

**Supplemental Table S1.** Overview of municipal health promotion offers targeted participants in the Check Your Health Preventive Program 2013-2019.

Promotion program	Target group	Duration		Frequency	Content	Professionals
		Overall	Session			
Check on lifestyle	Persons with low physical activity level, persons who are overweight or obese	10 meeting days (over 20 weeks)	2-3 hours (group based)	Every second week	<p>Aim: To provide the theoretical and practical background and motivation to a healthy eating and physically active lifestyle.</p> <ul style="list-style-type: none"> <li>- Exercise training programs (cardio- and strengths training)</li> <li>- Yoga</li> <li>- Mindfulness</li> <li>- nutritional counselling</li> </ul>	Health professionals: nutritionists, sport scientists, physical therapists
Check on well-being	Persons at high risk of mental health problems	10 meeting days (over 20 weeks)	2,5 hours (group based)	Every second week	<p>Aim: To empower persons with low well-being.</p> <p>Theoretical and practical counselling with focus on: enhancing self-efficacy, stress- and conflict handling, health behavior and its association with mental well-being, mindfulness, self-image, taking care of self.</p>	Health professionals: nurses, nutritionists, sport scientists, physical therapists, mindfulness coaches, psychologists.
Check on alcohol	Persons with an abnormal alcohol consumption and/or alcohol risk behavior	Individual	Individual	Individual	Evidence-based psychological and medical alcohol addiction treatment and aftercare	Professionals at the Municipal Drug Addiction Treatment and Rehabilitation Center in Randers
Check on smoking	Persons smoking	Various	Various	Various	Various existing smoking cessation programs, individual and group based counselling and education and follow-up (physical meetings and/or online counselling/motivation). According to the principles in the Danish healthcare reform and recommendations for practice <sup>1,2</sup>	Health professionals educated in smoking cessation and affiliated with the healthcare centre in Randers

<sup>1</sup> Andersen PT, Jensen J-J. Healthcare reform in Denmark. *Scand J Public Health* 2010;38:246-53

<sup>2</sup> Pisinger CH. Treatment for tobacco dependence – recommendations for practice. Danish Health Authority 2011 ([www.sst.dk](http://www.sst.dk)).

## 1 **SUPPLEMENTAL MATERIAL, S2, STATISTICAL METHODS:**

### 2 **Multiple imputations**

3 Multiple imputation (MI) was used to impute missing values only for persons participating in the  
4 health checks (i.e. not for non-participants). MI was performed by inclusion of baseline  
5 characteristics that explained the missingness: age, sex, income, occupation, nationality,  
6 cohabitation status, educational attainment, self-rated health, self-rated physical activity, fitness  
7 level, smoking status, height, weight, waist circumference, blood pressure, cholesterol, HDL  
8 cholesterol, HbA1c, sick leave and fraction of full-time employment. We treated the missingness  
9 mechanism as at random given the observed information (the Missing At Random (MAR)  
10 assumption) and used multiple imputations based on chained equations, (MICE).<sup>1</sup> We report  
11 analyses based on 100 imputations, with adjustments according to Rubin's rules,<sup>2</sup> since adding  
12 more imputations did not change results (results not shown). Additionally, sex and age-stratified  
13 imputations were performed. Since they did not change results either (results not shown), results  
14 from the non-stratified imputations are presented. To assess the robustness of the MAR assumption  
15 we conducted supplementary analyses. Since we were concerned that people with missing data for  
16 fitness level might have a lower fitness level, even after allowing for their observed characteristics,  
17 we subtracted the value 10 from the imputed records of fitness level, in order to test the effect of a  
18 significant manipulation (Supplemental Table S2). Following, the estimates from the analysis with  
19 and without multiple imputation were compared and evaluated. In addition to estimates of interest,  
20 we report the Fraction of Missing Information (FMI) to facilitate assessment of the impact of  
21 missing data.

