

A measurement error model for physical activity level as measured by a questionnaire with application to the 1999-2006 NHANES questionnaire

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Abstrak

Systematic investigations into the structure of measurement error of physical activity questionnaires are lacking. We propose a measurement error model for a physical activity questionnaire that uses physical activity level (the ratio of total energy expenditure to basal energy expenditure) to relate questionnaire-based reports of physical activity level to true physical activity levels. The 1999-2006 National Health and Nutrition Examination Survey physical activity questionnaire was administered to 433 participants aged 40-69 years in the Observing Protein and Energy Nutrition (OPEN) Study (Maryland, 1999-2000). Valid estimates of participants' total energy expenditure were also available from doubly labeled water, and basal energy expenditure was estimated from an equation; the ratio of those measures estimated true physical activity level ("truth"). We present a measurement error model that accommodates the mixture of errors that arise from assuming a classical measurement error model for doubly labeled water and a Berkson error model for the equation used to estimate basal energy expenditure. The method was then applied to the OPEN Study. Correlations between the questionnaire-based physical activity level and truth were modest ($r = 0.32-0.41$); attenuation factors (0.43-0.73) indicate that the use of questionnaire-based physical activity level would lead to attenuated estimates of effect size. Results suggest that sample sizes for estimating relationships between physical activity level and disease should be inflated, and that regression calibration can be used to provide measurement error-adjusted estimates of relationships between physical activity and disease.