

Preoperative NarxCare Overdose Risk Scores Greater Than 100 Are Associated with Worse 1-Year PROMs and Dissatisfaction After Primary TKA

Shujaa T Khan¹, Ignacio Pasqualini, Chao Zhang, Ahmed Emara, Alison K Klika¹, Carlos A Higuera Rueda, Kim L Stearns, Matthew Edward Deren¹, Nicolas Santiago Piuze

¹Cleveland Clinic

INTRODUCTION:

The NarxCare Overdose Risk Score (ORS) is a weighted scalar measure of patient-specific prescription drug use. It is calculated using a complex algorithm based on dose, duration, and dispensation of narcotics, sedatives, and stimulants. The score can range from 0-999 with higher scores suggesting worse prescription drug use patterns. While a preoperative NarxCare ORS of ≥ 300 has been linked with increased healthcare utilization following total knee arthroplasty (TKA), there are no studies on the impact of ORS on patient reported outcome measures (PROMs). Therefore, this study aimed to evaluate the association of preoperative NarxCare ORS with (1) achievement of clinically meaningful improvements in PROMs, and (2) self-reported patient satisfaction at 1-year.

METHODS:

All patients who underwent primary TKA at a USA tertiary healthcare system from November 2018-December 2022 were eligible. Patients with incomplete PROMs or missing Narx score at any time point were excluded. This led to 4,687 patients being enrolled in this study. Data were collected using the Orthopaedic Minimal Data Set Episode of Care, a validated data-collection system for all elective orthopedic surgical interventions taking place within the health care system. Continuous variables were summarized using medians and interquartile ranges, while categorical variables were summarized using counts and percentages. Multivariable linear regression models were used to assess the relationship between baseline Risk score and 1-year PROMs. The PROMs evaluated included the Knee Disability and Osteoarthritis Outcome Score (KOOS) Pain, Physical Function Shortform (PS), Joint Replacement (JR), and Veteran RAND-12 mental component score (VR-12 MCS). Clinically relevant improvements were determined by the minimal clinically important difference (MCID) and Patient Acceptable Symptom State (PASS) thresholds. All models were controlled for pre-specified demographics and surgical confounding variables. All statistical tests were two-sided with a Type I error rate of 0.05. Cohort characteristics are detailed in **Table 1**.

RESULTS:

A preoperative ORS of 200-299 is significantly associated with failure to achieve MCID in KOOS PS (OR 1.34; CI 1.05 – 1.70; $p=0.017$), while the ORS has to increase to 300-399 before it becomes associated with failure to achieve MCID in KOOS JR (OR 1.60; CI 1.07, 2.4; $p=0.023$) (**Table 2**). Preoperative ORS of 100-199 is significantly associated with failure to reach PASS threshold in KOOS Pain (OR 1.20; 1.02 – 1.41; $p=0.025$), PS (OR 1.23; 1.05 – 1.44; $p=0.012$) and JR (OR 1.26; CI 1.07, 1.49; $p=0.007$), with the odds of failure continually increasing as the ORS increases (**Table 3**). Patients with a preoperative ORS of 200-299 are 27% more likely to be dissatisfied at 1-year (OR 1.27; CI 1.01, 1.59; $p=0.038$) compared to opioid naïve patients. The likelihood of dissatisfaction increases to 177% in those with an ORS score of ≥ 500 (OR 2.77; CI 1.39 – 5.51; $p=0.004$) (**Table 2**).

DISCUSSION AND CONCLUSION:

Increasing preoperative NarxCare ORS, a measure of prescription drug use, has a dose-dependent association with adverse clinical outcomes after TKA. An ORS of just 100 may significantly decrease the chances of clinically meaningful improvements in knee pain and function, as well as satisfaction at 1-year. This is lower than the previously stated ORS of 300 associated with increased healthcare utilization. A multidisciplinary approach is warranted to nullify the detrimental effects of sedatives, opioids, or stimulant drug use and subsequently lower patient ORS. While the ORS does not qualify as a basis for surgical ineligibility as it's a reflection of drug-use patterns rather than health status, surgeons may use the quantitative score to guide a patient centered discussion regarding possible postoperative clinical improvements.

