



**A NOVEL APPROACH TO ESTIMATE ENERGY  
EXPENDITURE USING UPPER BODY JOINT TRACKING**

**Ann E. Rowley (Kai Kück, PhD)  
Department of Biomedical Engineering**

Physical fitness is known to be directly correlated with postoperative outcome, where better physical fitness leads to a better postoperative outcome. Patients that improved their physical fitness before surgery exhibited reduced postoperative mortality. The earlier that a patient's physical fitness can be evaluated, the more time the patient can engage in prehabilitation prior to surgery to potentially improve their postoperative outcome. Current methods to evaluate physical fitness, especially for patients undergoing hip or knee surgery, are costly and time consuming. We aim to assess in a small pilot study whether our simple joint tracking method and arm exercise routine is sufficient for a subject to reach a metabolic threshold of four times their resting oxygen consumption.

A C# software program was written in coordination with a Microsoft Kinect™ camera system to track the motion of a subject's joints in an arm exercise routine. The subject was tracked in parallel with a metabolic monitor and the Kinect™ while performing the arm exercise. This joint positional data was converted into kinetic energy and then converted into a measure of oxygen consumption.

While the Kinect™ was able to approximate the oxygen consumed by the subject, the arm exercise was unable to achieve the targeted patient oxygen consumption of four times the resting oxygen consumption. This lowered metabolic response may be due to the reduced muscle mass undergoing metabolic demand in the upper extremities during the activity. A new, more metabolically demanding, arm exercise or a submaximal metabolic threshold will need to be developed.