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**Supplemental Table S2. Violation of the missing at random assumption**

		Estimate	95% CI LB	95% CI UB	FMI	RVI
<i>Original estimates (see Table 3 in manuscript)</i>						
Cardiorespiratory fitness (ml O <sub>2</sub> / kg / min)	CG	32.073	31.433	32.713	0.177	0.214
	IG	32.206	31.648	32.764	0.047	0.049
	IG - CG	0.133	-0.560	0.826	0.158	0.187
<i>Imputed values of fitness level subtracted the value 10 before analysis:</i>						
Cardiorespiratory fitness (ml O <sub>2</sub> / kg / min)	CG	31.199	30.509	31.888	0.172	0.207
	IG	31.358	30.750	31.966	0.041	0.043
	IG - CG	0.159	-0.605	0.924	0.148	0.173

Violation of the missing at random assumption was performed by subtracting the value 10 from the imputed records of 'fitness level'. Following, the estimates from the analysis with and without manipulation were compared and evaluated.

### 23 Propensity score matching

24 Due to the modest participation in the initial health check (51% IG and 40% CG), and the even  
 25 lower participation at follow-up (26% IG), a direct comparison between the IG follow-up and CG  
 26 baseline would not represent a fair comparison based on randomisation. Consequently, we used  
 27 propensity score (PS) matching to restore the comparability of the two groups. The propensity  
 28 refers to the probability of IG individuals participating in their follow-up health check, given that  
 29 they had participated in their baseline health check. Propensity scores were estimated in imputed  
 30 datasets with logistic regression based on the following observed baseline characteristics: sex, age,  
 31 cohabitation status, educational attainment, income, nationality, occupation, smoking status, BMI,  
 32 HbA1c, cholesterol, and fitness level. The estimation was done among individuals in the IG who  
 33 participated in the year 2 examination using their participation status in the year 5 examination as  
 34 outcome in a logistic regression. These characteristics were selected based on information from  
 35 prior research<sup>3</sup> and by forward stepwise model selection. For all in the IG and the CG, who  
 36 participated in the first health check they were invited to, we predicted the propensity for  
 37 participating in a re-examination, based on the likelihood of participation in the re-examination  
 38 among the IG (as shown in Supplemental Table S3). This propensity score formed the basis for the  
 39 comparison between groups. To estimate the intervention effect we used a matching approach as

40 suggested and validated by Austin<sup>4</sup>, matching on the propensity scores. We examined the balancing  
 41 properties of the propensity score (Supplemental Figure S1). The capacity of the propensity score to  
 42 remove bias in estimated treatment effects was assessed by mimicking the analytic strategy for the  
 43 functional capacity outcomes, and comparing with the estimates obtained for these outcomes when  
 44 considering the entire invited population in an intention-to-treat analysis (Supplemental Table S4).

<b>Supplemental Table S3. Prediction of participation in 2nd health examination</b>				
<b>Parameter/Characteristics</b>	<b>Log Odds</b>	<b>95% confidence interval</b>		<b>P-value</b>
		Lower limit	Upper limit	
Men (ref. women)	0.161	0.010	0.333	0.064
Age (Age_0)	0.037	0.021	0.052	0.000
Living alone (ref. living with others)	-0.138	-0.389	0.113	0.281
Education (ref <10 years)				
10-15 years	-0.005	-0.268	0.257	0.968
+ 15 years	0.042	-0.241	0.325	0.771
Income	0.002	0.001	0.003	0.001
Immigrants or descendants (ref. Danish)	0.534	0.125	0.943	0.011
Occupation (ref. Employed)				
Self-employed	-0.510	-0.915	-0.106	0.013
Unemployed/On benefits	0.057	-0.422	0.535	0.817
Social welfare recipients	-0.248	-0.676	0.180	0.256
Others	1.072	0.149	1.995	0.023
Fitness level (ref. very poor)				
Poor	0.222	0.006	0.439	0.044
Fair	0.716	0.493	0.939	0.000
Very good	0.172	-0.172	0.517	0.326
Excellent	0.882	0.526	1.238	0.000
Smoking (ref. not smoking)	-0.490	-0.712	-0.268	0.000
HbA1c >=42mmol/mol (ref. below 42 mmol/mol)	-0.013	-0.028	-0.002	0.100

