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The link between cardiovascular risk and cardiorespiratory fitness in individuals with a low socioeconomic status: An indisputable call for more action

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Population-based studies have long been confirmed that cardiorespiratory fitness (CRF) tightly mirrors cardiovascular risk and outcome.[1–3] The level of CRF, in addition to established cardiovascular risk factors, improves the reclassification of risk for adverse outcome[4] and most recent evidence suggests that CRF linearly declines in proportion to the number of established risk factors, such as smoking, hypertension, diabetes mellitus, high cholesterol and metabolic syndrome.[5] Even minimal improvements in CRF yield a reduction in cardiovascular mortality[6] with studies reporting that the greatest health outcome benefits are observed in the least fit subjects and the margins of expected benefits narrow in the moderate to high fitness groups.[3]

CRF is primarily dependent on the level of daily activities, but there are additional determinants and correlates including age, gender, genetic and racial characteristics and socioeconomic status (SES).[7,8]

The association between lower SES and the highest rate of cardiovascular events[9,10] is well known and most recent attention has been addressed on how social, educational, economic and psychological interventions may impact on the measurable negative effects of SES on lifestyle and related incidence of non-communicable diseases.[11]

In the present issue of the *European Journal of Preventive Cardiology*, Young Jae and coworkers[12] investigate how different levels of CRF are associated with and help in predicting all-cause and cardiovascular-related mortality. The investigation included 2368 men aged 42–61 years enrolled in the *Kuopio Ischemic Heart Disease Risk Factor Studies* with variable levels of education and SES who were categorized in tertiles according to a prespecified SES score. Subjects were also stratified into four groups based on age ranges (42–47 years; 48–53 years; 54–59 years and >60 years).

As anticipated, the group with lower SES levels were older, presented with higher rate of cardiovascular risk factors and lower peak VO_2. After adjusting for confounding factors, unfit subjects with highest SES score (i.e. poorer social condition) exhibited worse hazard ratios. The risk decreased by 4% for any 1 ml/kg per min increment in CRF.

The study is retrospective, inclusive of a male population only; it is representative of a single European country, lacking a prospective randomized design and assessment of SES variations over the long-term follow-up. Also, results cannot be extended to younger and elderly subjects, considering the prevalent recruitment of just middle-age subjects.

Despite these clear limitations, this is one of the few studies that approaches the possibility that CRF may impact on cardiovascular prevention in lower level classes and minorities, pointing out how much health and cardiovascular risk control may be warranted and modulated by physical interventions.

The most significant finding of the study is that the low SES–fit phenotype had the same level of risk as the high SES–fit. An important consideration is that SES–unfit was 23% of the entire population, representing a naïve group susceptible to any preventive intervention. This significant proportion of unfit subjects, which could be even higher in low-income populations from other countries and realities, could effectively help to appreciate how significantly exercise programmes may impact on the public health trajectory of these individuals.

It is noteworthy that the majority of studies performed on CRF in the general population do not differentiate groups based on SES.

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In the few previous population-based studies that have focused on the burden of cardiovascular risk in minorities and low-income populations by exercise interventions there is no documentation on outcome and events collection. [13] Other findings showing an association between CRF and low-SES mortality rate have been obtained in post-myocardial infarction subjects.[14]

An undoubted strength of the study is the methodology of gas exchange assessment, that is, measured rather than estimated VO_2 quantification. Even if this warrants reproducibility of measures it does not correct exercise performance by age. For this reason, the authors reclassified patients into the four age groups, combining them in the same VO_2 categories from each group. However, an analysis based on VO_2 per cent of predicted value would have clarified more appropriately the confounding effect of age, actually providing the correct reclassification.

Interestingly, according to the average body mass index (BMI) this analysis does not include people with a high BMI, which may be quite unusual considering the high rate of obesity in the lower income populations.[15,16] The average BMI within normal range may account for the high average absolute peak VO_2 observed even in the lowest SES strata.

Potentially, although peak VO_2 is the standard reference measure for cardiovascular risk prediction, there are many other ventilatory and metabolic data that may be derived by exercise gas exchange analysis and assessed over time to generate 'functional scores' of cardiovascular risk and pick up, at earlier stages, those abnormal phenotypes encountered later on in advanced cardiovascular disease conditions.[17]

Overall, the present observations point emphasis to a fundamental question: what are the most likely subgroups that may benefit from exercise interventions? Despite an extraordinary body of literature supporting the ability of exercise capacity to predict cardiovascular risk, there are many challenges that caregivers and stakeholders have yet to face in cardiovascular prevention and science. Given the firm link between lowest SES and cardiovascular risk and the mitigating effect played by a high level of CRF, the future indisputably calls for more action in planning, at a national level, randomized prospective trials of exercise in the low-income communities.

