

Original research

# Do declines in occupational physical activity contribute to population gains in body mass index? Tromsø Study 1974–2016

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## ABSTRACT

**Objective** To examine whether occupational physical activity changes predict future body mass index (BMI) changes.

**Methods** This longitudinal cohort study included adult participants attending  $\geq 3$  consecutive Tromsø Study surveys (examinations 1, 2 and 3) from 1974 to 2016 (N=11 308). If a participant attended  $>3$  surveys, the three most recent surveys were included. Occupational physical activity change (assessed by the Saltin-Grimby Physical Activity Level Scale) was computed from the first to the second examination, categorised into persistently inactive (n=3692), persistently active (n=5560), active to inactive (n=741) and inactive to active (n=1315). BMI change was calculated from the second to the third examination (height being fixed at the second examination) and regressed on preceding occupational physical activity changes using analysis of covariance adjusted for sex, birth year, smoking, education and BMI at examination 2.

**Results** Overall, BMI increased by  $0.84 \text{ kg/m}^2$  (95% CI 0.82 to 0.89). Following adjustments as described previously, we observed no differences in BMI increase between the occupational physical activity change groups (Persistently Inactive:  $0.81 \text{ kg/m}^2$ , 95% CI 0.75 to 0.87; Persistently Active:  $0.87 \text{ kg/m}^2$ , 95% CI 0.82 to 0.92; Active to Inactive:  $0.81 \text{ kg/m}^2$ , 95% CI 0.67 to 0.94; Inactive to Active:  $0.91 \text{ kg/m}^2$ , 95% CI 0.81 to 1.01;  $p=0.25$ ).

**Conclusion** We observed no prospective association between occupational physical activity changes and subsequent BMI changes. Our findings do not support the hypothesis that occupational physical activity declines contributed to population BMI gains over the past decades. Public health initiatives aimed at weight gain prevention may have greater success if focusing on other aspects than occupational physical activity.

## INTRODUCTION

Excessive adiposity and weight gain arise from an imbalance between energy intake and expenditure.<sup>1</sup> Increased energy intake is likely the main driver for population weight gains,<sup>2</sup> but declines in physical activity levels may also contribute.<sup>1 3</sup> At the population level, it may be easier to prevent weight gain by increasing physical activity levels than changing food habits.<sup>1</sup> Although the evidence

## Key messages

### What is already known about this subject?

► The inconclusive results from observational studies on occupational physical activity change and body mass index (BMI) gain may be due to methodological issues.

### What are the new findings?

► Occupational physical activity declines were not prospectively associated with BMI gains in this large population-based sample.

### How might this impact on policy or clinical practice in the foreseeable future?

► Public health initiatives aimed at weight gain prevention may have greater success if focusing on other aspects than occupational physical activity.

for a prospective association between physical activity and weight gain is limited by methodological challenges,<sup>4</sup> higher levels of physical activity are reported to prevent weight gain at the population level.<sup>5</sup>

Energy expenditure contribution from occupational physical activity is considered higher than that from leisure-time physical activity.<sup>3 6</sup> Since leisure-time physical activity appears stable over the past decades and occupational physical activity has declined in western countries,<sup>3 7–10</sup> lower levels of occupational physical activity, rather than leisure-time physical activity, may contribute to population gains in weight.<sup>3 11 12</sup>

Studies assessing the association between occupational physical activity and body mass index (BMI) or weight show conflicting results.<sup>11–16</sup> Some studies reported no association between baseline occupational physical activity and future BMI change<sup>11 13–16</sup>; however, baseline physical activity does not take the reciprocal relationship of changing weight and physical activity into account (ie, physical activity level at baseline may change over time to follow-up, which may be related or unrelated to weight change).<sup>4</sup> Other studies computed change scores for both occupational physical activity and BMI and reported conflicting results<sup>12 17</sup>; however, without adjusting for previous physical activity or



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BMI/weight at baseline, this represents a cross-sectional analysis of change scores (ie, it is as likely that physical activity change leads to weight change as vice versa), and thus, the direction of the association is unexamined.<sup>4</sup>

To overcome these methodological challenges, the aim of this study was to assess whether changes in occupational physical activity predicted future changes in BMI over a 40-year period in a large cohort of Norwegian adults examined at three time points with ~6 years of follow-up between each time point.

## METHODS

### Design

The Tromsø Study is an ongoing population-based cohort study in the municipality of Tromsø, Norway, which includes seven repeated surveys with high attendance (%): 1974 (Tromsø 1) (83%), 1979–1980 (Tromsø 2) (85%), 1986–1987 (Tromsø 3) (81%), 1994–1995 (Tromsø 4) (77%), 2001 (Tromsø 5) (79%), 2007–2008 (Tromsø 6) (66%) and 2015–2016 (Tromsø 7) (65%). The cohort includes invited participants from total birth cohorts and random samples of inhabitants in the Tromsø municipality.<sup>10 18</sup> Tromsø 1 included only men, while Tromsø 2–7 included both sexes (details described elsewhere (Tromsø 1–6<sup>18</sup> and Tromsø 7<sup>10</sup>). In this study, we included participants attending at least three consecutive surveys (hereafter examinations 1–3). We computed change in physical activity from examination 1 to 2 followed by change in BMI and weight from examination 2 to 3. Consequently, the follow-up period for physical activity change from examination 1 to 2 and BMI change from examination 2 to 3 were 6–7 years (mean: 6.5 years) for all included participants. Inclusion criteria were information on (1) physical activity at examination 1 and 2, and height and weight at examination 2 and 3; (2) educational level and smoking habits at examination 2; and (3) not pregnant at examination 2 and/or 3. If participants attended more than three consecutive surveys, data from the three most recent surveys were included in the main analyses (overall cohort), while one participant could be included in multiple period-specific samples (Tromsø 1–3: 1974–1987, Tromsø 2–4: 1979–1995, Tromsø 3–5: 1986–2001, Tromsø 4–6: 1994–2008 and Tromsø 5–7: 2001–2016). The layout for the analyses is illustrated in figure 1.

### Participants

A flowchart illustrates the selection of participants for our samples (online supplemental figure 1). In short, the overall cohort comprised 11308 participants with their three most recent attendances. The period-specific sample sizes were as follows: Tromsø 1–3 (1974–1987): n=3570, Tromsø 2–4 (1979–1995): n=9679, Tromsø 3–5 (1986–2001): n=3827, Tromsø

4–6 (1994–2008): n=2212 and Tromsø 5–7 (2001–2016): n=1146). Each individual was eligible for inclusion in multiple period-specific samples. Some participants were excluded due to missing confounders: Tromsø 1–3 (1974–1987): n=512, Tromsø 2–4 (1979–1995): n=595, Tromsø 3–5 (1986–2001): n=15, Tromsø 4–6 (1994–2008): n=39 and Tromsø 5–7 (2001–2016): n=20 (online supplemental figure 1).

The descriptive characteristics at examination 2 for the overall cohort and period-specific samples are presented in table 1. Tromsø 1 (1974) included only men; thus, the Tromsø 1–3 (1974–1987) sample included only men. All other cohorts are well balanced on sex distribution. Across period-specific samples, age distribution increases, current smokers decrease and educational-level increase (table 1).

### Patient and public involvement

There was no public involvement in the design or implementation of this study. The Tromsø 7 advisory board included patient (University Hospital of North Norway) and public (Norwegian Health Association, Tromsø municipality) representatives, and some participants were invited as ambassadors during data collection where they actively contributed to participant recruitment.

### Physical activity

Physical activity was measured using the Saltin-Grimby Physical Activity Level Scale (SGPALS) questionnaire<sup>19 20</sup> for occupational and leisure-time physical activity (leisure time during the last 12 months) (four hierarchical levels), slightly modified compared with the original SGPALS from 1968<sup>19</sup> (differences described in online supplemental file 1; the SGPALS layout is presented in online supplemental table 1). For the occupational SGPALS, those reporting rank 1, *predominantly sedentary work*, were considered inactive; those reporting rank 2, *sitting or standing work with some walking*; rank 3, *walking and some handling of material*; or rank 4, *heavy manual work*, were considered active (online supplemental table 1). Similar inactive/active categorisation was used for the leisure time SGPALS (online supplemental table 1). The occupational SGPALS has shown acceptable reliability<sup>21</sup> and an ability to rank participants compared with accelerometry.<sup>22</sup>

Change in occupational and leisure time SGPALS was computed as (1) *persistently inactive* (reporting rank 1 at examinations 1 and 2), (2) *persistently active* (rank  $\geq 2$  at examinations 1 and 2), (3) *active to inactive* (rank  $\geq 2$  at examination 1 and rank 1 at examination 2) and (4) *inactive to active* (rank 1 at examination 1 and rank  $\geq 2$  at examination 2).

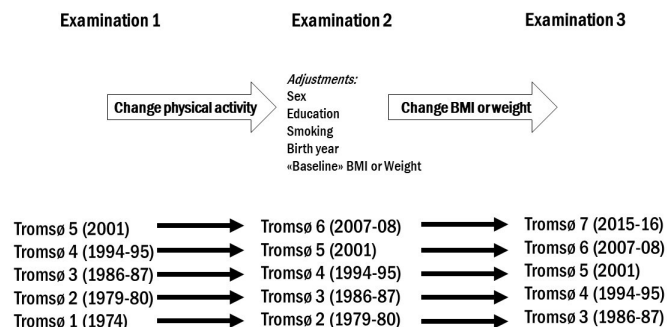
The occupational time SGPALS was used in all surveys of the Tromsø Study, while the leisure time SGPALS was used in all except Tromsø 4 (1994–1995). In Tromsø 5 (2001), the leisure time SGPALS was answered by those under 70 years.

### BMI and weight

Weight and height were measured in light clothing and expressed as kilogram (kg) and metre (m). BMI at examination 2 was calculated as weight divided by the square height ( $\text{kg/m}^2$ ). To eliminate the effect of possible height loss between examination 2 and 3, change in BMI at examination 3 was calculated as weight at examination 3 divided by the square height at examination 2. BMI change is our primary outcome, while weight change results are secondary outcomes (online supplemental tables 2 and 3 and 5–9).

### Confounders and effect modifiers

Our selected confounders were sex, birth year, smoking, education and baseline BMI/weight (at examination 2). Effect



**Figure 1** Layout for the analyses assessing the association between physical activity changes and future BMI change. BMI, body mass index.

**Table 1** Descriptive characteristics of the overall cohort and period-specific samples. The Tromsø Study 1974-2016

Cohort	Overall cohort	Period-specific samples*				
	Tromsø 1-7 (1974-2016)	Tromsø 1-3 (1974-1986)	Tromsø 2-4 (1979-1995)	Tromsø 3-5 (1985-2001)	Tromsø 4-6 (1994-2008)	Tromsø 5-7 (2001-2016)
Baseline	Examination 2	Tromsø 2 (1979-1980)	Tromsø 3 (1986-1987)	Tromsø 4 (1994-1995)	Tromsø 5 (2001)	Tromsø 6 (2007-2008)
Total N (%)	11 308 (100)	3570 (100)	9679 (100)	3827 (100)	2212 (100)	1146 (100)
Sex, n (%)						
Female	5482 (48.8)	N/A	4820 (49.8)	2023 (52.8)	1183 (53.5)	611 (53.3)
Male	5826 (51.2)	3570 (100%)	4859 (50.2)	1806 (47.2)	1029 (46.5)	535 (46.6)
Age (years), n (%)						
≤39	4072 (36.0)	1819 (51)	3831 (39.6)	673 (17.6)	102 (4.6)	32 (2.8)
40-49	2461 (21.8)	1186 (33.2)	3509 (36.3)	342 (8.9)	341 (15.4)	251 (21.9)
50-59	2561 (22.6)	565 (15.8)	2107 (21.8)	1977 (51.7)	689 (31.1)	291 (25.4)
60-69	1981 (17.5)	N/A	232 (2.4)	831 (21.7)	944 (42.7)	465 (40.6)
≥70	233 (2.0)	N/A	N/A	4 (0.1)	136 (6.1)	107 (9.3)
Smoking, n (%)						
Current smoker	4480 (39.6)	1705 (47.8)	4221 (43.6)	1263 (33.0)	579 (26.2)	196 (17.1)
Previous smoker	1790 (15.8)	503 (14.1)	754 (7.8)	390 (10.2)	843 (38.1)	517 (45.1)
Never smoker	5038 (44.6)	1362 (38.2)	4704 (48.6)	2174 (56.8)	790 (35.7)	433 (37.8)
Education, n (%)						
Primary school	4698 (41.5)	1842 (51.6)	4324 (44.7)	1456 (38.0)	782 (35.3)	299 (26.1)
High school	3610 (31.9)	1002 (28.1)	2936 (30.3)	1408 (36.8)	665 (30.0)	419 (36.6)
University<4 years	1641 (14.5)	423 (11.8)	1380 (14.3)	551 (14.4)	364 (16.5)	209 (18.2)
University≥4 years	1359 (12.0)	303 (8.5)	1039 (10.7)	412 (10.8)	401 (18.1)	219 (19.1)

\*Period-specific samples include all participants meeting our inclusion criteria for that period (ie, these samples do not add up to the overall cohort (Tromsø 1-7), which includes participants with their three most recent attendances).

modifiers included the abovementioned confounders, in addition to leisure-time physical activity change. Smoking (from questionnaire) was categorised into (1) current smoker, (2) previous smoker and (3) never smoker. Years of education (from questionnaire) were reported in Tromsø 2 (1979-1980), Tromsø 3 (1986-1987) and Tromsø 5 (2001), which we categorised into (1) primary school (<10 years), (2) high school (10-12 years), (3) university<4 years (13-15 years) and (4) university≥4 years (≥16 years). A five-group alternative for education was reported in Tromsø 4 (1994-1995) and Tromsø 6 (2007-2008), including the four aforementioned groups and a fifth named 'technical school 2 years senior high' (eg, craftsman, plumber, electrician and carpenter), which we categorised as high school. All confounders included in the models were retrieved from examination 2.

