

# Making a Case for Cardiorespiratory Fitness Surveillance Among Children and Youth

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## DISCLOSURE STATEMENT

- I have no affiliation (financial or otherwise) with a pharmaceutical, medical device or communications organization.



## KEY POINTS

- Cardiorespiratory fitness is an objective measure that is feasible to implement in the field
- Cardiorespiratory fitness is strongly associated with health in childhood and adolescence, and it is predictive of future health in adulthood



# PRESENTATION OUTLINE AND DISCLOSURES

## OUTLINE

1. Importance of health surveillance
2. What is cardiorespiratory fitness
3. Cardiorespiratory fitness and health
4. Utility for population-based surveillance
5. Prospective for progress

## ORIGINS OF WORK

- 2014 to 2017
- Part of my PhD dissertation
- Manuscript published in April 2018 “Exer Sport Sci Rev. 2018; 46(2): 66-75”

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# IMPORTANCE OF HEALTH SURVEILLANCE

## Health Surveillance

“Systematic, ongoing collection, management, analysis, and interpretation of data followed by the dissemination of these data to public health programs to stimulate [population] health action”

### Why is it important?

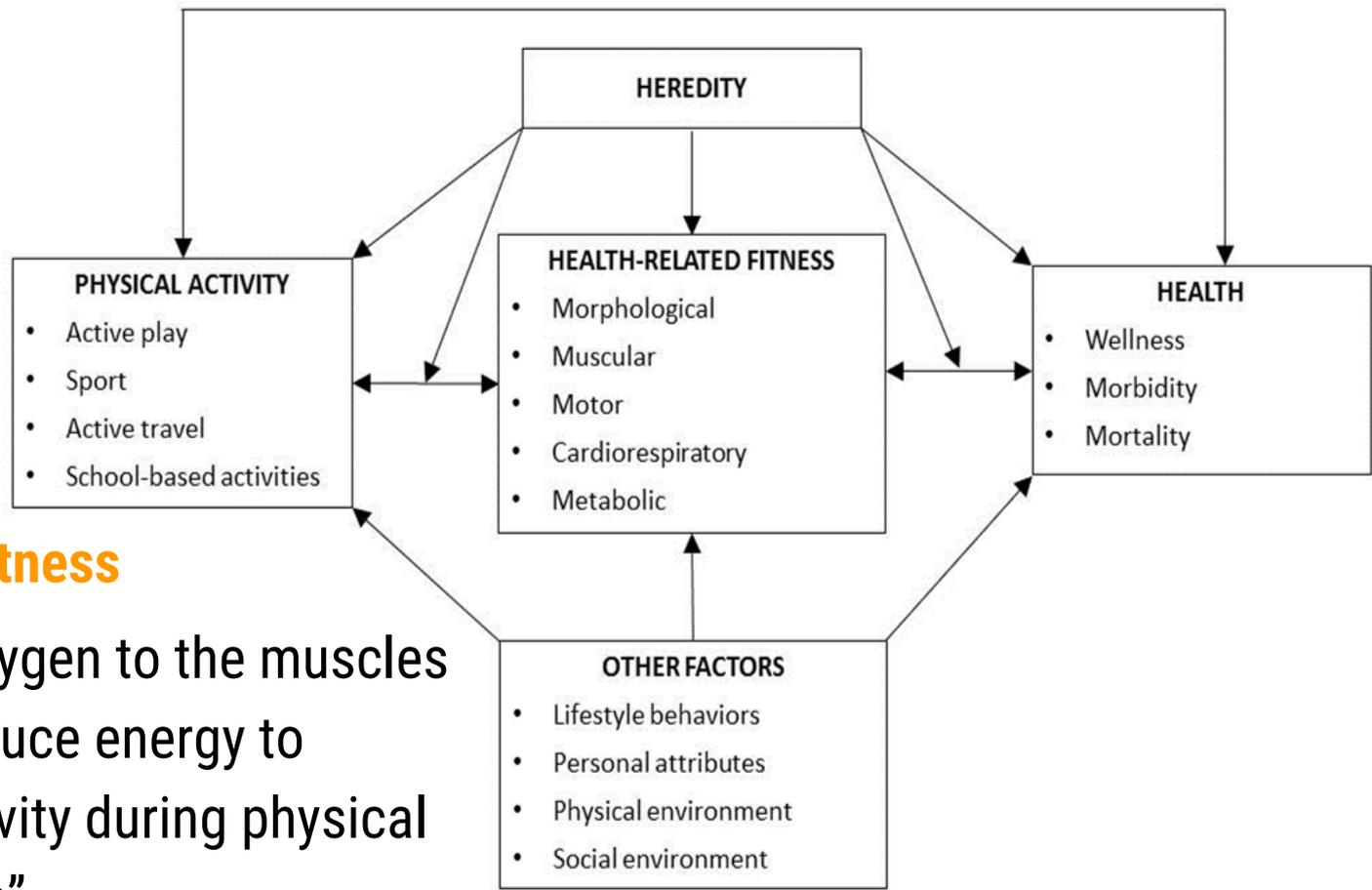
1. Provides a basis to *guide* policy efforts by identifying at risk population groups
2. Provides a basis to *monitor* and *evaluate* the effectiveness of implemented policies and programs

