Risk-Factors for Readmission by BMI Following Primary Total Knee Arthroplasty

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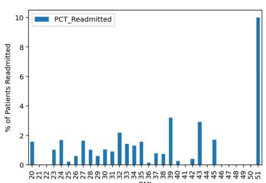
INTRODUCTION: Elevated Body Mass Index (BMI) is a recognized contributor to surgical complications following total knee arthroplasty (TKA). Readmissions within the early postoperative period impose significant challenges for both patients and healthcare systems. Understanding how BMI influences the risk of readmission is essential for guiding perioperative care. This study examined predictors of 90-day readmission across different BMI categories in patients undergoing primary TKA.

METHODS: A retrospective analysis of 13,844 primary unilateral TKAs from January 2017 to October 2024 was conducted. Revisions, conversions, and unicompartmental TKAs were excluded. Demographic variables and clinical data were obtained. Differences were assessed using chi-square and t-tests. Multivariable logistic regression analysis demonstrated odds ratios (OR) while controlling for age, same-day discharge (SDD), Charlson Comorbidity Index (CCI), smoking status, and race.

RESULTS: Multivariable analysis identified consistent predictors of 90-day readmission after TKA across BMI strata. Increasing age (OR-0.95,p<0.01), female sex (OR-0.63,p=0.01), and higher preoperative hemoglobin (OR-0.86,p<0.01) were associated with reduced readmission risk in all BMI groups. CCI was a significant risk factor across all strata (OR-1.24,p<0.01). ASA ≥3 reached significance only in BMI 40–45 and 45–50 (p=0.05). Same-day discharge was associated with increased readmission across all BMI groups (OR-2.0,p<0.01). Smoking status, race, and domestic partnered status were not significantly associated with readmission in any BMI category.

DISCUSSION AND CONCLUSION: Key predictors of 90-day readmission after TKA—including age, preoperative hemoglobin, and CCI—were consistent regardless of BMI, reinforcing the importance of optimizing modifiable risk factors. However, ASA classification became a more significant predictor at higher BMI levels, suggesting that physiologic burden may play a greater role in this subgroup. These findings may guide perioperative planning, particularly in high-BMI patients where closer attention to comorbidity and physiologic risk is warranted.



