KØBENHAVNS UNIVERSITET

REGION SJÆLLAND
HOLBÆK SYGEHUS
– vi er til for dig

Implementering af kondition til behandling af adipositas

Axel Illeris Poggi

Cand. Scient. Human Fysiologi

Kondition?

Cardio-Respiratorisk Fitness (CRF)

Det kardiopulmonære systems evne til at optage og levere ilt til den arbejdende muskulatur

VO^2maks (ml O^2 / min)

Kondital (ml O^2 / min / kg kropsvægt)

Metabolic equivalents (METS; 1 MET = 3,5ml O^2/ min)

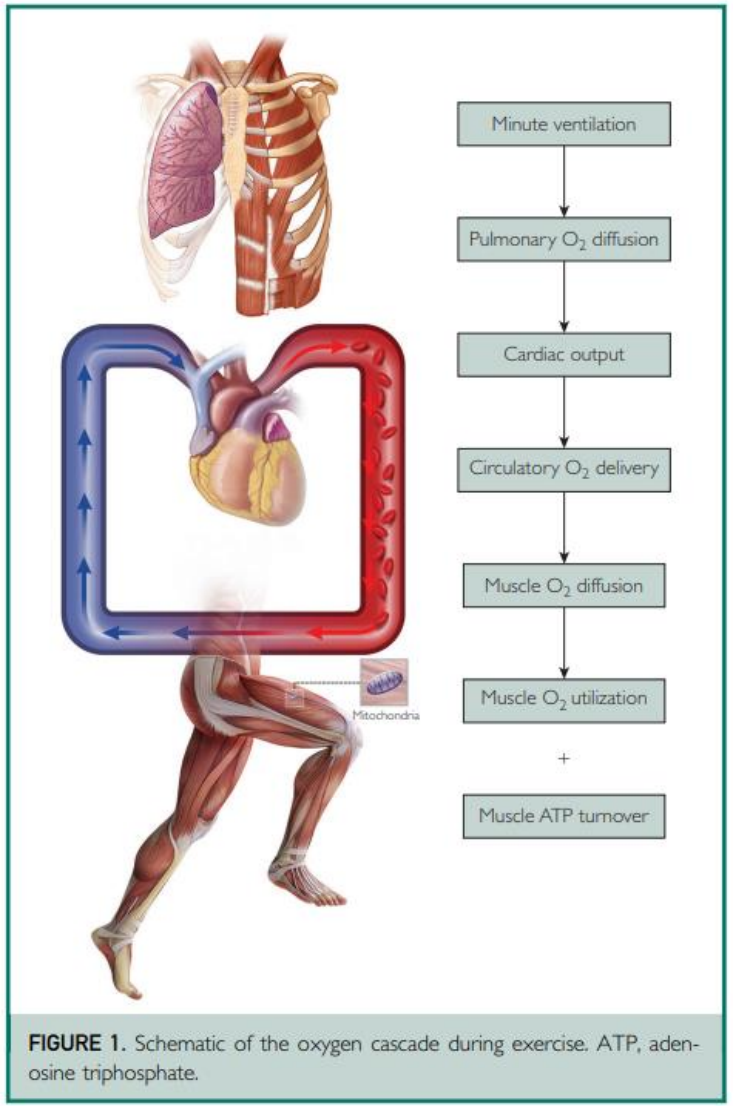


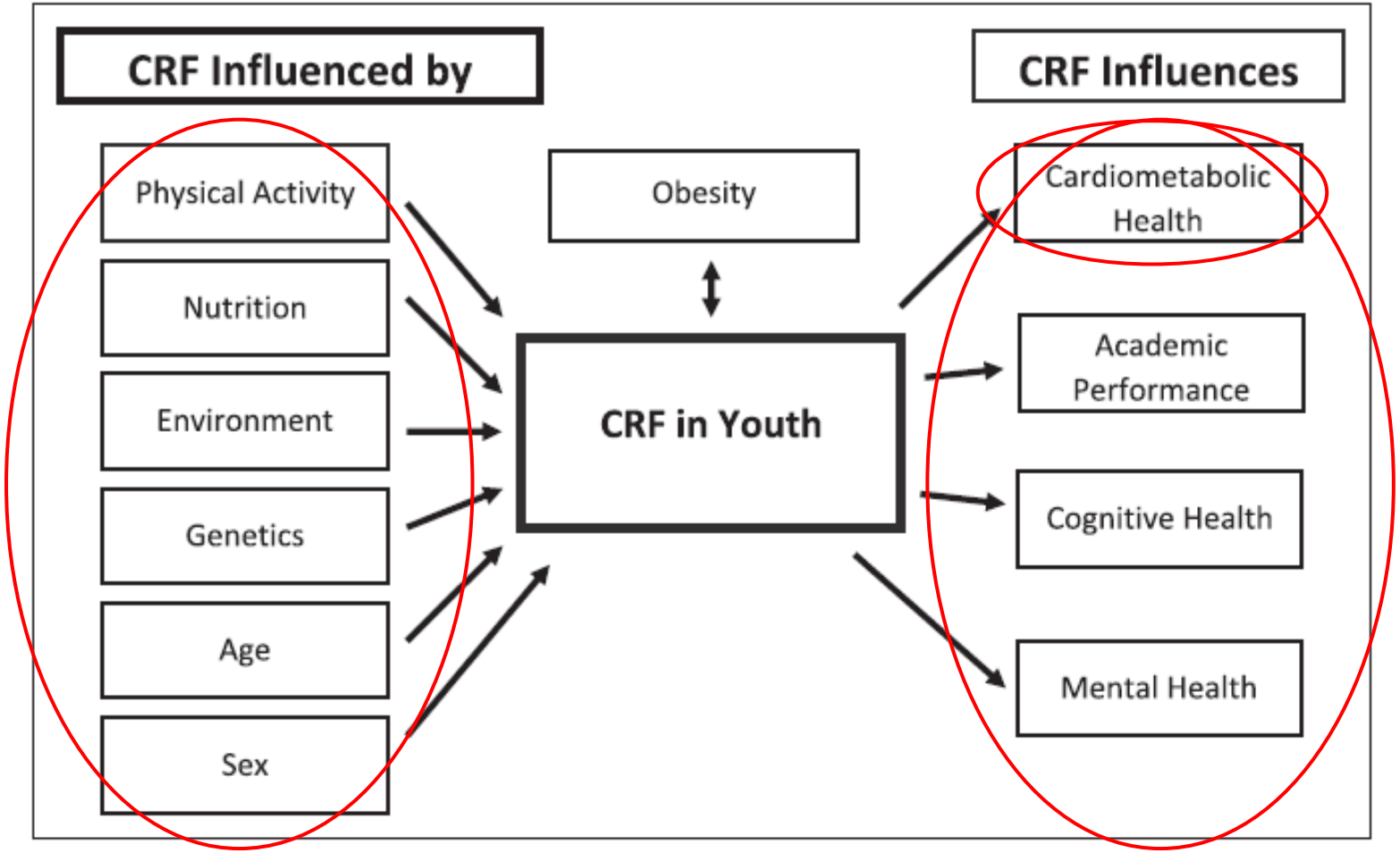
FIGURE 1. Schematic of the oxygen cascade during exercise. ATP, adenosine triphosphate.

