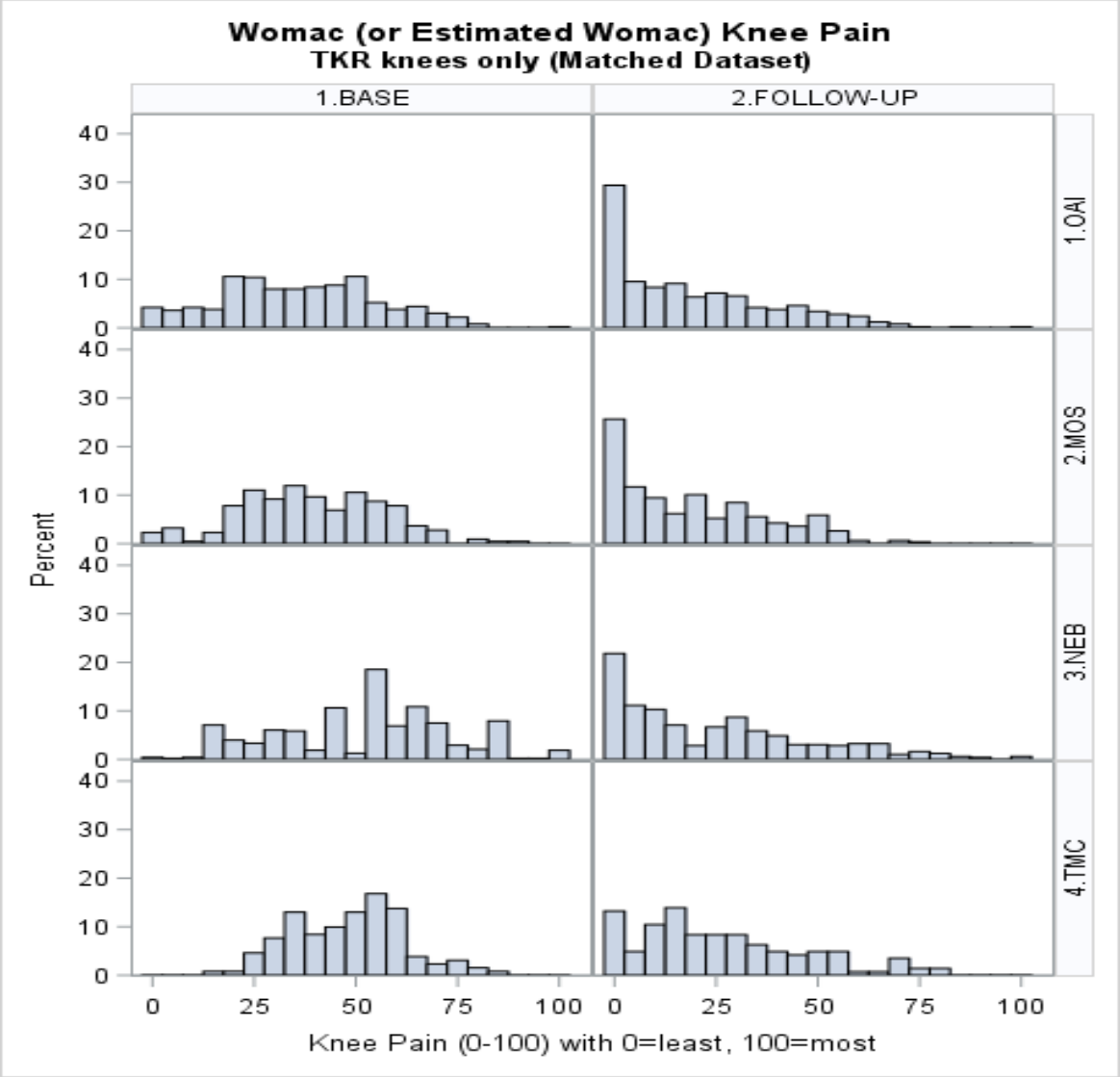
Appendix C. WOMAC Pain Score

APPENDIX C: WOMAC Pain Score

I. WOMAC Knee Pain Score agreement with other measures of Pain and Function

WOMAC Knee pain was selected as our primary outcome in collaboration with our stakeholders and study team. To confirm the importance, and better understand the meaning of the outcome, we reviewed correlations and scatter plots of WOMAC knee pain (WOMKP) with the following variables: baseline SF-12 physical score (HSPSS), the Physical activity scale for the Elderly (PASE), the WOMAC disability scales (WOMADL), the KOOS sport and recreational activity scale (KOOSFSR), the KOOS quality of life (KOOSQOL) and the KGLRS scale assessing the effects of knee pain and arthritis on function. We used the matched set of TKR and non-TKR knees in the OAI database for these evaluations. For some scales, higher scores represent worse outcomes (WOMKP, WOMADL, KGLRS) and for others, higher scores represent better outcomes (PASE, KOOS, SF-12). Most patterns we found were as expected. For both Control and TKR subjects, worse baseline WOMAC Knee pain (XWOMKP) was significantly ($p<.0001$) associated with worse scores for physical function (ADL, KOOS, and KGLRS) (**Table 1**)**.**

Figure 1. Distributions of WOMAC and Estimated WOMAC



II. Estimation of a WOMAC knee pain score using results from the KSS

Both the OAI and MOST data sources had data for WOMAC knee pain but the NEBH and TMC data sources did not. In order to create a common WOMAC or WOMAC like knee pain variable across data sources, we constructed a new variable based on the KSS data available in the NEBH and TMC datasets. Different versions of the KSS were used for NEBH versus TMC so we used different approaches to estimate a WOMAC score for each. We examined how the WOMAC scale was constructed and used that information to estimate a WOMAC score from KSS data. Figure 1 shows the distributions of the WOMAC and resulting estimated WOMAC from each of the four studies stratified by timing (baseline verses follow-up).