- Health surveillance among adults
  - Disease outcomes and risk factors
  - Prevalence, incidence, years lived with disability, years of life lost, disability-adjusted life years
- Health surveillance among children and youth
  - Behavioural outcomes and obesity levels
  - Physical activity, sedentary behaviours, sleep duration
    - Eg. 24hr movement guidelines

**Can we do more to understand the health of our children?**

# 2

## WHAT IS CARDIORESPIRATORY FITNESS?



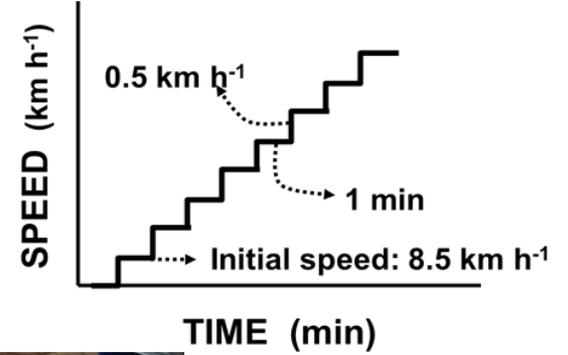
## Cardiorespiratory fitness

“Ability to deliver oxygen to the muscles and to use it to produce energy to support muscle activity during physical activity and exercise”

## How can we measure cardiorespiratory fitness?



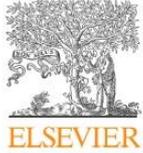
Ergospirometry treadmill test  
to measure  $\dot{V}O_{2\text{peak}}$



20m shuttle run test to  
predict  $VO_{2peak}$

# 3

## CARDIORESPIRATORY FITNESS AND HEALTH



Review

## Systematic review of the relationship between 20 m shuttle run performance and health indicators among children and youth

