Targeting Physical Activity in a Low Socio-Economic Status Population: Observations from the Norwegian "Romsås in Motion" Study

Keywords: community intervention, physical activity, psycho-social mediators, type 2 diabetes, socio-economic status

ABSTRACT

Objective: To summarize the main results of a community-based study on physical activity promotion - "Romsås in Motion".

Methods: We assessed changes in physical activity, body mass and psychosocial mediators of physical activity from a pseudo-experimental cohort study involving two districts with low socio-economic status in Oslo, Norway. In 2000, baseline investigation included 2,950 30-67 year olds - 48% of those invited. At follow-up in 2003 we measured 1,776 subjects (67% of those eligible). A set of theoretically informed strategies targeting individuals, groups and the environment were implemented, tailored towards groups with different psychosocial readiness for change. We report net changes (the difference between changes in the intervention and control districts) and results of mediation analyses related to the effect of the intervention.

Results: The increase in physical activity measured by two questionnaires was 9.5% ($p=0.008$) and 8.1% ($p=0.02$), respectively. The proportion who increased their body mass was reduced by 50% compared with the control district. Participation in walking and aerobic exercise groups, having seen the "Walk the stairs"-poster and used the walk path were particularly effective intervention components. The most promising psychosocial mediators of forward transition in stages of change were physical activity identity, perceived control, support from friends and family, and self-efficacy when facing psychological barriers.

Conclusion: Through a theoretically informed, low-cost, population-based intervention program we observed an increase in physical activity levels and a reduced weight gain. Mediation findings regarding forward transition in stages of change enhance our understanding of psychosocial mechanisms of behaviour change, and may prove helpful in guiding implementation and evaluation of future interventions.

In western societies today low socio-economic status (SES) at the individual, group and regional level represents a risk factor for premature cardiovascular disease (CVD),[1-2] a sedentary lifestyle and is linked to the world-wide increase in obesity and type 2 diabetes.[3-5] Although lifestyle interventions may be highly effective in high risk individuals,[6-7] very few community-based interventions have addressed behavioural risk factors for type 2 diabetes, and most study designs are flawed.[8] Even small improvements in one or more risk factors, if achieved in a large proportion of the population,[9] can provide considerable impact on public health. Thus, such interventions are needed, especially in low-income communities.[8]

The determinants of physical activity behaviour are multi-factorial.[10-17] The most promising theories and models hypothesize that behaviour change is mediated by change in proximal psychological factors such as attitudes, efficacy, control beliefs and identity. Further, influencing also more distal social and physical environmental factors comprising family support and social networks, organizations, communities and societies to reinforce change in proximal mediators seem warranted.[11 13-14 18-21] Conducting process evaluation of the intervention as well as measuring the effect of its specific intervention components and the role of the mediators would seem important as this may provide better understanding of program failure or success.[18 22-24]

Within Oslo, there are longstanding, large differences in life expectancy and CVD mortality rates between districts and these are strongly related to SES.[1] Therefore, the "Romsås in Motion" Study was implemented in a multiethnic district characterized by a low educational level and high total and CVD mortality rates.[1] The study comprised a low-cost three year community-based physical activity intervention program. There was a high prevalence of diabetes, obesity and physical inactivity at baseline.[25-26]

The aim of this paper is to summarize the main results and lessons learned from the study by reporting: 1) intervention effects on physical activity levels and body mass, blood pressure, serum lipids and glucose, and daily smoking, 2) mediation effects of psychosocial influences on the forward transition in stages of change in physical activity, 3) the most effective intervention components and mediation effects of psychosocial factors, and 4) participants` subjective evaluation of the intervention and its effects.

