



Edge Hill University

# The role of fitness testing in the evaluation of primary school running programmes

Making Strides in School Symposium

National Centre for Sport and Exercise Medicine

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Prof. Stuart Fairclough

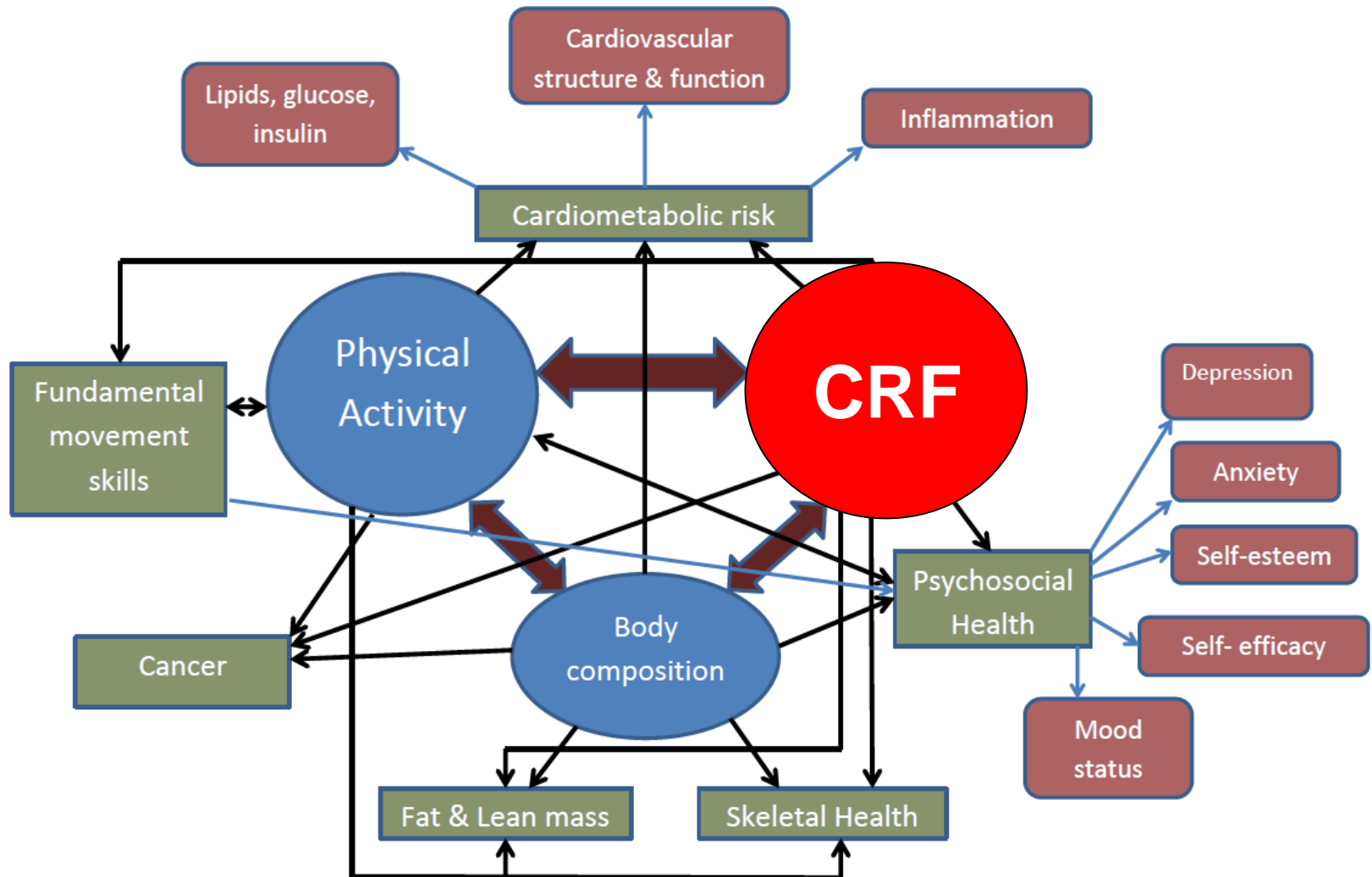
*Sport and Physical Activity Dept, Edge Hill University*

# School running programmes – likely health-related benefits

- Increased school day and daily physical activity
- More positive physical self-perceptions and improved physical activity self-efficacy
- Potential for improved engagement in class-based learning
- Improved health-related fitness
  - **Cardiorespiratory fitness (CRF)**

# Cardiorespiratory fitness...

the ability of the circulatory and respiratory systems to supply oxygen to skeletal muscles during sustained physical activity



