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Author(s): Kaasalainen, Karoliina; Kasila, Kirsti; Komulainen, Jyrki; Malvela, Miia; Poskiparta, Marita

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1 **Changes in psychosocial factors and physical activity among Finnish working-aged men in the**
2 **Adventures of Joe Finn Campaign**

3
4 Karoliina Kaasalainen^{1*}, Kirsti Kasila¹, Jyrki Komulainen², Miia Malvela², Marita Poskiparta¹

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6 ¹ Faculty of Sport and Health Sciences. University of Jyväskylä, P.O.Box 35 (L) FI-40014, Jyväskylä, Finland.

7 ² Fit for Life- Program, LIKES Foundation for Promotion of Physical Activity and Public Health, Lutakonaukio
8 1, 40100 Jyväskylä, Finland.

9 *Corresponding author, Email: karoliina.s.kaasalainen@student.jyu.fi

10

11 **Author's contribution**

12 The corresponding author analyzed the data and wrote the manuscript. Jyrki Komulainen (JK), Miia Malvela
13 (MM), Kirsti Kasila (KK) and Marita Poskiparta (MP) contributed to the study design, data collection and
14 critical review of draft manuscripts. All the authors read and approved the final manuscript.

15

16

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28 ABSTRACT

29 This study evaluated changes in psychosocial factors and self-reported physical activity (PA) among the
30 sample of Finnish men who underwent the fitness tests during the national health campaign. Another aim
31 was to examine whether the fitness test feedback was a meaningful experience for PA change. Baseline data
32 were collected in 2011 by fitness test and questionnaire. Men who had low/moderate fitness along with
33 overweight (n=361) were recruited to the post-campaign study in 2014. Data were analyzed with non-
34 parametric tests, logistic regression analysis and content analysis. The post-campaign survey was completed
35 by 102 men. Positive PA change was associated with high goals, planning skills and self-efficacy for PA. One
36 fourth of men recalled that they had surprisingly poor fitness at baseline. This experience was not related to
37 positive PA change. A fitness test may awake motivation but promotion of self-efficacy and self-regulatory
38 skills are needed to support concrete behavior change.

39 **Keywords:** physical activity, psychosocial factors, health campaign, men, health behavior change

40

41 BACKGROUND**42 Physical activity and psychosocial factors**

43 Physical activity (PA) and healthy diet are among the most important modifiable risk factors for non-
44 communicable diseases ¹. PA correlates with sociodemographic (e.g. age, gender, education), psychosocial
45 (e.g. knowledge, intention, self-regulation skills, self-efficacy) and environmental factors ². Among the
46 psychosocial factors, knowledge is assumed to increase perceived need and intentions to adopt a physically
47 active lifestyle ³. However, neither knowledge nor intention are sufficient predictors of PA ⁴. Self-efficacy and
48 self-regulatory skills are more proximal determinants of behavior change ^{5,6}. Self-efficacy refers to a person's
49 self-rated ability to adhere to a desired behavior ⁷⁻⁹, while self-regulatory skills help to actualize behavioral
50 intentions. These skills comprise goal setting, action planning, self-monitoring and self-reinforcement ^{10,11}.
51 Self-efficacy can be promoted by providing social support, appropriate role models, personal encouragement
52 and positive feedback ^{12,13}. Self-regulatory skills promote PA, but behavior is not influenced solely by rational
53 decision-making. Habitual and emotional factors also affect PA ^{14,15}. Social factors (i.e. support, norms, role

54 models) interact with personal determinants of PA. Changes in social norms have predicted changes in
55 individuals' intentions and behavior¹⁶. Still, contextual and cultural factors often continue to be neglected in
56 health behavior interventions^{2,16-18}.

57 Men have been less receptive to public health messages and more reluctant to participate in
58 health programs than women¹⁸⁻²¹. Masculine culture has been associated with ideals that contradict health-
59 promoting behaviors^{21,22}. For example, despite personal health risks, men more often than women perceive
60 no need for health behavior change^{21,23,24}. While the benefits of PA are well-known, and PA is socially
61 accepted behavior among men, they tend to overestimate their state of health and physical fitness²⁵⁻²⁹.
62 Misperceptions can attenuate intentions to change health behaviors^{23,24,27}. However, male health norms are
63 also changing, giving rise to differences between sub-groups of men^{3,21,30,31}. It has been proposed that once
64 men decide to participate in a health program, they tend to achieve good outcomes^{32,33}. Men's primary
65 motives for participation in PA programs have been a desire to lose weight, gain good fitness for valued
66 activities, be a healthier role model for the family, and to perform better at work^{32,34}. In contrast, major
67 barriers to PA have been lack of perceived need and motivation, poor social opportunities and lack of time
68³⁵⁻³⁷. Commitment to healthy lifestyle can be strengthened by recognizing men's needs and preferences in
69 intervention design.

