroup analysis by treatment facility was then performed. No differences in



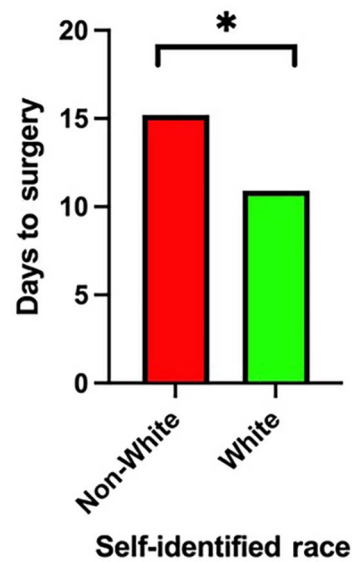
**Fig. 1.** Time to surgery determined by SES (14.7 d in the low-SES group, 14.0 d in the mid-SES group, and 11.1 d in the high-SES group, *P* = 0.00063). \**P* < 0.05.



**Fig. 2.** Time to surgery determined by hospital system (16.2 vs 10.9 d,  $P < 0.0001$ ). \* $P < 0.05$ .



**Fig. 3.** Time to surgery determined by insurance status (11.7 vs 16.3 d,  $P < 0.0001$ ). \* $P < 0.05$ .



**Fig. 4.** Time to surgery determined by self-identified race (15.2 vs White group: 10.9 d,  $P < 0.0001$ ). \* $P < 0.05$ .

time to surgery were identified after controlling for treatment facility (Table 2).

### DISCUSSION

DRF is one of the most common fractures requiring medical treatment.<sup>1</sup> In recent years, there has been an increase in rates of surgical fixation after DRF.<sup>15,16</sup> In the management of upper extremity fractures, time to surgery is vital to ensure proper fixation and allow for healing and bone remodeling.<sup>17,18</sup> In addition, timely fracture fixation shortens the postinjury recovery period and is the least costly option from a societal perspective, when considering lost productivity and unpaid caregiving.<sup>19</sup> Few studies have looked at socioeconomic and demographic factors affecting time to surgery after DRF. A recent study by Rahman et al<sup>20</sup> found significant differences in time to surgery and overall rate of operative fixation between socioeconomic cohorts, with patients from lower socioeconomic backgrounds being at increased risk for a delay to surgical fixation. We hoped to expand on the study by Rahman et al by including a larger cohort and evaluating differences in race and treatment facility on the care received.

This study evaluated time to surgery after DRF based on four socioeconomic variables: SES, treatment facility, insurance status, and race. We found that when evaluating all patients across multiple treatment facilities, individuals from a higher SES were more likely to be treated within

**Table 2. Days to Surgery within Treatment Facility**

	Low SES	Middle SES	High SES	P	White	Non-White	P value	Medicaid/No Insurance	Insurance	P
University	9.9 ± 5.9	11.5 ± 7.5	11.3 ± 8.6	0.576	13.0 ± 29.5	13.2 ± 10.7	0.9708	18.0 ± 22.7	12.9 ± 27.9	0.321
County	16.1 ± 16.5	17.6 ± 14.4	15.6 ± 9.3	0.724	13.6 ± 7.6	17.4 ± 15.2	0.1936	17.7 ± 15.2	14.9 ± 12.1	0.195

the university system and overall had a significantly shorter time to surgery than individuals residing in low or middle socioeconomic counties. This finding has been replicated in other fields of medicine, which have found that individuals from low socioeconomic backgrounds may face longer time to surgery.<sup>21,22</sup> In addition, delays in time to surgery have been previously demonstrated after other orthopedic injuries.<sup>23,24</sup> We found that when compared with White individuals, non-White individuals faced a significantly longer time to surgery. Previous studies have similarly found that minorities may face longer surgical waiting times in other fields of medicine.<sup>25,26</sup> When looking at the effect of treatment facility on delay in time to DRF fixation, individuals receiving care at a county hospital were more likely to experience a delay in time to surgery when compared with those receiving care at a university hospital system facility. Once the treatment facility was controlled for, no difference in time to surgery based on SES, insurance, or race was identified. Insurance status and race trended toward but did not reach significance in these groups. Although surgical waiting time within a facility is dependent on numerous factors, including operative caseload and operating room capacity, delays in time to surgery at county hospitals have been demonstrated in other fields of medicine, including time to surgery after breast cancer diagnosis.<sup>27</sup>