(Dominelli et al, Mayo Clinic Proceedings 2021)

Hvorfor?

- Omfavner en lang række modificerbare og ikke-modificerbare faktorer relateret til helbred og velvære i én måling

- Stærkt forbundet med en lang række somatiske og psykologiske helbredsparametre



(Raghuveer et al, Circulation, 2020)

KØBENHAVNS UNIVERSITET

REGION SJÆLLAND
HOLBÆK SYGEHUS
– vi er til for dig

Hvorfor?

Importance of Assessing Cardiorespiratory Fitness in Clinical Practice: A Case for Fitness as a Clinical Vital Sign

A Scientific Statement From the American Heart Association

Cardiorespiratory Fitness in Youth: An Important Marker of Health

A Scientific Statement From the American Heart Association

KØBENHAVNS UNIVERSITET

REGION SJÆLLAND
HOLBÆK SYGEHUS
– vi er til for dig

Hvorfor?

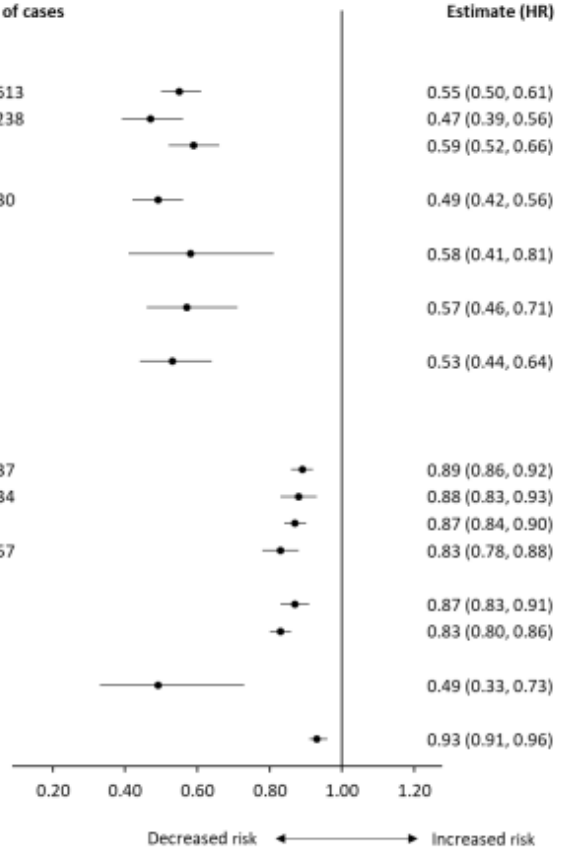
Cardiorespiratory fitness is a strong and consistent predictor of morbidity and mortality among adults: an overview of meta-analyses representing over 20.9 million observations from 199 unique cohort studies

Justin J Lang [1,2,3] Stephanie A Prince [1,2] Katherine Merucci,[4]
Cristina Cadenas-Sanchez [5,6] Jean-Philippe Chaput [2,7,8]
Brooklyn J Fraser [3,9] Taru Manyanga [10] Ryan McGrath,[3,11,12,13]
Francisco B Ortega [5,14] Ben Singh [3] Grant R Tomkinson [3]

Hvorfor?

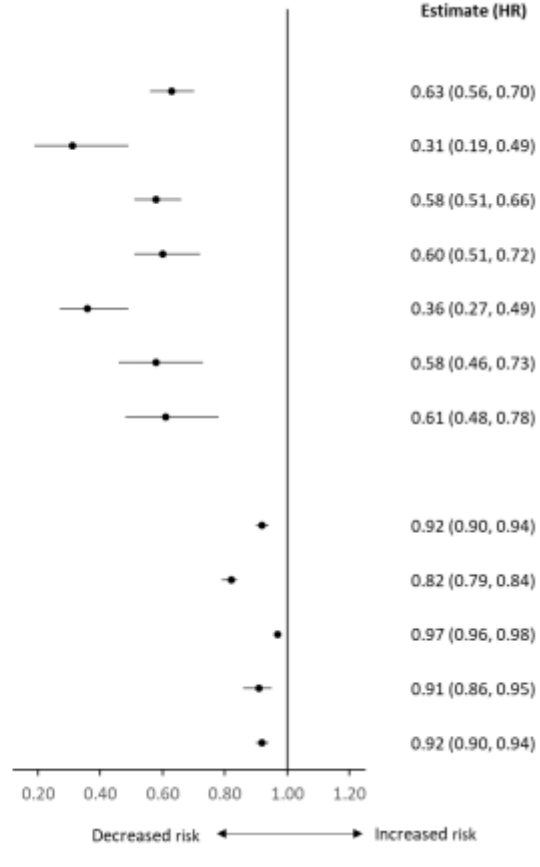
Tidlig død:

Study name	Number of studies	Sample size	Number of cases	Estimate (HR)
High vs. low CRF				
All-cause mortality				
Laukkanen, 2022 (54)	37	2,255,441	108,613	0.55 (0.50, 0.61)
Han, 2022 (35)	19	2,187,550	106,238	0.47 (0.39, 0.56)
Kodama, 2009 (24)	15	31,010	1877	0.59 (0.52, 0.66)
CVD mortality				
Han, 2022 (35)	13	1,952,352	13,530	0.49 (0.42, 0.56)
Sudden cardiac mortality				
Aune, 2020 (36)	2	57,813	362	0.58 (0.41, 0.81)
All cancer mortality				
Han, 2022 (35)	11	409,422	5482	0.57 (0.46, 0.71)
Lung cancer mortality				
Lee, 2020 (55)	5	12,758	NR	0.53 (0.44, 0.64)
Per 1-MET increase				
All-cause mortality				
Laukkanen, 2022 (54)	10	360,131	13,437	0.89 (0.86, 0.92)
Han, 2022 (35)	14	625,400	34,734	0.88 (0.83, 0.93)
Kodama, 2009 (24)	18	85,315	6230	0.87 (0.84, 0.90)
Qiu, 2021 (eCRF, 6)	7	154,015	13,457	0.83 (0.78, 0.88)
CVD mortality				
Han, 2022 (35)	10	392,240	2045	0.87 (0.83, 0.91)
Qiu, 2021 (eCRF, 6)	6	174,075	6751	0.83 (0.80, 0.86)
Sudden cardiac mortality				
Aune, 2020 (36)	2	57,813	362	0.49 (0.33, 0.73)
All cancer mortality				
Han, 2022 (35)	10	409,594	5503	0.93 (0.91, 0.96)



Sygdom:

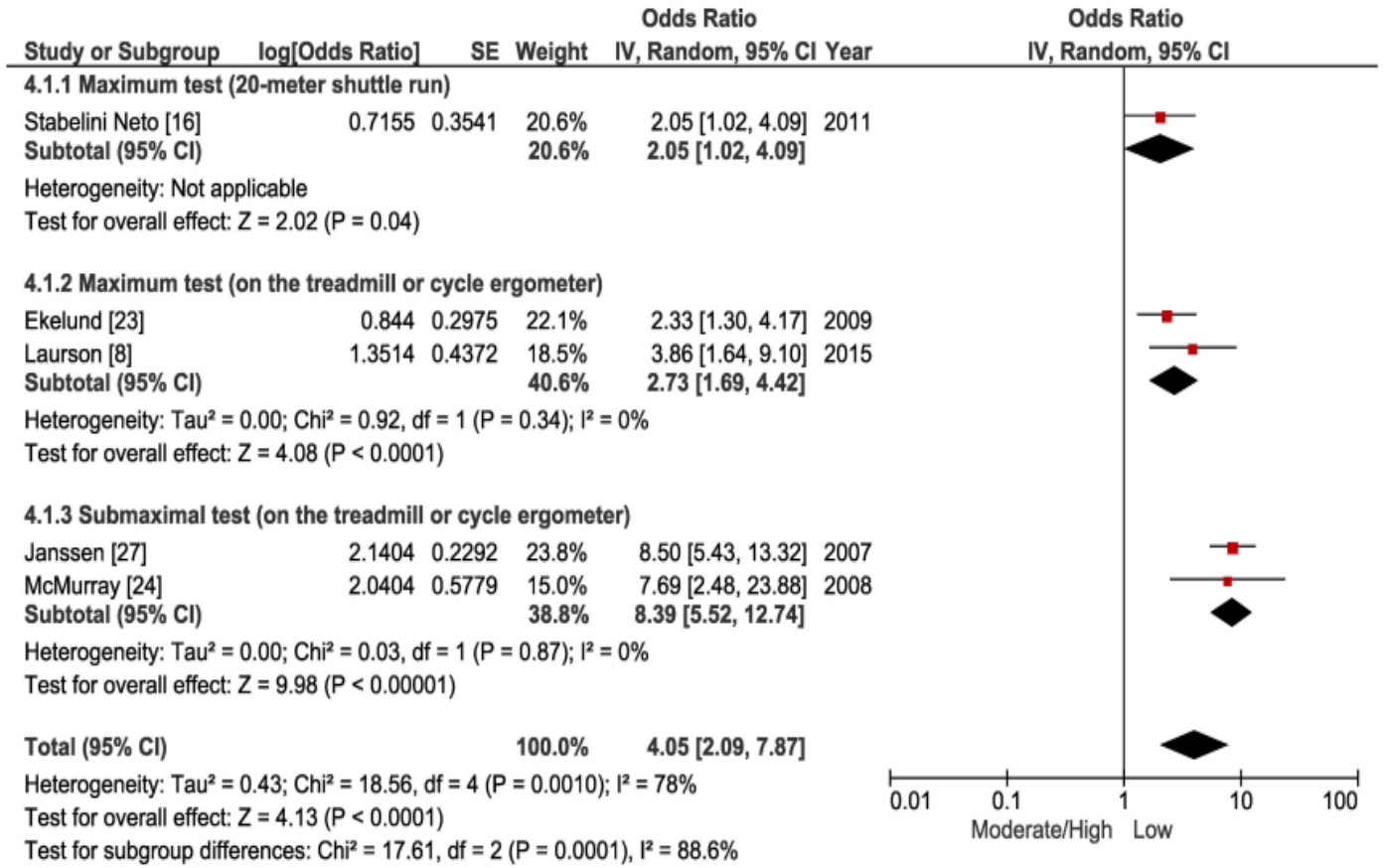
Study name	Number of studies	Sample size	Number of cases	Estimate (HR)
High vs. low CRF				
Incidence of hypertension				
Cheng, 2022 (37)	9	1,618,067	110,638	0.63 (0.56, 0.70)
Incidence of heart failure				
Aune, 2021 (38)	6	1,505,114	19,693	0.31 (0.19, 0.49)
Incidence of stroke				
Wang, 2020 (39)	14	1,409,340	23,894	0.58 (0.51, 0.66)
Incidence of atrial fibrillation				
Xue, 2020 (60)	7	2,168,739	NR	0.60 (0.51, 0.72)
Indicence of dementia				
Lee, 2021 (58)	3	11,694	NR	0.36 (0.27, 0.49)
Incidence of chronic kidney disease				
Kunutsor, 2023 (57)	5	32,447	4,043	0.58 (0.46, 0.73)
Incidence of depression				
Kandola, 2019 (56)	3	1,145,655	NR	0.61 (0.48, 0.78)
Per 1-MET increase				
Incidence of hypertension				
Cheng, 2022 (37)	9	1,618,067	110,638	0.92 (0.90, 0.94)
Incidence of heart failure				
Aune, 2021 (38)	5	173,678	9059	0.82 (0.79, 0.84)
Incidence of stroke				
Wang, 2020 (39)	9	NR	4419	0.97 (0.96, 0.98)
Incidence of atrial fibrillation				
Xue, 2020 (60)	7	222,124	NR	0.91 (0.86, 0.95)
Incidence of type 2 diabetes				
Tarp, 2019 (59)	10	1,601,490	40,286	0.92 (0.90, 0.94)