### Statistical analyses

We used paired t-tests to assess whether participants changed BMI and weight from examination 2 to 3. We used analysis of covariance to assess whether physical activity changes from examination 1 to 2 predicted BMI or weight changes from examination 2 to 3 as overall and in strata of sex, birth year, smoking, education and leisure-time physical activity change, with adjustment for sex, birth year, smoking, education and BMI or weight at examination 2. Q-Q plots confirmed change in BMI and weight from examination 2 to 3 to not deviate from normal distribution. The Levene test of equality variance confirmed homogeneity of variance across occupational physical activity change groups (all  $p>0.07$ ). We assessed interaction effects between occupational physical activity change and potential effect modifiers (sex, birth year, smoking, education and leisure-time physical activity change from examination 1 to 2) in the overall cohort. For sensitivity analyses, we computed occupational physical

activity change into six groups: (1) *Persistently Inactive*, (2) *Persistently Active*, (3) *active but decreasing* (rank 4 or 3→3 or 2), (4) *active and increasing* (rank 2 or 3→3 or 4), (5) *Active to Inactive* and (6) *Inactive to Active*. Data are shown as mean and 95% CIs unless otherwise stated. We used the Statistical Package for Social Sciences V.26 for all statistical analyses.

### RESULTS

The participants in the overall cohort and period-specific samples increased their BMI from examination 2 to 3 (all  $p<0.01$ ) (table 2). Weight change results are shown in online supplemental table 2).

#### Change in BMI by change in occupational physical activity

Changes in BMI by occupational physical activity change, overall and by strata of sex, birth year, smoking, education and leisure-time physical activity changes are presented in table 3. We observed no differences in BMI change from examination 2 to 3 by occupational physical activity changes from examination 1 to 2 (Persistently Inactive: 0.81 kg/m<sup>2</sup>, 95% CI 0.75 to 0.87; Persistently Active: 0.87 kg/m<sup>2</sup>, 95% CI 0.82 to 0.92; Active to Inactive: 0.81 kg/m<sup>2</sup>, 95% CI 0.67 to 0.94; Inactive to Active: 0.91 kg/m<sup>2</sup>, 95% CI 0.81 to 1.01;  $p=0.25$ ), which was consistent in stratified analyses (all  $p\geq 0.054$ ) (table 3).

We found no interaction effects of potential effect modifiers for the association between occupational physical activity changes and BMI changes (sex:  $p=0.87$ , smoking status:  $p=0.64$ , education:  $p=0.25$  and leisure-time physical activity changes:  $p=0.24$ ), except by birth year ( $p=0.01$ ).

Overall and stratified weight change results for the overall cohort are found in online supplemental table 3; we found no differences in weight change from examination 2 to 3 by

**Table 2** BMI at examinations 2 and 3 and BMI change in the overall cohort and period-specific samples. The Tromsø Study 1974–2016.

Overall cohort	N=11 308	Examination 2	Examination 3	Change
Examinations 2 and 3	Mean	24.96	25.80	0.84
BMI (kg/m <sup>2</sup> )	95% CI	24.89 to 25.03	25.73 to 25.87	0.82 to 0.89
Period-specific samples*				
Tromsø 1–3 (1974–1987)†	N=3570			
Tromsø 2 and 3 (1979–1987)	Mean	24.65	25.14	0.49
BMI (kg/m <sup>2</sup> )	95% CI	24.56 to 24.74	25.04 to 25.24	0.44 to 0.54
Tromsø 2–4 (1979–1995)	N=9679			
Tromsø 3 and 4 (1986–1995)	Mean	24.25	25.38	1.13
BMI (kg/m <sup>2</sup> )	95% CI	24.18 to 24.32	25.31 to 25.45	1.09 to 1.17
Tromsø 3–5 (1986–2001)	N=3827			
Tromsø 4 and 5 (1994–2001)	Mean	25.53	26.49	0.95
BMI (kg/m <sup>2</sup> )	95% CI	25.42 to 25.64	26.36 to 26.62	0.90 to 1.01
Tromsø 4–6 (1994–2008)	N=2212			
Tromsø 5 and 6 (2001–2008)	Mean	26.66	26.78	0.12
BMI (kg/m <sup>2</sup> )	95% CI	26.50 to 26.82	26.61 to 26.95	0.04 to 0.20
Tromsø 5–7 (2001–2016)	n=1146			
Tromsø 6 and 7 (2007–2016)	Mean	27.01	27.22	0.21
BMI (kg/m <sup>2</sup> )	95% CI	26.76 to 27.26	26.96 to 27.48	0.09 to 0.33

Data are shown as unadjusted mean and 95% CI. Examination 2 refers to the second survey of the three attended surveys; examination 3 refers to the third survey of the three attended surveys.

\*Period-specific samples include all participants meeting our inclusion criteria for that period (ie, these samples do not add up to the overall cohort (Tromsø 1–7), which includes participants with their three most recent attendances).

†Tromsø 1 included only men.

BMI, body mass index.

occupational physical activity change from examination 1 to 2 (all  $p \geq 0.049$ ).

In the sensitivity analyses, where we computed occupational physical activity change into six groups (1) *Persistently Inactive*, (2) *Persistently Active*, (3) *Active but Decreasing* (rank 4 or 3 to 3 or 2), (4) *Active and Increasing* (rank 2 or 3 to 3 or 4), (5) *Active to Inactive* and (6) *Inactive to Active*, the results generally remained unchanged (overall analysis:  $p=0.15$ ); however, some differences were observed in some strata analyses (birth year, born  $\leq 1929$ :  $p=0.03$ ; education, high school:  $p=0.04$ , university  $\geq 4$  years:  $p=0.049$ ; and leisure-time physical activity changes; PA:  $p=0.003$ ) (online supplemental table 4). We found no interaction in the association between occupational physical activity change and BMI change (sex:  $p=0.21$ , smoking:  $p=0.59$ , education:  $p=0.88$ , leisure-time physical activity change:  $p=0.12$ , except by birth year:  $p=0.04$ ).

We observed no differences in BMI change by occupational physical activity change in any period-specific sample (table 4): (1) there were no differences in BMI change from Tromsø 2 (1979–1980) to Tromsø 3 (1986–1987) between the physical activity change groups from Tromsø 1 (1974) to Tromsø 2 (1979–1980) ( $p=0.68$ ), (2) BMI change from Tromsø 3 (1986–1987) to Tromsø 4 (1994–1995) between the physical activity change groups from Tromsø 2 (1979–1980) to Tromsø 3 (1986–1987) ( $p=0.50$ ), (3) BMI change from Tromsø 4 (1994–1995) to Tromsø 5 (2001) between the physical activity change groups from Tromsø 3 (1986–1987) to Tromsø 4 (1994–1995) ( $p=0.90$ ), (4) BMI change from Tromsø 5 (2001) to Tromsø 6 (2007–2008) between the physical activity change groups from Tromsø 4 (1994–1995) to Tromsø 5 (2001) ( $p=0.98$ ), (5) BMI change from Tromsø 6 (2007–2008) to Tromsø 7 (2015–2016) between the physical activity change groups from Tromsø 5 (2001) to Tromsø 6 (2007–2008) ( $p=0.20$ ). Stratified analyses for the period-specific samples are presented in online supplemental tables 5–9). We observed no differences in BMI or weight change by occupational physical activity change in any strata analysis

(all  $p \geq 0.13$ ; except Tromsø 2–4 (1979–1995) sample,  $\geq 4$  years university education:  $p \leq 0.04$ ; online supplemental table 8).

## DISCUSSION

In this large Norwegian population-based prospective study over four decades, we found no association between occupational physical activity changes and future BMI and weight changes.

Most previous longitudinal studies examined the association between baseline occupational physical activity and future BMI change,<sup>13–16</sup> which do not account for the reciprocal temporal changes in physical activity and BMI.<sup>4</sup> Two studies assessed changes in both occupational physical activity and BMI where one found lower occupational physical activity to be associated with weight gain,<sup>12</sup> while one found no association.<sup>17</sup> Without adjustment for previous physical activity levels, the direction of association and thus indication of causality, remains uncertain.<sup>4</sup> Our study corroborates the findings of a recent study by Dobson *et al*,<sup>23</sup> which regressed trajectories of self-reported BMI (ie, weight and height) on physical work exertion trajectories over nine time points in Canadian adults and showed no association between physical work exertion change and BMI trajectories, except for higher odds of being in a very obese trajectory (from 36 to 40 kg/m<sup>2</sup> at follow-up) compared to a reference normal weight trajectory (22 to 24 kg/m<sup>2</sup>) with no higher odds of being in other BMI trajectories among those who decreased their physical work exertion compared with those who sustained low physical work exertion.<sup>23</sup> Our study expands the work by Dobson *et al*<sup>23</sup> by using measured weight and height on both examinations and non-dichotomized BMI change as the outcome. Consequently, with higher accuracy in the outcome,<sup>24</sup> the observed magnitudes in the association between occupational physical activity change and BMI change can be interpreted with higher confidence.<sup>4</sup>

As we did not adjust for energy intake due to unavailable data, our results may be influenced by residual confounding. Nevertheless, a previous study estimated that increasing physical activity



**Table 3** BMI change by occupational physical activity change for the overall cohort and in strata of sex, birth year, smoking, education and leisure-time physical activity change. The Tromsø Study 1974-2016.

Tromsø 1-7 (1974-2016)	Change occupational physical activity examinations 1 and 2					P <sub>equality</sub>
	Total	Persistently Inactive	Persistently Active	Active to Inactive	Inactive to Active	
<b>BMI change examinations 2 and 3</b>						
<b>Total (N)</b>	11 308	3692	5560	741	1315	
BMI (kg/m <sup>2</sup> )	Mean	0.81	0.87	0.81	0.91	0.25
	95% CI	0.75 to 0.87	0.82 to 0.92	0.67 to 0.94	0.81 to 1.01	
<b>Sex</b>						
Women (n)	5482	1638	2925	319	600	
BMI (kg/m <sup>2</sup> )	Mean	1.06	1.09	1.10	1.18	0.74
	95% CI	0.96 to 1.17	1.02 to 1.17	0.87 to 1.33	1.01 to 1.34	
Men (n)	5826	2054	2635	422	715	
BMI (kg/m <sup>2</sup> )	Mean	0.56	0.67	0.55	0.66	0.11
	95% CI	0.49 to 0.63	0.61 to 0.74	0.39 to 0.71	0.54 to 0.78	
<b>Birth year</b>						
≤1929 (n)	748	239	350	60	99	
BMI (kg/m <sup>2</sup> )	Mean	0.09	0.15	0.20	0.31	0.054
	95% CI	0.31 to 0.14	-0.03 to 0.33	-0.22 to 0.62	0.64 to 0.01	
1930-1939 (n)	2974	856	1580	189	349	
BMI (kg/m <sup>2</sup> )	Mean	0.43	0.53	0.55	0.36	0.39
	95% CI	0.30 to 0.57	0.43 to 0.62	0.28 to 0.82	0.16 to 0.56	
1940-1949 (n)	4192	1483	2020	260	429	
BMI (kg/m <sup>2</sup> )	Mean	0.85	0.92	0.73	1.06	0.10
	95% CI	0.75 to 0.95	0.84 to 1.00	0.50 to 0.96	0.88 to 1.24	
1950-1959 (n)	3947	932	1430	205	380	
BMI (kg/m <sup>2</sup> )	Mean	1.34	1.28	1.28	1.52	0.12
	95% CI	1.22 to 1.45	1.19 to 1.37	1.04 to 1.52	1.34 to 1.70	
≥1960 (n)	447	182	180	27	58	
BMI (kg/m <sup>2</sup> )	Mean	1.04	1.11	1.13	1.34	0.88
	95% CI	0.69 to 1.39	0.75 to 1.46	0.24 to 2.02	0.72 to 1.95	
<b>Smoking</b>						
Current smoker (n)	4480	1250	2343	306	581	
BMI (kg/m <sup>2</sup> )	Mean	0.96	1.00	0.82	1.02	0.44
	95% CI	0.85 to 1.07	0.92 to 1.08	0.60 to 1.03	0.86 to 1.17	
Previous smoker (n)	1790	703	782	126	179	
BMI (kg/m <sup>2</sup> )	Mean	0.34	0.42	0.52	0.43	0.71
	95% CI	0.19 to 0.48	0.28 to 0.55	0.19 to 0.85	0.16 to 0.71	
Never smoker (n)	5038	1739	2435	309	555	
BMI (kg/m <sup>2</sup> )	Mean	0.87	0.91	0.91	0.95	0.79
	95% CI	0.78 to 0.95	0.83 to 0.98	0.71 to 1.10	0.81 to 1.10	
<b>Education</b>						
Primary school (n)	4698	878	3010	265	545	
BMI (kg/m <sup>2</sup> )	Mean	0.75	0.83	0.68	0.79	0.52
	95% CI	0.62 to 0.88	0.76 to 0.90	0.45 to 0.92	0.63 to 0.95	
High school (n)	3610	1361	1566	271	412	
BMI (kg/m <sup>2</sup> )	Mean	0.87	0.95	0.82	1.11	0.09
	95% CI	0.77 to 0.97	0.86 to 1.04	0.60 to 1.03	0.93 to 1.29	
University<4 years (n)	1641	787	539	117	198	
BMI (kg/m <sup>2</sup> )	Mean	0.85	0.90	0.88	0.97	0.85
	95% CI	0.72 to 0.98	0.75 to 1.06	0.55 to 1.21	0.71 to 1.22	
University>4 years (n)	1359	666	445	88	160	
BMI (kg/m <sup>2</sup> )	Mean	0.72	0.80	1.16	0.75	0.14
	95% CI	0.59 to 0.85	0.64 to 0.96	0.81 to 1.50	0.49 to 1.01	
<b>Leisure time physical activity change examinations 1 and 2*</b>						
Persistently Inactive (n)	813	332	317	63	101	
BMI (kg/m <sup>2</sup> )	Mean	0.81	0.98	1.25	0.94	0.42
	95% CI	0.60 to 1.03	0.76 to 1.20	0.76 to 1.73	0.55 to 1.33	
Persistently Active (n)	5368	1599	2798	328	643	
BMI (kg/m <sup>2</sup> )	Mean	1.00	1.02	0.82	1.13	0.08
	95% CI	0.91 to 1.08	0.95 to 1.08	0.63 to 1.02	1.00 to 1.27	

continued

Table 3 continued

Tromsø 1–7 (1974–2016)	Change occupational physical activity examinations 1 and 2					P <sub>equality</sub>
	Total	Persistently Inactive	Persistently Active	Active to Inactive	Inactive to Active	
Active to Inactive (n)	974	291	469	71	143	
BMI (kg/m <sup>2</sup> )	Mean	0.82	1.03	1.24	1.11	0.23
	95% CI	0.60 to 1.04	0.86 to 1.21	0.80 to 1.68	0.80 to 1.42	
Inactive to Active (n)	999	348	451	66	134	
BMI (kg/m <sup>2</sup> )	Mean	0.90	1.09	0.89	0.77	0.31
	95% CI	0.69 to 1.11	0.91 to 1.28	0.42 to 1.37	0.43 to 1.10	