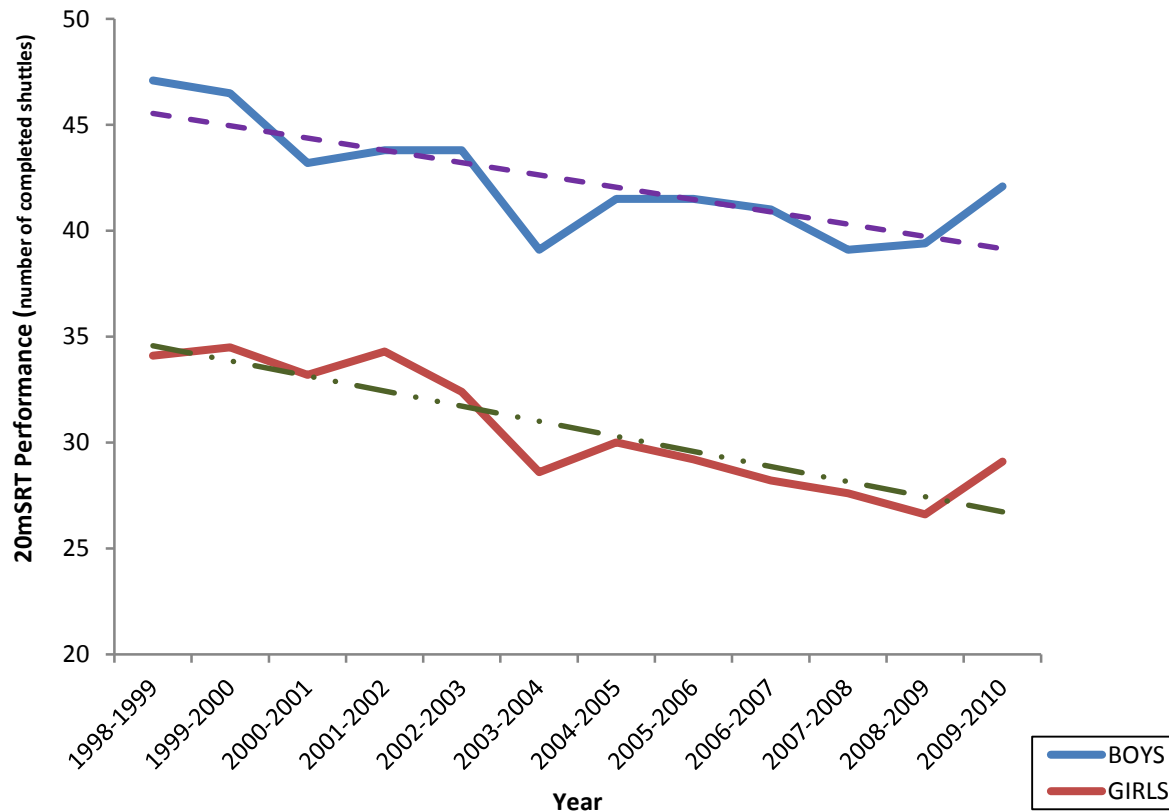
# Declining CRF

## Changes in Cardiorespiratory Fitness in 9- to 10.9-Year-Old Children: SportsLinx 1998–2010

LYNNE M. BODDY<sup>1,2,3</sup>, STUART J. FAIRCLOUGH<sup>1,2</sup>, GREG ATKINSON<sup>3</sup>, and GARETH STRATTON<sup>1,3</sup>

*Med. Sci. Sports Exerc.*, Vol. 44, No. 3, pp. 481–486, 2012.

20mSRT Performance in 9-10 year old boys and girls: 1998-2010



Annual decline of 1.34% for boys

Annual decline of 2.29% for girls.

# To evaluate school running programmes we may wish to measure CRF

Testing environment	Level of exertion	Mode of test
Laboratory	Maximal/submaximal	Graded ergometer (treadmill, cycle)
Field	Maximal/submaximal	Running, walking, stepping, subjective

# Testing CRF in the laboratory

- Treadmill most specific ergometer
- **Maximal** 'ramp' protocols to exhaustion
  - Direct measurement of oxygen consumption
- **Submaximal** tests based on HR-energy expenditure relationship