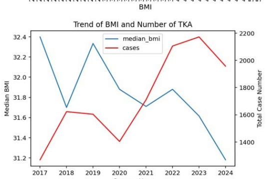


Table 1. Demographics of TKA Patients by BMI Bucket

BMI category (n)	<20 (88)	20-25 (1,312)	25-30 (3,914)	30-35 (4,299)	35-40 (2,686)	40-45 (1,088)	45-50 (368)	50+ (89)
Age, mean [min-max] (SD)	67.91 [9.00-93.00] (14.18)	71.15 [24.00-94.00] (9.80)	69.52 [24.00-94.00] (9.12)	67.67 [30.00-92.00] (8.97)	65.15 [28.00-93.00] (8.85)	63.82 [31.00-86.00] (8.43)	61.74 [34.00-84.00] (8.91)	59.96 [38.00-76.00] (8.67)
Race, n (%)								
White	55 (62)	864 (66)	2,332 (60)	2,427 (56)	1,413 (53)	550 (51)	192 (52)	44 (49)
Black	13 (15)	141 (11)	596 (15)	829 (19)	623 (23)	312 (29)	98 (27)	35 (39)
Asian	11 (12)	117 (9)	246 (6)	162 (4)	67 (2)	19 (2)	0 (0)	0 (0)
Other	9 (10)	190 (14)	740 (19)	881 (20)	583 (22)	207 (19)	78 (21)	10 (11)
Smoking Status n (%)								
Current	7 (8)	57 (4)	183 (5)	198 (5)	140 (5)	44 (4)	20 (5)	7 (8)
Former	38 (43)	506 (39)	1,445 (37)	1,617 (38)	936 (35)	383 (35)	135 (37)	29 (33)
Never	43 (49)	749 (57)	2,286 (58)	2,484 (58)	1,610 (60)	661 (61)	213 (58)	53 (60)
Sex, n (% F)	74 (84)	896 (68)	2,316 (59)	2,850 (66)	1,901 (71)	857 (79)	285 (77)	72 (81)
ASA, n (%)								
1	7 (8)	54 (4)	71 (2)	45 (1)	18 (1)	3 (0)	0 (0)	0 (0)
2	45 (51)	810 (62)	2,311 (59)	2,395 (56)	1,212 (45)	217 (20)	44 (12)	14 (16)
3	36 (41)	432 (33)	1,471 (38)	1,798 (42)	1,415 (53)	849 (78)	313 (85)	68 (76)
4	0 (0)	15 (1)	61 (2)	61 (1)	41 (2)	19 (2)	11 (3)	7 (8)
CCI, mean [min-max] (SD)	3.80 [0.00-12.00] (2.63)	4.00 [0.00-18.00] (2.65)	3.86 [0.00-19.00] (2.52)	3.63 [0.00-18.00] (2.47)	3.50 [0.00-18.00] (2.42)	3.41 [0.00-18.00] (2.38)	3.36 [0.00-14.00] (2.64)	2.94 [0.00-12.00] (2.50)
Anxiety Diagnosis, n (%)	21 (24)	227 (17)	608 (16)	611 (14)	411 (15)	147 (14)	49 (13)	10 (11)
Depression Diagnosis, n (%)	13 (15)	185 (14)	459 (12)	588 (14)	374 (14)	176 (16)	69 (19)	19 (21)
Preop Hgb, mean [min-max] (SD)	12.41 [6.80-15.80] (1.60)	12.84 [7.50-17.40] (1.53)	13.15 [6.20-19.60] (1.57)	13.16 [6.80-19.30] (1.57)	13.10 [6.30-18.70] (1.57)	12.92 [7.10-18.40] (1.53)	12.66 [8.50-18.00] (1.65)	12.92 [8.10-16.20] (1.65)
Marital Status, n (%)								
Married	35 (40)	689 (53)	2,166 (55)	2,279 (53)	1,359 (51)	495 (45)	173 (47)	34 (38)
Single	22 (25)	269 (21)	760 (19)	859 (20)	618 (23)	317 (29)	94 (26)	32 (36)
Widowed	13 (15)	207 (16)	517 (13)	591 (14)	327 (12)	133 (12)	47 (13)	3 (3)
Divorced	10 (11)	106 (8)	344 (9)	391 (9)	259 (10)	101 (9)	30 (8)	14 (16)
Legally	3 (3)	9 (1)	37 (1)	59 (1)	50 (2)	18 (2)	11 (3)	2 (2)
Separated	3 (3)	10 (1)	32 (1)	40 (1)	32 (1)	13 (1)	10 (3)	2 (2)
Significant Other	0 (0)	16 (1)	22 (1)	41 (1)	26 (1)	2 (0)	1 (0)	0 (0)
Partner	0 (0)	2 (0)	15 (0)	18 (0)	8 (0)	7 (1)	0 (0)	1 (1)
Unknown/Other	2 (2)	4 (0)	21 (1)	21 (0)	7 (0)	2 (0)	2 (1)	1 (1)
Surgery Performed on Friday, n (%)	10 (11)	172 (13)	600 (15)	670 (16)	400 (15)	165 (15)	76 (21)	11 (12)

Table 2 – 90-Day Readmissions Cohort Comparison

Demographic variable	Not Readmitted (n = 13,695)	Readmitted within 90 Days (n = 149)	*P*-Value
Age, mean [min-max] (SD)	67.53 [9.00-94.00] (9.38)	67.07 [38.00-85.00] (9.95)	0.55
Race, n (%)			**0.03**
White	7,785 (57)	92 (62)	
Black	2,611 (19)	36 (24)	
Asian	618 (5)	4 (3)	
Other/Unknown	2,681 (20)	17 (11)	
Smoking Status, n (%)			**<0.01**
Current	647 (5)	9 (6)	
Former	5,001 (37)	88 (59)	
Never	8,047 (59)	52 (35)	
Sex, n (% Women)	9161 (67)	90 (60)	0.11
ASA, n (%)			**<0.01**
1	198 (1)	0 (0)	
2	6,990 (51)	58 (39)	
3	6,299 (46)	83 (56)	
4	208 (2)	8 (5)	
BMI, mean [min-max] (SD)	32.34 [13.85-74.37] (6.18)	32.67 [20.31-50.88] (5.51)	0.51
CCI, mean [min-max] (SD)	3.66 [0.00-19.00] (2.48)	5.34 [0.00-18.00] (3.54)	**<0.01**
Anxiety Diagnosis, n (%)	2,042 (15)	42 (28)	**<0.01**
Depression Diagnosis, n (%)	1,844 (13)	39 (26)	**<0.01**
Preop Hgb, mean [min-max] (SD)	13.08 [6.20-19.60] (1.57)	13.01 [8.50-17.70] (2.00)	0.26
Marital Status, n (%)			**<0.01**
Married	7,163 (52)	67 (45)	
Single	2,938 (21)	33 (22)	
Widowed	1,821 (13)	17 (11)	
Divorced	1,241 (9)	14 (9)	
Legally Separated	189 (1)	0 (0)	
Significant Other	142 (1)	0 (0)	
Partner	96 (1)	12 (8)	
Unknown	47 (0)	4 (3)	
Other	58 (0)	2 (1)	