METHODS

The design and methods of the study are detailed elsewhere.[26-27] All individuals 30-67 years of age in two similar low-income districts in Oslo were invited to the baseline health investigation in 2000. A total of 2,950 persons (48% of the invited cohort) were examined at

baseline[26] and 1776 (67% of those alive and still living in the Oslo area, 60% retention of original cohort) were included in follow-up.[27] Extensive analyses of the non-responders have been performed.[25-31]

Data collected included demographics, health status and health behaviour from one questionnaire (Q1),[32] a physical examination, blood samples including serum cholesterol, HDL-cholesterol, triglycerides and glucose,[25-26 32] and a questionnaire (Q2) concerning self-reported physical activity and psychosocial mediators of change in physical activity. An identical follow-up survey was performed in 2003. At follow-up, intervention participants also completed a process evaluation questionnaire assessing exposure to, participation in, and subjective evaluation of the intervention (Q3). All questionnaires were translated to English, Urdu, Turkish, Vietnamese and Tamil. The Regional Ethics Committee and the Norwegian Data Inspectorate approved the study protocol.

The intervention

The comprehensive intervention program (figure 1), mainly tailored towards physically inactive groups with low psychosocial readiness for behaviour change, was informed by social-psychological and ecological perspectives on behaviour change, empowerment and participatory approaches.[11 13-14 20-21 33] The intervention, also detailed elsewhere,[27-31] was implemented to optimize synergistic and reinforcing physical activity behaviour change effects in the community.[16 24 33-35] We included local political and lay leaders and health and welfare workers in the planning and implementation of the intervention.[11 16 18-19] Culturally sensitive physical activity groups were organized for immigrants attending Norwegian language classes. Furthermore, high risk individuals at baseline were offered individual counselling regarding physical activity, dietary and smoking habits, and specially designed physical activity groups during the intervention period.

Measurements of physical activity and psychosocial factors

Q1 assessed the duration of "heavy physical activity making you sweat and feel out of breath" in leisure time and commuting to work in hours/week on a four-category scale. Those reporting no such activity were categorized as inactive. Q2 measured the five stages of change in physical activity construct: *1. Pre-contemplation* (physically inactive, no intentions to change), *2.Contemplation* (physically inactive, change intended), *3. Preparation* (irregularly physically active), *4. Action* (recently regularly active), *5. Maintenance* (regularly active more

than six months)[12] and the following potential psychosocial mediators of change in physical activity, described in detail elsewhere:[26 29] *Social support for physical activity,*[36] *Self-efficacy for physical activity,*[37] *Attitude towards physical activity,*[10 38] *Perceived control over physical activity*[10 38] as well as *Physical activity identity.*[17 39-40]

Statistical methods

For each subject outcome changes were calculated as the difference between baseline and follow-up. Net changes for the intervention versus the control district are reported (difference in changes from baseline to follow-up between the two districts). For categorical data the proportion in each district with negative change was subtracted from the proportion with positive change. Group differences were tested by non-parametric tests (Mann-Whitney) for categorical ordinal data, by z-tests for dichotomous variables, and by multiple linear regression analysis for the continuous variables, using districts as a dichotomized independent variable. We assessed the vector of change for the two categorical ordinal physical activity variables together by MANOVA (GLM). Interaction tests were performed for all relevant outcomes. A significance level of p=0.05 was used and the 95% confidence interval (CI) given when appropriate. Mediation was tested according to the formula by Baron and Kenny.[41]

RESULTS

The net reduction in favour of the intervention district in the proportion reporting no strenuous activity was 8.1% (95% CI: 2.4% to13.8%, p=0.005), and the net reduction in the proportion of inactive people (pre-contemplators and contemplators) was 6.9% (1.2% to12.6%, p=0.019) (figure 2). The net increase in favour of the intervention district in strenuous physical activity was 9.5% (p=0.008) and in the stages of change 8.1% (p=0.024). Including the two variables with all categories as a vector in a MANOVA, the increase in physical activity was highly significant for both sexes (p=0.004).

Mean body mass increased in both districts, but less in the intervention district (50% compared to the control district). Correspondingly, the net proportion who increased their body mass was significantly lower in the intervention district (figure 3). This was found overall (14.2%, p<0.001) and across educational and other subgroups (27.5% for non-Western immigrants, p=0.001) except for women and those <50 years of age. Beneficial effects were seen for triglyceride levels, cholesterol/HDL-cholesterol ratio, glucose levels (men only)

(figure 3), systolic blood pressure [3.6 mm Hg (2.2 to 4.8), p<0.001] and for the net proportion quitting smoking [2.9%, (0.1 to 5.7), p=0.043].