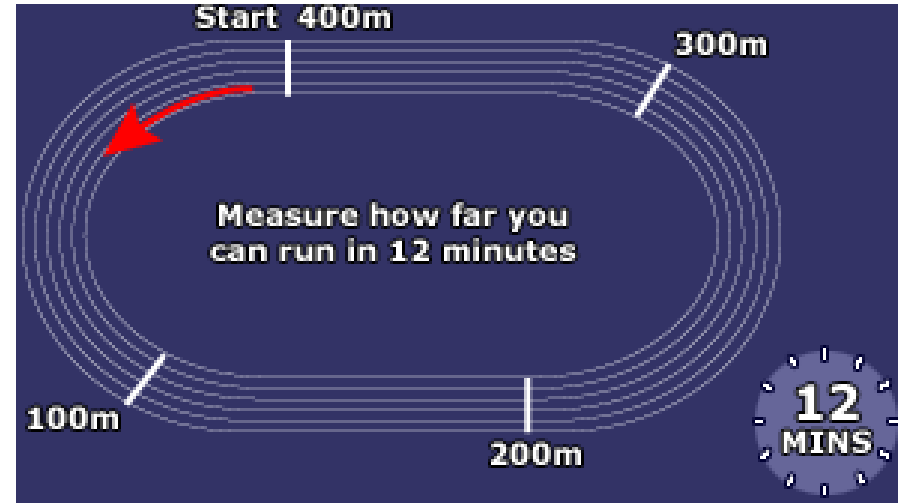
# Testing CRF in the field through running (1)

- **Continuous distance** tests (e.g., Cooper 12 minute run test, 1 Mile Run/Walk)
- **Continuous**, maximal **shuttle run tests** (e.g., 20m multistage fitness test)
- **Intermittent** shuttle run tests (e.g., Andersen test)



# Testing CRF in the field through running (2)

- Cooper test
- Aim is to run as far as possible in 12 minutes around a marked track
  - 1.5 mile timed run sometimes used as an alternative
- Normative values available based on original 1968 study



RESULTS						
AGE	GENDER	EXCELLENT	GOOD	AVERAGE	LOW	WEAK
13-14	M	> 2700 m	2400 - 2700 m	2200 - 2400 m	2100 - 2200 m	< 2100 m
	F	> 2000 m	1900 - 2000 m	1600 - 1900 m	1500 - 1600 m	< 1500 m
15-16	M	> 2800 m	2500 - 2800 m	2300 - 2500 m	2200 - 2300 m	< 2200 m
	F	> 2100 m	2000 - 2100 m	1900 - 2000 m	1600 - 1700 m	< 1600 m

- 6 minute version for 5-12 year olds

(Fjortoft et al, 2011. Phys Ther. 91: 1087-1095)




# Testing CRF in the field through running (2)

- **1-Mile Run** (FITNESSGRAM


<http://www.fitnessgram.net>)

- Aim is to run 1-mile as quickly as possible
- Criterion-referenced standards available when height and weight are recorded
- Cut-off is 13 minutes
- Alternative is 1-Mile Walk (valid for age 13+)

(Chun et al., 2000. Res Q Exerc Sport, 71: 125-134)



## FITNESSGRAM



<b>FITNESSGRAM STANDARDS FOR HEALTHY FITNESS ZONE</b>								
AGE	20M PACER	MILE RUN	CURL-UPS	PUSH-UPS	MODIFIED PULL-UPS	TRUNK LIFT		BACK SAVER SIT & REACH
	VO <sub>2</sub> Max (ml/kg/min)		(# completed)	(# completed)	(# completed)	(inches)		(inches)
<b>10</b>	> 40.2		>12	> 5	> 5	9	12	8
<b>11</b>	> 40.2		> 15	> 6	> 6	9	12	8
<b>12</b>	> 40.3		> 18	> 7	> 7	9	12	8
<b>13</b>	> 41.1		> 21	> 8	> 8	9	12	8
<b>14</b>	> 42.5		> 24	> 9	> 9	9	12	8
<b>15</b>	> 43.6		> 24	> 10	>10	9	12	8

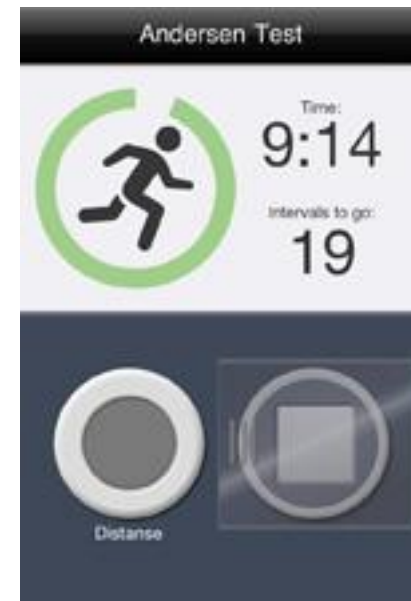
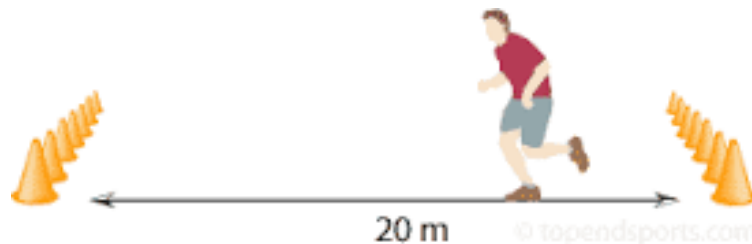
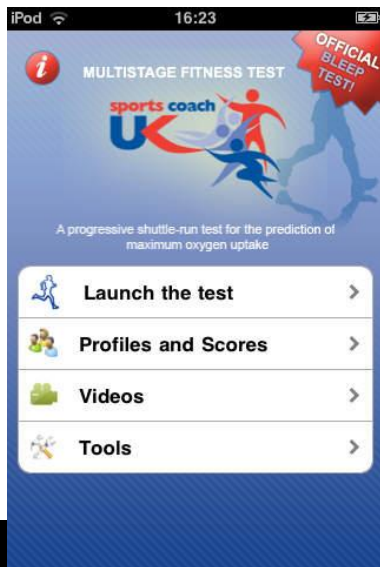
  

