

# Tobacco and Cannabis Use Have a Synergistic Effect on Infection Risk following Total Knee Arthroplasty

Oliver Sax<sup>1</sup>, Zhongming Chen, Sandeep Singh Bains, Daniel Hameed, Christopher George Salib, Ethan Remily, Jeremy Dubin, James Nace, Ronald Emilio Delanois<sup>2</sup>

<sup>1</sup>Rubin Institute For Advanced Orthopedics, <sup>2</sup>Rubin Institute for Advanced Orthopedics

## INTRODUCTION:

Nearly 13% of Americans smoke tobacco and about 18% use cannabinoids. Studies suggest a synergistic effect between the two products, whereby users of one are far more likely to use the other. Though tobacco use is a well-known risk contributor to impaired or delayed wound healing and soft tissue regeneration, a paucity of data exists regarding combined use of tobacco and cannabis in the setting of joint arthroplasty. With the recent changes in federal legalization of cannabis, we sought to determine if the known associations of tobacco use apply to cannabis use. We specifically assessed tobacco, cannabis, and combined users who underwent primary total knee arthroplasty (TKA) to determine: 90 day to 2 year 1) prosthetic joint infection (PJI); and 2) revision risk; as well as 3) independent risk factors for PJI.

## METHODS:

We queried a national, all payer database of patients undergoing primary TKA between 2010 and 2020. Patients were stratified according to prior use of tobacco products (n=30,000), cannabis (n=400), or a combination (n=3,526). These were defined according to International Classification of Disease codes, Ninth and Tenth Edition. Patients were tracked from the two years prior to TKA through two years following. A fourth cohort of TKA recipients without tobacco or cannabis use was used as a control. PJI, revisions, and other medical/surgical complications from 90-day through 2-years were evaluated between these cohorts using bivariate analyses. Multivariate analyses assessed independent risk factors for PJI at 90-days through 2-years, adjusted for patient demographics and health metrics.

## RESULTS:

Combined tobacco and cannabis use were associated with the highest rates of PJI following TKA. The odds of 90-day PJI risk among cannabis, tobacco, and combined users was 1.60, 2.14, and 3.39, respectively, as compared to the control cohort (p<0.001). The odds of 1-year PJI risk was 1.12, 1.63, and 2.46, respectively (p<0.001). Similarly, the odds of 2-year PJI risk was 1.08, 1.61, and 2.46 (p<0.001).

## DISCUSSION AND CONCLUSION:

Tobacco and cannabis use prior to primary TKA demonstrated a synergistic effect on PJI risk from 90-days through 2-years. Although the harms of tobacco use are well-known, this newfound knowledge should be incorporated in the shared decision-making discussions in the preoperative setting to best prepare for expected risks following primary TKA.

Table 1. Demographics and baseline characteristics

	Control (n=30,000) (%)	Cannabis only (n=400) (%)	Cannabis and Smokers (n=3,526)	Smokers only (n=30,000)	p-value
Age (SD)	67 (8.9)	61 (9.2)	57 (8.7)	66 (9.3)	<0.001
Sex					
Female	20,124 (67.08)	197 (49.25)	1,756 (49.80)	16,199 (54.00)	
Male	9,876 (32.92)	203 (50.75)	1,769 (50.17)	13,801 (46.00)	
Alcohol Abuse	718 (2.39)	93 (23.25)	1,997 (56.63)	2,723 (9.11)	<0.001
CCI-3	2,251 (7.50)	30 (7.50)	651 (18.01)	5,986 (18.45)	<0.001
DM	12,202 (40.67)	141 (35.25)	1,643 (46.60)	13,019 (43.40)	<0.001
Obesity	14,981 (49.93)	209 (52.25)	3,312 (94.69)	11,250 (37.50)	<0.001
Chronic Kidney Disease	4,709 (15.70)	56 (14.00)	645 (18.29)	5,859 (19.53)	<0.001

BMI: body mass index; no.: number; yr.: year; SD: standard deviation; DM: diabetes mellitus; CCI: Charlson Comorbidity Index; TKA: total knee arthroplasty