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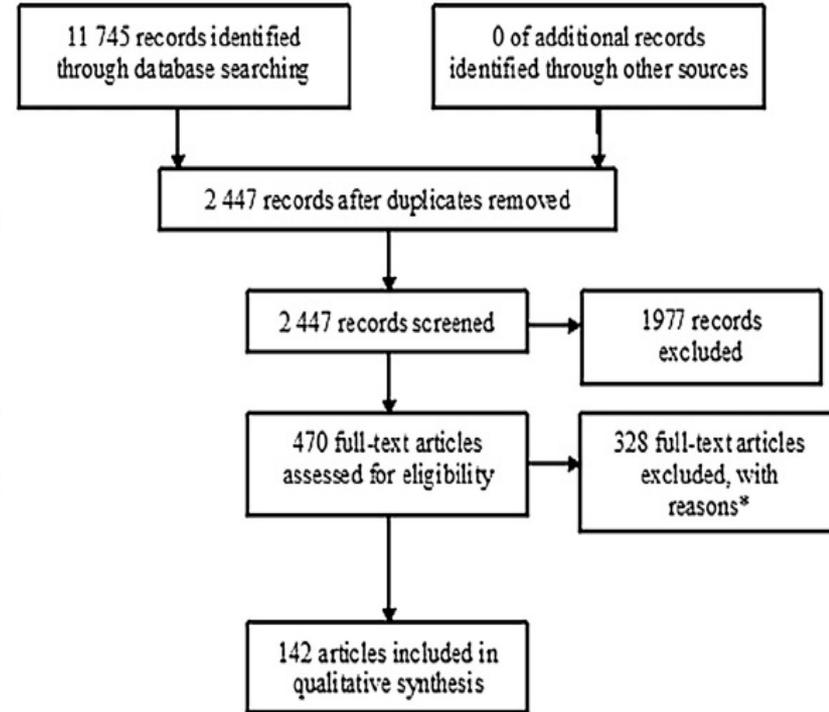
<sup>e</sup> Department of Kinesiology and Public Health Education, University of North Dakota, USA

Identification

Screening

Eligibility

Included



**Table 12**

High-level summary of findings by health indicator.

Health indicator	No. of studies	Quality of the evidence	Summary of findings
Adiposity	89	Low to moderate	71 studies reported favourable findings between 20mSRT performance and adiposity 16 studies reported mixed favourable and/or null findings
Cardiometabolic biomarkers	42	Low	2 studies reported mixed favourable and unfavourable findings 13 studies reported favourable findings between 20mSRT performance and cardiometabolic biomarkers 28 studies reported mixed favourable and/or null findings
Cognition/academic achievement	15	Very low	1 study reported mixed unfavourable and null findings 6 studies reported favourable findings between 20mSRT performance and cognition/academic achievement
Mental health	2	Low	8 studies reported mixed favourable and/or null findings 1 study reported mixed unfavourable and null findings 1 study reported mixed favourable and null findings between 20mSRT performance and mental health
Psychosocial health	5	Very low	1 study reported null findings 4 studies reported favourable findings between 20mSRT performance and psychosocial health 1 study reported mixed favourable and null findings

**Table 12**

High-level summary of findings by health indicator.

Health indicator	No. of studies	Quality of the evidence	Summary of findings
Self-esteem/physical self-perception	9	Very low	5 studies reported favourable findings between 20mSRT performance and self-esteem/physical self-perception
Quality of life/wellbeing	6	Very low	4 studies reported mixed favourable and null findings 3 studies reported favourable findings between 20mSRT performance and quality of life/wellbeing 2 studies reported mixed favourable and null findings
Bone health	1	Very low	1 study reported mixed unfavourable and null findings
Musculoskeletal fitness	9	Very low	1 study reported favourable findings between 20mSRT performance and health 3 studies reported favourable findings between 20mSRT performance and musculoskeletal health 6 studies reported mixed favourable and null findings
Motor skill development	4	Very low	2 studies reported favourable findings between 20mSRT performance and motor skill development
Risk of injury/harm	2	Very low	2 studies reported mixed favourable and null findings 1 study reported favourable findings between 20mSRT performance and harms/risk of injury 1 study reported unfavourable findings



## Predictive validity of health-related fitness in youth: a systematic review

J R Ruiz, J Castro-Piñero, E G Artero, et al.