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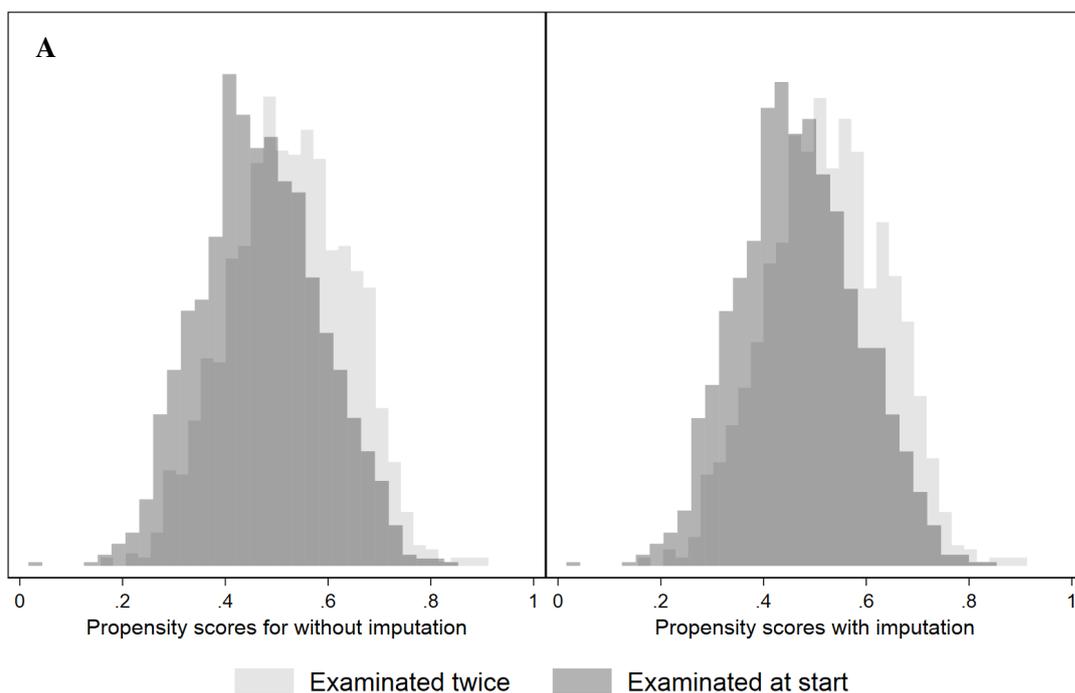
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**Supplemental Table S4.** Comparison of two analysis models to estimate the treatment effect of CHPP on work participation and sick leave.

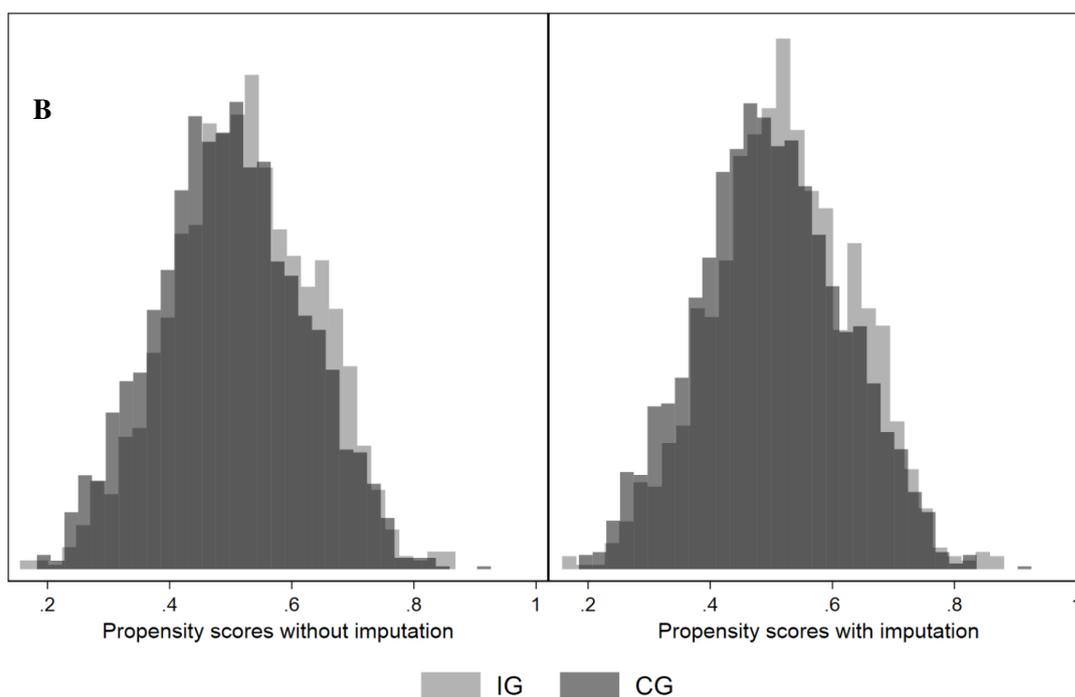
		Estimate	95% CI LB	95% CI UB
<i>Estimates from analysis using multiple imputation and propensity score matching</i>				
Employment degree (fraction)	CG	0.805	0.783	0.826
	IG	0.800	0.781	0.820
	IG - CG	-0.004	-0.032	0.024
Sick leave 3w periods (N)	CG	0.068	0.052	0.084
	IG	0.064	0.050	0.078
	IG - CG	-0.004	-0.025	0.017
<i>Estimates from intention-to-treat-analysis</i>				
Employment degree (fraction)	IG	0.703	0.692	0.715
	CG	0.702	0.691	0.714
	IG-CG	-0.001	-0.015	0.017
Sick leave 3w periods (N)	IG	0.078	0.070	0.086
	CG	0.074	0.069	0.086
	IG-CG	0.000	-0.012	0.012

