

# Composition of the Knee Index, a 3D biomechanical index for knee joint load, in subjects with mild to moderate knee OA

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## AIM

Knee joint load is an important factor associated with progression of knee osteoarthritis. The commonly used external knee adduction moment (KAM) includes the frontal plane only. The new Knee Index includes moments from all three planes (Figure 3). The purpose of this study was to investigate how the frontal, sagittal and transversal moments contribute to the Knee Index.

## CONCLUSION

- The primary contributors to the Knee Index are:
  - Frontal plane kinematics
  - Sagittal plane kinematics
- The frontal plane contributes more, with large in-between subject variation.

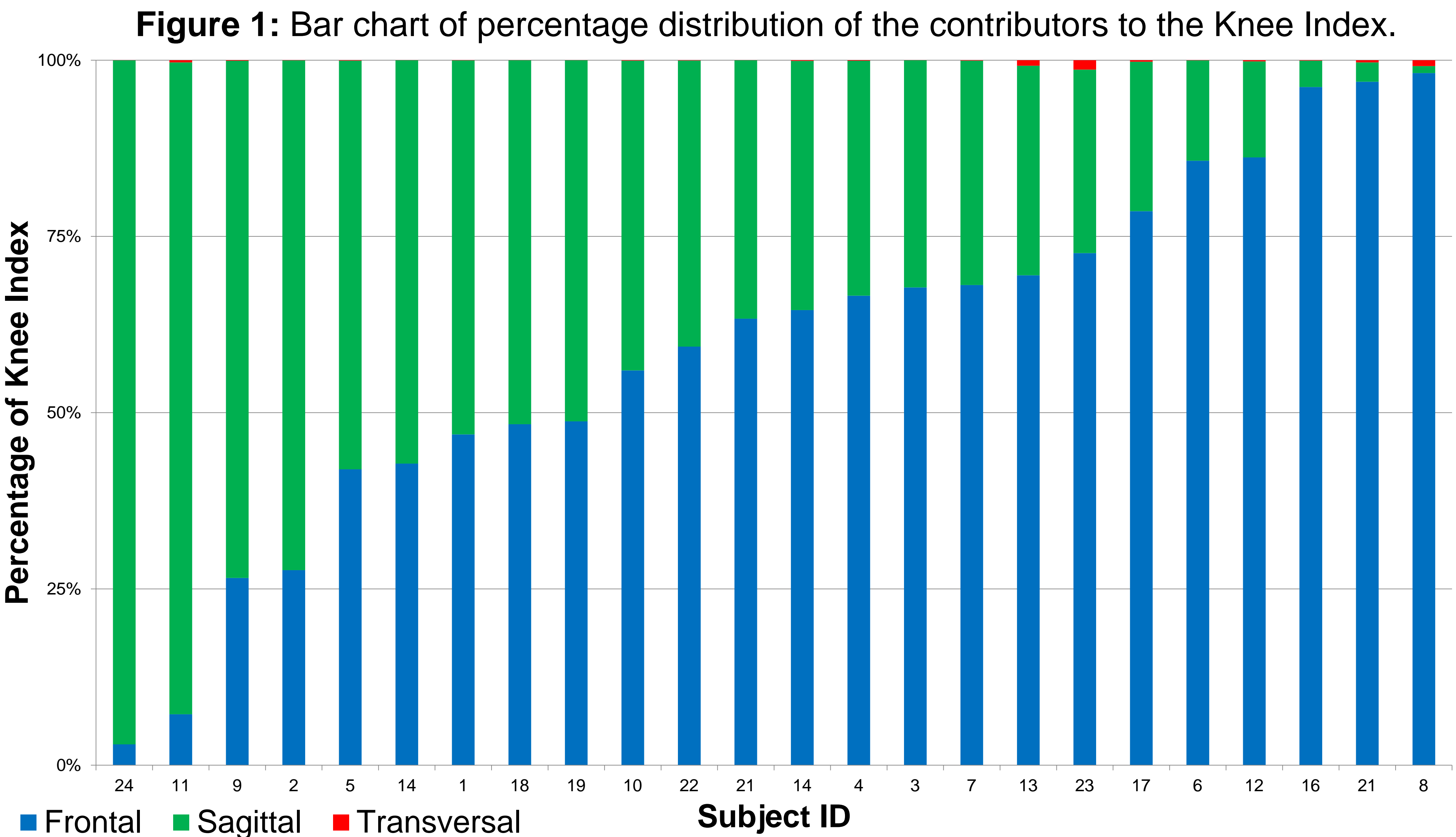
The present findings add to the knowledge of knee joint load distribution and osteoarthritis.

