

Knee Replacement Failure More Likely in Patients with a Higher BMI

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Last updated 07 December 2023 • Check for updates at EpicResearch.org

Key Findings:

- Patients with a higher BMI have a greater risk of knee replacement failure within a year of the procedure.
- Patients with a BMI over 50 are more than twice as likely to have a failure compared to patients with a BMI between 18.5 and 35.

Total knee replacement (TKR) is a procedure performed primarily for arthritis with the goal of relieving pain and improving quality of life.¹ Some studies have found that patients with a body mass index (BMI) greater than 30 have an increased risk of infection and repeat knee replacement.² We sought to understand how a patient's starting BMI affects outcomes after a TKR.

We studied 344,269 patients who had a total knee replacement between January 1, 2017, and July 31, 2023, to determine whether there were differences in rates of failure after a TKR based on the patient's starting BMI. We considered mechanical failures, infections, embolism, and hemorrhage as failures. Patients with class 3 obesity (BMI over 40) had the highest rate of failure within the first year after their TKR, as seen in Figure 1. Patients with a BMI over 50 were more than twice as likely to have a replacement failure compared to those with a BMI between 18.5 and 35. While the rate of failure was high in the underweight group (BMI under 18.5), it was not statistically significant.

Knee Replacement Failure Rates by BMI

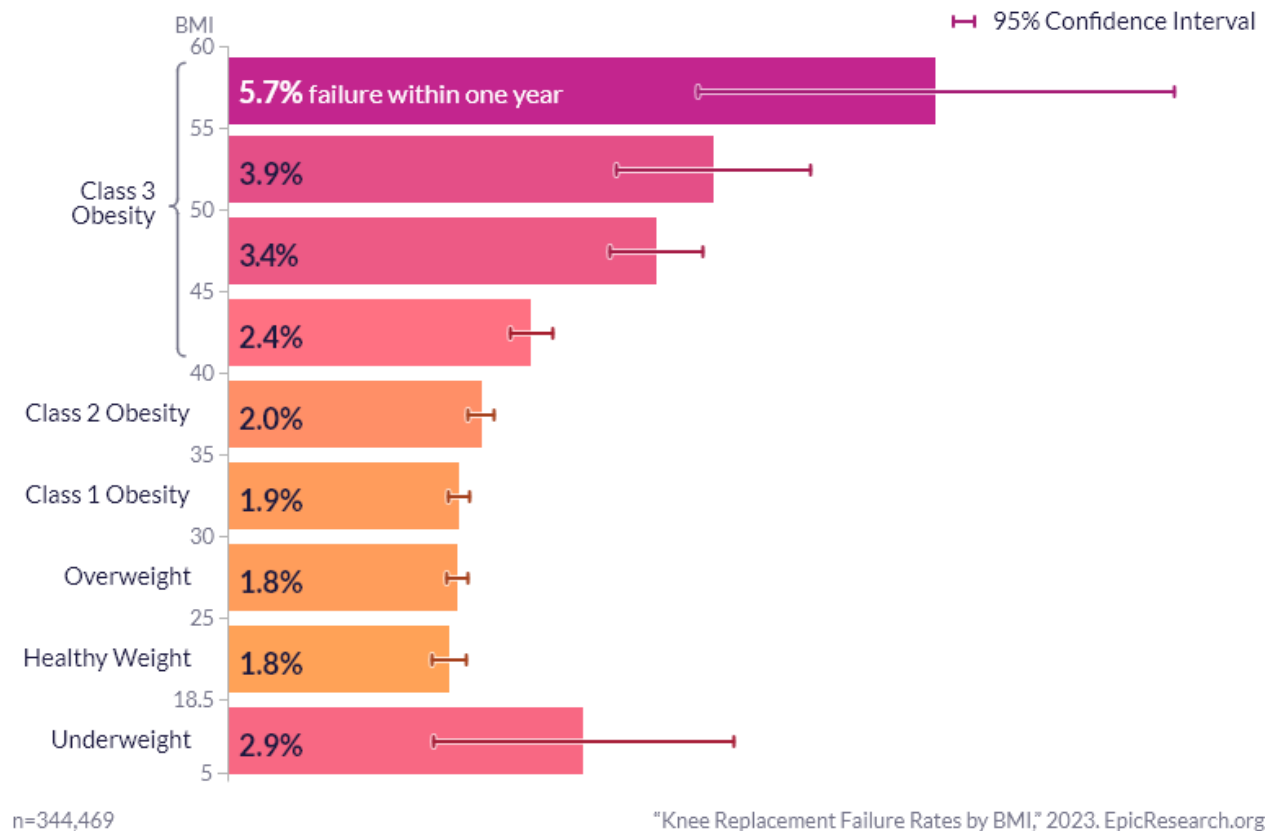


Figure 1. Knee replacement failure rates by patient's starting BMI.