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51 **Supplemental Figure S1. Comparison of propensity scores for participation at the follow-up examination among**  
 52 **those who participated in the initial examination** **A)** Histograms of propensity scores in the intervention group  
 53 without imputation (left panel) and with imputation (right panel – one imputed dataset out of 100). **B)** Histograms  
 54 comparing propensity scores in the intervention group (IG) and the comparison group (CG), without imputation (left  
 55 panel) and with imputation (right panel – one imputed dataset out of 100). The comparisons confirm a large overlap of  
 56 propensity scores, which enables estimation of treatment effects.

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58 **References**

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60 epidemiological and clinical research: potential and pitfalls. *BMJ : British medical journal.*  
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63 York 1987. XXIX+258 pp. *Stat. Pap.* 1990;31, 180.
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65 checks in a municipality setting: the Danish ‘Check Your Health Preventive Program’. *Prev.*  
66 *Med. Reports* 2017;5, 175–182
- 67 4. Austin PC. Optimal caliper widths for propensity-score matching when estimating  
68 differences in means and differences in proportions in observational studies. *Pharm Stat*  
69 2011;10(2):150-61.Ds

<b>Supplemental Table S5. Clinical and behavioral profile of the citizens allocated to the intervention group (IG) at the time of their first health check (HC)</b>				
<b>Characteristic</b>	<b>Allocated to IG and only participating in the first HC (N=1,358)</b>	<b>Allocated to IG participating in the first and second HC (N=1,340)</b>	<b>Total (N=2,698)</b>	<b>Missings / N (Pct)</b>
BMI (kg/m <sup>2</sup> ), mean (sd)	27.5 (5.3)	26.6 (4.9)	27.0 (5.1)	0 / 2698 (0.00)
BMI > 25 < 30, n (%)	533 (39.2)	515 (38.4)	1048 (38.8)	0 / 2698 (0.00)
BMI ≥ 30, n (%)	351 (25.8)	261 (19.5)	612 (22.7)	0 / 2698 (0.00)
Systolic BP (mmHg), mean (sd)	123.9 (15.7)	123.1 (15.4)	123.5 (15.5)	0 / 2698 (0.00)
Diastolic BP (mmHg), mean (sd)	81.2 (10.3)	80.5 (10.1)	80.9 (10.2)	0 / 2698 (0.00)
Systolic BP ≥ 140 mmHg, n (%)	195 (14.4)	177 (13.2)	372 (13.8)	5 / 2698 (0.19)
Diastolic BP ≥ 95 mmHg, n (%)	145 (10.7)	112 (8.4)	257 (9.5)	5 / 2698 (0.19)
Total cholesterol ≥ 6 mmol/l, n (%)	194 (14.3)	147 (11.0)	341 (12.7)	5 / 2698 (0.19)
HbA1c (mmol/mol), mean (sd)	34.4 (7.7)	33.9 (5.7)	34.2 (6.8)	6 / 2698 (0.22)
HbA1c ≥ 42 ≤ 48 mmol/mol, n (%)	31 (2.3)	14 (1.0)	45 (1.7)	6 / 2698 (0.22)
HbA1c ≥ 48 mmol/mol, n (%)	31 (2.3)	19 (1.4)	50 (1.9)	6 / 2698 (0.22)
HbA1c ≥ 42 mmol/mol, n (%)	62 (4.6)	33 (2.5)	95 (3.5)	6 / 2698 (0.22)
FEV/FVC ratio, mean (sd)	0.8 (0.1)	0.8 (0.1)	0.8 (0.1)	52 / 2698 (1.93)
FEV/FVC ratio ≤ 0.7, n (%)	169 (12.7)	161 (12.2)	330 (12.5)	52 / 2698 (1.93)
HeartSCORE% extrapolated to age 60 years, mean (sd)	2.2 (1.8)	1.9 (1.4)	2.0 (1.6)	57 / 2698 (2.11)
HeartSCORE extrapolated to age 60 years (≥5%), n (%)	85 (6.4)	47 (3.6)	132 (5.0)	57 / 2698 (2.11)