Creation of a WOMAC Pain score from the NEBH version of KSS

We used the OAI database to establish and explore relationships between the WOMAC pain score, based on five components, and the estimated WOMAC score based on fewer components that would be captured in a KSS.

The KSS captures data on walking, stairs, and rest. Keeping similar weighting as the WOMAC, we developed the following mapping of the KSS to make an estimated WOMAC instrument.

Table 2. NEBH WOMAC/KSS Mapping Schemes

WOMAC Scale	KSS Scale (NEBH)	Walking		Stairs		Rest	
		KSS score	Estimated WOMAC component score	KSS score	Estimated WOMAC component score	KSS score	Estimated WOMAC component score
None (0)	None	35	0	15	0	0	0
Mild (1)	Mild/Occasional	30	1	10	1	-5	3
Moderate (2)	Moderate	15	2	5	2	-10	6

Severe (3) Extreme (4)	Severe	0	3.5	0	3.5	-15	10.5

WOMAC is a sum of 5 pain scores on a 0 to 4 point scale (Stairs + Walking + In Bed + Sit/Lie down + Standing), where high numbers mean high pain. The KSS is a sum of 3 pain scores, each with their own scale (Stairs + Walking + Rest), where low numbers mean high pain.

Both scales give more 'weight' for rest pain than stair or walking pain. The KSS weights stair pain as worse than walking pain, unless it is severe, then they are the same. WOMAC weights stair pain and walking pain the same and distinguishes different types of rest pain.

Our estimated WOMAC pain score weights stair and walking pain the same, as with the WOMAC. The range is 0 to 17.5 (rather than 0 to 20). It assumes that the ("KSS Pain at Rest" x 3) is the same as (WOMAC Pain in Bed + WOMAC Pain Sitting/Lying down + WOMAC Pain Standing).

Creation of a WOMAC Pain score from the TMC version of KSS

The Tufts database used an older version of the KSS and presented the biggest challenge for the pain score outcome. We asked members of the research team to use the questions collected on the Tufts KSS and review the WOMAC scale and weightings and try to score items that they believed would approximate the WOMAC. We then calculated scores and plotted distributions at baseline and follow-up. After reviewing the distribution of scores at baseline and follow-up the team decided to use the version shown in Table 3 which looked most like what was seen in the NEBH, the OAI, and MOST databases.

Table 3. TMC WOMAC/KSS Mapping Schemes				
KSS Pain	KSS Walk (I. Walking)	Estimated WOMAC component score	KSS Stairs (Stairs)	Estimated WOMAC component score
None	Unlimited, > 10 Blocks, 5 - 10 Blocks	0	Normal Up & Down, Normal Up; Down with Rail; Up & Down with Rail	0
	< 5 blocks, Housebound, Unable	0.5	Up with Rail; Unable	0.5
Mild or Occasional	Unlimited, > 10 Blocks, 5 - 10 Blocks	1	Normal Up & Down, Normal Up; Down with Rail; Up & Down with Rail	1
	< 5 blocks, Housebound, Unable	1.5	Up with Rail; Unable	1.5
Mild or Occasional, Stairs Only	Unlimited, > 10 Blocks, 5 - 10 Blocks	2	Normal Up & Down, Normal Up; Down with Rail; Up & Down with Rail	2
	< 5 blocks, Housebound, Unable	2.5	Up with Rail; Unable	2.5
Mild or Occasional, Walking & Stairs	Unlimited, > 10 Blocks, 5 - 10 Blocks	2	Normal Up & Down, Normal Up; Down with Rail; Up & Down with Rail	2
	< 5 blocks, Housebound, Unable	2.5	Up with Rail; Unable	2.5
Moderate Occasional	Unlimited, > 10 Blocks, 5 - 10 Blocks	3	Normal Up & Down, Normal Up; Down with Rail; Up & Down with Rail	3
	< 5 blocks, Housebound, Unable	3.5	Up with Rail; Unable	3.5
Moderate Continual	Unlimited, > 10 Blocks, 5 - 10 Blocks	4	Normal Up & Down, Normal Up; Down with Rail; Up & Down with Rail	4
	< 5 blocks, Housebound, Unable	4.5	Up with Rail; Unable	4.5
Severe	--	5	--	5

In summary, we re-scaled the estimated WOMAC pain scores from 0 to 100 in our matched datasets. The distributions of scores pre and post-TKR were similar to those observed in the MOST and OAI databases. Also, we looked at follow-up scores and controlled for baseline scores, which were based on the same scale within studies. We reviewed pain scores between controls and matched TKR subjects within each study and did not see any gross inconsistencies. While we are aware that our methods are not validated, we believe they are adequate and reasonable based on patient and clinician stakeholder and research team input.