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<b>10</b>	> 40.2		> 12	> 7	> 4	9	12	9
<b>11</b>	> 40.2		> 15	> 7	> 4	9	12	10
<b>12</b>	> 40.1		> 18	> 7	> 4	9	12	10
<b>13</b>	> 39.7		> 18	> 7	> 4	9	12	10
<b>14</b>	> 39.4		> 18	> 7	> 4	9	12	10
<b>15</b>	> 39.1		> 18	> 7	> 4	9	12	12

# Testing CRF in the field through shuttle running

- 20m SRT test (aka 'bleep test')
  - Aim: to complete as many shuttles as possible before reaching maximal capacity
  - Prediction of aerobic capacity ( $VO_{2peak}$ )

- Andersen test
  - Aim: to complete as many shuttles as possible in 10 minutes
  - Prediction of aerobic capacity ( $VO_{2peak}$ )



# Adaptations to shuttle running tests

- **15m shuttles PACER test - FITNESSGRAM**
  - Conversion tables to criterion-referenced standards available
- **10m Shuttle Test** - for children with Cerebral Palsy (*Verschuren et al., 2006. Phys Ther, 86: 1107-1117*)
  - Starting and incremental speeds of 20m SRT may be too difficult for children with CP

# Alternative field tests of CRF

- **Stepping tests:** based on relationship between heart rate and oxygen consumption
  - Generally developed for adults
  - Submaximal
- **Queens College Step Test**
  - 3 minute submaximal, paced step test
  - Estimated CRF based on 15-s pulse reading at end of the test
- **Chester Step Test**
  - Graded based on heart rate reading every 2 minutes
- **Harvard Step Test**
  - CRF based on recovery heart rate



# Subjectively evaluating CRF:

## The International Fitness Scale (IFIS)

*(Ortega et al., 2011. Int J Epidemiol. doi:10.1093/ije/dyr0390)*

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**Please try to think about your level of physical fitness (compared to your friends) and choose the right option.**

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**Your general physical fitness is:**

Very poor

Poor

Average

Good

Very good

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**Your cardiorespiratory fitness (capacity to do exercise, for instance running, for a long time) is:**

Very poor

Poor

Average

Good

Very good

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# How 'good' is the CRF measure?

## Reliability and Validity

- **Reliability**
  - Consistency or repeatability of measurements/results
- **Validity**
  - The extent to which a test accurately measures what it purports to measure
- **Field tests of CRF in children: moderate-strong reliability ( $r = 0.61-0.92$ ) & validity ( $r = 0.63-0.93$ )**

*(Freedson et al, 2000. Prev Med, 31: S77-S85; Mayorga-Vega et al, 2015. J Sports Sci Med, 14: 536-547)*

# Pros (+) and Cons (-) overview

Lab	Field	Maximal	Sub-maximal
+ validity and reliability	+ time/pupil	+ accuracy if exertion is maximal	+ pupil compliance
- cost	+ cost	- motivation	+ relatively easy administration
- technical expertise	+ ease	- stressful/painful	+/- time/pupil
- time/pupil	+/- validity and reliability depending on mode		- degree of error in results
- data interpretation	- control over confounding factors		

# Considerations before deciding on a CRF testing approach

- Validity and reliability of tests
- Age of pupils
- Growth and maturation
- Motivation of pupils
- Practice/learning effect
- PA level/training status
- Understanding of 'normal exertion'
- Time available
- Group size
- Size and suitability of space
- Weather conditions
- Equipment and resources
- Expertise
- Number of staff needed
- Pupil feedback and personalisation
- Feedback to others (e.g., parents)
- Educational/learning opportunities
- Group vs. individual results



# Final thoughts

- Seek **advice** from academic partners / expert practitioners
- Evaluate running programme impact on CRF at **regular intervals**
- Tailor test selection to intended **aims** and available **resources**
- **Record** and **communicate** results accurately and appropriately, depending on evaluation aims



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