A significant favourable intervention effect was found on stages of change (β=0.062, p=0.037) and on the following potential psychosocial mediators; identity (β=0.099, p=0.001), perceived control (β=0.065, p=0.031) and support from family (β=0.069, p=0.036). Further, these factors partially mediated the overall intervention effect on stage movement, 34%, 27%, and 18%, respectively.[31] Gender, age, ethnicity, education and BMI did not moderate the intervention effect on stage transition. Exposure and participation rates for the various intervention components varied greatly (1.5–92.7%)[30], but were comparable for people with different educational status for most of the intervention components, although highest for the least educated with regard to walking groups. Having participated in walking groups (β=0.12, p=0.011) and aerobic exercise groups (β=0.211, p<0.001), seen the "Walk the stairs"-poster (β=0.105, p=0.014) and used the walk path [women (β=0.209, p=0.001) and Westerners (β=0.149, p=0.003)], were related to forward transition in stages of change in physical activity. These effects were partly mediated by enhanced identity, perceived control, support from friends and from family, and self-efficacy when faced with psychological barriers.[30] Generally, the intervention group evaluated the programme and its effects on own physical activity attitudes and behaviours positively (table 1). A higher proportion of persons with low education, non-Western origin, and high BMI reported a more positive attitude toward physical activity and perceived support for being physically active from people close to them, as compared to their counterparts.

DISCUSSION

We observed a net increase in physical activity corresponding to 25% relative reduction in the proportion of inactive people in the intervention district compared to a 5% reduction in the control district. The net proportion with an increase in body mass was reduced by 50%. The changes in body weight were most pronounced in subgroups at highest risk of type 2 diabetes (men, participants >50 years, those with low education and non-western immigrants). Overall, high proportions of inactive subjects, subjects with low education or high BMI were reached by or participated in the intervention activities. Aside from the observed effectiveness of the total intervention package in generating forward transition in stages of change, the walking and aerobic exercise groups, the "Walk the stairs"-poster, and the walk path proved particularly effective. Such forward transition was mediated by a positive change in peoples` identification as being physically active, in their perception of physical activity as personally

controllable and in their perceived physical activity support from friends and family. Generally, the target group, including subgroups usually considered hard to reach in health promotion,[8 24 35] evaluated the project and its effects positively.

Reviews of community-based physical activity interventions reveal few controlled studies of similar duration reporting positive results.[8 24 35] To our knowledge, no other comparable community-based study has reported a similar net increase in physical activity and relative protection against the trend of increasing body mass, consistent across the most susceptible subgroups targeted. Our results can be evaluated against the US Healthy People 2010 goals of reducing the inactive proportion from 40% in 2000 to 20% ten years later, achieving nearly 50% of this target in the intervention district in three years.[35]

Restricting the main focus of the intervention to change physical activity may have made the intervention sufficiently intense to result in behavioural change at the community level, even with the limited resources available. The physical activity groups still meet, more than five years after the project period. The groups now consist of both original study participants and newcomers. We have also noted a more positive media coverage of the intervention district, and the project has led directly or indirectly to several new initiatives in the nearby districts to promote physical activity. The project may have strengthened the collective self-efficacy, social capital and sense of cohesion in the district,[42] factors also having the potential to improve health. Furthermore, the project has increased awareness of unfavourable trends for obesity, inactivity and type 2 diabetes in Norway.[43-44] Intervention findings have influenced national policies on tackling the social gradient in health and strategies to promote physical activity.[43-46]

The main strengths include a pseudo-experimental design, a theoretically informed multilevel intervention programme, an extended intervention period, the measurement of mediating mechanisms and of additional health outcome parameters. Although successful promotion of physical activity has a greater potential to improve health in populations with high risk, such a task is nevertheless recognized as more challenging in groups with low socioeconomic status.[8 24 35]

The main limitations of the study, discussed in detail elsewhere,[25-31] include the non-randomized design, although a reasonable approach in community interventions,[47] and the risk of selection biases, although only minor baseline differences between the attendees and non-attendees were observed.[25-26] In an urban population with high mobility, we achieved a re-attendance rate of 67% in both districts. Despite a slight re-attendance selection of healthier and better-off participants in the control district, the main results were robust when

adjusting for these differences.[27] However, lower follow-up response rate to Q2 and Q3 by non-Western people indicates that one must still be cautious in terms of generalizing mediation and subjective evaluation results to the non-Western population.[29] Our data on physical activity, although validated[48-49], are based on self-reports.[50] Misclassification attenuates true effect measurements, and "contamination" in the control district may well have occurred.[51] Several of these factors indicate that the observed effect on physical activity is likely to be an underestimate.