In cardiovascular prevention programmes this is one of the most compelling and socially relevant areas still in need of personalized interventions for impacting the burden of cardiovascular risk.

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References

1. Blair SN, Kohl HW, 3rd, Paffenbarger RS Jr, et al. Physical fitness and all-cause mortality. *A prospective study of healthy men and women*. JAMA 1989; 262: 2395–2401.
2. Laukkanen JA, Araujo CGS, Kurl S, et al. Relative peak exercise oxygen pulse is related to sudden cardiac death, cardiovascular and all-cause mortality in middle-aged men. *Eur J Prev Cardiol* 2018; 25: 772–782.
3. Myers J, Prakash M, Froelicher V, et al. Exercise capacity and mortality among men referred for exercise testing. *N Engl J Med* 2002; 346: 793–801.
4. Gupta S, Rohatgi A, Ayers CR, et al. Cardiorespiratory fitness and classification of risk of cardiovascular disease mortality. *Circulation* 2011; 123: 1377–1383.
5. Laforgia P, Bandera F, Alfonzetti E, et al. Exercise chronotropic incompetence phenotypes the level of cardiovascular risk and exercise gas exchange impairment in the general population. An analysis of the Euro-EX prevention trial. *Eur J Prev Cardiol*. Epub ahead of print 25 July 2019. DOI: 10.1177/2047487319863506.
6. Erikssen G, Bodegard J, Bjornholt JV, et al. Exercise testing of healthy men in a new perspective: From diagnosis to prognosis. *Eur Heart J* 2004; 25: 978–986.
7. Howard EN, Frierson GM, Willis BL, et al. The impact of race and higher socioeconomic status on cardiorespiratory fitness. *Med Sci Sports Exerc* 2013; 45: 2286–2291.
8. Ombrellaro KJ, Perumal N, Zeiher J, et al. Socioeconomic correlates and determinants of cardiorespiratory fitness in the general adult population: A systematic review and meta-analysis. *Sports Med Open* 2018; 4: 25.
9. Schultz WM, Kelli HM, Lisko JC, et al. Socioeconomic status and cardiovascular outcomes: Challenges and interventions. *Circulation* 2018; 137: 2166–2178.
10. Stringhini S, Carmeli C, Jokela M, et al., for the LIFEPATH Consortium. Socioeconomic status, noncommunicable disease risk factors, and walking speed in older adults: Multi-cohort population based study. *BMJ* 2018; 360: k1046.
11. Arena R, Guazzi M, Lianov L, et al. Healthy lifestyle interventions to combat noncommunicable disease – a novel nonhierarchical connectivity model for key stakeholders: A policy statement from the American Heart Association, European Society of Cardiology, European Association for Cardiovascular Prevention and Rehabilitation, and American College of Preventive Medicine. *Eur Heart J* 2015; 36: 2097–2109.
12. Young Jae S, Kurl S BK, Franklin BA, et al. Impact of cardiorespiratory fitness on survival in men with low socioeconomic status. *Eur J Prev Cardiol* 2019; in press.
13. Schulz AJ, Israel BA, Mentz GB, et al. Effectiveness of a walking group intervention to promote physical activity and cardiovascular health in predominantly non-Hispanic Black and Hispanic urban neighborhoods:

Findings from the walk your heart to health intervention. *Health Educ Behav* 2015; 42: 380–392.
14. Alter DA, Franklin B, Ko DT, et al. Socioeconomic status, functional recovery, and long-term mortality among patients surviving acute myocardial infarction. *PLoS One* 2014; 8: e65130.
15. Wang Y and Beydoun MA. The obesity epidemic in the United States—gender, age, socioeconomic, racial/ethnic, and geographic characteristics: A systematic review and meta-regression analysis. *Epidemiol Rev* 2007; 29: 6–28.
16. Pigeyre M, Rousseaux J, Trouiller P, et al. How obesity relates to socio-economic status: Identification of eating behavior mediators. *Int J Obes (Lond)* 2016; 40: 1794–1801.
17. Guazzi M, Arena R, Pellegrino M, et al. Prevalence and characterization of exercise oscillatory ventilation in apparently healthy individuals at variable risk for cardiovascular disease: A subanalysis of the EURO-EX trial. *Eur J Prev Cardiol* 2016; 23: 328–334.