Year	Country	Region	Population (millions)										GDP (trillion USD)	GDP per capita (USD)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
			1950	1960	1970	1980	1990	2000	2010	2020	2030	2040																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
1950	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150	2160	2170	2180	2190	2200	2210	2220	2230	2240	2250	2260	2270	2280	2290	2300	2310	2320	2330	2340	2350	2360	2370	2380	2390	2400	2410	2420	2430	2440	2450	2460	2470	2480	2490	2500	2510	2520	2530	2540	2550	2560	2570	2580	2590	2600	2610	2620	2630	2640	2650	2660	2670	2680	2690	2700	2710	2720	2730	2740	2750	2760	2770	2780	2790	2800	2810	2820	2830	2840	2850	2860	2870	2880	2890	2900	2910	2920	2930	2940	2950	2960	2970	2980	2990	3000	3010	3020	3030	3040	3050	3060	3070	3080	3090	3100	3110	3120	3130	3140	3150	3160	3170	3180	3190	3200	3210	3220	3230	3240	3250	3260	3270	3280	3290	3300	3310	3320	3330	3340	3350	3360	3370	3380	3390	3400	3410	3420	3430	3440	3450	3460	3470	3480	3490	3500	3510	3520	3530	3540	3550	3560	3570	3580	3590	3600	3610	3620	3630	3640	3650	3660	3670	3680	3690	3700	3710	3720	3730	3740	3750	3760	3770	3780	3790	3800	3810	3820	3830	3840	3850	3860	3870	3880	3890	3900	3910	3920	3930	3940	3950	3960	3970	3980	3990	4000	4010	4020	4030	4040	4050	4060	4070	4080	4090	4100	4110	4120	4130	4140	4150	4160	4170	4180	4190	4200	4210	4220	4230	4240	4250	4260	4270	4280	4290	4300	4310	4320	4330	4340	4350	4360	4370	4380	4390	4400	4410	4420	4430	4440	4450	4460	4470	4480	4490	4500	4510	4520	4530	4540	4550	4560	4570	4580	4590	4600	4610	4620	4630	4640	4650	4660	4670	4680	4690	4700	4710	4720	4730	4740	4750	4760	4770	4780	4790	4800	4810	4820	4830	4840	4850	4860	4870	4880	4890	4900	4910	4920	4930	4940	4950	4960	4970	4980	4990	5000	5010	5020	5030	5040	5050	5060	5070	5080	5090	5100	5110	5120	5130	5140	5150	5160	5170	5180	5190	5200	5210	5220	5230	5240	5250	5260	5270	5280	5290	5300	5310	5320	5330	5340	5350	5360	5370	5380	5390	5400	5410	5420	5430	5440	5450	5460	5470	5480	5490	5500	5510	5520	5530	5540	5550	5560	5570	5580	5590	5600	5610	5620	5630	5640	5650	5660	5670	5680	5690	5700	5710	5720	5730	5740	5750	5760	5770	5780	5790	5800	5810	5820	5830	5840	5850	5860	5870	5880	5890	5900	5910	5920	5930	5940	5950	5960	5970	5980	5990	6000	6010	6020	6030	6040	6050	6060	6070	6080	6090	6100	6110	6120	6130	6140	6150	6160	6170	6180	6190	6200	6210	6220	6230	6240	6250	6260	6270	6280	6290	6300	6310	6320	6330	6340	6350	6360	6370	6380	6390	6400	6410	6420	6430	6440	6450	6460	6470	6480	6490	6500	6510	6520	6530	6540	6550	6560	6570	6580	6590	6600	6610	6620	6630	6640	6650	6660	6670	6680	6690	6700	6710	6720	6730	6740	6750	6760	6770	6780	6790	6800	6810	6820	6830	6840	6850	6860	6870	6880	6890	6900	6910	6920	6930	6940	6950	6960	6970	6980	6990	7000	7010	7020	7030	7040	7050	7060	7070	7080	7090	7100	7110	7120	7130	7140	7150	7160	7170	7180	7190	7200	7210	7220	7230	7240	7250	7260	7270	7280	7290	7300	7310	7320	7330	7340	7350	7360	7370	7380	7390	7400	7410	7420	7430	7440	7450	7460	7470	7480	7490	7500	7510	7520	7530	7540	7550	7560	7570	7580	7590	7600	7610	7620	7630	7640	7650	7660	7670	7680	7690	7700	7710	7720	7730	7740	7750	7760	7770	7780	7790	7800	7810	7820	7830	7840	7850	7860	7870	7880	7890	7900	7910	7920	7930	7940	7950	7960	7970	7980	7990	8000	8010	8020	8030	8040	8050	8060	8070	8080	8090	8100	8110	8120	8130	8140	8150	8160	8170	8180	8190	8200	8210	8220	8230	8240	8250	8260	8270	8280	8290	8300	8310	8320	8330	8340	8350	8360	8370	8380	8390	8400	8410	8420	8430	8440	8450	8460	8470	8480	8490	8500	8510	8520	8530	8540	8550	8560	8570	8580	8590	8600	8610	8620	8630	8640	8650	8660	8670	8680	8690	8700	8710	8720	