Data are adjusted for sex, birth year, smoking, education and BMI at examination 2, and are shown as adjusted mean and 95% CI. Examination 1 refers to the first survey of the three attended surveys; examination 2 refers to the second survey of the three attended surveys; examination 3 refers to the third survey of the three attended surveys. P<sub>equality</sub> is the main difference between groups.

\*The leisure-time Saltin-Grimby Physical Activity Scale was not included in Tromsø 4 (1994–1995).

BMI, body mass index.

energy expenditures of about 100 kcal/day would be sufficient for weight gain prevention at the population level,<sup>25</sup> indicating that equivalent decreases would result in weight gain. This is similar to the estimated lower energy expenditure deriving from declines in occupational physical activity.<sup>3</sup> As leisure time physical activity influences energy expenditure, one could hypothesise that occupational physical activity decline is only hazardous for those being physically inactive in leisure time. However, we observed no effect modification by leisure time physical activity changes.

It has been suggested that achieving energy balance and weight stability is easier at higher energy turnover.<sup>1</sup> For example, energy intake increased by 500 kcal/day from the 1970s to 2000s in the USA, and 110–150 min of walking per day is needed to compensate for this increase.<sup>26</sup> Consequently, as 150 min of walking per day is up to seven times higher than the current minimum recommendations for physical activity (150 min/week),<sup>27</sup> and

considering that one out of three adults in Western high-income countries fail to meet the recommendations,<sup>28</sup> it is unlikely that the physical activity volume performed by the general population is sufficiently high to prevent weight gain.<sup>29</sup>

As occupational physical activity energy expenditure is dependent on activity duration, the effect of occupational physical activity on weight gain prevention may be influenced by whether individuals work full or part time. Thus, as we did not adjust for full-time and part-time work due to unavailable data, this may also have introduced residual confounding. However, these energy expenditure differences may in reality be small. For example, heavy manual labour workers are estimated to work at ~30% to 35% of maximal oxygen uptake over an 8 hours work day,<sup>30</sup> which can be a sufficient volume to compensate the 500 kcal/day energy intake increase.<sup>26</sup> However, few individuals in the Tromsø Study report heavy manual labour (~8% in 1979–1980, ~2% in 2015–2016<sup>10</sup>). In contrast, most

Table 4 BMI changes by occupational physical activity change in period-specific samples. The Tromsø Study 1974–2016.

Period-specific samples*	Change occupational physical activity examinations 1 and 2					P <sub>equality</sub>
	Total	Persistently inactive	Persistently active	Active to inactive	Inactive to active	
Tromsø 1–3 (1974–1987)#	n					
Tromsø 2–3 (1979–1987)	3570	1033	1805	366	366	
BMI (kg/m <sup>2</sup> )	Mean	0.48	0.48	0.49	0.57	0.68
	95% CI	0.39 to 0.57	0.41 to 0.54	0.35 to 0.64	0.43 to 0.71	
Tromsø 2–4 (1979–1995)	n					
Tromsø 3 and 4 (1986–1995)	9679	2512	5179	665	1323	
BMI (kg/m <sup>2</sup> )	Mean	1.12	1.15	1.12	1.07	0.50
	95% CI	1.05 to 1.19	1.10 to 1.20	0.99 to 1.26	0.98 to 1.17	
Tromsø 3–5 (1986–2002)	n					
Tromsø 4 and 5 (1994–2001)	3827	1315	1915	223	374	
BMI (kg/m <sup>2</sup> )	Mean	0.96	0.96	1.02	0.91	0.90
	95% CI	0.86 to 1.05	0.87 to 1.04	0.79 to 1.25	0.73 to 1.09	
Tromsø 4–6 (1994–2008)	n					
Tromsø 5 and 6 (2001–2008)	2212	884	985	166	177	
BMI (kg/m <sup>2</sup> )	Mean	0.12	0.12	0.15	0.07	0.98
	95% CI	–0.004 to 0.24	0.01 to 0.24	–0.13 to 0.43	–0.20 to 0.35	
Tromsø 5–7 (2001–2016)	n					
Tromsø 6 and 7 (2007–2016)	1146	481	501	60	104	
BMI (kg/m <sup>2</sup> )	Mean	0.07	0.35	0.14	0.21	0.20
	95% CI	–0.11 to 0.25	0.17 to 0.53	–0.36 to 0.64	–0.17 to 0.60	

Data are adjusted for sex, birth year, smoking, education and BMI at examination 2, and are shown as adjusted mean and 95% CI. P<sub>equality</sub> is the main difference between groups.

\*Period-specific samples include all participants for that period (ie, these samples do not add up to the overall cohort (Tromsø 1–7), which includes participants with their three most recent attendances).

†Tromsø 1 included only men.

BMI, body mass index.

occupational physical activities in the Tromsø Study changed from standing and walking to sitting,<sup>10</sup> which is consistent with some cohorts.<sup>3 11 12</sup> The energy expenditure difference while sitting compared with standing is estimated to be 54 kcal over 6 hours (ie, 72 kcal over 8 hours),<sup>31</sup> which is unlikely to have any apparent effect on weight gain.

Some study cohorts in Southern Europe include a substantially larger proportion of heavy manual labour workers (Portugal, 37%<sup>32</sup>; Spain, Barcelona, 68%<sup>17</sup>); however, this is not consistent (Madrid, Spain: 2%,<sup>33</sup> Italy: 8%<sup>34</sup>). Consequently, the generalisability of our findings may be limited to Northern/Central European<sup>8–10</sup> and North American<sup>3 11</sup> high-income countries. Studies examining weight gain prevention in heavy manual labour workers may be a future research target.

In our study, 741 (7%) participants are categorised as 'Active to Inactive', while 1315 (12%) participants were categorised as 'Inactive to Active' (table 3), indicating that more individuals increased their occupational physical activity level in our cohort. However, this is due to our crude categorisation of physical activity change; in our sensitivity analysis, 1315 (12%) are categorised as active but decreasing (rank 4 or 3→rank 3 or 2) (online supplemental table 4), where these are categorised as 'Persistently Active' in our main analysis (rank  $\geq 2$ →rank  $\geq 2$ ) (table 3). Thus, the consistent pattern of declining occupational physical activity levels as in previous studies<sup>3 7–10</sup> is confirmed in our study.

Our results indicate that occupational physical activity declines play a minor, if any, role in the observed population gain in BMI and weight. Consequently, public health initiatives aimed at weight gain prevention may have greater success by focusing on other aspects than occupational physical activity, for example, intake of energy dense food.<sup>2 26</sup>

The association between physical activity and BMI gain may also be reversed and/or bidirectional.<sup>4</sup> High body weight appears causally associated with lower levels of physical activity when examining these associations using a Mendelian randomisation approach.<sup>35</sup> However, intuitively, leisure-time physical activity is self-regulated while occupational physical activity is less controllable by the individual. Whether individuals regulate their occupational physical activity level depending on their BMI gain is questionable.

### Strengths

First, as population gains in BMI have gradually increased over decades,<sup>36</sup> the long follow-up time (~6 years) between each examination allowed us to examine whether occupational physical activity has contributed to BMI gain in this cohort.<sup>4</sup> Second, by computing change in physical activity followed by change in BMI (accounting for previous physical activity level), we are able to interpret the direction of the association with more certainty.<sup>4</sup> Third, by merging our period-specific samples to an overall cohort, we had higher power to examine multiple potential effect modifiers (table 3). For example, one warranted effect modification to be elucidated in associations between occupational physical activity and health outcomes is sex.<sup>37</sup> Although we found differences in BMI gain by sex, we observed no effect modification of the associations by sex. Fourth, we used measured weight and height to calculate BMI as our outcome, which are more valid than self-reported weight and height,<sup>24</sup> likely influenced by social desirability bias. Finally, the efforts to recruit representative samples and the high attendance in the Tromsø Study surveys indicate high representability of the population.<sup>18</sup>

### Limitations

We categorised self-reported physical activity into crude groups, which have introduced misclassification, as described previously. Thus, we may have missed potential energy expenditure changes deriving from physical activity that could influence energy balance. However, crude groups of self-reported physical activity are valuable for categorisation of population levels of physical activity,<sup>38</sup> and the SGPALS categorisations have previously shown associations with multiple health outcomes, suggesting predictive validity of the instrument.<sup>20</sup> Moreover, our findings were unaltered when occupational physical activity change was categorised into six groups.

The recall and social desirability bias associated with self-reported physical activity likely results in over-reporting of physical activity levels,<sup>39</sup> which is also demonstrated in office workers.<sup>40</sup> Over-reporting of physical activity underestimates or overestimates the effect magnitude between physical activity and health outcomes.<sup>4</sup> However, self-reported physical activity is currently the only instrument available in long-term ongoing cohort studies.<sup>4</sup> Finally, as we did not adjust our models for energy intake and full-time/part-time work due to unavailable data, our results may be influenced by residual confounding.

### CONCLUSION

We observed no association between changes in occupational physical activity and subsequent changes in BMI. Our findings do not support the hypothesis that occupational physical activity declines contributed to population gains in BMI over the past decades. Public health initiatives aimed at weight gain prevention may have greater success if focusing on other aspects than occupational physical activity.

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from the Tromsø Study, but restrictions apply to the availability of these data, which were used under licence for the current study, and so are not publicly available. The data can be made available from the Tromsø Study upon application to the Data and Publication Committee for the Tromsø Study (see [www.tromsostudy.com](http://www.tromsostudy.com)).

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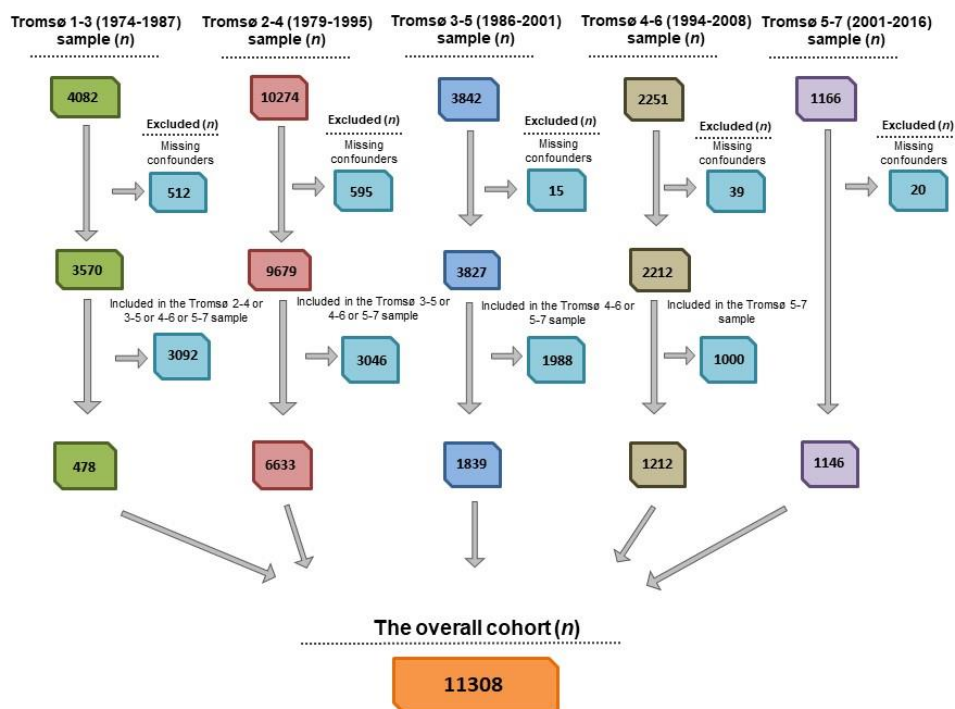
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## Supplementary materials



Supplementary Figure 1. Flow chart of selected participants.

### Supplementary file 1: Differences in the SGPALS questionnaire between the original and the one used in the Tromsø Study surveys.