## RESULTS

Mean kinetic contribution to the Knee Index (standard deviation):

- Frontal plane 59.3% (25.6)
- Sagittal plane 40.5% (26.1)
- Transversal plane 0.2% (0.3)

Subject description	
Subjects, n (women)	24 (13)
Age, years (sd)	58 (7.6)
BMI, Kg/m <sup>2</sup> (sd)	27.1 (3.0)
Clinically diagnosed with mild to moderate knee osteoarthritis according to the ACR criteria	



## METHODS

**Figure 2:** Equation of the Knee Index and percentage distribution.

A.

$$Knee\ Index = \sqrt{\frac{(Frontal\ plane\ moment^2 + Sagittal\ plane\ moment^2 + Trans\ plane\ moment^2)}{3}}$$

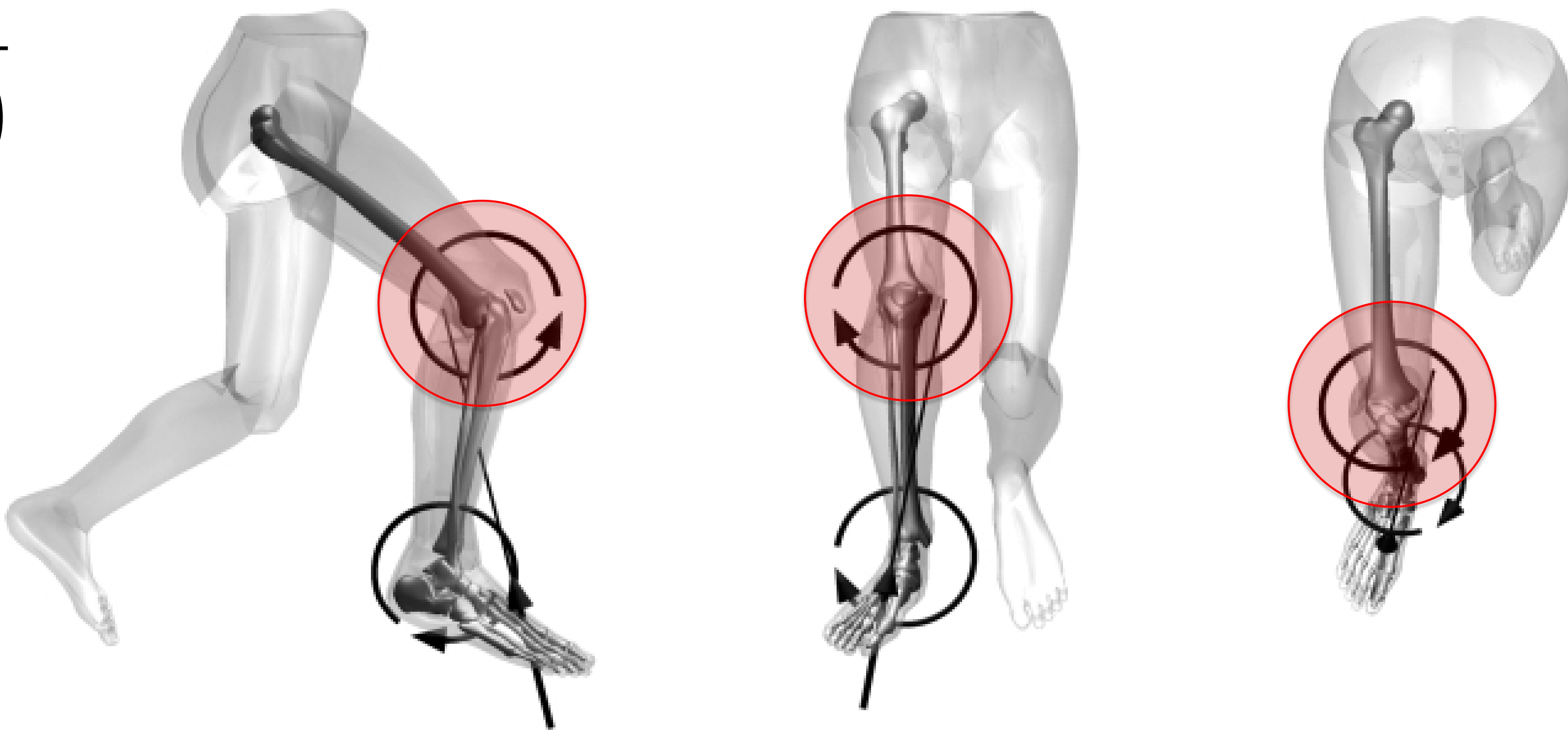
B.

$$\%Frontal = \left( \frac{\left( \frac{Frontal\ plane\ moment^2}{Knee\ Index^2} \right)}{3} \right) * 100\%$$

$$\%Sagittal = \left( \frac{\left( \frac{Sagittal\ plane\ moment^2}{Knee\ Index^2} \right)}{3} \right) * 100\%$$

$$\%Transversal = \left( \frac{\left( \frac{Trans\ plane\ moment^2}{Knee\ Index^2} \right)}{3} \right) * 100\%$$

**Figure 3:** Sagittal, frontal, and transversal planes of the Knee Index.



Three dimensional gait analysis was performed using a 6-camera Vicon MX (Vicon, Oxford, UK) movement analysis system (100 Hz) with the Plug-in-Gait marker set. Ground reaction forces were recorded (1000 Hz) by two AMTI force-plates (AMTI, OR6-7, Watertown, MA, USA) embedded at floor level. Subjects walked barefoot at self-selected walking speed. The trial (out of 5 trials) representing the median velocity was selected for further analysis. The first peak (approximately 50 % of stance phase) magnitude Knee Index (calculated by the root mean square of frontal, sagittal and transversal knee moments (for equation, see figure 2A) and the corresponding knee moments (at the same time points) from all three planes were calculated for the knee diagnosed with osteoarthritis using inverse dynamics. Percentage distribution of the contributors of the Knee Index (for equation, see figure 2B).