8730	8740	8750	8760	8770	8780	8790	8800	8810	8820	8830	8840	8850	8860	8870	8880	8890	8900	8910	8920	8930	8940	8950	8960	8970	8980	8990	9000	9010	9020	9030	9040	9050	9060	9070	9080	9090	9100	9110	9120	9130	9140	9150	9160	9170	9180	9190	9200	9210	9220	9230	9240	9250	9260	9270	9280	9290	9300	9310	9320	9330	9340	9350	9360	9370	9380	9390	9400	9410	9420	9430	9440	9450	9460	9470	9480	9490	9500	9510	9520	9530	9540	9550	9560	9570	9580	9590	9600	9610	9620	9630	9640	9650	9660	9670	9680	9690	9700	9710	9720	9730	9740	9750	9760	9770	9780	9790	9800	9810	9820	9830	9840	9850	9860	9870	9880	9890	9900	9910	9920	9930	9940	9950	9960	9970	9980	9990	10000	10010	10020	10030	10040	10050	10060	10070	10080	10090	10100	10110	10120	10130	10140	10150	10160	10170	10180	10190	10200	10210	10220	10230	10240	10250	10260	10270	10280	10290	10300	10310	10320	10330	10340	10350	10360	10370	10380	10390	10400	10410	10420	10430	10440	10450	10460	10470	10480	10490	10500	10510	10520	10530	10540	10550	10560	10570	10580	10590	10600	10610	10620	10630	10640	10650	10660	10670	10680	10690	10700	10710	10720	10730	10740	10750	10760	10770	10780	10790	10800	10810	10820	10830	10840	10850	10860	10870	10880	10890	10900	10910	10920	10930	10940	10950	10960	10970	10980	10990	11000	11010	11020	11030	11040	11050	11060	11070	11080	11090	11100	11110	11120	11130	11140	11150	11160	11170	11180	11190	11200	11210	11220	11230	11240	11250	11260	11270	11280	11290	11300	11310	11320	11330	11340	11350	11360	11370	11380	11390	11400	11410	11420	11430	11440	11450	11460	11470	11480	11490	11500	11510	11520	11530	11540	11550	11560	11570	11580	11590	11600	11610	11620	11630	11640	11650	11660	11670	11680	11690	11700	11710	11720	11730	11740	11750	11760	11770	11780	11790	11800	11810	11820	11830	11840	11850	11860	11870	11880	11890	11900	11910	11920	11930	11940	11950	11960	11970	11980	11990	12000	12010	12020	12030	12040	12050	12060	12070	12080	12090	12100	12110	12120	12130	12140	12150	12160	12170	12180	12190	12200	12210	12220	12230	12240	12250	12260	12270	12280	12290	12300	12310	12320	12330	12340	12350	12360	12370	12380	12390	12400	12410	12420	12430	12440	12450	12460	12470	12480	12490	12500	12510	12520	12530	12540	12550	12560	12570	12580	12590	12600	12610	12620	12630	12640	12650	12660	12670	12680	12690	12700	12710	12720	12730	12740	12750	12760	12770	12780	12790	12800	12810	12820	12830	12840	12850	12860	12870	12880	12890	12900	12910	12920	12930	12940	12950	12960	12970	12980	12990	13000	13010	13020	13030	13040	13050	13060	13070	13080	13090	13100	13110	13120	13130	13140	13150	13160	13170	13180	13190	13200	13210	13220	13230	13240	13250	13260	13270	13280	13290	13300	13310	13320	13330	13340	13350	13360	13370	13380	13390	13400	13410	13420	13430	13440	13450	13460	13470	13480	13490	13500	13510	13520	13530	13540	13550	13560	13570	13580	13590	13600	13610	13620	13630	13640	13650	13660	13670	13680	13690	13700	13710	13720	13730	13740	13750	13760	13770	13780	13790	13800	13810	13820	13830	13840	13850	13860	13870	13880	13890	13900	13910	13920	13930	13940	13950	13960	13970	13980	13990	14000	14010	14020	14030	14040	14050	14060	14070	14080	14090	14100	14110	14120	14130	14140	14150	14160	14170	14180	14190	14200	14210	14220	14230	14240	14250	14260	14270	14280	14290	14300	14310	14320	14330	14340	14350	14360	14370	14380	14390	14400	14410	14420	14430	14440	14450	14460	14470	14480	14490	14500	14510	14520	14530	14540	14550	14560	14570	14580	14590	14600	14610	14620	14630	14640	14650	14660	14670	14680	14690	14700	14710	14720	14730	14740	14750	14760	14770	14780	14790	14800	14810	14820	14830	14840	14850	14860	14870	14880	14890	14900	14910	14920	14930	14940	14950	14960