As new behavioural concepts have emerged[1] and perhaps some jobs are automated due to technological developments, some of the work examples in answer alternatives for occupational physical activity are omitted and new examples are added. Work examples in our study differ from the original Saltin-Grimby Physical Activity Scale (SGPALS) by Saltin and Grimby in 1968[2]. For leisure time physical activity, a frequency specification in answering alternative three is added. The detailed differences are presented below. Table 1

presents the original occupational time SGPALS, and Table 2 presents the occupational time SGPALS used in the Tromsø Study.

**Table 1.** The original Occupational time SGPALS by Saltin and Grimby (1968, *Circulation*).

<b>Question: Occupational Activity:</b>			
1	2	3	4
<i>Predominantly sedentary, sitting: desk worker, watch maker, sitting assembly line worker (light gods)</i>	<i>Sitting or standing, some walking: cashier, general office worker, light tool and machinery worker, foreman</i>	<i>Walking, some handling of material: mailman, waiter, construction worker, heavy tool and machinery worker</i>	<i>Heavy manual work: lumberjack, dock worker, stone mason, farm worker, ditch digger</i>

SGPALS=Saltin-Grimby Physical Activity Level Scale

**Table 2.** The Occupational time SGPALS in The Tromsø Study.

<b>Occupational Physical Activity Question:</b>			
<i>Tromsø 1-3: Type of work: During the last year, have you had:</i>			
<i>Tromsø 4-6: If you have paid or unpaid work, which statement describes your work best?</i>			
1	2	3	4
<i>Mostly sedentary work? (e.g. office work, watchmaker, light manual work)</i>	<i>Work that requires a lot of walking? (e.g. shop assistant, light industrial work, teaching)</i>	<i>Work that requires a lot of walking and lifting? (e.g. postman, heavy industrial work, construction)</i>	<i>Heavy manual labour? (e.g. forestry, heavy farmwork, heavy construction)</i>

SGPALS=Saltin-Grimby Physical Activity Level Scale

Tromsø 1, 2 and 3 included the same Occupational time SGPALS. Tromsø 4-6 asks the question differently, but the answer alternatives are similar. Both the questions and answer alternatives differ from the original SGPALS. Tromsø 5 replaced “*heavy industrial work*”

with “*nursing*” in their examples of work in answer alternative 3. When comparing the original with the occupational time SGPALS used in the Tromsø Study, questions differ.

- **Answer alternative 1)** have different wording but presents similar work examples.
- **Answer alternative 2)** the original states “*sitting, standing, some walking*” while the Tromsø Study states “*a lot of walking*”. In the Tromsø Study, “*cashier*” is rephrased to “*shop assistant*”, “*general office worker*” is removed, “*light tool and machinery worker*” is rephrased to “*light industrial work*” and “*foreman*” is replaced with “*teaching*”.
- **Answering alternative 3:** both the original and the Tromsø Study states walking and lifting but with different wording. Some work examples are similar, but “*waiter*” is removed in the Tromsø study and “*machinery worker*” is replaced with “*construction*”.
- **Answering alternative 4:** The original states “*heavy manual work*” and the Tromsø Study states “*heavy manual labour*”. In the Tromsø Study, “*lumberjack*” is replaced with “*forestry*”, “*stone mason*” is removed and “*ditch digger*” is replaced with “*construction*”.

Table 3 presents the original leisure time Saltin-Grimby Physical Activity Scale (SGPALS), and Table 4 presents the leisure time SGPALS used in the Tromsø Study.

**Table 3.** The original Leisure time SGPALS by Saltin and Grimby (1968, *Circulation*).

<b>Leisure time Physical Activity</b>			
<b>Question:</b>			
<i>The following section deals with your spare-time physical activity. The table outlines four different levels. Please read the table carefully and then check appropriate boxes below:</i>			
1	2	3	4
<i>Almost completely inactive: reading, TV watching, movies etc.</i>	<i>Some physical activity during at least 4 hours per week: riding a bicycle or walking to work, walking or skiing with the family, gardening</i>	<i>Regular activity, such as heavy gardening, running, calisthenics, tennis etc.</i>	<i>Regular hard physical training for competition in running events, soccer, racing, European handball etc. Several times per week</i>

SGPALS=Saltin-Grimby Physical Activity Level Scale

**Table 4.** The Leisure time SGPALS used in the Tromsø Study.

<b>Leisure time Physical Activity</b>			
<b>Question:</b>			
<i>Exercise and physical exertion in leisure time. If your activity varies much, for example between summer and winter, then give an average. The question refers only to the last twelve months.</i>			
1	2	3	4
<i>Reading, watching TV, or other sedentary activity?</i>	<i>Walking, cycling, or other forms of exercise at least 4 hours a week? Include walking or cycling to workplace, Sunday stroll/walk etc</i>	<i>Participation in recreational sports, heavy gardening, etc.? (note: duration of activity at least 4 hours a week).</i>	<i>Participation in hard training or sports competitions, regularly several times a week?</i>

When comparing the original with the leisure time SGPALS used in the Tromsø Study, questions differs, and “*spare-time*” is rephrased to “*leisure time*” in the Tromsø Study. The Tromsø Study asks for an average over the last 12 months, while the original has no time period specification.

- **Answer alternative 1:** In the Tromsø Study, “*almost inactive*” is replaced by “*sedentary activity*”. Examples are similar.



- **Answer alternative 2:** both the original and the Tromsø Study require 4 hours per week and provide walking and cycling to work as an example. In the Tromsø Study, “*skiing with the family*” is replaced by “*Sunday stroll/walk*” and “*gardening*” is removed.
- **Answer alternative 3:** The Tromsø study require 4 hours per week, while the original have no frequency specification. “*Heavy gardening*” is in both, while “*running, calisthenics, tennis etc.*” is rephrased to “*recreational sports*” in the Tromsø Study.
- **Answer alternative 4:** Both specify hard training and require several time per week, while Tromsø Study rephrased “*running events, soccer, racing, European handball etc.*” with “*sports competition*”.

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**Supplementary Table 1.** Saltin-Grimby physical activity level scale (SGPALS).

	<b>Occupational Physical Activity Level</b>	<b>Leisure Time Physical Activity Level</b>
Question	<i>If you are in payed or unpaid work, how will you describe your work?</i>	<i>Estimate your physical activity level in your leisure time over the past year. If the physical activity varies throughout the year, give an average.</i>
Answer alternative 1	Light occupational physical activity: <i>“Predominantly sedentary work: desk worker, sitting assembly line worker (light goods)”</i> ,	Almost completely inactive: <i>“reading, TV watching or other sedentary activity”</i>
Answer alternative 2	Moderate occupational physical activity: <i>“Sitting or standing, some walking, teaching, cashier, general office worker, light tool and machinery worker,”</i> ,	Moderately active: <i>“walking, cycling, or other forms of exercise at least 4 hours per week”</i>
Answer alternative 3	Heavy occupational physical activity: <i>“Walking, some handling of material: nurse, construction worker”</i> ,	Highly active: <i>“participation in recreational sports, heavy gardening, etc. at least 4 hours per week”</i>
Answer alternative 4	Very heavy occupational physical activity: <i>“Heavy manual work”</i> .	Vigorously active: <i>“participation in hard training or sports competitions regularly several times a week”</i> .

**Supplementary Table 2.** Weight at examination 2 and 3 and weight change in the overall cohort and period-specific samples.

<b>Tromsø 1-7 (1974-2016)</b>	<b>N=11308</b>	<b>Examination 2</b>	<b>Examination 3</b>	<b>Change</b>
Examination 2-3	Mean	72.71	75.15	2.44
Weight (kg)	95%CI	72.46 to 72.96	74.89 to 75.41	2.34 to 2.54
<b>Period-specific samples*</b>				
<i>Tromsø 1-3 (1974-87)#</i>	N=3570			
Tromsø 2-3 (1979-87)	Mean	76.86	78.41	1.54
Weight (kg)	95%CI	76.52 to 77.20	78.05 to 77.77	1.40 to 1.69
<i>Tromsø 2-4 (1979-95)</i>	N=9679			
Tromsø 3-4 (1986-95)	Mean	70.73	73.97	3.24
Weight (kg)	95%CI	70.48 to 70.98	73.70 to 74.24	3.14 to 3.34
<i>Tromsø 3-5 (1986-2001)</i>	N=3827			
Tromsø 4-5 (1994-2001)	Mean	73.71	76.41	2.71
Weight (kg)	95%CI	73.29 to 74.13	75.97 to 76.85	2.54 to 2.87
<i>Tromsø 4-6 (1994-2008)</i>	N=2212			
Tromsø-5-6 (2001-08)	Mean	76.71	77.05	0.34
Weight (kg)	95%CI	76.13 to 77.29	75.46 to 77.64	0.12 to 0.56
<i>Tromsø 5-7 (2001-2016)</i>	N=1146			
Tromsø 6-7 (2007-16)	Mean	78.18	78.75	0.57
Weight (kg)	95%CI	77.32 to 79.04	77.89 to 79.62	0.24 to 0.91

Data are shown as unadjusted mean and 95% CI. CI=confidence interval, Examination 2=second survey of the three attended surveys, Examination 3=third survey of the three attended surveys. \*Period specific samples include all participants for that period (i.e. these samples do not add up to the total cohort: Tromsø 1-7), #Tromsø 1 included only men.

**Supplementary Table 3.** Weight change by occupational physical activity change for the overall cohort and in strata of birth year, smoking, education and leisure time physical activity change.

<b>Tromsø 1-7 (1974-2016)</b>	<b>Change occupational physical activity examination 1 to 2</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
<b>Weight change examination 2 to 3</b>						
<i>Total (N)</i>	11308	3692	5560	741	1315	
Weight (kg)	Mean	2.32	2.49	2.37	2.61	0.32
	95% CI	2.15 to 2.50	2.35 to 2.63	1.98 to 2.75	2.32 to 2.90	
<b>Sex</b>						
<i>Women (n)</i>	5482	1638	2925	319	600	
Weight (kg)	Mean	2.89	2.92	3.05	3.18	0.70
	95% CI	2.62 to 3.16	2.72 to 3.12	2.44 to 3.66	2.74 to 3.62	
<i>Men (n)</i>	5826	2054	2635	422	715	
Weight (kg)	Mean	1.76	2.11	1.79	2.08	0.17
	95% CI	1.54 to 2.01	1.91 to 2.32	1.29 to 2.28	1.70 to 2.46	
<b>Birth year</b>						
<i>≤1929 (n)</i>	748	239	350	60	99	
Weight (kg)	Mean	-0.28	0.51	0.68	-0.92	0.049
	95% CI	-0.97 to 0.42	-0.05 to 1.06	-0.60 to 1.96	-1.93 to 0.08	
<i>1930-1939 (n)</i>	2974	856	1580	189	349	
Weight (kg)	Mean	1.17	1.44	1.60	0.97	0.34
	95% CI	0.80 to 1.54	1.17 to 1.70	0.84 to 2.36	0.41 to 1.53	
<i>1940-1949 (n)</i>	4192	1483	2020	260	429	
Weight (kg)	Mean	2.47	2.61	2.12	3.09	0.09
	95% CI	2.19 to 2.75	2.37 to 2.85	1.46 to 2.77	2.58 to 3.60	
<i>1950-1959 (n)</i>	3947	932	1430	205	380	
Weight (kg)	Mean	3.91	3.72	3.75	4.40	0.15
	95% CI	3.58 to 4.25	3.45 to 3.99	3.04 to 4.45	3.88 to 4.91	
<i>≥1960 (n)</i>	447	182	180	27	58	

Weight (kg)	Mean	3.01	3.18	3.22	3.83	0.88
	95% CI	2.05 to 3.98	2.20 to 4.17	0.77 to 5.68	2.13 to 5.52	
<b>Smoking</b>						
<i>Current smoker (n)</i>	4480	1250	2343	306	581	
Weight (kg)	Mean	2.75	2.88	2.41	2.93	0.51
	95% CI	2.43 to 3.07	2.65 to 3.11	1.79 to 3.03	2.47 to 3.38	
<i>Previous smoker (n)</i>	1790	703	782	126	179	
Weight (kg)	Mean	0.97	1.18	1.54	1.28	0.69
	95% CI	0.56 to 1.38	0.79 to 1.57	0.58 to 2.49	0.47 to 2.08	
<i>Never smoker (n)</i>	5038	1739	2435	309	555	
Weight (kg)	Mean	2.52	2.57	2.64	2.72	0.87
	95% CI	2.28 to 2.76	2.36 to 2.77	2.08 to 3.21	2.30 to 3.15	
<b>Education</b>						
<i>Primary school (n)</i>	4698	878	3010	265	545	
Weight (kg)	Mean	2.14	2.31	1.97	2.25	0.70
	95% CI	1.78 to 2.51	2.12 to 2.51	1.30 to 2.64	1.79 to 2.72	
<i>High School (n)</i>	3610	1361	1566	271	412	
Weight (kg)	Mean	2.49	2.71	2.40	3.20	0.10
	95% CI	2.21 to 2.77	2.45 to 2.97	1.77 to 3.02	2.68 to 3.70	
<i>University &lt;4 years (n)</i>	1641	787	539	117	198	
Weight (kg)	Mean	2.53	2.68	2.59	2.78	0.93
	95% CI	2.15 to 2.91	2.22 to 3.14	1.61 to 3.57	2.02 to 3.53	
<i>University &gt;4 years (n)</i>	1359	666	445	88	160	
Weight (kg)	Mean	2.12	2.40	3.46	2.13	0.11
	95% CI	1.74 to 2.51	1.92 to 2.88	2.43 to 4.49	1.37 to 2.90	
<b>Leisure time physical activity change examination 1 to 2*</b>						
<i>Persistently inactive (n)</i>	813	332	317	63	101	
Weight (kg)	Mean	2.37	2.76	3.63	2.62	0.46
	95% CI	1.73 to 3.01	2.11 to 3.41	2.19 to 5.06	1.47 to 3.76	
<i>Persistently active (n)</i>	5368	1599	2798	328	643	
Weight (kg)	Mean	2.90	2.94	2.39	3.26	0.10
	95% CI	2.64 to 3.16	2.74 to 3.13	1.84 to 2.95	2.86 to 3.66	
<i>Active to inactive (n)</i>	974	291	469	71	143	
Weight (kg)	Mean	2.32	2.92	3.71	3.11	0.19
	95% CI	1.68 to 2.96	2.42 to 3.43	2.44 to 4.98	2.21 to 4.01	
<i>Inactive to active (n)</i>	999	348	451	66	134	
Weight (kg)	Mean	2.56	3.09	2.59	2.33	0.45
	95% CI	1.94 to 3.18	2.55 to 3.63	1.21 to 3.97	1.36 to 3.30	

Data are adjusted for sex, birth year, smoking, education and weight at examination 2, and shown as adjusted mean and 95% CI. CI=confidence interval, Examination 1=first survey of the three attended surveys, Examination 2=second survey of the three attended surveys, Examination 3=third survey of the three attended surveys,  $P_{\text{equality}}$ =main differences between groups. \*The leisure time Saltin-Grimby Physical Activity Scale was not included in Tromsø 4 (1994-95), the analysis stratified on leisure time physical activity change is smaller ( $n=8154$ ) compared with the overall analysis ( $N=11308$ ).



