INTRODUCTION
Older adults have a reduced ability to perform activities of daily living (ADLs). One possible reason, older adults perform ADLs at a higher level of relative effort which has been quantified by expressing joint torques during an activity as a percentage of the maximum voluntary torque [1].

Anderson et al. developed a model to predict maximum voluntary joint torque as a function of joint angle and angular velocity using a regimen of isokinetic and isometric measurements and can be used to estimate maximum voluntary torque when assessing relative effort [2].

The main purpose of this study was to compare two methods of determining relative effort during sit-to-stand (STS). It was hypothesized that relative effort values that account for variations in maximum voluntary joint torque with joint angle and angular velocity will be higher than relative effort values that do not account for these variations.

METHODS
Thirty participants (mean 43.5 ± 21.6 years) performed six STS trials at three self-selected speeds (slow, normal, fast). Participants rose from an armless, backless chair that was positioned on a forceplate with feet spaced shoulder width apart and each resting on a forceplate.

Sagittal plane joint torques in the right lower extremity were estimated using a 2-D rigid-link model. Body segment data was sampled at 100 Hz (Vicon, CA) and force plate data were sampled at 1000 Hz. Isometric and isokinetic maximum voluntary contractions (MVC) for knee extension were collected using a Biodex System 3 dynamometer and used for model parameters to predict the participant-specific theoretical maximum voluntary joint torque (Anderson 2007).

Two methods were used to calculate relative effort (Fig 1). Method 1 (M1) first determined the peak joint torque during STS, then normalized this torque by dividing it by the maximum isometric torque. Method 2 (M2) first normalized joint torques throughout STS by dividing each instantaneous value by the theoretical maximum voluntary joint torque at the specific joint angle-angular velocity combination, then determined peak relative effort.

RESULTS AND DISCUSSION
Relative knee extension effort showed main effects of speed (p<0.001), method (p<0.001), and a speed x method interaction (p<0.001) (Fig 2). Relative effort at a fast speed (82.5 ± 31.8%) was higher than at a normal speed (66.8 ± 23.0%), and both were higher than at a slow speed (45.5 ± 13.4%). M2 (78.4 ± 32.1%) was higher than M1 (51.7 ± 15.0%).

SUMMARY/CONCLUSIONS
In conclusion, incorporating variations in joint torque production with joint angle and angular velocity was shown to have an effect on calculated relative effort.

REFERENCES

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