Table 2 - Multivariable logistic regression model, using failure to reach satisfaction and MCIE improvements in KOOS Pain, PS, and JR as outcomes

Predictors	Pain (n=9)		MCID KOPS Pain		MCID KOPS FS		MCID KOPS JR	
	OR (95%CI)	P	OR (95%CI)	P	OR (95%CI)	P	OR (95%CI)	P
Baseline Risk Score (1.59 ± 0.9)	1.28 (0.83 – 1.93)	0.271	0.81 (0.37 – 1.80)	0.611	1.20 (0.72 – 1.99)	0.480	1.67 (0.93 – 2.99)	0.088
Baseline Risk Score (100/159 ± 0.1)	1.14 (0.98 – 1.35)	0.187	1.14 (0.98 – 1.35)	0.360	0.88 (0.80 – 1.32)	0.484	1.16 (0.82 – 1.51)	0.263
Baseline Risk Score (200/259 ± 0.1)	1.27 (1.01 – 1.59)	0.038	1.30 (0.94 – 1.80)	0.109	1.34 (1.05 – 1.70)	0.017	1.31 (0.97 – 1.74)	0.082
Baseline Risk Score (300/359 ± 0.1)	1.23 (1.00 – 1.51)	0.196	1.39 (0.98 – 2.15)	0.145	1.11 (0.79 – 1.59)	0.552	1.60 (0.97 – 2.63)	0.023
Baseline Risk Score (400/399 ± 0.1)	1.89 (1.19 – 2.98)	0.007	1.53 (0.89 – 3.09)	0.237	1.41 (0.79 – 2.46)	0.234	1.75 (1.09 – 3.30)	0.066
Baseline Risk Score (n=500 ± 0.1)	2.77 (1.39 ± 5.51)	0.004	2.19 (0.91 – 5.21)	0.122	2.94 (0.96 – 5.23)	0.063	3.52 (0.81 – 1.45)	0.452

This model was adjusted for Age, Sex, BMI, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, PROM Phenotype

Table 3 - Multivariable logistic regression model, using failure to reach attainment of PASS Threshold in KQOS Pain, PS, and IR as outcomes.

Predictors	KOOS PAIR PASS		KOOS PS PASS		KOOS JR PASS	
	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Baseline Risk Score (1-99.0)	1.23 (0.05 - 1.99)	0.280	0.15 (0.79 - 1.67)	0.452	1.39 (0.52 - 2.04)	0.050
Baseline Risk Score (100-199.0)	1.20 (1.02 - 1.41)	0.025	1.23 (1.05 - 1.44)	0.012	1.26 (1.07 - 1.49)	0.007
Baseline Risk Score (200-299.0)	1.37 (1.14 - 1.66)	0.001	1.55 (1.25 - 1.82)	<0.001	1.54 (1.27 - 1.88)	<0.001
Baseline Risk Score (300-399.0)	1.29 (0.99 - 1.69)	0.060	1.65 (1.26 - 2.15)	<0.001	1.55 (1.18 - 2.05)	0.002
Baseline Risk Score (400-499.0)	1.59 (1.04 - 2.42)	0.031	2.05 (1.34 - 3.14)	0.001	1.99 (1.29 - 3.07)	0.002
Baseline Risk Score (≥500.0)	2.46 (1.22 - 4.80)	0.012	4.68 (2.10 - 10.33)	<0.001	2.65 (1.22 - 5.64)	0.010

This model was adjusted for Age, Sex, BMI, Race, Education, Smoking, ADI, CCI, Insurance, Diagnosis, Anesthesia, PROM Phenotype