(Lang et al, British Journal of Sports Medicine, 2024)

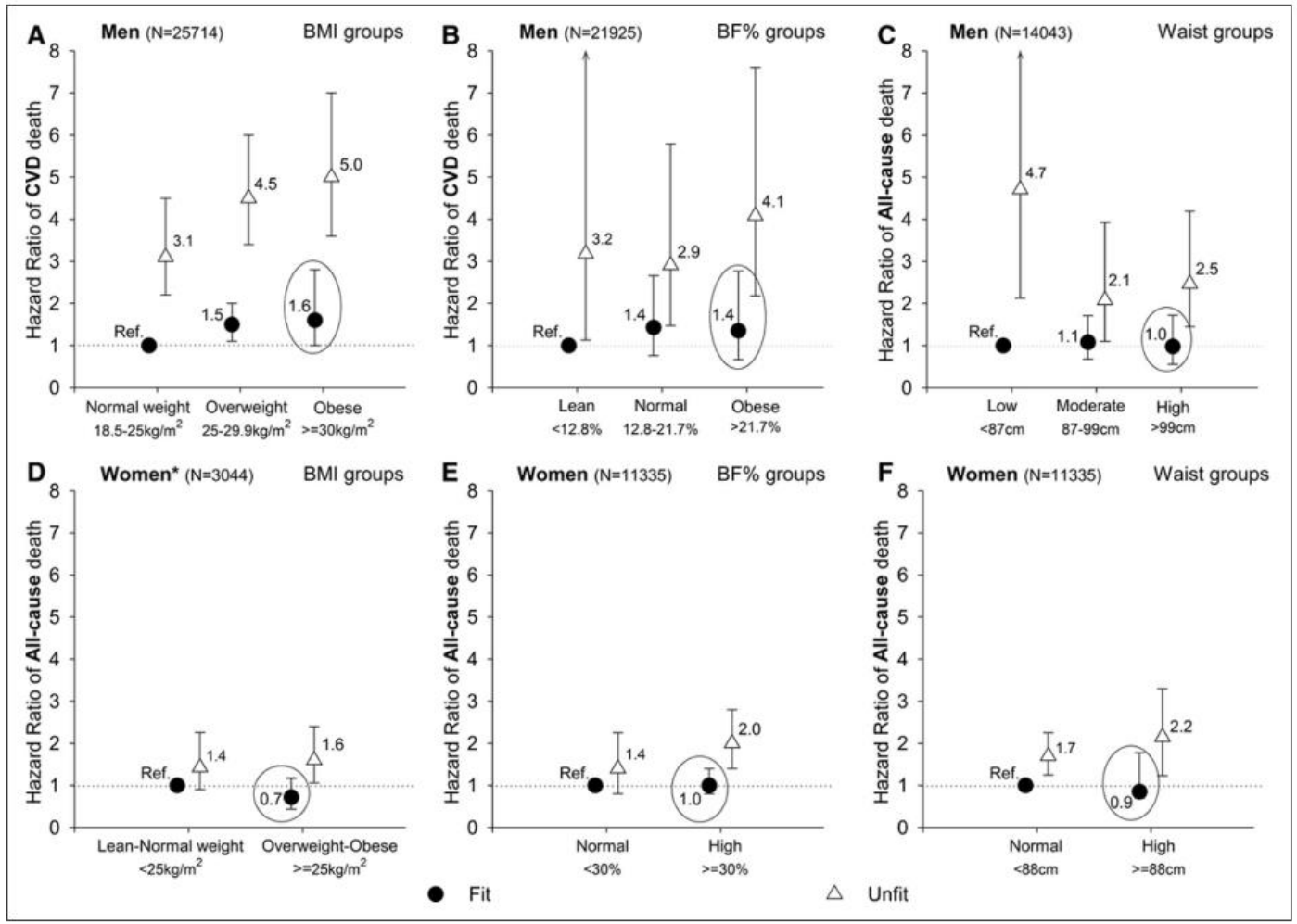
Hvorfor?

Metabolisk syndrom (10-19 år):



(Oliveira & Guedes, PLOS ONE, 2016)

Hvorfor?



(Ortega et al, Circulation Research, 2016)

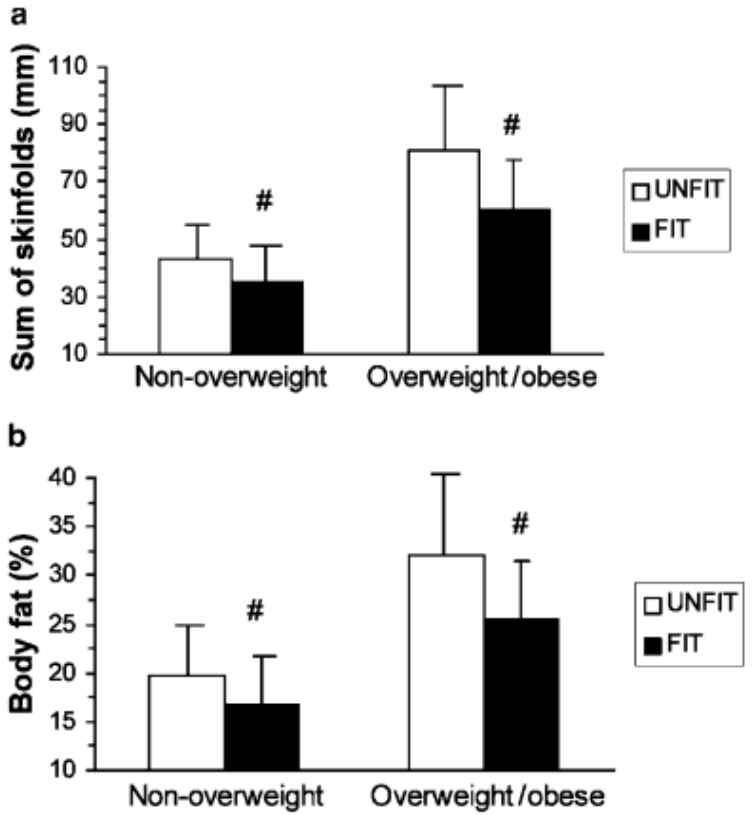


Figure 2 Sum of skinfolds (a) and per cent body fat (b) for the nonoverweight and overweight/obese children with high (fit) and low (unfit) CRF (means±s.d.). # $P<0.01$ between fit and unfit within the same BMI category.