Our data provide the following direction for clinicians aiming to stimulate increased physical activity. First, a theoretically informed multilevel and targeted intervention combining a community- and high risk approach to promote physical activity has merit. Second, people with low levels of education and ethnic minority groups have the capacity to adopt physical activity behaviours provided a culturally sensitive intervention that change their psychological readiness for physical activity. Third, in order to be successful it seems decisive that intervention efforts are developed and implemented in tight partnership between researchers and empowered local people to promote local ownership to intervention efforts. Forth, clinicians should continue to advocate for health promotion in disadvantaged areas to be part of a broad national policy to reduce the social gradient in health.[42 47]

In conclusion, results suggest the intervention stimulated increased physical activity, reduced weight gain and beneficially influenced other CVD risk factors, not least for people with low education and non-westerners. Intervention components proved to be particularly effective were identified, as well as selected psychosocial processes operating between intervention and successful behaviour change.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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FIGURE LEGENDS

Figure 1 Main intervention components* and their exposure time in relation to the health surveys.

Footnote

* Information activities (light grey), physical activity groups (medium grey), structural activities (dark grey), individual counselling (black)
** A leaflet with stage-specific information to promote physical activity sent to all family units
$ Prescription of physical activity by local GPs
# Weekly physical activity in Norwegian classes for non-western immigrants
§ Fitness test offered twice a year - early May and late September

Figure 2 Change in physical activity from baseline to follow-up, intervention versus control district by two ordinal measures. Net differences between districts in change were tested by Mann-Whitney: the heavy physical activity measure (no activity or hours/week, p=0.008) and the stages of change variable, stages 1-5 (1-2: inactive, 3: active, but not regularly, 4: regularly active, but only recently, 5: regularly active >6 months, p=0.024).

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Figure 3 Net change (difference between changes in the intervention and control district) overall and in subgroups, in body mass (proportion with increase), cholesterol/HDL-cholesterol ratio, triglycerides and glucose. Changes in body mass were assessed in categories; gain (>2 kg), stable, or loss (>2 kg), and the proportion with reduction was subtracted from the proportion with increase. The net difference between districts in this ordinal change variable was tested by Mann-Whitney. *=p<0.01. The non-fasting blood samples were adjusted for time since last meal both at baseline and follow-up (ANOVA), and net change by multiple regression analyses. Net changes with 95% confidence intervals are given.

