

## Reduced cardiorespiratory fitness is a mediator of excess all-cause mortality in rheumatoid arthritis – The Trøndelag Health Study

Authors: Marthe Halsan Liff, Mari Hoff, Ulrik Wisløff, Vibeke Videm

### **Data Supplement 1: Formulas for eCRF used in this study**

Several formulas for estimation of cardiorespiratory fitness (eCRF) were employed in the study, depending on the available variables in HUNT2 and HUNT3, respectively, and whether the individual had rheumatoid arthritis (RA) or was a control participant. The formulas were published previously and their comparability and suitability for RA patients and controls have been validated<sup>1,2</sup>.

#### **Calculation of eCFR for RA patients in HUNT2<sup>1,3</sup>**

The new RA equation based on ACSM/AHA 2007 recommendations for PA\* and including SBP was used.

Coding: Sex: female=0, male=1; smoking: never smoked=0, ever smoked=1; PA recommendations: did not fulfill ACSM/AHA 2007 recommendations for PA =0, fulfilled ACSM/AHA 2007 recommendations for PA =1.

$$\text{eCRF} = 85.982 + (\text{sex} \times 25.844) - (\text{age} \times 0.406) - (\text{age} \times \text{sex interaction} \times 0.269) - (\text{BMI} \times 0.644) - (\text{RHR} \times 0.094) - (\text{smoking} \times 2.522) + (\text{PA recommendations fulfilled} \times 2.984) - (\text{SBP} \times 0.071)$$

#### **Calculation of eCRF for RA patients in HUNT3<sup>1</sup>**

The alternative new RA equation including PA index\*\* and SBP was used.

Coding: sex: female=0, male=1; smoking: never smoked=0, ever smoked=1.

$$\text{eCRF} = 82.487 + (\text{sex} \times 28.053) - (\text{age} \times 0.361) - (\text{age} \times \text{sex interaction} \times 0.296) - (\text{BMI} \times 0.648) - (\text{RHR} \times 0.095) - (\text{smoking} \times 2.299) + (\text{PA index} \times 0.223) - (\text{SBP} \times 0.079)$$

#### **Calculation of eCRF for controls in HUNT2<sup>4</sup>**

$$\text{Men: } 105.91 - (\text{age} \times 0.334) - (\text{WC} \times 0.402) - (\text{RHR} \times 0.144) + (\text{PA} \times 3.102)$$

$$\text{Women: } 78.0 - (\text{age} \times 0.297) - (\text{WC} \times 0.270) - (\text{RHR} \times 0.110) + (\text{PA index} \times 2.674)$$

#### **Calculation of eCRF for controls in HUNT3<sup>5</sup>**

$$\text{Men: } 100.27 - (\text{age} \times 0.296) - (\text{WC} \times 0.369) - (\text{RHR} \times 0.155) + (\text{PA index} \times 0.226)$$

$$\text{Women: } 74.74 - (\text{age} \times 0.247) - (\text{WC} \times 0.259) - (\text{RHR} \times 0.114) + (\text{PA index} \times 0.198)$$

**Abbreviations:** ACSM, American College of Sports Medicine; AHA, American Heart Association; BMI, body mass index ( $\text{kg} \times \text{m}^{-2}$ ); eCRF, estimated cardiorespiratory fitness ( $\text{mL} \times \text{min}^{-1} \times \text{kg}^{-1}$ ); HUNT2 and HUNT3, the second and third wave of The Trøndelag Health Study; PA, physical activity; SBP, systolic blood pressure (mmHg); RHR, resting heart rate (bpm); WC, waist circumference (cm).

\* ACSM/AHA 2007 recommendations for PA: To perform either moderate-intensity physical activity  $\geq 30$  min in  $\geq 5$  days a week ( $\geq 150$  min per week) or to perform vigorous-intensity aerobic activity  $\geq 20$  min  $\geq 3$  days per week ( $\geq 75$  min per week). PA at these intensities may also be combined<sup>3</sup>.

\*\* PA index: Based on intensity, duration and frequency of PA<sup>5</sup>

**References:**

1. Liff MH, Hoff M, Fremo T, et al. An Estimation Model for Cardiorespiratory Fitness in Adults with Rheumatoid Arthritis. *Med Sci Sports Exerc* 2020;52:1248-55 doi:10.1249/MSS.0000000000002250 [published Online First: 25 January 2020]
2. Liff MH, Hoff M, Wisløff U, et al. Faster age-related decline in cardiorespiratory fitness in rheumatoid arthritis patients: an observational study in the Trøndelag Health Study. *Rheumatol Int* 2021;41:369-379 doi:10.1007/s00296-020-04713-2 [published Online First: 9 October 2020]
3. Garber CE, Blissmer B, Deschenes MR, et al. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc* 2011 43:1334-59 doi: 10.1249/MSS.0b013e318213fefb
4. Nauman J, Nes BM, Lavie CJ, et al. Prediction of Cardiovascular Mortality by Estimated Cardiorespiratory Fitness Independent of Traditional Risk Factors: The HUNT Study. *Mayo Clin Proc* 2017;92:218-27 doi:10.1016/j.mayocp.2016.10.007 [published Online First: 22 November 2016]
5. Nes BM, Janszky I, Vatten LJ, et al. Estimating V.O<sub>2</sub> peak from a nonexercise prediction model: the HUNT Study, Norway. *Med Sci Sports Exerc* 2011;43:2024-30 doi:10.1249/MSS.0b013e31821d3f6f