*Br J Sports Med* 2009 43: 909-923 originally published online January 21, 2009

doi: 10.1136/bjsm.2008.056499

- Strong evidence indicating that CRF in youth is predictive of future CVD risk factors (blood lipids, blood pressure, adiposity)
- Moderate evidence indicating that CRF in youth is predictive of metabolic syndrome and arterial stiffness later in life
- Moderate evidence indicating that increasing CRF is associated with decreases in CVD risk factors later in life

# WHAT IS THE MINIMUM AMOUNT OF CARDIORESPIRATORY FITNESS NEEDED FOR HEALTH?

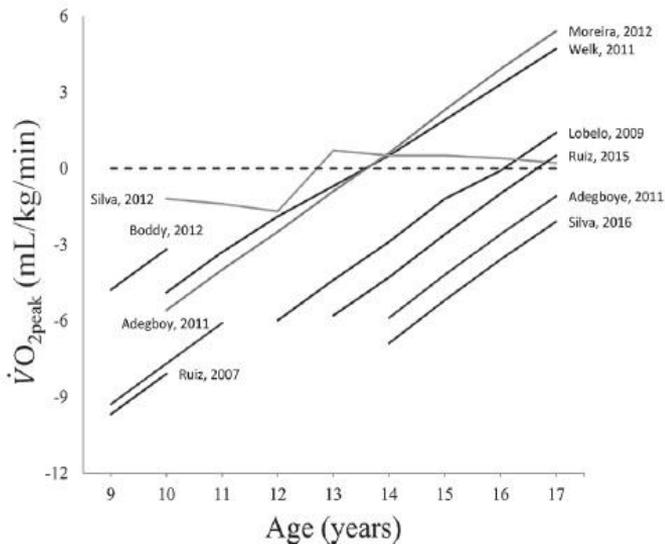
For those aged 8-19 years the standards are 35 and 42 mL/kg/min for girls and boys, respectively

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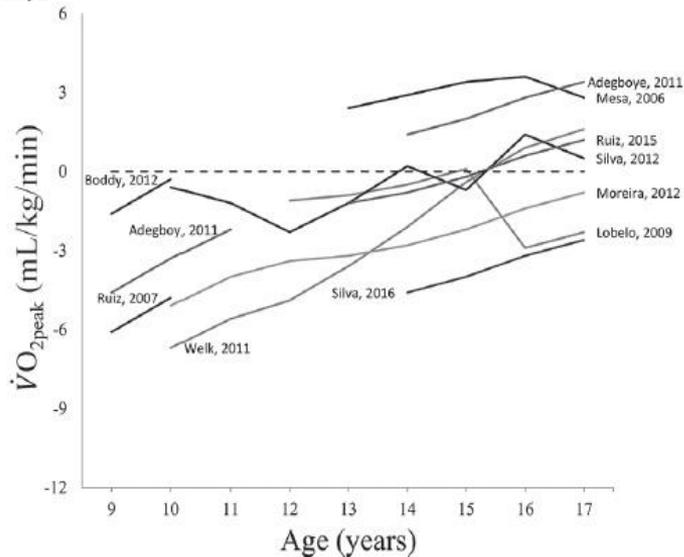
Review of criterion-referenced standards for cardiorespiratory fitness: what percentage of 1 142 026 international children and youth are apparently healthy?

Justin J Lang,<sup>1</sup> Mark S Tremblay,<sup>1</sup> Francisco B Ortega,<sup>2,3</sup> Jonatan R Ruiz,<sup>2,3</sup>  
Grant R Tomkinson<sup>4,5</sup>