(Nassis et al., 2005)

Table 2 Adjusted means of cardiometabolic correlates by fitness status and sex among adults with type 2 diabetes in the Look AHEAD study

	Adjusted mean (95% CI)					
	Women			Men		
	Low fit	Moderate fit	High fit (reference)	Low fit	Moderate fit	High fit (reference)
Anthropometric and blood pressure variables (n=4215)						
Body mass index, kg/m^2	41.1 (40.7 to 41.5)‡	37.0 (36.7 to 37.3)‡	33.4 (33.1 to 33.8)	39.5 (39.0 to 40.1)‡	36.0 (35.6 to 36.3)‡	32.5 (32.1 to 32.9)
Waist circumference, cm	119.2 (118.2 to 120.2)‡	111.9 (111.2 to 112.7)‡	104.6 (103.9 to 105.4)	128.3 (127.0 to 129.7)‡	120.9 (119.9 to 121.8)‡	111.7 (110.8 to 112.6)
Systolic BP, mm Hg	132.5 (131.1 to 133.9)‡	129.8 (128.7 to 130.8)‡	126.7 (125.7 to 127.7)	132.1 (130.2 to 133.9)‡	129.7 (128.4 to 130.9)†	127.1 (125.9 to 128.4)
Diastolic BP, mm Hg	68.7 (67.9 to 69.4)	68.4 (67.8 to 69.0)	68.1 (67.6 to 68.7)	73.4 (72.4 to 74.4)	73.9 (73.2 to 74.5)	74.2 (73.5 to 74.8)
Glycemic and lipid variables (n=4215)						
Fasting plasma glucose, mg/dL	158.4 (154.8 to 162.1)‡	149.8 (147.0 to 152.5)	147.8 (145.1 to 150.5)	162.6 (157.3 to 167.8)†	156.7 (153.1 to 160.3)*	151.3 (147.7 to 154.9)
Hemoglobin A_{1C}, %	7.42 (7.33 to 7.51)‡	7.28 (7.21 to 7.35)*	7.16 (7.09 to 7.22)	7.44 (7.30 to 7.57)‡	7.30 (7.21 to 7.39)†	7.07 (6.98 to 7.16)
Duration of diabetes, years	6.9 (6.4 to 7.4)‡	6.3 (6.0 to 6.7)†	5.5 (5.2 to 5.9)	7.5 (6.9 to 8.2)‡	6.9 (6.5 to 7.4)†	6.0 (5.6 to 6.5)
Triglyceride, mg/dL	168.7 (160.0 to 177.4)	176.7 (170.1 to 183.3)	170.5 (164.0 to 177.0)	197.6 (183.5 to 211.6)*	197.7 (188.0 to 207.4)*	179.7 (170.1 to 189.3)
Total cholesterol, mg/dL	197.3 (194.3 to 200.3)	197.0 (194.7 to 199.3)	200.0 (197.8 to 202.3)	183.2 (179.2 to 187.2)	184.5 (181.7 to 187.2)	184.8 (182.1 to 187.6)
HDL cholesterol, mg/dL	47.5 (46.5 to 48.5)	46.7 (46.0 to 47.5)	47.8 (47.0 to 48.5)	37.4 (36.4 to 38.4)*	38.1 (37.4 to 38.8)	39.0 (38.3 to 39.7)
LDL cholesterol, mg/dL	116.9 (114.2 to 119.6)	115.9 (113.9 to 118.0)*	118.8 (116.8 to 120.8)	107.3 (103.9 to 110.7)	108.1 (105.7 to 110.4)	111.2 (108.8 to 113.5)
Calorie intake (n=2305)						
Calorie intake, kcal/day	1959.4 (1861.9 to 2056.9)*	1910.5 (1842.9 to 1978.1)*	1814.6 (1748.1 to 1881.0)	2148.7 (2015.6 to 2281.9)	2201.2 (2108.7 to 2293.7)	2176.0 (2083.0 to 2269.0)
Physical activity (n=2402)						
Physical activity, kcal/week	460.7 (342.7 to 578.8)‡	663.9 (569.5 to 758.4)‡	928.9 (834.7 to 1023.1)	587.6 (404.9 to 770.2)‡	1 065.7 (935.8 to 1195.5)†	1330.0 (1193.7 to 1466.3)
Body fat composition (n=1186)						
Whole body fat, kg	47.1 (45.5 to 48.7)‡	41.3 (40.3 to 42.3)‡	35.9 (35.0 to 36.9)	39.3 (37.3 to 41.4)‡	35.4 (34.2 to 36.7)‡	28.4 (27.3 to 29.6)
Whole body fat-free mass, kg	55.8 (54.6 to 56.9)‡	53.6 (52.9 to 54.3)‡	51.4 (50.8 to 52.1)	72.8 (71.0 to 74.6)*	71.3 (70.1 to 72.4)	70.4 (69.4 to 71.4)
Whole body lean mass, kg	53.5 (52.4 to 54.6)‡	51.4 (50.7 to 52.1)‡	49.3 (48.6 to 49.9)	70.0 (68.2 to 71.7)*	68.5 (67.4 to 69.6)	67.6 (66.7 to 68.6)
Whole body mass, kg	102.9 (100.4 to 105.3)‡	94.9 (93.3 to 96.4)‡	87.4 (85.9 to 88.8)	112.1 (108.9 to 115.3)‡	106.7 (104.7 to 108.7)‡	98.8 (97.0 to 100.6)
Percent body fat, %	45.3 (44.5 to 46.1)‡	43.1 (42.6 to 43.6)‡	40.8 (40.3 to 41.2)	34.6 (33.4 to 35.7)‡	32.8 (32.1 to 33.5)‡	28.6 (27.9 to 29.2)

(Kaze et al, BMJ Open Diabetes Research & Care, 2022)

