**Title:** A web based risk calculator incorporating preoperative opioid use to predict revision of total-knee arthroplasty

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**Background:** Over 700,000 total-knee arthroplasties (TKAs) are performed in the United States each year with 6% requiring revision after 5 years. Some risk factors for knee revision have been previously identified. However, despite the role pain can play in electing to proceed with initial TKA, there is a paucity of research investigating preoperative prescription opioid use as a risk factor for TKA revision. Accordingly, we sought to investigate if such an association existed. Additionally, using our findings, we aimed to create and publish online a freely available risk calculator to assist providers in estimating an individual patient’s risk of TKA revision over time.

**Methods:** We retrospectively analyzed medical records of all Veterans Affairs patients who underwent unilateral TKA from Jan. 1, 2006 to Jan. 1, 2012. Preoperative daily oral morphine equivalent doses (MEs) were calculated from prescription records from Jan. 1, 2005 to initial TKA dates. Patients were followed from their initial TKA date until Jan. 1, 2013. Time to revision, grouped by non-opioid users versus tertiles of opioid users, was plotted using Kaplan-Meier curves. A multivariate Cox proportional hazard model was then fit to predict revision with MEs as a continuous variable. Backwards stepwise selection with the Akaike information criterion, employing 10-fold cross validation, was used for variable selection. Model performance was evaluated by the accuracy on a 40-sample bootstrapped calibration plot for predicting revision at one year. This model was used for a decision support application to quantify the risk of revision following TKA.

**Results:**  33,573 patients were included. The cohort was 94.4% male and the median age was 63. Follow-up was 1 – 7 years (median = 3.7). 1,646 (4.90%) patients required revision. Survival curves found non-opioid users less likely to need revision than patients in the first tertile of use, < 3.7 MEs (p = 0.003). Patients in the first tertile of use were less likely to be revised than patients in the second tertile, 3.7 – 14.3 MEs (p = 0.002). For the model, age (HR = 0.9485, CI: 0.9434 - 0.9536, p < 0.0001), BMI (HR = 0.9873, CI: 0.9782 - 0.9964, p = 0.0061), diabetes (HR = 1.2051, CI: 1.0828 - 1.3412, p = 0.0006), CKD (HR = 1.4656, CI: 1.0828 - 1.3412, p < 0.001), and MEs (HR = 1.0004, CI: 1.0001 - 1.0007, p = 0.0141) were associated with revision. The bias-corrected mean absolute error at one year was 0.0029.

**Conclusions:** Preoperative opioid use predicts TKA revision in a dose-dependent manner.In an effort to quantify patients’ preoperative risk of TKA revision, we published a web based risk calculator for TKA revision at [bit.do/tka](http://bit.do/tka). A screenshot of the application is shown in Figure 1. For patients using a significant amount of opioids, before electing with TKA, it may be helpful to utilize the calculator to facilitate discussions of risk, benefits, and expectations.

**Figure 1:**