A girls



B boys



# 4

## UTILITY FOR POPULATION-BASED SURVEILLANCE

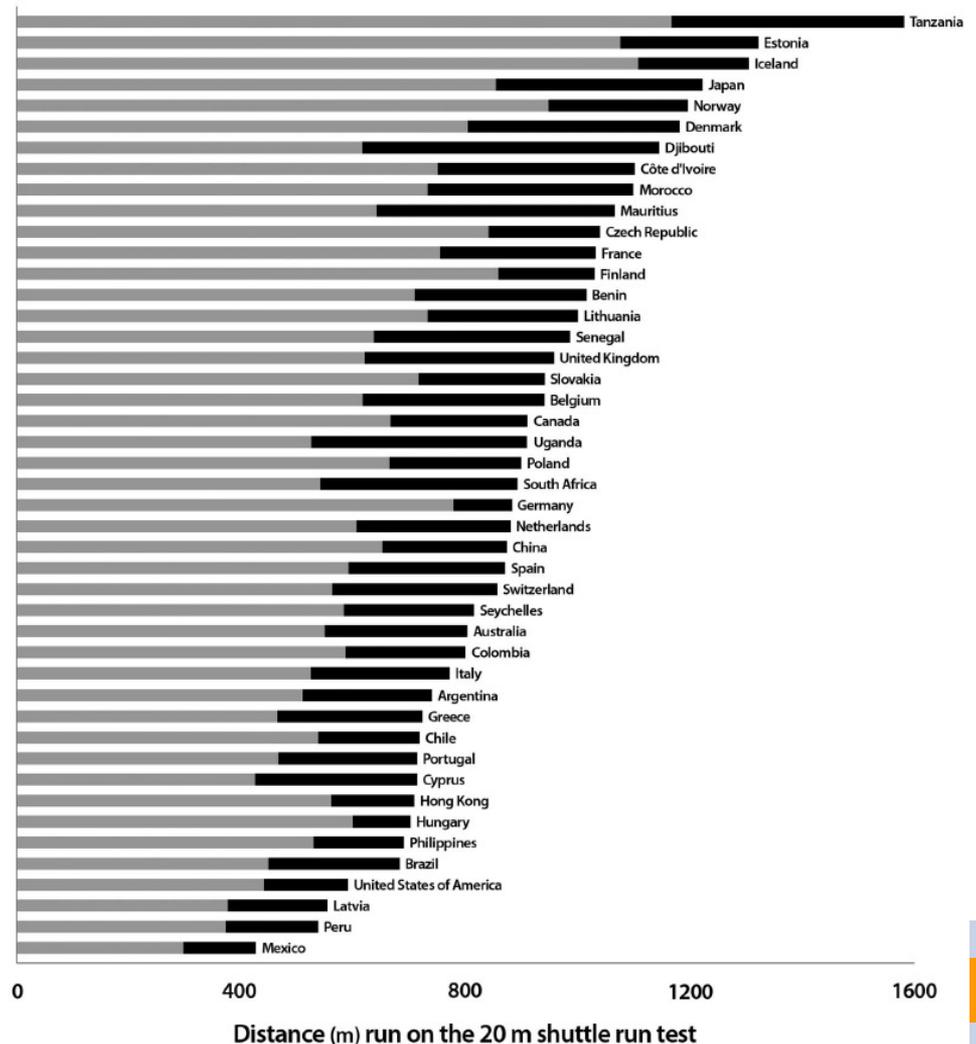
## HOW CAN WE USE SURVEILLANCE DATA?

- We can look at difference *between geographic areas, sexes, cultures, levels of development, inequalities, etc.*
  - Identify at risk groups
  - Identify groups exceeding the norms
- We can look at changes *across time points*
  - Identify groups on the decline and magnitude of decline
  - Identify groups on the rise
  - Monitor and evaluate impact of policies and programs

## International variability in 20 m shuttle run performance in children and youth: who are the fittest from a 50-country comparison? A systematic literature review with pooling of aggregate results

Justin J Lang,<sup>1</sup> Mark S Tremblay,<sup>1</sup> Luc Léger,<sup>2</sup> Tim Olds,<sup>3</sup> Grant R Tomkinson<sup>3,4</sup>

