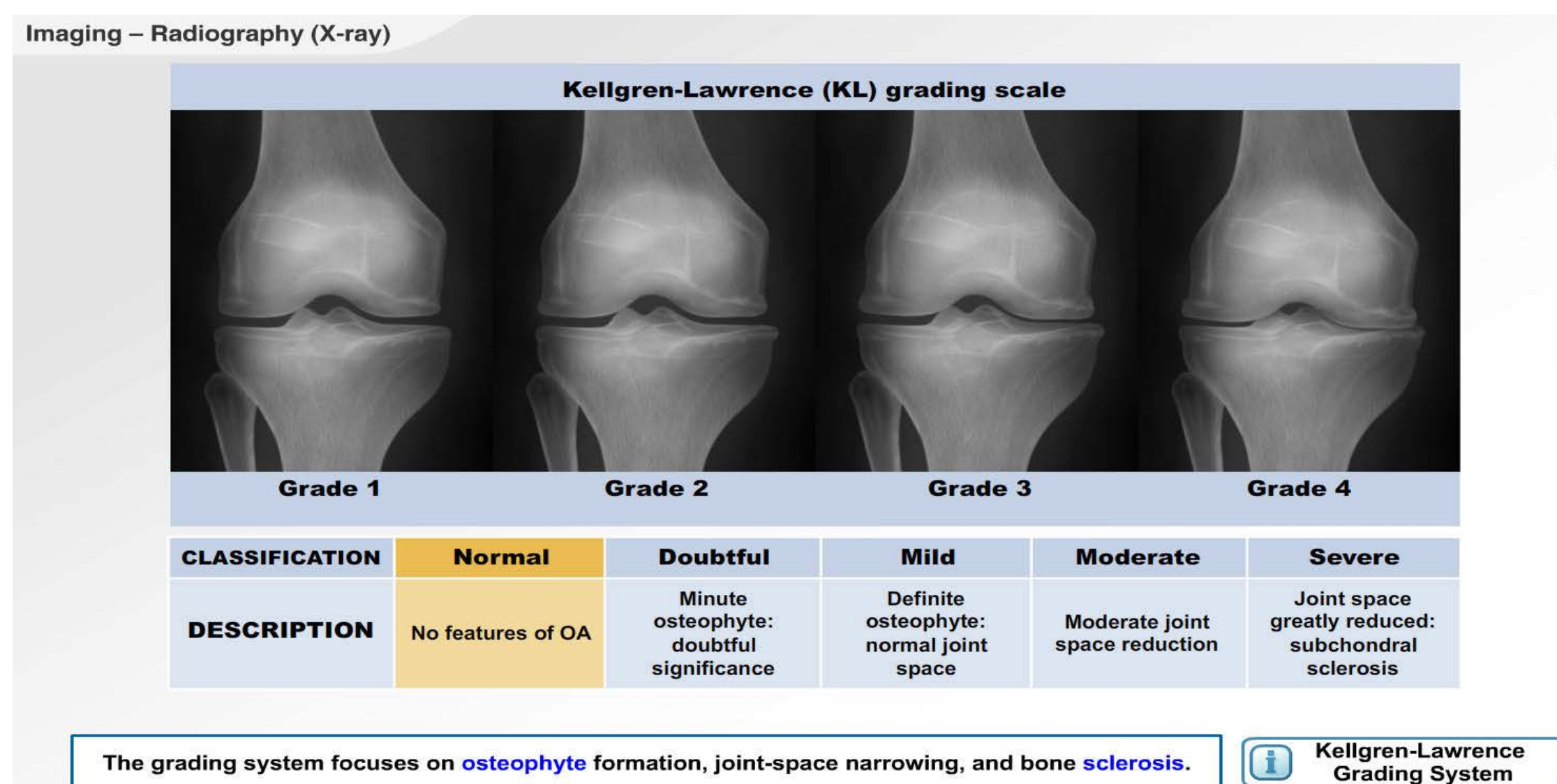


Introduction

Presently in medicine there is a push to change the way physicians are paid to deliver healthcare. The compensation method has changed from the Sustainable Growth Rate (SGR) formula in which physicians were compensated on a volume-based “fee for service method” to the Medicare access and children’s health insurance program (MACRA). MACRA is best described as a “pay for performance” model, in which physicians would be rewarded based on their treatment results. Critics of the pay for performance model argue that it would incentivize physicians to accept patients with the greatest likelihood of improvement and dissuade physicians from accepting high-risk patients with lower likelihood of improvement. This may result in denial of treatment to the most vulnerable of patients, including those with risk factors such as chronic disease: obesity, older age, and lower socioeconomic status. An equitable pay for performance model requires understanding how these patient risk factors affect outcomes so that risk-adjusted patient outcomes can be developed. This study aims to characterize the differences in OA knee pain observed among different patient populations. It is our expectation that patient characteristics such as high BMI, Charleston comorbidity index and KL score, will lead to lower KOOS scores (worse pain). We also predict females to have lower KOOS scores than males, and patients with Medicare and Medicaid will have lower KOOS scores than patients with private insurance. With reliable data on how initial OA pain differs between different patient populations orthopedists will be able to more accurately define improvement with regards to knee OA treatment. This will lead to fair compensation for treatment of all patients in a pay for performance model of healthcare.