We also evaluated whether a patient's starting BMI affected recovery time after a TKR surgery. We found that the average number of physical therapy appointments per week does not vary greatly across BMI classes, at around 2.25 sessions per week. The average length of time a patient goes to physical therapy after a TKR also did not vary much between BMI classes, with all classes going for 36.8 to 44.5 days.

These data come from Cosmos, a HIPAA-defined Limited Data Set of more than 220 million patients from 222 Epic organizations including 1,272 hospitals and more than 27,200 clinics, serving patients in all 50 states and Lebanon. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

1. Martin, G. M., & Harris, I. (2023, September 12). *Total knee arthroplasty*. UpToDate. https://www.uptodate.com/contents/total-knee-arthroplasty?search=total%20knee%20replacement&source=search_result&selectedTitle=1~150&usage_type=default&display_rank=1
2. Kerkhoffs, G. M. M. J., Servien, E., Dunn, W., Dahm, D., Bramer, J. A. M., & Haverkamp, D. (2012). The influence of obesity on the complication rate and outcome of total knee arthroplasty: A meta-analysis and systematic literature review. *The Journal of Bone and Joint Surgery. American Volume*, 94(20), 1839–1844. <https://doi.org/10.2106/jbjs.k.00820>

Data Definitions

Term	Definition
Study period	1/1/2017 – 7/31/2023
Study population	Patients with a TKR procedure with no history of TKR . The patient's first TKR must not be a TKR revision . The patient must have a recent BMI and at least one face-to-face visit in the two years prior to the TKR procedure .
Matching	A 1:1 matched population of patients who have never had a TKR procedure and had an encounter during the same year and month as a patient in the study population . Matched on sex and age.
TKR procedure	A diagnosis with a SNOMED CT code of 609588000 or an unmapped procedure via string matching (list available upon request).
History of TKR	A diagnosis with ICD-10-CM code Z96.65* or prior TKR procedure .
Obesity classification	The BMI documented between three months before and one month after a patient's TKR procedure : <18.5 - Underweight 18.5-25 - Normal (Healthy Weight) 25-30 - Overweight 30-35 - Class 1 Obesity 35-40 - Class 2 Obesity >40 - Class 3 Obesity
Knee replacement failure	A knee replacement failure categorized as mechanical , infection , or other .
Knee replacement failure - mechanical	A diagnosis with ICD-10-CM code T84.012*, T84.013*, T84.022*, T84.023*, T84.032*, T84.033*, T84.052*, T84.053*, T84.062*, T84.063*, T84.092*, T84.093*, T84.114*, T84.115*, T84.116*, T84.117*, T84.124*, T84.125*, T84.126*, T84.127*, T84.194*, T84.195*, T84.196*, T84.197*, T84.418*, T84.428*, or T84.498*.
Knee replacement failure - infection	A diagnosis with ICD-10-CM code T84.53*, T84.54*, T84.620*, T84.621*, T84.622*, T84.623*, or T84.7*.
Knee replacement failure – other	A diagnosis with ICD-10-CM code T84.8* or T84.9*.
Physical therapy visits	Physical therapy visits in following six months identified by: • Encounter type of "Occupational/Physical Therapy" • Provider type of "Physical Therapist" • Department specialty in any of: ("Occupational Therapy", "Physical Rehabilitation", "Physical Therapy")

Table 1: Knee Replacement Failure Rates by BMI

BMI Group	Any Failure		
	Total	Rate	CI
Class 3 Obesity [55-60)	564	5.67%	1.91%
Class 3 Obesity [50-55)	2,389	3.89%	0.78%
Class 3 Obesity [45-50)	9,233	3.43%	0.37%
Class 3 Obesity [40-45)	31,118	2.43%	0.17%

Class 2 Obesity	70,320	2.03%	0.10%
Class 1 Obesity	100,760	1.86%	0.08%
Overweight	94,566	1.85%	0.09%
Normal	34,783	1.77%	0.14%
Underweight	736	2.85%	1.20%

Table 2: Physical Therapy Characteristics by BMI

BMI Group	n	Days of Treatment	95% CI	Avg. # of Encounters	95% CI	Encounters per week	95% CI
Class 3 Obesity [55-60]	40	36.8	8.0	11.7	2.6	2.3	0.2
Class 3 Obesity [50-55]	201	42.3	3.3	13.0	1.2	2.2	0.1
Class 3 Obesity [45-50]	823	40.9	1.7	12.9	0.6	2.3	0.1
Class 3 Obesity [40-45]	2,892	42.9	0.9	13.4	0.3	2.3	0.0
Class 2 Obesity	6,781	44.5	0.6	13.7	0.2	2.3	0.0
Class 1 Obesity	9,614	43.0	0.5	13.4	0.2	2.3	0.0
Overweight	9,073	43.0	0.5	13.3	0.2	2.3	0.0
Normal	3,068	42.2	0.9	12.9	0.3	2.3	0.0
Underweight	56	37.6	6.1	11.2	1.8	2.2	0.2