# Building better prediction models for exposure assessment of trapezius muscle activity during computer use

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## Abstract

### Purposes
Prediction models have been proposed as an alternative method of exposure assessment for epidemiologic studies that are currently difficult to perform within the field of ergonomics (Winkel and Mathiassen 1994, Svendsen et al 2005). Previous prediction models based only on task have been unsuccessful. We developed and evaluated a prediction model of trapezius muscle activity during computer use including both task and other predictors (individual characteristics, job characteristics, computer work behaviors, psychosocial factors, workstation setups, health outcomes, and leisure time exposures).

### Methods
We predicted median right and left trapezius muscle activities using 103 potential predictors of trapezius muscle activity during computer use. Trapezius muscle activities of 120 computer workers were calculated using data from Bruno Garza et al (2012). Potential predictors were categorized as individual characteristics, job characteristics, computer work behaviors, psychosocial factors, workstation setups, health outcomes, and leisure time exposures, and measured using a questionnaire (Ijmker et al 2006) and direct measurements of task, anthropometry, and workstation setup. Predictions were generated using a linear regression incorporating the relevant predictors as determined using a two-step backwards selection technique. All predictors had $p<0.10$ in the final model. The efficiency of predictions was evaluated using r-squared values and root mean squared (RMS) errors of the predicted compared to the measured values. We also calculated the percentage increase in participants needed in order to have the same power for epidemiological studies when using the model-based predictions, which is proportional to the increased standard deviation in the predicted dataset compared to the observed dataset, by dividing the square root of the R-squared value by the slope from the regression equation.

### Results
The r-squared values were 0.39 for the right trapezius and 0.52 for the left trapezius. The RMS errors were 2%MVC for both the right and left trapezius. The percent increase in number of participants needed was 255% for the right trapezius and 191% for the left trapezius. Task was significant in the right trapezius model only.

### Conclusions
We were able to explain a majority of the variation in left median trapezius muscle activity, and the RMS errors for both right and left trapezius were fairly small. More participants would be needed to use predictions than direct measurements, but the collection of the necessary information for predictions is

likely less time and cost intensive than collection of direct measurements. Our models performed better than previous prediction models based only on task.

**Keyword :** Exposure assessment, Task-based, Trapezius, Computer workers, Musculoskeletal

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