The study has retrospectively analyzed 712 patient charts. Of these, 97 patients did not fall into the racial categories of either White or Black, five patients were either uninsured or insured by Veterans Health, and 53 patients had missing clinical or demographic data (5 missing BMI and 48 missing KL score) resulting in a sample of 559 patients. We analyzed the data looking for differences between the 4 KOOS subscales based on sex, insurance category, race, knee laterality, BMI, age, KL score, and Charleston comorbidity index

The relationship between KOOS subscale scores and age, sex, race, BMI, insurance type, CCI, and KL grade was evaluated using an initial model with sex, age, race, insurance type, BMI, CCI, and KL grade as main effects and two-, three- and four-way interactions. SAS/STAT software version 9.4 (SAS Institute Inc., Cary, North Carolina) was used for data analysis. Non-significant interactions ($p > .05$) were excluded from the final model and $p < .05$ indicated statistical significance.



Patient Demographic Information

Table 1. Patient characteristics (n=559)

Characteristic	
Sex, n (%)	
Male	28.3 (158)
Female	71.7 (401)
Race, n (%)	
African American/Black	52.1 (291)
Caucasian/White	47.9 (268)
Insurance type, n (%)	
Private	31.5 (176)
Medicare	29.0 (162)
Medicaid	39.5 (221)
KL grade, n (%)	
1, 2, or 3	32.2 (180)
4	67.8 (379)
BMI, kg/m ² , n (%)	
< 25 kg/m ²	10.0 (56)
25 to <30 kg/m ²	20.2 (113)
30- to <35 kg/m ²	25.0 (140)
35 to <40 kg/m ²	18.8 (105)
≥ 40 kg/m ²	25.9 (145)
Age (years), mean (SD)	60.0 (12.2)
CCI, mean (SD)	2.1 (1.7)
KOOS, mean (SD)	
Symptoms	44.1 (21.9)
Pain	37.4 (21.8)
ADL	40.4 (22.9)
QOL	22.8 (20.1)

ADL = activities of daily living; BMI = body mass index; CCI = Charlson comorbidity index; KL = Kellgren-Lawrence; KOOS = Knee Osteoarthritis and Outcomes Score; QOL = quality of life; SD = standard deviation.

Results

TABLE 2B: Multivariate association between patient characteristics and KOOS subscales at osteoarthritis diagnosis (n = 559).