KØBENHAVNS UNIVERSITET

REGION SJÆLLAND
HOLBÆK SYGEHUS
– vi er til for dig

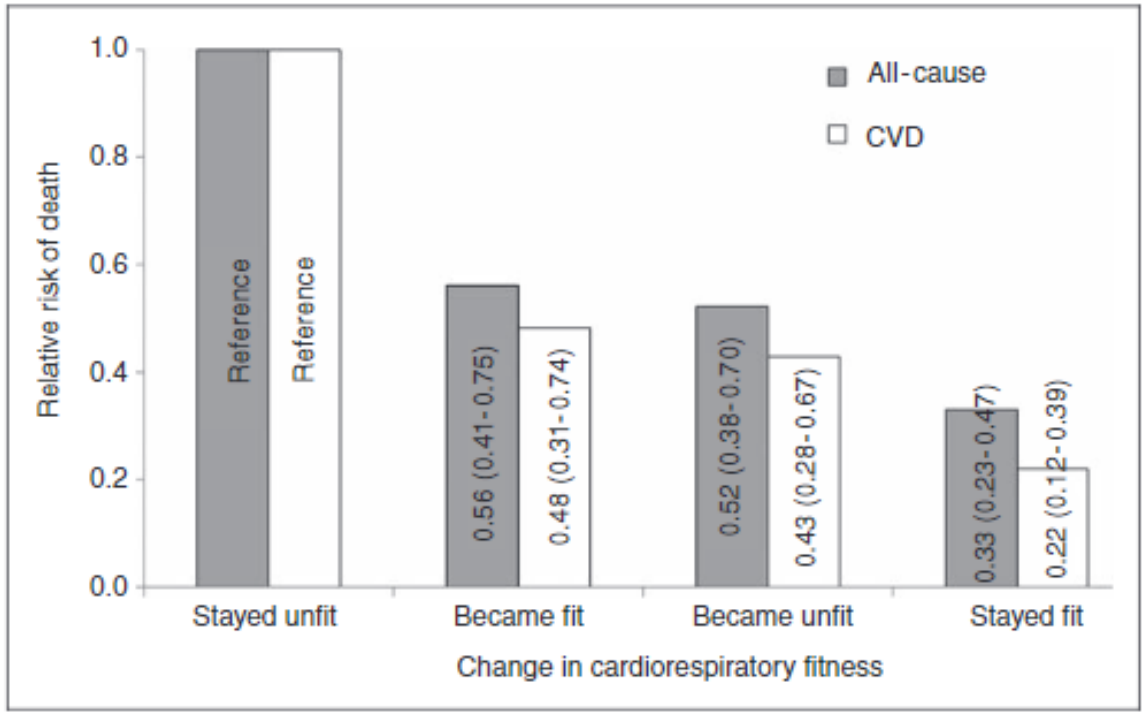
Hvorfor?

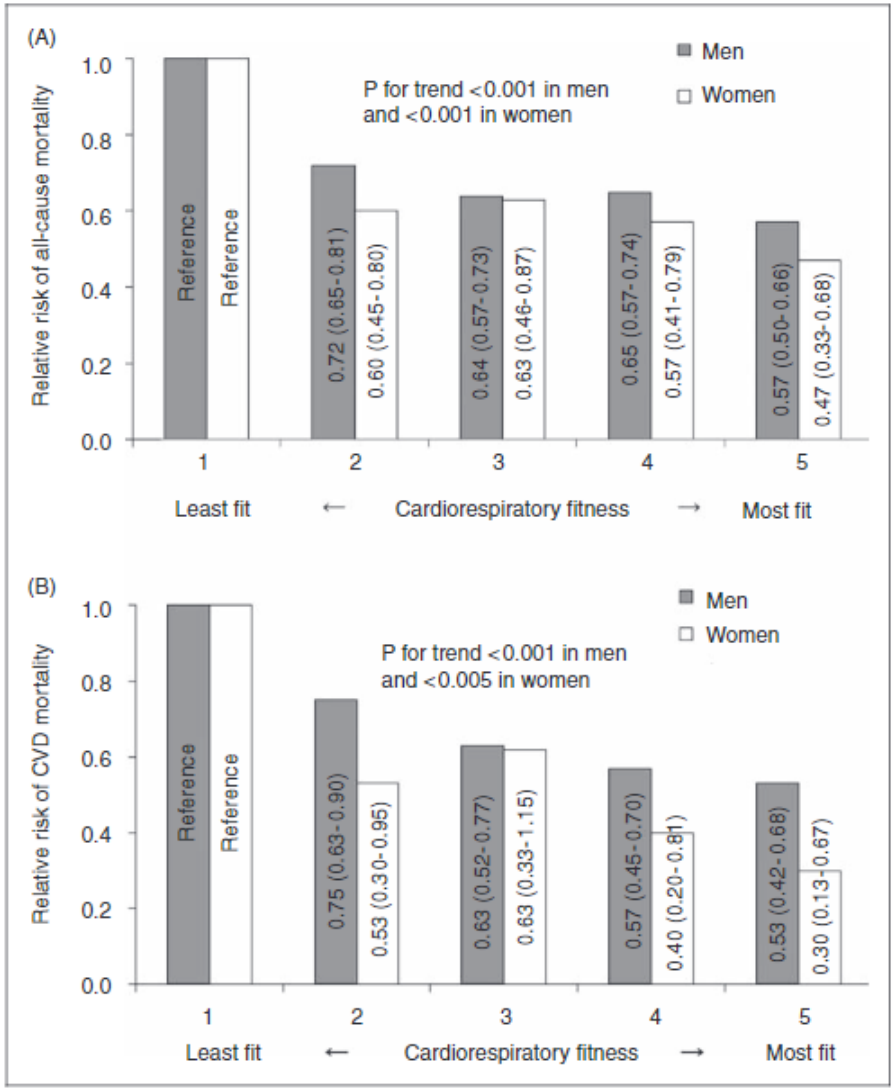
Table 3 Adjusted odds of selected correlates by sex among participants with low (vs moderate or high) fitness status in the Look AHEAD study

	Women		Men	
Correlate	**OR (95% CI)**	**P value**	**OR (95% CI)**	**P value**
Obesity*	3.86 (2.55 to 5.84)	<0.001	3.19 (1.95 to 5.20)	<0.001
Abdominal obesity	2.28 (1.08 to 4.79)	0.030	3.99 (2.00 to 7.96)	<0.001
Hypertension	1.44 (1.02 to 2.05)	0.040	1.74 (1.09 to 2.77)	0.021
Hypercholesterolemia	1.10 (0.89 to 1.38)	0.375	1.14 (0.84 to 1.53)	0.402
Low HDL cholesterol	0.87 (0.71 to 1.08)	0.209	1.02 (0.71 to 1.45)	0.927
Hypertriglyceridemia	0.77 (0.60 to 0.97)	0.028	1.10 (0.79 to 1.53)	0.589
Metabolic syndrome	2.25 (1.35 to 3.76)	0.002	5.52 (2.51 to 12.14)	<0.001
Current smoking	2.02 (1.25 to 3.28)	0.004	1.47 (0.75 to 2.86)	0.260
Alcohol drinking	0.84 (0.65 to 1.08)	0.177	0.80 (0.61 to 1.05)	0.111
Beta-blocker use	1.33 (1.03 to 1.73)	0.029	1.22 (0.86 to 1.73)	0.267
Use of ACEI or ARB	1.07 (0.86 to 1.32)	0.543	1.86 (1.39 to 2.50)	<0.001

Hvorfor?