Self-rated health ('good' or better), n (%)	1176 (87.3)	1188 (89.4)	2364 (88.3)	22 / 2698 (0.82)
NEMC mental health t-score - SF12 <sub>mcs</sub> , mean (sd)	49.8 (9.3)	50.3 (9.1)	50.1 (9.2)	217 / 2698 (8.04)
Poor mental health, SF12 <sub>mcs</sub> < 35.76, n (%)	107 (8.6)	102 (8.3)	209 (8.4)	217 / 2698 (8.04)
Alcohol risk behaviour (AUDIT), n (%)	107 (8.1)	79 (6.1)	186 (7.2)	97 / 2698 (3.60)
Daily smoker, n (%)	312 (23.5)	176 (13.4)	488 (18.5)	57 / 2698 (2.11)
Moderate Phys. Act (days with min 30 min), mean (sd)	3.5 (2.2)	3.7 (2.2)	3.6 (2.2)	65 / 2698 (2.41)
Moderate Phys. Act (days with min 30 min) (≥ 5 days), n (%)	288 (21.7)	296 (22.7)	584 (22.2)	65 / 2698 (2.41)
Cardiorespiratory fitness mlO <sub>2</sub> /kg/min, mean (sd)	31.3 (9.3)	33.6 (9.4)	32.5 (9.4)	178 / 2698 (6.60)
Fitness level, n (%)				178 / 2698 (6.60)
Very poor, n (%)	592 (47.1)	442 (35.0)	1034 (41.0)	
Poor, n (%)	298 (23.7)	286 (22.6)	584 (23.2)	
Fair, n (%)	223 (17.7)	340 (26.9)	563 (22.3)	
Very good, n (%)	85 (6.8)	84 (6.7)	169 (6.7)	
Excellent, n (%)	59 (4.7)	111 (8.8)	170 (6.7)	

<b>Supplemental Table S6.</b> Proportion of missing values in individual baseline characteristics from citizens allocated to the control group (CG) and participating in the HC (N=2120)	
<b>Characteristic</b>	<b>Missings / N (Pct)</b>
BMI (kg/m <sup>2</sup> ), mean (sd)	< 5/2120
BMI > 25 < 30, n (%)	< 5/2120
BMI ≥ 30, n (%)	< 5/2120
Systolic BP (mmHg), mean (sd)	0/2120 (0.00)
Diastolic BP (mmHg), mean (sd)	0/2120 (0.00)
Systolic BP ≥ 140 mmHg, n (%)	0/2120 (0.00)
Diastolic BP ≥ 95 mmHg, n (%)	0/2120 (0.00)
Total cholesterol ≥ 6 mmol/l, n (%)	0/2120 (0.00)
HbA1c (mmol/mol), mean (sd)	< 5/2120
HbA1c ≥ 42 ≤ 48 mmol/mol, n (%)	< 5/2120
HbA1c ≥ 48 mmol/mol, n (%)	< 5/2120
HbA1c ≥ 42 mmol/mol, n (%)	< 5/2120
HeartSCORE% extrapolated to age 60 years, mean (sd)	5/2120 (0.24)
HeartSCORE extrapolated to age 60 years (≥5%), n (%)	5/2120 (0.24)
Self-rated health ('good' or better), n (%)	5/2120 (0.24)
NEMC mental health t-score - SF12 <sub>mcs</sub> , mean (sd)	161/2120 (7.59)
Poor mental health, SF12 <sub>mcs</sub> < 35.76, n (%)	161/2120 (7.59)
Alcohol risk behaviour (AUDIT), n (%)	5/2120 (0.24)
Daily smoker, n (%)	< 5/2120
Moderate Phys. Act (days with min 30 min), mean (sd)	47/2120 (2.22)