Table 3. Odds ratios for readmission by BMI class.

Factors OR [95% CI] (p-value)	<20	20-25	25-30	30-35	35-40	40-45	45-50	50+
Age	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**	**0.95 [0.94-0.97] (<0.01)**
Sex (Female)	**0.64 [0.46-0.9] (0.01)**	**0.63 [0.45-0.89] (0.01)**	**0.62 [0.44-0.87] (0.01)**	**0.63 [0.45-0.88] (0.01)**	**0.62 [0.44-0.87] (0.01)**	**0.65 [0.46-0.92] (0.01)**	**0.65 [0.46-0.91] (0.01)**	**0.63 [0.45-0.88] (0.01)**
ASA ≥ 3	1.36 [0.96-1.92] (0.08)	1.35 [0.95-1.9] (0.09)	1.33 [0.94-1.87] (0.11)	1.39 [0.99-1.97] (0.06)	1.34 [0.95-1.89] (0.1)	1.43 [1.01-2.02] (0.05)	1.41 [1.0-1.99] (0.05)	1.35 [0.95-1.9] (0.09)
CCI	**1.24 [1.18-1.3] (<0.01)**	**1.24 [1.18-1.3] (<0.01)**	**1.24 [1.18-1.3] (<0.01)**	**1.24 [1.18-1.3] (<0.01)**	**1.24 [1.18-1.3] (<0.01)**	**1.23 [1.17-1.29] (<0.01)**	**1.23 [1.18-1.3] (<0.01)**	**1.24 [1.18-1.3] (<0.01)**
Same Day Discharge	**2.02 [1.33-3.05] (<0.01)**	**2.02 [1.33-3.05] (<0.01)**	**2.04 [1.34-3.08] (<0.01)**	**2.03 [1.34-3.07] (<0.01)**	**2.02 [1.33-3.06] (<0.01)**	**2.0 [1.32-3.02] (<0.01)**	**1.99 [1.32-3.02] (<0.01)**	**2.02 [1.34-3.07] (<0.01)**
Current Partner	0.81 [0.58-1.14] (0.23)	0.82 [0.58-1.14] (0.24)	0.81 [0.58-1.14] (0.23)	0.81 [0.58-1.13] (0.22)	0.81 [0.58-1.14] (0.22)	0.81 [0.58-1.14] (0.23)	0.82 [0.59-1.15] (0.25)	0.82 [0.58-1.14] (0.24)
Current Smoker	1.1 [0.55-2.2] (0.79)	1.09 [0.54-2.17] (0.81)	1.1 [0.55-2.19] (0.79)	1.09 [0.54-2.17] (0.81)	1.09 [0.54-2.17] (0.82)	1.07 [0.53-2.13] (0.85)	1.08 [0.54-2.15] (0.83)	1.08 [0.54-2.16] (0.82)
Preoperative Hemoglobin	**0.86 [0.8-0.92] (<0.01)**	**0.86 [0.8-0.92] (<0.01)**	**0.86 [0.8-0.92] (<0.01)**	**0.85 [0.8-0.91] (<0.01)**	**0.85 [0.79-0.91] (<0.01)**	**0.86 [0.81-0.93] (<0.01)**	**0.86 [0.81-0.92] (<0.01)**	**0.86 [0.8-0.92] (<0.01)**
Race (Non-White)	0.73 [0.52-1.02] (0.07)	0.73 [0.52-1.02] (0.07)	0.74 [0.53-1.03] (0.07)	0.74 [0.53-1.03] (0.07)	0.73 [0.52-1.02] (0.07)	0.74 [0.53-1.04] (0.08)	0.74 [0.53-1.03] (0.08)	0.73 [0.52-1.03] (0.07)

*Bold signifies statistical significance.