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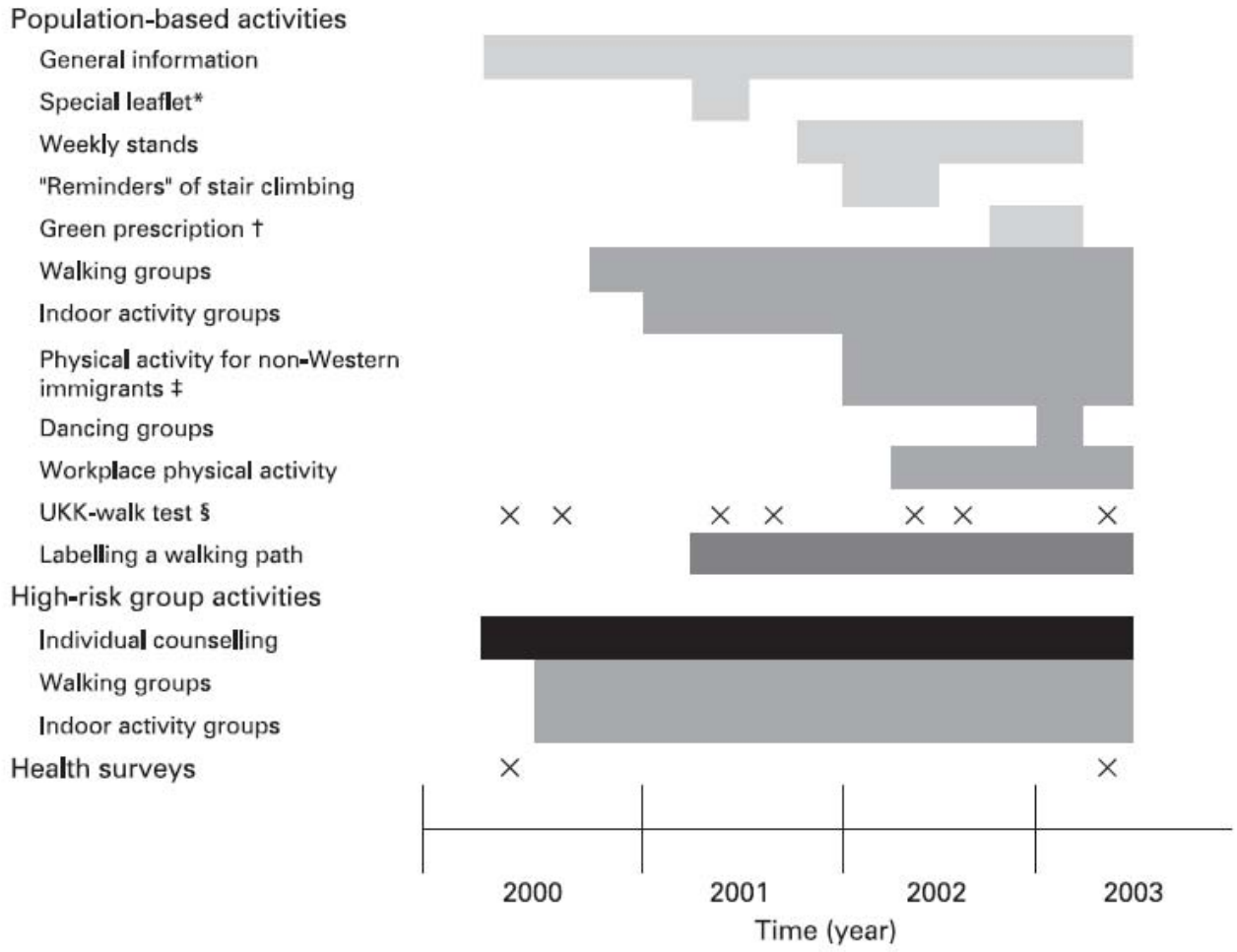
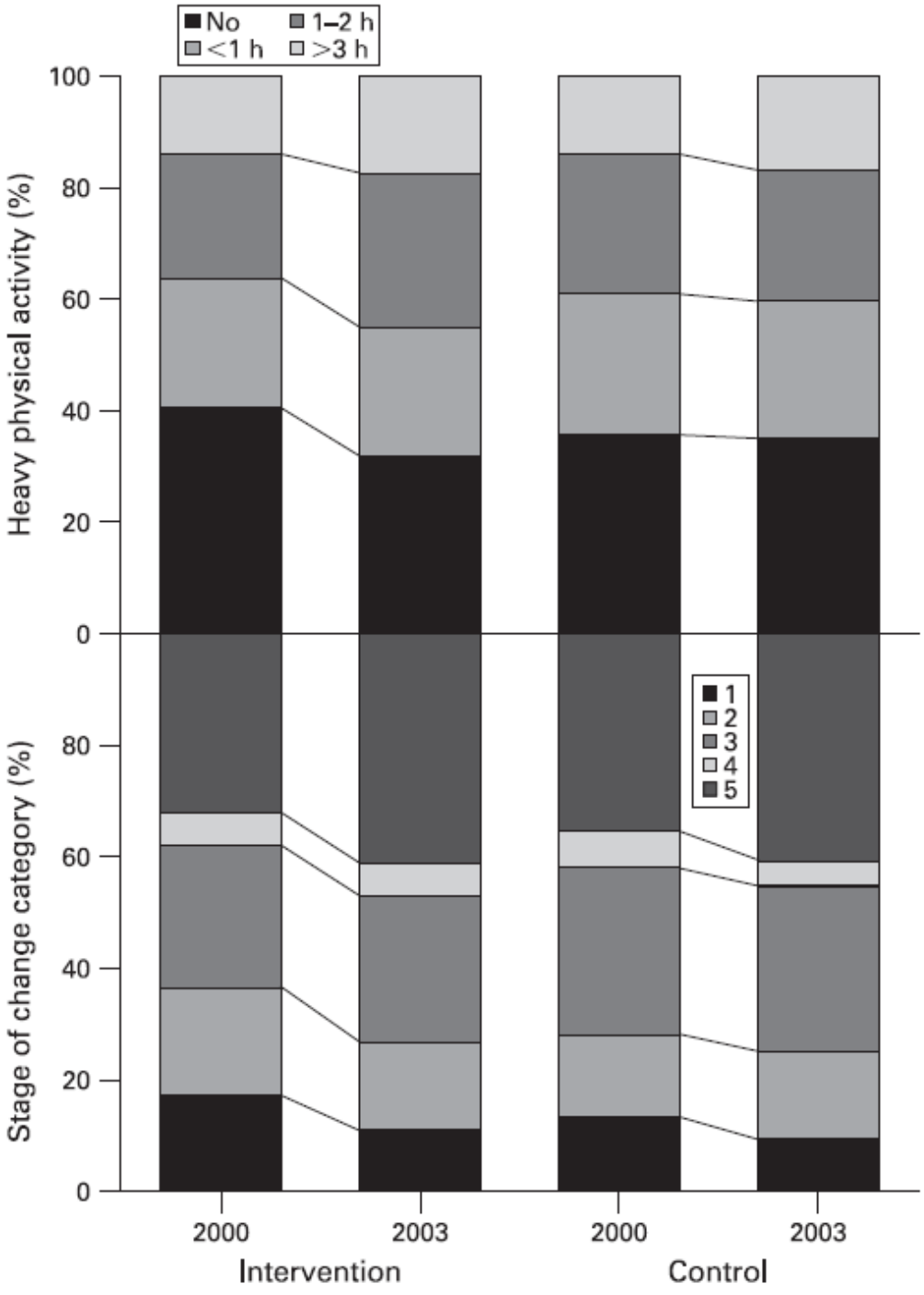
Figure 1 Main intervention components and their exposure time in relation to the health surveys. Information activities (light grey), physical activity groups (medium grey), structural activities (dark grey), individual counselling (black). * A leaflet with stage-specific information to promote physical activity sent to all family units. † Prescription of physical activity by local GPs. ‡ Weekly physical activity in Norwegian classes for non-western immigrants. § Fitness test offered twice a year — early May and late September.