**Supplementary Table 4.** Body mass index and weight change by six-group occupational physical activity change for sensitivity analyses. Results are for the overall cohort as overall and in strata of sex, birth year, smoking, education and leisure time physical activity change.

Tromsø 1-7 (1974-2016)	Change occupational physical activity examination 1 to 2							P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active but decreasing	Active and increasing	active to inactive	Inactive to active	
Outcome change examination 2 to 3								
Total (n)	11308	3692	3991	1315	741	896	673	
BMI (kg/m <sup>2</sup> )	Mean	0.80	0.84	0.91	0.81	0.98	0.90	0.15
	95% CI	0.75 to 0.87	0.79 to 0.90	0.81 to 1.01	0.67 to 0.94	0.86 to 1.10	0.76 to 1.04	
<b>Sex</b>								
Women (n)	5482	1638	2110	600	319	362	453	
BMI (kg/m <sup>2</sup> )	Mean	1.06	1.04	1.18	1.10	1.36	1.13	0.10
	95% CI	0.96 to 1.16	0.95 to 1.13	1.01 to 1.34	0.87 to 1.33	1.15 to 1.58	0.94 to 1.32	
Men (n)	5826	2054	1881	715	422	534	220	
BMI (kg/m <sup>2</sup> )	Mean	0.56	0.68	0.66	0.55	0.67	0.68	0.30
	95% CI	0.49 to 0.63	0.60 to 0.75	0.54 to 0.78	0.39 to 0.71	0.52 to 0.81	0.47 to 0.90	
<b>Birth year</b>								
≤1929 (n)	748	239	237	99	60	85	28	
BMI (kg/m <sup>2</sup> )	Mean	-0.09	0.05	-0.31	0.20	0.28	0.71	0.03
	95% CI	-0.32 to 0.13	-0.16 to 0.27	-0.64 to 0.01	-0.22 to 0.62	-0.08 to 0.63	0.09 to 1.32	
1930-1939 (n)	2974	856	1154	349	189	243	183	
BMI (kg/m <sup>2</sup> )	Mean	0.43	0.53	0.36	0.55	0.60	0.41	0.54
	95% CI	0.30 to 0.57	0.42 to 0.64	0.16 to 0.56	0.28 to 0.82	0.36 to 0.84	0.14 to 0.69	
1940-1949 (n)	4192	1483	1475	429	260	291	254	
BMI (kg/m <sup>2</sup> )	Mean	0.85	0.87	1.06	0.73	1.06	1.03	0.09
	95% CI	0.75 to 0.95	0.78 to 0.97	0.88 to 1.23	0.50 to 0.96	0.84 to 1.28	0.80 to 1.26	
1950-1959 (n)	2947	932	1005	380	205	243	182	
BMI (kg/m <sup>2</sup> )	Mean	1.34	1.27	1.52	1.28	1.30	1.28	0.31
	95% CI	1.22 to 1.45	1.16 to 1.38	1.34 to 1.70	1.04 to 1.52	1.08 to 1.52	1.02 to 1.54	
≥1960 (n)	447	182	120	58	27	34	26	
BMI (kg/m <sup>2</sup> )	Mean	1.04	0.92	1.13	1.84	1.84	1.00	0.45
	95% CI	0.70 to 1.39	0.72 to 1.94	0.24 to 2.02	1.04 to 2.63	1.04 to 2.63	0.09 to 1.92	
<b>Smoking</b>								
Smoker (n)	4480	1250	1645	581	306	393	305	
BMI (kg/m <sup>2</sup> )	Mean	0.96	0.99	1.02	0.82	1.12	0.93	0.46
	95% CI	0.85 to 1.07	0.89 to 1.08	0.86 to 1.17	0.60 to 1.03	0.93 to 1.31	0.71 to 1.15	
Previous (n)	1790	703	572	179	126	126	84	
BMI (kg/m <sup>2</sup> )	Mean	0.33	0.39	0.43	0.52	0.55	0.45	0.83
	95% CI	0.19 to 0.48	0.23 to 0.55	0.16 to 0.71	0.19 to 0.85	0.21 to 0.88	0.04 to 0.85	
Never smoker (n)	5038	1739	1774	555	309	377	284	
BMI (kg/m <sup>2</sup> )	Mean	0.87	0.87	0.95	0.91	0.99	1.02	0.58
	95% CI	0.78 to 0.95	0.79 to 0.95	0.81 to 1.10	0.71 to 1.10	0.81 to 1.17	0.81 to 1.23	
<b>Education</b>								
Primary school (n)	4690	878	2110	545	265	532	368	
BMI (kg/m <sup>2</sup> )	Mean	0.75	0.81	0.79	0.68	0.89	0.87	0.66
	95% CI	0.62 to 0.88	0.72 to 0.89	0.63 to 0.95	0.45 to 0.92	0.73 to 1.06	0.67 to 1.07	
High School (n)	3610	1361	1092	412	271	253	221	
BMI (kg/m <sup>2</sup> )	Mean	0.87	0.90	1.11	0.82	1.19	0.92	0.04
	95% CI	0.77 to 0.97	0.79 to 1.01	0.93 to 1.29	0.60 to 1.03	0.97 to 1.42	0.68 to 1.16	
University <4 years (n)	1641	787	398	198	117	76	65	
BMI (kg/m <sup>2</sup> )	Mean	0.85	0.96	0.97	0.88	0.76	0.75	0.84
	95% CI	0.72 to 0.98	0.78 to 1.14	0.71 to 1.22	0.55 to 1.21	0.34 to 1.17	0.31 to 1.20	
University ≥4 years (n)	1359	666	391	160	88	35	19	
BMI (kg/m <sup>2</sup> )	Mean	0.72	0.73	0.75	1.16	1.17	1.48	0.049
	95% CI	0.59 to 0.85	0.56 to 0.90	0.49 to 1.01	0.81 to 1.50	0.62 to 1.72	0.73 to 2.23	
<b>Leisure time physical activity change*</b>								

<i>Persistently inactive</i>	813	332	233	101	63	45	39	
BMI (kg/m <sup>2</sup> )	Mean	0.82	1.05	0.94	1.25	0.51	1.07	0.34
	95% CI	0.60 to 1.03	0.80 to 1.31	0.55 to 1.32	0.76 to 1.73	-0.07 to 1.10	0.44 to 1.69	
<i>Persistently active</i>	5368	1599	1998	643	328	462	338	
BMI (kg/m <sup>2</sup> )	Mean	0.99	0.95	1.13	0.82	1.23	1.13	0.003
	95% CI	0.90 to 1.08	0.87 to 1.03	1.00 to 1.27	0.63 to 1.02	1.07 to 1.40	0.93 to 1.32	
<i>Active to inactive</i>	974	291	324	143	71	78	67	
BMI (kg/m <sup>2</sup> )	Mean	0.82	1.02	1.11	1.25	1.26	0.77	0.25
	95% CI	0.60 to 1.04	0.82 to 1.23	0.80 to 1.43	0.80 to 1.69	0.84 to 1.69	0.31 to 1.24	
<i>Inactive to active</i>	999	348	318	134	66	85	48	
BMI (kg/m <sup>2</sup> )	Mean	0.90	1.09	0.77	0.89	1.19	0.95	0.54
	95% CI	0.69 to 1.11	0.87 to 1.31	0.43 to 1.10	0.42 to 1.37	0.77 to 1.61	0.39 to 1.51	

Data are adjusted for sex, birth year, smoking, education and BMI or weight at examination 2, and shown as adjusted mean and 95% CI. CI=confidence interval, BMI=body mass index, P<sub>equality</sub>=main difference between groups. \*The leisure time Saltin-Grimby Physical Activity Scale was not included in Tromsø 4 (1994-95).

**Supplementary Table 5.** BMI and weight change by occupational physical activity change for the Tromsø 5-7 sample in total and in strata of sex, birth year, smoking, education and leisure time physical activity change.

Tromsø 5-7 (2001-2016)	Change occupational physical activity Tromsø 5-6 (2001 to 2007-08)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
	Outcome change Tromsø 6-7 (2007-08 to 2015-16)					
Total (n)	1146	481	501	60	104	
BMI (kg/m <sup>2</sup> )	Mean	0.07	0.35	0.14	0.21	0.19
	95% CI	-0.11 to 0.25	0.17 to 0.53	-0.36 to 0.64	-0.17 to 0.60	
Weight (kg)	Mean	0.24	1.01	0.32	0.57	0.13
n=1147	95%CI	-0.36 to 0.65	0.51 to 1.51	-1.09 to 1.73	-0.50 to 1.65	
		n=482				
Sex	Change occupational physical activity Tromsø 5-6 (2001 to 2007-08)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
	Outcome change Tromsø 6-7 (2007-08 to 2015-16)					
Women (n)	611	253	278	30	50	
BMI (kg/m <sup>2</sup> )	Mean	0.29	0.40	0.50	0.37	0.92
	95% CI	0.01 to 0.56	0.14 to 0.66	-0.29 to 1.29	-0.25 to 0.98	
Weight (kg)	Mean	0.77	1.06	1.40	1.05	0.91
n=612	95% CI	0.05 to 1.48	0.38 to 1.75	-0.57 to 3.48	-0.57 to 2.67	
		n=254				
Men (n)	535	228	223	30	54	
BMI (kg/m <sup>2</sup> )	Mean	-0.21	0.34	-0.26	0.02	0.016
	95% CI	-0.44 to 0.02	0.10 to 0.58	-0.86 to 0.35	-0.44 to 0.47	
Weight (kg)	Mean	-0.64	1.08	-0.89	-0.02	0.013
	95% CI	-1.35 to 0.08	0.34 to 1.82	-2.78 to 1.01	-1.44 to 1.40	
Birth year	Change occupational physical activity Tromsø 5-6 (2001 to 2007-08)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
	Outcome change Tromsø 6-7 (2007-08 to 2015-16)					
≤1949 (n)	625	249	290	32	54	
BMI (kg/m <sup>2</sup> )	Mean	-0.39	0.01	0.18	-0.09	0.07
	95% CI	-0.63 to -0.16	-0.21 to 0.23	-0.47 to 0.82	-0.59 to 0.41	
Weight change (kg)	Mean	-1.23	0.03	0.45	-0.22	0.041
n=626	95% CI	-1.90 to -0.56	-0.60 to 0.65	-1.39 to 2.30	-1.65 to 1.20	
		n=250				
1950-1959 (n)	266	125	111	15	15	
BMI (kg/m <sup>2</sup> )	Mean	0.42	0.64	0.18	0.18	0.57
	95% CI	0.13 to 0.71	0.32 to 0.95	-0.65 to 1.02	-0.66 to 1.02	
Weight (kg)	Mean	1.12	1.83	0.31	0.37	0.50