Item	KOOS Symptoms		KOOS Pain		KOOS QOL		KOOS ADL	
	-LSM (SEM)-	P-value	-LSM (SEM)-	P-value	-LSM (SEM)-	P-value	-LSM (SEM)-	P-value
Sex		0.027		0.007		0.308		0.003
Male	49.7 (1.9)		43.8 (1.9)		25.9 (1.8)		47.1 (2.0)	
Female	45.1 (1.2)		38.2 (1.2)		23.8 (1.2)		40.6 (1.3)	
Race		0.011		0.010		0.473		0.024
Caucasian/White	49.7 (1.4)		43.5 (1.4)		25.5 (1.4)		46.2 (1.5)	
African American/Black	44.9 (1.6)		38.5 (1.6)		24.2 (1.6)		41.5 (1.7)	
Insurance		0.004		0.035		0.018		0.039
Private	50.4 ^a (1.8)		44.0 ^a (1.8)		27.2 ^a (1.7)		47.3 ^a (1.9)	
Medicare	49.2 ^a (2.0)		41.2 ^a (1.9)		26.5 ^{ab} (1.9)		43.2 ^{ab} (2.1)	
Medicaid	42.7 ^b (1.9)		37.8 ^b (1.8)		20.8 ^b (1.8)		41.1 ^b (2.0)	
KL score		<0.0001		0.0002		0.010		0.001
1, 2 or 3	52.4 (1.8)		44.8 (1.8)		27.4 (1.7)		47.3 (1.9)	
4	42.4 (1.3)		37.2 (1.3)		22.3 (1.2)		40.4 (1.4)	
BMI, kg/m ²		0.346		0.185		0.990		0.338
< 25	46.5 (3.0)		42.0 (3.0)		24.8 (2.9)		44.7 (3.2)	
25 - 30	50.4 (2.1)		45.0 (2.1)		25.6 (2.1)		47.4 (2.3)	
30 - 35	44.8 (1.9)		39.9 (1.8)		24.2 (1.8)		43.5 (2.0)	
35 - 40	47.7 (2.2)		38.0 (2.2)		24.6 (2.1)		40.9 (2.3)	
≥ 40	47.6 (2.1)		40.0 (2.1)		25.1 (2.1)		42.8 (2.2)	
Age		0.049		0.013		0.160		0.042
< 50	41.5 ^b (2.7)		35.3 ^{ab} (2.7)		19.9 (2.7)		38.7 ^{ab} (2.9)	
50 - 60	46.0 ^{ab} (1.9)		36.9 ^b (1.9)		22.8 (1.8)		40.0 ^a (2.0)	
60 - 70	51.3 ^a (1.9)		44.6 ^a (1.9)		26.7 (1.9)		47.3 ^b (2.0)	
≥ 70	50.8 ^{ab} (3.1)		47.1 ^{ac} (3.1)		29.9 (3.0)		49.4 ^{ab} (3.3)	
Charlson Comorbidity Index	-- $\hat{\beta}$ (SEM)--	0.577	-- $\hat{\beta}$ (SEM)--	0.598	-- $\hat{\beta}$ (SEM)--	0.879	-- $\hat{\beta}$ (SEM)--	0.794

¹LSM = least square means. SEM = standard error of the mean.

^{ab}Least squares means within the same item with different superscripts are different ($P < 0.05$) following Tukey multiple comparison adjustment.

Conclusions

This study was able to reaffirm a multitude of research previously performed detailing predictive factors such as age, race, KL score and sex and their effect on OA knee pain. In addition to validating previous literature this study was able to provide novel insight into the relationship between the type of insurance a patient holds and their initial OA knee pain. If we are to transition to a pay for performance model of healthcare compensation, studies like this one will be necessary in order to gather data on patient demographics and comorbidities that affect OA pain and thereby treatment outcomes. With such data risk adjusted outcomes based upon specific patient characteristics can be developed in order to provide physicians with realistic goals for treatment and fair compensation for the treatment of vulnerable patient populations. While we do concede this is a daunting task, it is our only option if we wish to adopt a pay for performance model of healthcare compensation while not limiting access to healthcare for our most liable patient populations.