Moderate Phys. Act (days with min 30 min) ( $\geq 5$ days), n (%)	47/2120 (2.22)
Cardiorespiratory fitness mlO <sub>2</sub> /kg/min, mean (sd)	197/2120 (9.29)
Fitness level, n (%)	197/2120 (9.29)

<b>Supplemental Table S7.</b> Proportion of missing values in individual characteristics for the analytic sample, using modeled CVD as outcome example			
<b>Characteristic</b>	<b>Missings / N (Pct)</b>		
	<b>Intervention group</b>	<b>Comparison group</b>	<b>Total</b>
BMI (kg/m <sup>2</sup> ), mean (sd)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
BMI > 25 < 30, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
BMI ≥ 30, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Systolic BP (mmHg), mean (sd)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Diastolic BP (mmHg), mean (sd)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Systolic BP ≥ 140 mmHg, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Diastolic BP ≥ 95 mmHg, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Total cholesterol ≥ 6 mmol/l, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
HbA1c (mmol/mol), mean (sd)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
HbA1c ≥ 42 ≤ 48 mmol/mol, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
HbA1c ≥ 48 mmol/mol, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
HbA1c ≥ 42 mmol/mol, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
HeartSCORE% extrapolated to age 60 years, mean (sd)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
HeartSCORE extrapolated to age 60 years (≥5%), n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)

Self-rated health ('good' or better), n (%)	0/1206 (0.00)	<5/1206 (0.00)	<5/2412 (0.00)
NEMC mental health t-score - SF12 <sub>mcs</sub> , mean (sd)	85/1206 (7.05)	67/1206 (5.56)	152/2412 (6.30)
Poor mental health, SF12 <sub>mcs</sub> < 35.76, n (%)	85/1206 (7.05)	67/1206 (5.56)	152/2412 (6.30)
Alcohol risk behaviour (AUDIT), n (%)	<5 /1206	<5 /1206	<5 /2412
Daily smoker, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Moderate Phys. Act (days with min 30 min), mean (sd)	16/1206 (1.33)	18/1206 (1.49)	34/2412 (1.41)
Moderate Phys. Act (days with min 30 min) (≥ 5 days), n (%)	16/1206 (1.33)	18/1206 (1.49)	34/2412 (1.41)
Cardiorespiratory fitness mlO <sub>2</sub> /kg/min, mean (sd)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Fitness level, n (%)	0/1206 (0.00)	0/1206 (0.00)	0/2412 (0.00)
Due to the matching procedure, which is different depending on the outcome, the presentation of the analytic sample was based on the outcome modeled CVD risk, as an example.			

**Supplemental Table S8.** Outcome measures in the participants allocated to the intervention group (IG) and participating in both the first and second health check (N=1,340)\*

	<b>At the time of the first health check (baseline)</b>	<b>Missings N (Pct)</b>	<b>At the time of the second health check (follow-up)</b>	<b>Missings N (Pct)</b>
<b>Outcome</b>				
n (%)				
Participation (complete), n (%)	1340 (100.0)	0/1340 (0.00)	1340 (100.0)	0/1340 (0.00)
CVD risk, HeartSCORE(%), mean (sd)	1.9 (1.4)	33/1340 (2.46)	2.0 (1.5)	7/1340 (0.52)
Moderate Phys. Act (days with min 30 min), mean (sd)	3.7 (2.2)	34/1340 (2.54)	3.7 (2.1)	31/1340 (2.31)
Cardiorespiratory fitness (mlO <sub>2</sub> /kg/min), mean (sd)	33.6 (9.4)	77/1340 (5.75)	32.6 (9.6)	115/1340 (8.58)
Self-rated health – SF12 (good or better), n (%)	1188 (89.4)	11/1340 (0.82)	1142 (85.2)	0/1340 (0.00)
NEMC mental health t-score - SF12_MCS, mean (sd)	50.3 (9.1)	108/1340 (8.06)	50.9 (9.0)	111/1340 (8.28)
Employment degree (fraction), mean (sd)	0.8 (0.3)	0/1340 (0.00)	0.8 (0.4)	0/1340 (0.00)
Sick leave periods $\geq$ 3 weeks duration (N), mean (sd)	0.1 (0.3)	0/1340 (0.00)	0.1 (0.3)	0/1340 (0.00)

\*Un-adjusted values based on original non-imputed datasets