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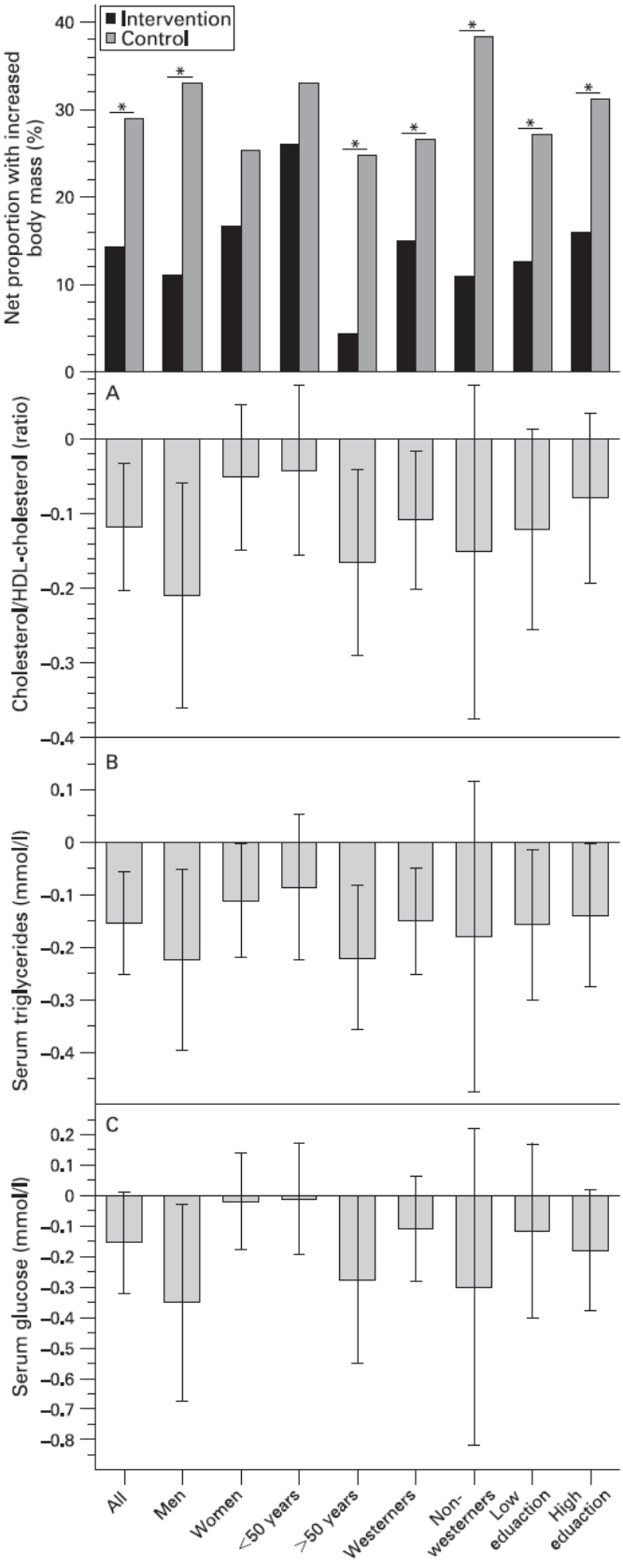