Table 2. Odds ratios of post-operative complications

	Cannabis only (n=400) (%)		Cannabis and Smokers (n=3,526)		Smokers only (n=30,000)	
	OR	CI	OR	CI	OR	CI
<b>90-Day complications</b>						
DVT	1.03	0.42-2.50	1.41	1.07-1.85	1.13	0.98-1.30
MI	3.58	0.86-14.86	2.44	1.28-4.63	2.29	1.59-3.29
PE	0.43	0.06-3.11	1.34	0.89-2.01	1.01	0.81-1.24
RF	1.42	0.35-5.76	3.24	2.25-4.66	1.55	1.21-1.98
PJI	1.62	0.66-3.94	3.77	2.97-4.77	1.84	1.57-2.17
Revision	0.94	0.13-6.75	1.60	0.92-2.78	1.16	0.86-1.57
MUA	0.82	0.44-1.54	1.08	0.88-1.31	0.85	0.77-0.93
<b>1-Year complications</b>						
DVT	1.06	0.50-2.24	1.25	0.98-1.61	1.15	1.02-1.30
MI	1.96	0.62-6.21	2.23	1.49-3.34	1.96	1.57-2.46
PE	0.28	0.04-2.00	1.28	0.92-1.79	0.98	0.83-1.16
RF	1.71	0.70-4.16	3.61	2.82-4.62	1.67	1.42-1.98
PJI	2.01	1.09-3.88	4.21	3.50-5.05	1.94	1.71-2.21
SSI	1.75	0.82-3.73	3.61	2.93-4.47	1.85	1.60-2.13
Revision	1.41	0.52-3.80	1.36	0.94-1.95	1.39	1.16-1.65
MUA	0.90	0.52-1.53	1.11	0.93-1.32	0.83	0.76-0.91
<b>2-Year complications</b>						
DVT	0.94	0.44-1.99	1.36	1.09-1.71	1.20	1.07-1.34
MI	2.17	0.89-5.31	2.62	1.92-3.56	1.83	1.52-2.20
PE	0.74	0.24-2.32	1.35	0.96-1.84	1.04	0.89-1.22
RF	1.81	0.85-3.85	4.04	3.28-4.96	1.84	1.59-2.12
PJI	1.96	1.07-3.6	3.89	3.26-4.63	1.86	1.65-2.10
SSI	1.73	0.85-3.51	3.53	2.89-4.30	1.91	1.68-2.18
Revision	1.79	0.88-3.64	1.52	1.15-2.00	1.41	1.23-1.62
MUA	1.02	0.62-1.69	1.11	0.93-1.31	0.83	0.76-0.91

\*Reference group: control cohort.  
OR: odds ratio; 95% CI: 95% confidence intervals;  
DVT: deep vein thrombosis; MI: myocardial infarction; PE: pulmonary embolism;  
RF: respiratory failure; PJI: prosthetic joint infection; MUA: manipulation under anesthesia

Table 3. Multivariate logistic regression for PJI

90-Day PJI	OR*	95% CI	p-value
Male sex	1.34	1.32-1.37	<0.001
Age <60	0.67	0.66-0.69	<0.001
Alcohol Abuse	1.14	1.11-1.16	<0.001
Chronic Kidney Disease	1.90	1.86-1.94	<0.001
Diabetes Mellitus	1.05	1.03-1.07	<0.001
Obesity	1.06	1.04-1.08	<0.001
Cannabis only	1.60	1.41-1.82	<0.001
Smokers and cannabis	3.39	3.31-3.48	<0.001
Smokers only	2.14	2.09-2.20	<0.001
<b>1-Year PJI</b>			
Male sex	1.52	1.50-1.55	<0.001
Age <60	0.68	0.67-0.69	<0.001
Alcohol Abuse	1.35	1.32-1.38	<0.001
Chronic Kidney Disease	2.25	2.21-2.29	<0.001
Diabetes Mellitus	0.91	0.89-0.92	<0.001
Obesity	1.27	1.25-1.29	<0.001
Cannabis only	1.12	0.99-1.26	0.0661
Smokers and cannabis	2.46	2.41-2.51	<0.001
Smokers only	1.63	1.59-1.67	<0.001
<b>2-Year PJI</b>			
Male sex	1.65	1.63-1.68	<0.001
Age <60	0.69	0.67-0.70	<0.001
Alcohol Abuse	1.36	1.33-1.39	<0.001
Chronic Kidney Disease	2.16	2.12-2.20	<0.001
Diabetes Mellitus	0.94	0.92-0.95	<0.001
Obesity	1.14	1.12-1.16	<0.001
Cannabis only	1.08	0.96-1.21	0.198
Smokers and cannabis	2.46	2.41-2.52	<0.001
Smokers only	1.61	1.57-1.65	<0.001

\*Reference group: control cohort