	95% CI	0.36 to 2.06	0.91 to 2.75	-2.12 to 2.73	-2.06 to 2.79	
$\geq 1960$ (n)	255	107	100	13	35	
BMI (kg/m <sup>2</sup> )	Mean	0.82	0.85	-0.01	0.98	0.67
	95% CI	0.33 to 1.31	0.34 to 1.36	-1.40 to 1.38	0.13 to 1.84	
Weight (kg)	Mean	2.30	2.45	-0.07	2.75	0.62
	95% CI	0.97 to 3.63	1.06 to 3.84	-3.82 to 3.68	0.43 to 5.06	
<b>Change occupational physical activity Tromsø 5-6 (2001 to 2007-08)</b>						
<b>Smoking</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 6-7 (2007-08 to 2015-16)</b>						
<i>Smoker</i> (n)	196	64	100	11	21	
BMI (kg/m <sup>2</sup> )	Mean	0.80	0.83	-0.12	1.07	0.67
	95% CI	0.11 to 1.48	0.29 to 1.38	-1.71 to 1.46	-0.10 to 2.23	
Weight (kg)	Mean	1.98	2.39	-0.17	2.78	0.70
(n=197)	95% CI	0.18 to 3.79	0.93 to 3.85	-4.40 to 4.07	-0.39 to 5.82	
		(n=65)				
<i>Previous</i> (n)	517	222	225	27	43	
BMI (kg/m <sup>2</sup> )	Mean	-0.10	0.29	0.12	0.19	0.18
	95% CI	-0.34 to 0.14	0.04 to 0.53	-0.57 to 0.80	-0.36 to 0.74	
Weight (kg)	Mean	-0.31	0.77	0.22	0.59	0.20
	95% CI	-1.01 to 0.40	0.07 to 1.47	-1.77 to 2.22	-1.00 to 2.19	
<i>Never smoker</i> (n)	433	195	176	22	40	
BMI (kg/m <sup>2</sup> )	Mean	-0.05	0.23	0.34	-0.19	0.37
	95% CI	-0.31 to 0.21	-0.05 to 0.50	-0.42 to 1.10	-0.76 to 0.38	
Weight (kg)	Mean	-0.16	0.72	0.85	-0.54	0.29
	95% CI	-0.88 to 0.56	-0.05 to 1.49	-1.26 to 2.97	-2.13 to 1.05	
<b>Change occupational physical activity Tromsø 5-6 (2001 to 2007-08)</b>						
<b>Education</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 6-7 (2007-08 to 2015-16)</b>						
<i>Primary school</i> (n)	299	77	186	18	18	
BMI (kg/m <sup>2</sup> )	Mean	0.04	0.54	0.14	0.20	0.33
	95% CI	-0.42 to 0.50	0.24 to 0.83	-0.83 to 1.11	-0.76 to 1.16	
Weight (kg)	Mean	0.12	1.55	0.38	0.94	0.32
	95% CI	-1.20 to 1.43	0.71 to 2.39	-2.35 to 3.12	-1.89 to 3.56	
<i>High School</i> (n)	419	161	206	20	32	
BMI (kg/m <sup>2</sup> )	Mean	0.02	0.50	-0.004	0.13	0.16
	95% CI	-0.31 to 0.35	0.21 to 0.79	-0.92 to 0.91	-0.60 to 0.86	
Weight change (kg)	Mean	-0.06	1.38	0.03	0.12	0.10
(n=420)	95% CI	-0.95 to 0.83	0.60 to 2.16	-2.46 to 2.53	-1.87 to 2.11	
		(n=162)				
<i>University &lt;4 years</i> (n)	209	128	46	12	23	
BMI (kg/m <sup>2</sup> )	Mean	-0.07	-0.18	0.39	-0.10	0.83
	95% CI	-0.40 to 0.26	-0.75 to 0.38	-0.70 to 1.48	-0.89 to 0.68	
Weight (kg)	Mean	-0.14	-0.63	0.95	-0.30	0.86
	95% CI	-1.12 to 0.84	-2.29 to 1.03	-2.27 to 4.17	-2.62 to 2.01	
<i>University &gt;4 years</i> (n)	219	115	63	10	31	
BMI (kg/m <sup>2</sup> )	Mean	0.17	0.001	0.37	0.42	0.73
	95% CI	-0.16 to 0.49	-0.45 to 0.46	-0.71 to 1.45	-0.19 to 1.03	
Weight (kg)	Mean	0.40	0.08	0.83	1.27	0.75
	95% CI	-0.53 to 1.33	-2.25 to 3.91	-2.25 to 3.91	-0.49 to 3.02	
<b>Change occupational physical activity Tromsø 5-6 (2001 to 2007-08)</b>						
<b>Leisure time physical activity change Tromsø 5-6 (2001-08)</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 6-7 (2007-08 to 2015-16)</b>						
<i>Persistently inactive</i> (n)	85	48	28	3	6	
BMI (kg/m <sup>2</sup> )	Mean	-0.32	0.63	0.35	-1.15	0.13
	95% CI	-0.88 to 0.24	-0.14 to 1.39	-1.84 to 2.53	-2.71 to 0.42	
Weight (kg)	Mean	-1.12	2.26	0.79	-2.45	0.14
	95% CI	-2.89 to 0.65	-0.16 to 4.68	-6.14 to 7.72	-7.40 to 2.49	

<i>Persistently active (n)</i>	771	295	361	42	73	
BMI (kg/m <sup>2</sup> )	Mean	0.11	0.33	0.18	0.23	0.58
	95% CI	-0.12 to 0.33	0.12 to 0.54	-0.42 to 0.77	-0.23 to 0.68	
Weight (kg)	Mean	0.24	0.95	0.41	0.63	0.46
(n=772)	95% CI	-0.40 to 0.87	0.37 to 1.53	-1.24 to 2.07	-0.64 to 1.89	
		(n=296)				
<i>Active to inactive (n)</i>	117	62	36	7	12	
BMI (kg/m <sup>2</sup> )	Mean	0.57	0.96	-0.45	-0.07	0.20
	95% CI	0.07 to 1.08	0.29 to 1.64	-1.95 to 1.05	-1.22 to 1.09	
Weight (kg)	Mean	1.59	2.70	-1.47	-0.24	0.19
	95% CI	0.16 to 3.03	0.79 to 4.61	-5.74 to 2.80	-3.52 to 3.05	
<i>Inactive to active (n)</i>	80	42	28	3	7	
BMI (kg/m <sup>2</sup> )	Mean	-0.52	-0.17	0.004	1.01	0.32
	95% CI	-1.11 to 0.07	-0.89 to 0.56	-2.19 to 2.20	-0.48 to 2.49	
Weight (kg)	Mean	-1.71	-0.40	0.02	2.98	0.26
	95% CI	-3.44 to 0.02	-2.53 to 1.72	-6.37 to 6.41	-1.34 to 7.30	

Data are adjusted for sex, birth year, smoking, education and BMI or weight at Tromsø 6, and shown as adjusted mean and 95% CI. CI=confidence interval, BMI=body mass index, P<sub>equality</sub>=main differences between groups.

**Supplementary Table 6.** BMI and weight change by occupational physical activity change for the Tromsø 4-6 sample in total and in strata of sex, birth year, smoking and education.

<b>Tromsø 4-6 (1994-2008)</b>	<b>Change occupational physical activity Tromsø 4-5 (1994-95 to 2001)</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
	<b>Outcome change Tromsø 5-6 (2001 to 2007-08)</b>					
<i>Total (n)</i>	2212	884	985	166	177	
BMI (kg/m <sup>2</sup> )	Mean	0.12	0.12	0.15	0.07	0.98
	95% CI	-0.004 to 0.24	0.01 to 0.24	-0.13 to 0.43	-0.20 to 0.35	
Weight (kg)	Mean	0.31	0.37	0.42	0.27	0.99
(n=2213)	95% CI	-0.04 to 0.66	0.04 to 0.71	-0.38 to 1.22	-0.50 to 1.04	
		(n=885)				
<b>Sex</b>	<b>Change occupational physical activity Tromsø 4-5 (1994-95 to 2001)</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
	<b>Outcome change Tromsø 5-6 (2001 to 2007-08)</b>					
<i>Women (n)</i>	1183	455	585	68	85	
BMI (kg/m <sup>2</sup> )	Mean	0.31	0.07	0.18	0.04	0.27
	95% CI	0.12 to 0.50	-0.09 to 0.24	-0.31 to 0.66	-0.40 to 0.47	
Weight (kg)	Mean	0.86	0.22	0.43	0.18	0.29
	95% CI	0.35 to 1.38	-0.23 to 0.67	-0.88 to 1.74	-0.98 to 1.35	
<i>Men (n)</i>	1029	439	400	98	92	
BMI (kg/m <sup>2</sup> )	Mean	-0.09	0.22	0.10	0.10	0.07
	95% CI	-0.25 to 0.06	0.06 to 0.39	-0.22 to 0.41	-0.22 to 0.43	
Weight (kg)	Mean	-0.28	0.65	0.34	0.30	0.09
(n=1030)	95% CI	-0.76 to 0.20	0.15 to 1.15	-0.63 to 1.31	-0.70 to 1.31	
		(n=440)				
<b>Birth year</b>	<b>Change occupational physical activity Tromsø 4-5 (1994-95 to 2001)</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
	<b>Outcome change Tromsø 5-6 (2001 to 2007-08)</b>					
<i>≤1939 (n)</i>	761	288	342	67	64	
BMI (kg/m <sup>2</sup> )	Mean	-0.15	-0.13	-0.02	-0.42	0.56
	95% CI	-0.35 to 0.05	-0.31 to 0.05	-0.42 to 0.39	-0.83 to 0.00	
Weight (kg)	Mean	-0.46	-0.42	0.004	-1.16	0.57
	95% CI	-1.04 to 0.11	-0.94 to 0.10	-1.14 to 1.15	-2.34 to 0.02	
<i>1940-1949 (n)</i>	950	392	430	64	64	



BMI (kg/m <sup>2</sup> )	Mean	0.06	0.07	-0.002	0.24	0.89
	95% CI	-0.13 to 0.25	-0.11 to 0.25	-0.46 to 0.46	-0.22 to 0.71	
Weight change (kg)	Mean	0.14	0.17	-0.05	0.84	0.77
	95% CI	-0.39 to 0.67	-0.34 to 0.68	-1.35 to 1.25	-0.47 to 2.14	
≥1950 (n)		501	204	213	35	49
BMI (kg/m <sup>2</sup> )	Mean	0.66	0.62	0.57	0.51	0.97
	95% CI	0.39 to 0.94	0.35 to 0.90	-0.10 to 1.24	-0.05 to 1.08	
Weight (kg)	Mean	1.90	1.93	1.62	1.46	0.96
(n=502)	95% CI	1.10 to 2.69	1.13 to 2.72	-0.30 to 3.55	-0.16 to 3.08	
		(n=205)				
<b>Change occupational physical activity Tromsø 4-5 (1994-95 to 2001)</b>						
<b>Smoking</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
	<b>Outcome change Tromsø 5-6 (2001 to 2007-08)</b>					
<i>Smoker (n)</i>	579	213	277	46	43	
BMI (kg/m <sup>2</sup> )	Mean	0.47	0.61	0.52	0.34	0.82
	95% CI	0.18 to 0.75	0.36 to 0.86	-0.08 to 1.13	-0.28 to 0.97	
Weight (kg)	Mean	1.26	1.81	1.54	0.95	0.71
(n=580)	95% CI	0.44 to 2.07	1.10 to 2.53	-0.19 to 3.27	0.83 to 2.74	
		(n=214)				
<i>Previous (n)</i>	843	355	350	70	68	
BMI (kg/m <sup>2</sup> )	Mean	-0.01	-0.10	-0.14	-0.53	0.20
	95% CI	-0.20 to 0.18	-0.29 to 0.10	-0.57 to 0.29	-0.96 to -0.10	
Weight (kg)	Mean	-0.03	-0.32	-0.40	-1.43	0.24
	95% CI	-0.58 to 0.51	0.87 to 0.24	-1.63 to 0.82	-2.67 to -0.20	
<i>Never smoker (n)</i>	790	316	358	50	66	
BMI (kg/m <sup>2</sup> )	Mean	0.01	-0.01	0.16	0.52	0.11
	95% CI	-0.17 to 0.20	-0.19 to 0.16	-0.30 to 0.62	0.12 to 0.92	
Weight (kg)	Mean	-0.01	-0.001	0.40	1.58	0.07
	95% CI	-0.53 to 0.51	-0.49 to 0.49	-0.89 to 1.69	0.46 to 2.70	
<b>Change occupational physical activity Tromsø 4-5 (1994-95 to 2001)</b>						
<b>Education</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
	<b>Outcome change Tromsø 5-6 (2001 to 2007-08)</b>					
<i>Primary school (n)</i>	782	205	461	50	66	
BMI (kg/m <sup>2</sup> )	Mean	0.19	-0.02	0.03	0.01	0.62
	95% CI	-0.07 to 0.46	-0.20 to 0.15	-0.51 to 0.57	0.45 to 0.48	
Weight (kg)	Mean	0.50	-0.06	0.14	0.13	0.67
	95% CI	-0.23 to 1.24	-0.55 to 0.43	-1.36 to 1.64	-1.17 to 1.43	
<i>High School (n)</i>	665	279	285	53	48	
BMI (kg/m <sup>2</sup> )	Mean	0.17	0.16	0.07	0.32	0.91
	95% CI	-0.03 to 0.38	-0.04 to 0.36	-0.39 to 0.54	-0.18 to 0.82	
Weight change (kg)	Mean	0.46	0.43	0.18	0.96	0.89
	95% CI	-0.13 to 1.05	-0.15 to 1.01	-1.16 to 1.53	-0.47 to 2.39	
<i>University &lt;4 years (n)</i>	364	199	107	33	25	
BMI (kg/m <sup>2</sup> )	Mean	0.19	0.40	0.09	0.08	0.70
	95% CI	-0.05 to 0.44	0.06 to 0.74	-0.52 to 0.69	-0.62 to 0.78	
Weight (kg)	Mean	0.53	1.28	0.22	0.28	0.56
	95% CI	-0.18 to 1.23	0.31 to 2.24	-1.52 to 1.96	-1.72 to 2.28	
<i>University &gt;4 years (n)</i>	401	201	132	30	38	
BMI (kg/m <sup>2</sup> )	Mean	-0.05	0.26	0.51	-0.16	0.26
	95% CI	-0.32 to 0.23	-0.8 to 0.60	-0.17 to 1.19	-0.77 to 0.45	
Weight (kg)	Mean	-0.11	0.75	1.57	-0.52	0.25
(n=402)	95% CI	-0.91 to 0.69	-0.26 to 1.75	-0.43 to 3.56	-2.31 to 1.27	
		(n=202)				

Data are adjusted for sex, birth year, smoking, education and BMI or weight at Tromsø 5, and shown as adjusted mean and 95% CI. CI=confidence interval, BMI=body mass index, P<sub>equality</sub>=main differences between groups.

**Supplementary Table 7.** BMI and weight change by occupational physical activity change for the Tromsø 3-5 sample in total and in strata of sex, birth year, smoking and education.