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*p,0.01. The non-fasting blood samples were adjusted for time since last meal both at baseline and follow-up (ANOVA) and net change by multiple regression analyses. Net changes with 95% confidence intervals are given. Printed with permission from Diabetes Care.

Table 1. Subjective evaluation of the project and its effects by the whole sample and baseline subgroups. Values are shown in percentages of yes.

	Whole sample n= 556-598	Women n= 347	Men n= 256	≤ 50 years n= 262	> 50 years n= 341	Western n= 550	Non-Western n= 53	Low education n= 295	High education n= 303	Low BMI n= 297	High BMI n= 305	Inactive n= 221	Active n= 382
What is your opinion of the project?													
Positive	83.6	84.9	81.8	85.7	82.0	83.9	80.8	78.5**	88.6	84.0	83.4	72.0***	90.2
Has the project changed your view on physical activity?													
Yes, more positive	44.5	45.5	43.1	41.1	47.1	42.4**	66.0	50.0**	39.0	37.0***	51.9	45.6	43.8
Has the project changed your level of physical activity?													
Yes, more physically active	26.3	25.2	27.6	20.0**	31.2	26.3	25.5	29.5	22.6	21.3**	31.3	26.0	26.4
Do you talk more about physical activity with others as a result of the project?	47.8	49.4	45.7	41.6**	52.8	48.1	45.1	53.2**	42.2	41.9**	53.7	44.9	49.5
Do you perceive more support for being physically active from those nearest to you as a result of the project?	30.6	32.0	28.8	25.7*	34.5	29.4*	43.5	38.6***	22.9	25.2**	35.9	29.9	30.9
Have people in your community become more positive to physical activity as a result of the project?	57.8	63.5**	50.2	53.1*	61.6	59.2*	42.9	60.4	55.8	56.7	59.2	55.9	58.9
Have people in your community become more physically active as a result of the project?	51.7	56.4*	45.5	45.9*	56.4	53.0*	38.0	55.1	48.8	49.1	54.1	49.3	53.1

* = p<.05, ** = p<.01, *** = p<.001

Education and BMI are dichotomized by their median values (12 years and 26.3 kg/m², respectively).