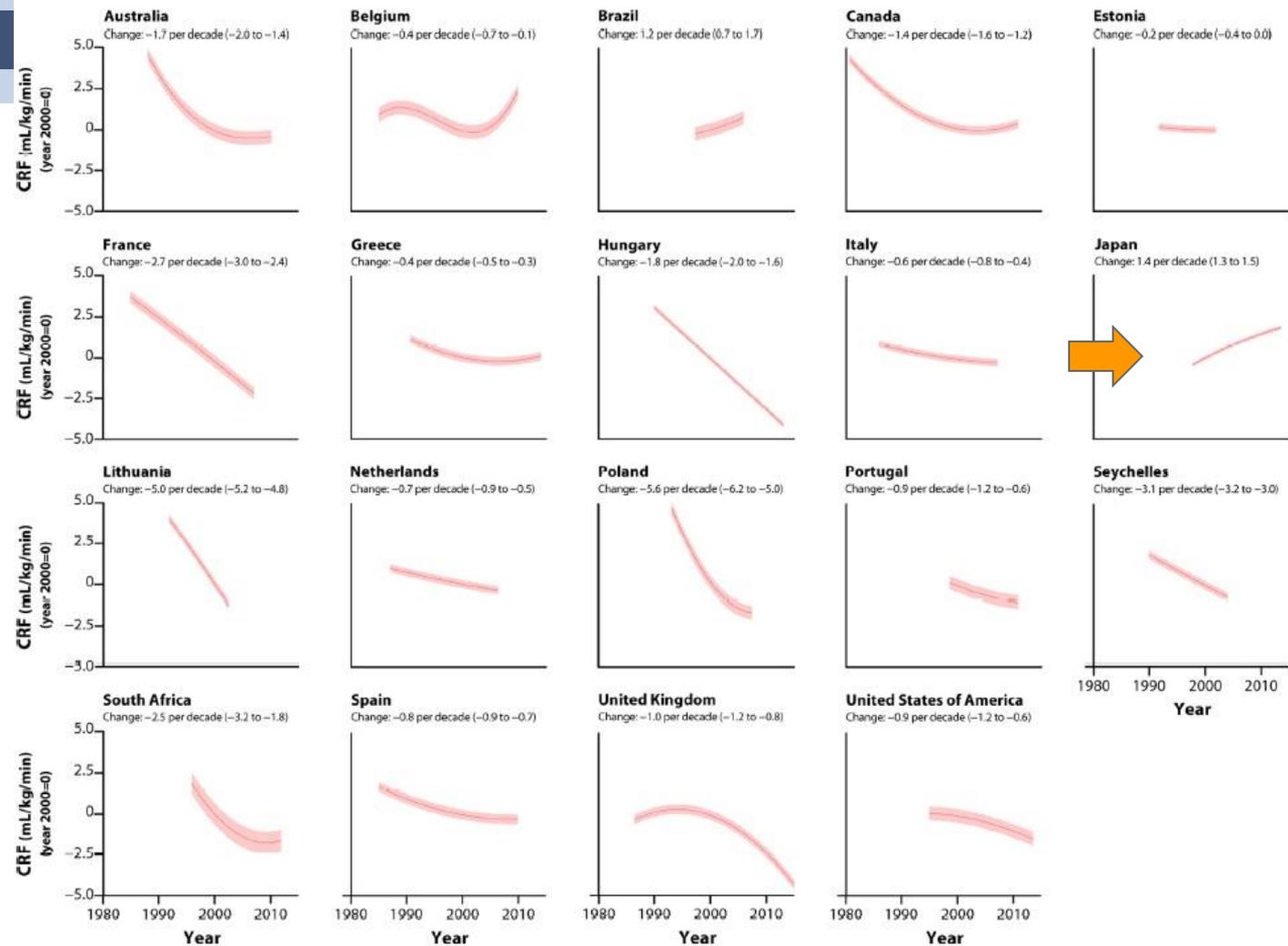
Generally, those in *Northern Europe* and *Africa* had the highest, and *South America* had the lowest cardiorespiratory fitness levels



# Temporal trends in the cardiorespiratory fitness of children and adolescents representing 19 high-income and upper middle-income countries between 1981 and 2014

Grant R Tomkinson,<sup>1,2</sup> Justin J Lang,<sup>3</sup> Mark S Tremblay<sup>3</sup>