Reducing the time to surgery after DRF is of utmost importance for patients and surgeons, as a delay in care may be associated with poor short-term outcomes.<sup>28</sup> It is hypothesized that earlier time to surgery may mitigate stiffness and edema while reducing complications.<sup>29,30</sup> Although there is not a specific, proven threshold in the literature for when DRFs need to be operatively fixated, having a modest reduction and attempt to reduce time to surgery to less than 14 days is a reasonable goal, and has been demonstrated to be within a safe window of time for operative fixation.<sup>31</sup> Given that the average time to surgery for the county hospital patients in our study was 16.2 days, we feel that a modest 2-day improvement is certainly possible. Attempts to accomplish this goal could include more frequent attempts to contact patients that initially no-show for appointments and attempts to schedule sooner follow-up for patients after initial date of injury. Although the results of our study were statistically significant in demonstrating differences in time to surgery between groups, it is important to note that a difference of a few days to surgery, if within 2 weeks of initial injury, may not be of significant detriment to the patient.<sup>31,32</sup> Additionally, measuring functional outcomes was not one of the aims of this study, but is extremely important in elucidating the effect of delaying time to surgery for these patients. Whether an individual who gets surgery earlier may heal better, have a better intraoperative reduction, have improved pain control, or be more likely to follow-up with physical/occupational therapy, are all important factors to consider when evaluating the comprehensive impact of this difference. Furthermore, improving access to care would result in a reduction in costs associated with lost productivity during the postsurgical recovery process. Addressing these disparities is a substantial and important challenge. A multipronged approach, including patient education,

improved access to social resources and workers, increasing resources for county safety-net facilities, and increasing healthcare access for individuals in high-risk areas, is necessary to reduce delays in care for at-risk patients. Based on this analysis, focusing efforts on improving care delivery within county facilities may serve to provide more equitable care to patients of lower SES.

Limitations in this study include the retrospective and single-institution nature of this study. Multiple surgeons were included within this analysis, which introduces additional variables in treatment patterns. The reasons for delay in care within the studied county hospital system may not be generalizable to other healthcare institutions. Furthermore, this study may be underpowered to detect a difference in time to surgery after controlling for facility. Additionally, the factors evaluated are all intimately related. This limits the ability to individually understand the impact of each factor on time to surgery. For example, patients living in low socioeconomic areas may be more likely to be under or uninsured and to identify as non-White/White. We chose to use MHI based on ZIP code as a proxy for SES. Although this may provide a relative estimation, it is not specific to the patient's actual household income. Finally, functional outcomes and return to activity/work after surgery were not assessed. Although there are obvious benefits to receiving timely care of traumatic injuries (reduced healing time, faster return to activity and/or work, and decreased societal costs from lost productivity), long-term outcomes may not be affected by earlier treatment. Future studies should aim to evaluate the factors affecting delay to fixation after DRF and its effects on short- and long-term outcomes, as well as on societal costs such as lost productivity.

## CONCLUSIONS

Faster time to surgery after DRF is an important factor in improving functional outcomes and reducing productivity loss. This study demonstrates an association between socioeconomic factors and treatment facility which is related to time to surgery in DRF within a single metropolitan healthcare system. Measures aimed to reduce barriers to care, increase healthcare coverage, and improve patient education should be initiated to help mitigate these disparities.

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## DISCLOSURE

*The authors have no financial interest to declare in relation to the content of this article.*

## DECLARATION OF HELSINKI

*All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation*

(institutional and national) and with the Declaration of Helsinki of 1975, as revised 2008.

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