Tromsø 3-5 (1986-2001)	Change occupational physical activity Tromsø 3-4 (1986-87 to 1994-95)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
Outcome change Tromsø 4-5 (1994-95 to 2001)						
Total (n)	3827	1315	1915	223	374	
BMI (kg/m <sup>2</sup> )	Mean	0.96	0.96	1.02	0.91	0.90
	95% CI	0.86 to 1.05	0.87 to 1.04	0.79 to 1.25	0.73 to 1.09	
Weight (kg)	Mean	2.71	2.70	2.95	2.59	0.87
	95% CI	2.44 to 2.99	2.47 to 2.93	2.29 to 3.60	2.08 to 3.09	
Sex	Change occupational physical activity Tromsø 3-4 (1986-87 to 1994-95)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
Outcome change Tromsø 4-5 (1994-95 to 2001)						
Women (n)	2021	637	1069	122	193	
BMI (kg/m <sup>2</sup> )	Mean	1.22	1.13	1.21	1.07	0.70
	95% CI	1.07 to 1.37	1.01 to 1.25	0.86 to 1.55	0.79 to 1.34	
Weight (kg)	Mean	3.29	3.01	3.28	2.85	0.63
	95% CI	2.89 to 3.69	2.70 to 3.32	2.36 to 4.19	2.12 to 3.57	
Men (n)	1806	678	846	101	181	
BMI (kg/m <sup>2</sup> )	Mean	0.66	0.77	0.81	0.74	0.59
	95% CI	0.54 to 0.78	0.66 to 0.88	0.51 to 1.11	0.51 to 0.97	
Weight (kg)	Mean	2.08	2.37	2.59	2.32	0.65
	95% CI	1.70 to 2.46	2.03 to 2.71	1.64 to 3.53	1.61 to 3.03	
Birth year	Change occupational physical activity Tromsø 3-4 (1986-87 to 1994-95)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
Outcome change Tromsø 4-5 (1994-95 to 2001)						
≤1939 (n)	1829	624	951	100	154	
BMI (kg/m <sup>2</sup> )	Mean	0.51	0.58	0.73	0.64	0.55
	95% CI	0.37 to 0.64	0.47 to 0.69	0.40 to 1.06	0.38 to 0.91	
Weight (kg)	Mean	1.40	1.63	2.13	1.81	0.47
	95% CI	1.01 to 1.79	1.31 to 1.94	1.18 to 3.08	1.05 to 2.57	
1940-1949 (n)	1216	445	585	73	113	
BMI (kg/m <sup>2</sup> )	Mean	1.23	1.23	1.16	1.18	0.98
	95% CI	1.06 to 1.40	1.09 to 1.38	0.74 to 1.57	0.84 to 1.51	
Weight change (kg)	Mean	3.48	3.47	3.30	3.34	0.99
	95% CI	3.00 to 3.95	3.06 to 3.89	2.14 to 4.45	2.41 to 4.27	
≥1950 (n)	782	246	379	50	107	
BMI (kg/m <sup>2</sup> )	Mean	1.56	1.40	1.55	1.24	0.48
	95% CI	1.32 to 1.79	1.21 to 1.59	1.03 to 2.07	0.89 to 1.59	
Weight (kg)	Mean	4.53	4.03	4.47	3.60	0.44
	95% CI	3.85 to 5.20	3.48 to 4.57	2.98 to 5.96	2.59 to 4.61	
Smoking	Change occupational physical activity Tromsø 3-4 (1986-87 to 1994-95)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
Outcome change Tromsø 4-5 (1994-95 to 2001)						
Smoker (n)	1263	383	679	84	117	
BMI (kg/m <sup>2</sup> )	Mean	0.99	0.95	0.70	1.20	0.34
	95% CI	0.79 to 1.19	0.80 to 1.10	0.28 to 1.12	0.85 to 1.56	
Weight (kg)	Mean	2.80	2.68	2.07	3.43	0.37
	95% CI	0.23 to 3.36	2.26 to 3.10	0.88 to 3.25	2.42 to 4.44	
Previous (n)	390	161	171	20	38	
BMI (kg/m <sup>2</sup> )	Mean	0.96	1.21	1.51	0.75	0.33
	95% CI	0.66 to 1.26	0.92 to 1.51	0.67 to 2.34	0.14 to 1.37	
Weight (kg)	Mean	2.78	3.47	4.61	2.10	0.27
	95% CI	1.91 to 3.64	2.62 to 4.32	2.19 to 7.03	0.32 to 3.87	
Never smoker (n)	2174	771	1065	119	219	

BMI (kg/m <sup>2</sup> )	Mean	0.94	0.91	1.16	0.79	0.23
	95% CI	0.83 to 1.06	0.82 to 1.01	0.87 to 1.45	0.57 to 1.00	
Weight (kg)	Mean	2.67	2.58	3.26	2.25	0.27
	95% CI	2.34 to 3.00	2.30 to 2.86	2.44 to 4.08	1.64 to 2.85	
<b>Change occupational physical activity Tromsø 3-4 (1986-87 to 1994-95)</b>						
<b>Education</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 4-5 (1994-95 to 2001)</b>						
<i>Primary school (n)</i>	1456	280	980	70	126	
BMI (kg/m <sup>2</sup> )	Mean	0.91	0.92	0.59	1.07	0.38
	95% CI	0.69 to 1.13	0.80 to 1.04	0.15 to 1.03	0.75 to 1.40	
Weight (kg)	Mean	0.55	2.54	1.69	3.06	0.37
	95% CI	1.94 to 3.16	2.21 to 2.89	0.48 to 2.91	2.15 to 3.97	
<i>High School (n)</i>	1408	565	621	80	142	
BMI (kg/m <sup>2</sup> )	Mean	1.00	1.04	1.45	0.90	0.14
	95% CI	0.85 to 1.14	0.91 to 1.18	1.06 to 1.84	0.61 to 1.19	
Weight change (kg)	Mean	2.82	2.98	4.17	2.53	0.11
	95% CI	2.40 to 3.24	2.69 to 3.38	3.07 to 5.26	1.71 to 3.36	
<i>University &lt;4 years (n)</i>	551	279	169	37	66	
BMI (kg/m <sup>2</sup> )	Mean	0.88	1.04	0.95	0.52	0.22
	95% CI	0.68 to 1.09	0.78 to 1.30	0.40 to 1.50	0.11 to 0.93	
Weight (kg)	Mean	2.60	2.95	2.86	1.56	0.29
	95% CI	2.00 to 3.19	2.18 to 3.72	1.23 to 4.48	0.35 to 2.77	
<i>University &gt;4 years (n)</i>	412	191	145	36	40	
BMI (kg/m <sup>2</sup> )	Mean	0.98	0.72	0.98	1.12	0.36
	95% CI	0.76 to 1.20	0.48 to 0.98	0.50 to 1.46	0.67 to 1.58	
Weight (kg)	Mean	2.87	2.12	2.76	3.18	0.41
	95% CI	2.22 to 3.51	1.39 to 2.86	1.36 to 4.17	1.85 to 4.51	

Data are adjusted for sex, birth year, smoking, education and BMI or weight at Tromsø 4, and shown as adjusted mean and 95% CI. CI=confidence interval, BMI=body mass index, P<sub>equality</sub>=main differences between groups.

**Supplementary Table 8.** BMI and weight change by occupational physical activity change for the Tromsø 2-4 sample in total and in strata of sex, birth year, smoking, education and leisure time physical activity change.

<b>Tromsø 2-4 (1979-95)</b>	<b>Change occupational physical activity Tromsø 2-3 (1979-80 to 1986-87)</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
<b>Outcome change Tromsø 3-4 (1986-87 to 1994-95)</b>						
<i>Total (n)</i>	9679	2512	5179	665	1323	
BMI (kg/m <sup>2</sup> )	Mean	1.12	1.15	1.12	1.07	0.50
	95% CI	1.05 to 1.19	1.10 to 1.20	0.99 to 1.26	0.98 to 1.17	
Weight (kg)	Mean	3.20	3.30	3.27	3.09	0.58
	95% CI	3.00 to 3.40	3.16 to 3.43	2.89 to 3.65	2.82 to 3.36	
<b>Change occupational physical activity Tromsø 2-3 (1979-80 to 1986-87)</b>						
<b>Sex</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 3-4 (1986-87 to 1994-95)</b>						
<i>Women (n)</i>	4838	1062	2788	294	694	
BMI (kg/m <sup>2</sup> )	Mean	1.45	1.43	1.37	1.36	0.77
	95% CI	1.33 to 1.57	1.35 to 1.49	1.15 to 1.59	1.21 to 1.50	
Weight (kg)	Mean	3.93	3.82	3.73	3.68	0.78
	95% CI	3.62 to 4.24	3.63 to 4.02	3.14 to 4.33	3.29 to 4.06	
<i>Men (n)</i>	4859	1458	2397	372	632	
BMI (kg/m <sup>2</sup> )	Mean	0.80	0.88	0.89	0.78	0.30
	95% CI	0.72 to 0.88	0.82 to 0.95	0.73 to 1.04	0.66 to 0.90	
Weight (kg)	Mean	2.54	2.77	2.83	2.49	0.37
	95% CI	2.28 to 2.80	2.57 to 2.97	2.34 to 3.32	2.12 to 2.86	
<b>Change occupational physical activity Tromsø 2-3 (1979-80 to 1986-87)</b>						

Birth year	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	P <sub>equality</sub>
	Outcome change Tromsø 3-4 (1986-87 to 1994-95)					
≤1929 (n)	549	174	258	45	72	
BMI (kg/m <sup>2</sup> )	Mean	0.02	0.38	0.28	0.06	0.15
	95% CI	-0.23 to 0.28	0.18 to 0.57	-0.18 to 0.74	-0.30 to 0.42	
Weight (kg)	Mean	0.10	1.16	0.87	0.11	0.14
	95% CI	-0.67 to 0.87	0.56 to 1.76	-0.54 to 2.27	-1.00 to 1.22	
1930-1939 (n)	2666	675	1532	144	315	
BMI (kg/m <sup>2</sup> )	Mean	0.81	0.88	0.83	0.72	0.51
	95% CI	0.68 to 0.95	0.79 to 0.97	0.55 to 1.12	0.52 to 0.91	
Weight (kg)	Mean	2.32	2.45	2.42	2.01	0.54
	95% CI	1.93 to 2.70	2.19 to 2.70	1.61 to 3.22	1.46 to 2.55	
1940-1949 (n)	3849	1071	2010	225	543	
BMI (kg/m <sup>2</sup> )	Mean	1.30	1.26	1.20	1.18	0.56
	95% CI	1.19 to 1.41	1.19 to 1.34	0.97 to 1.43	1.03 to 1.32	
Weight change (kg)	Mean	3.72	3.60	3.48	3.39	0.64
	95% CI	3.41 to 4.02	3.38 to 3.82	2.82 to 4.13	2.97 to 3.81	
≥1950 (n)	2615	592	1379	251	393	
BMI (kg/m <sup>2</sup> )	Mean	1.36	1.43	1.50	1.47	0.67
	95% CI	1.22 to 1.50	1.34 to 1.53	1.29 to 1.72	1.30 to 1.64	
Weight (kg)	Mean	3.97	4.16	4.39	4.30	0.66
	95% CI	3.56 to 4.39	3.89 to 4.43	3.75 to 5.02	3.80 to 4.80	
<b>Change occupational physical activity Tromsø 2-3 (1979-80 to 1986-87)</b>						
Smoking	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	P <sub>equality</sub>
	Outcome change Tromsø 3-4 (1986-87 to 1994-95)					
Smoker (n)	4221	1015	2351	279	576	
BMI (kg/m <sup>2</sup> )	Mean	1.15	1.16	1.12	1.01	0.32
	95% CI	1.03 to 1.26	1.09 to 1.24	0.91 to 1.34	0.86 to 1.16	
Weight (kg)	Mean	3.28	3.35	3.31	2.92	0.38
	95% CI	2.95 to 3.61	3.14 to 3.57	2.69 to 3.92	2.50 to 3.35	
Previous (n)	754	200	375	57	122	
BMI (kg/m <sup>2</sup> )	Mean	0.88	0.90	1.21	0.99	0.60
	95% CI	0.62 to 1.13	0.70 to 1.08	0.74 to 1.69	0.67 to 1.31	
Weight (kg)	Mean	2.52	2.57	3.66	2.96	0.45
	95% CI	1.78 to 3.26	2.03 to 3.11	2.29 to 5.03	2.02 to 3.89	
Never smoker (n)	4704	1297	2453	329	625	
BMI (kg/m <sup>2</sup> )	Mean	1.14	1.18	1.11	1.14	0.86
	95% CI	1.05 to 1.23	1.11 to 1.24	0.93 to 1.29	1.02 to 1.27	
Weight (kg)	Mean	3.28	3.34	3.16	3.26	0.91
	95% CI	3.01 to 3.54	3.16 to 3.53	2.65 to 3.67	2.89 to 3.63	
<b>Change occupational physical activity Tromsø 2-3 (1979-80 to 1986-87)</b>						
Education	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	P <sub>equality</sub>
	Outcome change Tromsø 3-4 (1986-87 to 1994-95)					
Primary school (n)	4324	663	2929	221	511	
BMI (kg/m <sup>2</sup> )	Mean	1.03	1.05	1.12	0.93	0.53
	95% CI	0.89 to 1.16	0.98 to 1.11	0.88 to 1.36	0.78 to 1.09	
Weight (kg)	Mean	2.93	2.93	3.23	2.62	0.47
	95% CI	2.54 to 3.32	2.74 to 3.11	2.55 to 3.90	2.17 to 3.06	
High School (n)	2936	904	1364	211	457	
BMI (kg/m <sup>2</sup> )	Mean	1.16	1.23	1.22	1.14	0.68
	95% CI	1.05 to 1.28	1.14 to 1.33	0.98 to 1.45	0.98 to 1.29	
Weight change (kg)	Mean	3.33	3.56	3.53	3.27	0.63
	95% CI	3.01 to 3.66	3.29 to 3.82	2.86 to 4.21	2.82 to 3.73	
University <4 years (n)	1380	503	531	117	229	
BMI (kg/m <sup>2</sup> )	Mean	1.31	1.23	1.29	1.15	0.67
	95% CI	1.16 to 1.47	1.09 to 1.38	0.98 to 1.60	0.93 to 1.37	
Weight (kg)	Mean	3.86	3.60	3.84	3.43	0.69