Størst effekt/forskel fra laveste til næst laveste CRF!

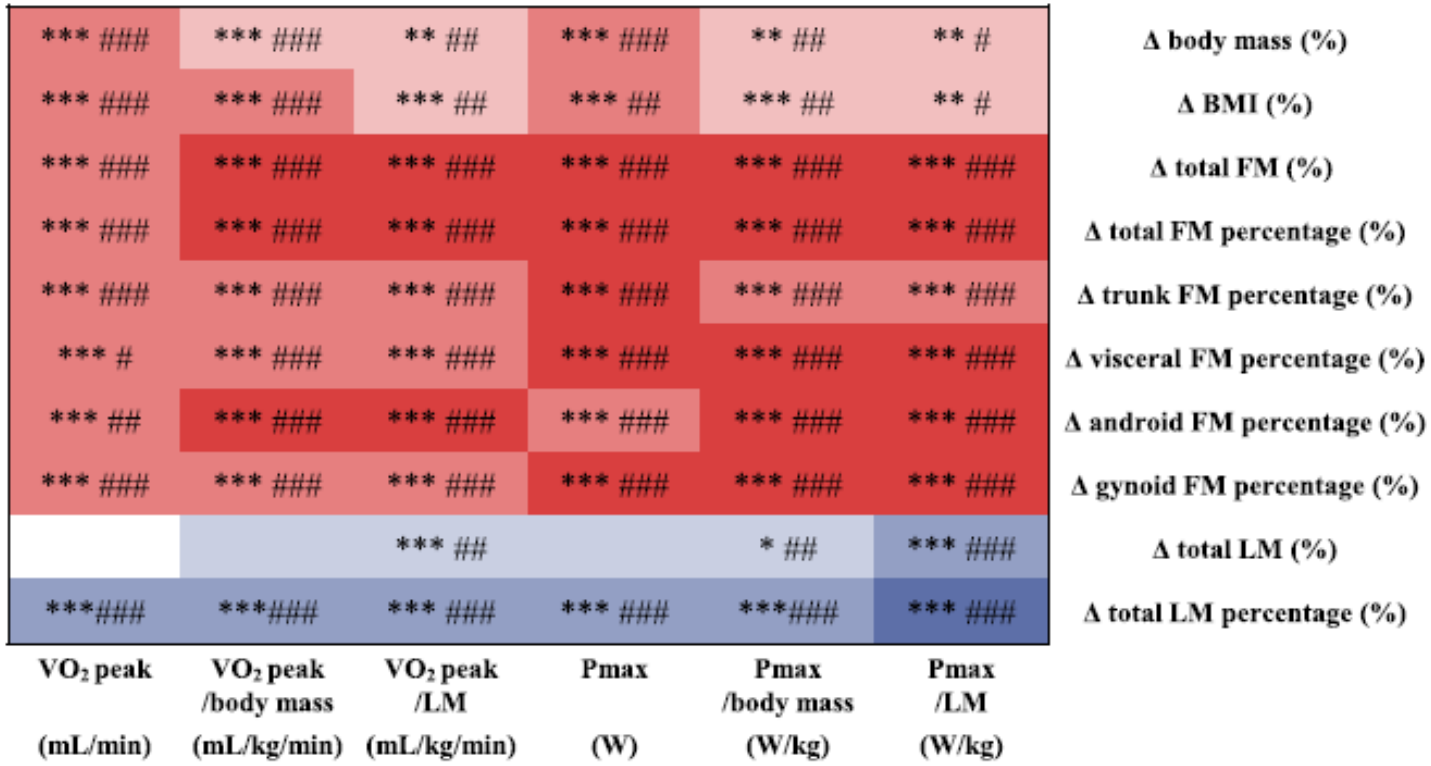




Hvorfor?

Baseline CRF associeret med effekt af behandling mod adipositas

The effectiveness of multidisciplinary weight loss interventions is associated with initial cardiorespiratory fitness in adolescents with obesity



(Allali et al, Pediatric Obesity 2024)

Hvorfor?

- Stærkt forbundet med nuværende og fremtidigt helbred og velvære uafhængigt af graden af adipositas.

  - Helbredsmarkør, prognostisk værktøj

- Identificering af individer med størst behov.

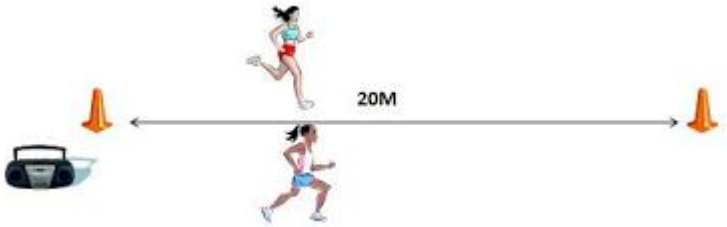
- Monitorering / evaluering

Hvordan?

Table 2. Comparison of Selected Tests Used to Measure CRF*

	Description	Ability to Assess CRF†
CPET (gas analyzed)	Participants exercise with incrementally increasing difficulty/workload with $\dot{V}O_2$ measured via respiratory gases	+++
20mSRT (not gas analysed; field based)	Participants run/walk between 2 points on a floor in sync with audio signals with incrementally increasing frequency	++
Run tests (eg, 1.5 miles/2400 m; field based)	Participants run a given distance as quickly as possible	++
Step test (office or field based)	Participants step up and down on a block of a given height; each stage is associated with an increased step rate	+
Walk tests (office based; eg, 6MWT)	Participants instructed to walk as far as possible in 6 min	+/–
Questionnaires	Questionnaire to assess fitness level	+/–

(Raghuveer et al, Circulation, 2020)



Hvordan

- Seismokardiografi:

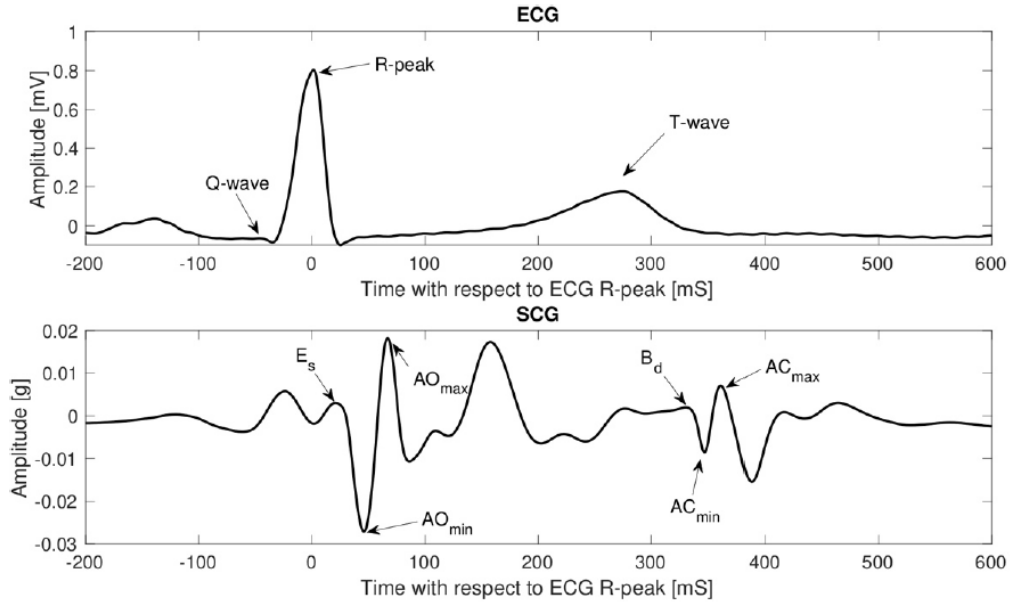


Fig. 2 Representative filtered signals from a subject. Signals are means of simultaneously recorded ECG and SCG recordings. Arrows on the SCG signal indicate the fiducial points used in this article:

(Sørensen et al, International Journal of Sports Medicine, 2020)

Hvordan

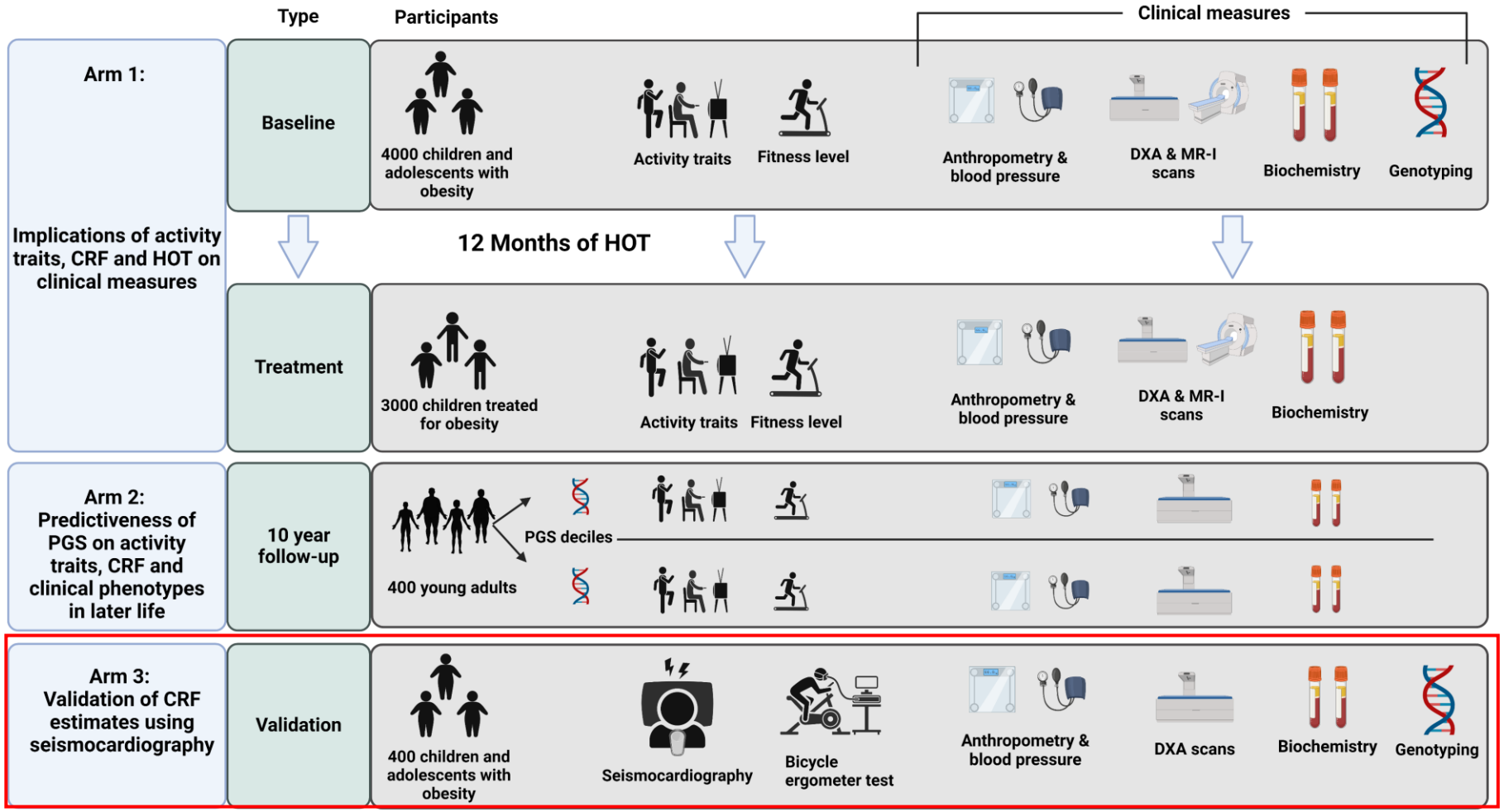


Figure 1. Project overview, number of participants and data used and generated.
Abbreviations: Dual-energy X-ray absorptiometry (DXA), magnetic resonance (MR) -imaging (I) and -spectroscopy (S), polygenic score (PGS), Holbaek Obesity Treatment (HOT)

KØBENHAVNS UNIVERSITET

REGION SJÆLLAND
HOLBÆK SYGEHUS
– vi er til for dig

Spørgsmål?

?