- Substantial declines since 1981, which have slowed/stabilized since 2000
- Variability in temporal trends exist between countries
- The decline was greater in boys than in girls



# 5

## PERSPECTIVES FOR PROGRESS

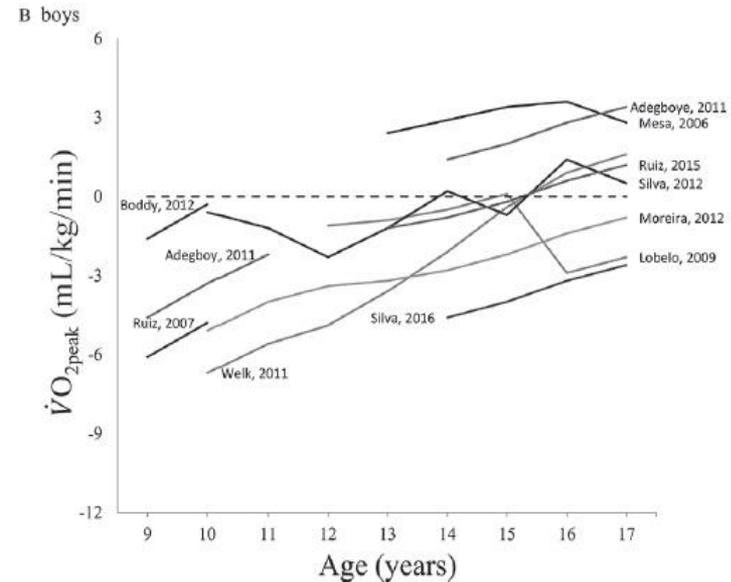
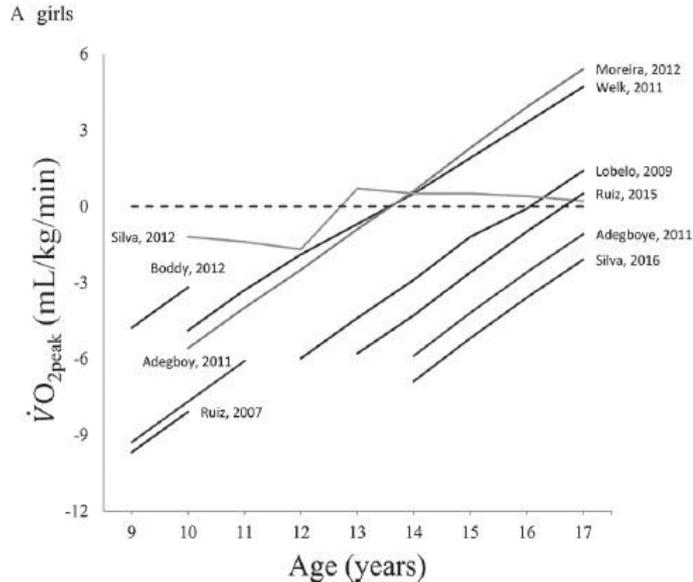
# WHAT IS NEXT?

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Review of criterion-referenced standards for cardiorespiratory fitness: what percentage of 1 142 026 international children and youth are apparently healthy?

Justin J Lang,<sup>1</sup> Mark S Tremblay,<sup>1</sup> Francisco B Ortega,<sup>2,3</sup> Jonatan R Ruiz,<sup>2,3</sup>  
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For those aged 8-19 years the standards are 35 and 42 mL/kg/min for girls and boys, respectively





## CONCLUSIONS - KEY POINTS

- Cardiorespiratory fitness is an objective measure that is feasible to implement in the field
  - Demonstrated in compiling over 1.1 million test scores from 50 countries, including data from 16 developing countries
- Cardiorespiratory fitness is strongly associated with health in childhood and adolescence, and it is predictive of future health in adulthood
  - Strong cross-section and prospective associations with health indicators

**THANK YOU! QUESTIONS?**

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