	95% CI	3.42 to 3.31	3.17 to 4.03	2.94 to 4.74	2.78 to 4.08	
<i>University &gt;4 years (n)</i>		1039	442	355	116	126
BMI (kg/m <sup>2</sup> )	Mean	1.06	1.29	1.02	1.38	0.04
	95% CI	0.92 to 1.20	1.14 to 1.45	0.75 to 1.28	1.12 to 1.63	
Weight (kg)	Mean	3.12	3.87	2.98	4.09	0.02
	95% CI	2.70 to 3.54	3.41 to 4.33	2.18 to 3.78	3.33 to 4.84	
<b>Change occupational physical activity Tromsø 2-3 (1979-80 to 1986-87)</b>						
<b>Leisure time physical activity change Tromsø 2-3 (1979-87)</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
	<b>Outcome change Tromsø 3-4 (1986-87 to 1994-95)</b>					
<i>Persistently inactive (n)</i>	890	334	352	60	144	
BMI (kg/m <sup>2</sup> )	Mean	1.12	1.04	1.52	1.03	0.35
	95% CI	0.91 to 1.33	0.84 to 1.25	1.03 to 2.01	0.71 to 1.35	
Weight (kg)	Mean	3.20	2.93	4.40	2.94	0.30
	95% CI	2.58 to 3.81	2.33 to 3.52	2.98 to 5.81	2.02 to 3.85	
<i>Persistently active (n)</i>	6484	1564	3645	439	836	
BMI (kg/m <sup>2</sup> )	Mean	1.12	1.16	1.08	1.12	0.78
	95% CI	1.04 to 1.21	1.10 to 1.21	0.93 to 1.24	1.00 to 1.23	
Weight (kg)	Mean	3.25	3.32	3.13	3.23	0.84
	95% CI	3.01 to 3.50	3.16 to 3.48	2.68 to 3.58	2.90 to 3.55	
<i>Active to inactive (n)</i>	1059	271	567	96	125	
BMI (kg/m <sup>2</sup> )	Mean	1.07	1.19	1.08	1.21	0.78
	95% CI	0.86 to 1.28	1.04 to 1.34	0.73 to 1.44	0.90 to 1.52	
Weight (kg)	Mean	3.03	3.37	3.20	3.47	0.79
	95% CI	2.42 to 3.63	2.95 to 3.79	2.19 to 4.21	2.59 to 4.35	
<i>Inactive to active (n)</i>	1232	341	695	69	217	
BMI (kg/m <sup>2</sup> )	Mean	1.14	1.15	1.10	0.87	0.28
	95% CI	0.93 to 1.34	1.00 to 1.30	0.65 to 1.54	0.62 to 1.12	
Weight (kg)	Mean	3.20	3.28	3.26	2.49	0.30
	95% CI	2.63 to 3.78	2.85 to 3.72	2.00 to 4.52	1.79 to 3.20	

Data are adjusted for sex, birth year, smoking, education and BMI or weight at Tromsø 3, and shown as adjusted mean and 95% CI. CI=confidence interval, BMI=body mass index, P<sub>equality</sub>=main differences between groups.

**Supplementary Table 9.** BMI and weight change by occupational physical activity change for the Tromsø 1-3 sample in total and in strata of birth year, smoking, education and leisure time physical activity change.

<b>Tromsø 1-3 (1974-87)</b>	<b>Change occupational physical activity Tromsø 1-2 (1974 to 1979-80)</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
	<b>Outcome change Tromsø 2-3 (1979-80 to 1986-87)</b>					
<i>Total (n)</i>	3570	1033	1805	366	366	
BMI (kg/m <sup>2</sup> )	Mean	0.48	0.48	0.49	0.57	0.68
	95% CI	0.39 to 0.57	0.41 to 0.54	0.35 to 0.64	0.43 to 0.71	
Weight (kg)	Mean	1.53	1.50	1.53	1.80	0.69
(n=3571)	95% CI	1.25 to 1.81	1.30 to 1.71	1.08 to 1.97	1.36 to 2.25	
		(n=1806)				
<b>Birth year</b>	<b>Change occupational physical activity Tromsø 1-2 (1974 to 1979-80)</b>					<b>P<sub>equality</sub></b>
	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	
	<b>Outcome change Tromsø 2-3 (1979-80 to 1986-87)</b>					
<i>≤1929 (n)</i>	565	174	280	60	51	
BMI (kg/m <sup>2</sup> )	Mean	0.02	0.05	0.11	0.15	0.93
	95% CI	-0.21 to 0.25	-0.13 to 0.22	-0.25 to 0.46	-0.24 to 0.54	
Weight (kg)	Mean	0.08	0.13	0.40	0.34	0.95
	95% CI	-0.63 to 0.79	-0.41 to 0.67	-0.71 to 1.51	-0.85 to 1.54	

<i>1930-1939 (n)</i>	<i>1186</i>	<i>344</i>	<i>619</i>	<i>116</i>	<i>107</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.47	0.27	0.46	0.27	0.20
	95% CI	0.31 to 0.63	0.16 to 0.39	0.21 to 0.72	0.01 to 0.54	
Weight (kg)	Mean	1.49	0.87	1.46	0.82	0.18
(n=1187)	95% CI	1.00 to 1.98	0.51 to 1.22	0.66 to 2.26	-0.02 to 1.65	
			(n=620)			
<i>1940-1949 (n)</i>	<i>1391</i>	<i>418</i>	<i>682</i>	<i>140</i>	<i>151</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.53	0.69	0.52	0.86	0.03
	95% CI	0.40 to 0.66	0.59 to 0.80	0.30 to 0.73	0.65 to 1.07	
Weight change (kg)	Mean	1.69	2.19	1.55	2.75	0.02
	95% CI	1.27 to 2.11	1.87 to 2.52	0.85 to 2.25	2.07 to 3.42	
<i>≥1950 (n)</i>	<i>428</i>	<i>97</i>	<i>224</i>	<i>50</i>	<i>57</i>	
BMI (kg/m <sup>2</sup> )	Mean	1.03	0.86	1.18	1.02	0.51
	95% CI	0.74 to 1.32	0.67 to 1.05	0.79 to 1.58	0.66 to 1.38	
Weight (kg)	Mean	3.22	2.71	2.71	3.15	0.53
	95% CI	2.31 to 4.14	2.11 to 3.31	2.48 to 4.95	2.02 to 4.28	
<b>Change occupational physical activity Tromsø 1-2 (1974 to 1979-80)</b>						
<b>Smoking</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 2-3 (1979-80 to 1986-87)</b>						
<i>Smoker (n)</i>	<i>1705</i>	<i>429</i>	<i>930</i>	<i>174</i>	<i>172</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.41	0.49	0.52	0.44	0.79
	95% CI	0.27 to 0.56	0.39 to 0.59	0.31 to 0.74	0.23 to 0.66	
Weight (kg)	Mean	1.29	1.54	1.61	1.39	0.80
	95% CI	0.84 to 1.74	1.24 to 1.84	0.93 to 2.28	0.71 to 2.07	
<i>Previous (n)</i>	<i>503</i>	<i>141</i>	<i>242</i>	<i>52</i>	<i>68</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.49	0.40	0.18	0.47	0.55
	95% CI	0.25 to 0.72	0.23 to 0.58	-0.19 to 0.55	0.15 to 0.79	
Weight (kg)	Mean	1.55	1.26	0.47	1.50	0.46
	95% CI	0.81 to 2.28	0.70 to 1.81	-0.70 to 1.64	0.48 to 2.52	
<i>Never smoker (n)</i>	<i>1362</i>	<i>463</i>	<i>633</i>	<i>140</i>	<i>126</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.56	0.48	0.58	0.81	0.08
	95% CI	0.44 to 0.69	0.37 to 0.58	0.37 to 0.79	0.58 to 1.03	
Weight (kg)	Mean	1.80	1.51	1.83	2.54	0.08
(n=1363)	95% CI	1.41 to 2.19	1.18 to 1.84	1.15 to 2.50	1.83 to 3.25	
			(n=634)			
<b>Change occupational physical activity Tromsø 1-2 (1974 to 1979-80)</b>						
<b>Education</b>	<b>Total</b>	<b>Persistently inactive</b>	<b>Persistently Active</b>	<b>Active to inactive</b>	<b>Inactive to active</b>	<b>P<sub>equality</sub></b>
<b>Outcome change Tromsø 2-3 (1979-80 to 1986-87)</b>						
<i>Primary school (n)</i>	<i>1842</i>	<i>296</i>	<i>1198</i>	<i>162</i>	<i>186</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.21	0.31	0.40	0.45	0.26
	95% CI	0.05 to 0.37	0.23 to 0.39	0.19 to 0.61	0.25 to 0.65	
Weight (kg)	Mean	0.64	0.97	1.22	1.39	0.26
	95% CI	0.15 to 1.13	0.72 to 1.21	0.55 to 1.88	0.77 to 2.01	
<i>High School (n)</i>	<i>1002</i>	<i>332</i>	<i>446</i>	<i>117</i>	<i>107</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.74	0.58	0.55	0.76	0.28
	95% CI	0.59 to 0.89	0.45 to 0.71	0.30 to 0.81	0.50 to 1.03	
Weight change (kg)	Mean	2.36	1.81	1.72	2.38	0.24
	95% CI	1.88 to 2.84	1.39 to 2.22	0.92 to 2.51	1.55 to 3.22	
<i>University &lt;4 years (n)</i>	<i>423</i>	<i>210</i>	<i>107</i>	<i>55</i>	<i>51</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.75	0.81	0.55	0.39	0.23
	95% CI	0.56 to 0.93	0.56 to 1.07	0.19 to 0.91	0.01 to 0.76	
Weight (kg)	Mean	2.41	2.60	1.76	1.28	0.25
	95% CI	1.81 to 3.00	1.77 to 3.42	0.60 to 2.91	0.09 to 2.48	
<i>University &gt;4 years (n)</i>	<i>303</i>	<i>195</i>	<i>54</i>	<i>32</i>	<i>22</i>	
BMI (kg/m <sup>2</sup> )	Mean	0.65	0.79	0.93	1.10	0.33
	95% CI	0.47 to 0.83	0.45 to 1.13	0.48 to 1.38	0.57 to 1.64	
Weight (kg)	Mean	2.08	2.65	2.91	3.54	0.33
(n=304)	95% CI	1.50 to 2.66		1.47 to 4.35	1.81 to 5.26	



1.56 to 3.73  
(n=55)

Leisure time physical activity change Tromsø 1-2 (1974-80)	Change occupational physical activity Tromsø 1-2 (1974 to 1979-80)					P <sub>equality</sub>
	Total	Persistently inactive	Persistently Active	Active to inactive	Inactive to active	
	Outcome change Tromsø 2-3 (1979-80 to 1986-87)					
<i>Persistently inactive (n)</i>	343	137	127	38	41	
BMI (kg/m <sup>2</sup> )	Mean	0.42	0.36	0.32	0.60	0.83
	95% CI	0.16 to 0.68	0.10 to 0.63	-0.14 to 0.78	0.12 to 1.07	
Weight (kg)	Mean	1.33	1.16	0.99	1.93	0.80
	95% CI	0.52 to 2.14	0.32 to 2.00	-0.45 to 2.43	0.43 to 3.43	
<i>Persistently active (n)</i>	2323	635	1245	218	225	
BMI (kg/m <sup>2</sup> )	Mean	0.49	0.47	0.55	0.53	0.83
	95% CI	0.38 to 0.59	0.40 to 0.55	0.38 to 0.72	0.36 to 0.70	
Weight (kg)	Mean	1.54	1.50	1.70	1.65	0.88
(n=2324)	95% CI	1.21 to 1.88	1.26 to 1.73	1.17 to 2.24	1.11 to 2.20	
<i>Active to inactive (n)</i>	572	163	278	56	75	
BMI (kg/m <sup>2</sup> )	Mean	0.43	0.55	0.39	0.68	0.62
	95% CI	0.18 to 0.67	0.37 to 0.73	0.04 to 0.73	0.28 to 1.08	
Weight (kg)	Mean	1.35	1.75	1.14	2.11	0.59
	95% CI	0.58 to 2.13	1.17 to 2.33	0.06 to 2.22	0.85 to 3.36	
<i>Inactive to active (n)</i>	326	97	151	53	25	
BMI (kg/m <sup>2</sup> )	Mean	0.63	0.48	0.58	0.61	0.92
	95% CI	0.30 to 0.97	0.22 to 0.75	-0.04 to 1.19	0.19 to 1.03	
Weight (kg)	Mean	2.02	1.43	2.01	1.93	0.82
	95% CI	0.98 to 3.07	0.61 to 2.24	0.10 to 3.92	0.62 to 3.25	

Data are adjusted for birth year, smoking, education and BMI or weight at Tromsø 2, and shown as adjusted mean and 95% CI. CI=confidence interval, BMI=body mass index, P<sub>equality</sub>=main differences between groups. Tromsø 1 included only men.