70

71 **Promoting health behavior changes among men**

72 Social marketing is one potential strategy to promote desired health behaviors among hard-to-reach groups
73^{2,38}. A special feature of social marketing is that it aims to influence behavior change by presenting the target
74 behavior attractively and emphasizing the minimal cost of behavior change^{39,40}. Thus, a key element in social
75 marketing is getting people to voluntarily adopt a behavior. Successful marketing is based on careful
76 formative research, target group segmentation, constructing a marketing mix (product, price, place and
77 promotion) and evaluation of the forces competing with behavior change³⁹. Social marketing is not a theory
78 but rather a planning framework for health campaigns. However, theories exist that may be helpful in
79 understanding target group behavior^{39,40}. This study applied the Health Action Process Approach (HAPA)

80 model ⁸. HAPA is a dual-phase model that explains behavioral change by reference to motivational and
81 volitional processes ⁸. In the motivational phase, risk perceptions, knowledge, positive outcome expectations
82 and action self-efficacy, represent psychosocial factors that promote intention formation. Volitional
83 processes imply autonomous motivation and efforts to turn intention into action. For behavior maintenance
84 in the volitional phase, self-regulatory skills and self-efficacy are of major importance. The HAPA model
85 suggests further that social support and barriers are moderators of intention formation and action ⁸.

86 Effective PA promotion strategies take into account the most relevant determinants of PA ³⁸.
87 However, evidence on the effectiveness of social marketing campaigns is conflicting ⁴¹⁻⁴³. One reason for
88 inconsistencies in results may be that campaign strategies have strongly relied on mass media
89 communication. A recent meta-analysis indicated that while mass media campaigns have induced moderate
90 change in PA knowledge, intentions and behavior, their long-term effects have been mixed ^{38,42,44}. Knowledge
91 is only a distal promoter of behavioral change ⁴⁵. If the goal is to succeed in promoting self-efficacy, self-
92 regulatory skills and long-term PA, mass media communication should be supplemented by other
93 interventions, such as mobilization, community events and interpersonal communication ³⁸.

94

95 **The present study and the Adventures of Joe Finn campaign**

96 The Adventures of Joe Finn (www.suomimies.fi) is a Finnish health campaign for men. The campaign aims to
97 raise awareness of health issues among working-age men and encourage them to look after their health. The
98 campaign was designed on social marketing principles and took a gender-sensitized approach ⁴⁶. The
99 multilevel campaign utilized several media channels (e.g. TV, radio, internet, newspapers, social media) along
100 with a humorous tone and an emphasis on fun. A visible part of the campaign was the Adventures of Joe Finn
101 road tour and fitness test events in local communities. Its purpose was to increase the personal relevance of
102 campaign messages by free and easy-to-perform fitness tests. Tour events were organized in public
103 marketplaces using a mobile fitness test laboratory. Each fitness test participant received a personal feedback
104 sheet and engaged in a professional-led feedback session. Testing aside, several campaign partners provided
105 friendly competitions, entertainment activities and information stands in the event venue. The test situation

106 also facilitated meeting other men with similar interests. More detailed description of the campaign has been
107 published elsewhere ^{47,48}.

108 Compared to mass media campaigns in general ³⁸, a strength of the Joe Finn campaign is that
109 it has interactive elements, such as inspirational community events and personalized test feedback. These
110 elements can influence participants' emotions, intentions and action self-efficacy ⁴⁹. Volitional PA changes
111 typically stem from enjoyable experiences, exercising for fun and challenging oneself ⁵⁰. A fitness test is a
112 form of experiential marketing, as participants can personally experience the product ⁵¹. Research suggests
113 that men prefer engagement in programs which include social aspects, practical exercises and a sense of
114 humour, without demanding strict commitment or moralizing about unhealthy behaviors ^{21,52}. These ideas
115 were consistent with the practices adopted in the Adventures of Joe Finn campaign.

116 The rationale for initiating the Adventures of Joe Finn campaign in 2007 was the high
117 prevalence of unhealthy behaviors among men ⁵³. For example, only one-third of Finnish men aged 18-64
118 reach the recommended amount of PA (≥ 150 min moderate-to-vigorous PA/wk ⁵⁴) and 60 % are overweight
119 or obese ⁵⁵. Prevalence of unhealthy behaviors is well-known but the research literature has recommended
120 better identification of behavioral determinants and longitudinal assessment of campaign outcomes among
121 target groups ^{38,56-58}. A previous cross-sectional study indicated that good knowledge, self-efficacy, self-
122 regulatory skills and social support were related to better fitness ^{29,59}. One-fifth of the Adventures of Joe Finn
123 campaign participants had poor fitness, 85% were aware of PA recommendations and 70 % intended to
124 increase their PA level during the next year ^{29,48}. The former study also found that 63 % of low-fit men
125 overestimated their physical fitness ²⁹. Thus far, the baseline characteristics of the participants in the
126 Adventures of Joe Finn campaign have been identified, but not changes in psychosocial factors or PA ^{29,59}.

127 This study focused on evaluating changes in psychosocial factors and self-reported PA among
128 the sample of men who underwent the fitness tests during the 2011 road tour. Another aim was to examine
129 whether the campaign event was a meaningful experience for the participants and an inducement for PA
130 change. It was assumed that inconsistency between perceived and evaluated fitness at baseline would awake
131 motivation for PA change.

132

133 **METHODS**134 **Data collection and fitness tests**

135 Baseline data (n=900) were collected in September 2011 during the Adventures of Joe Finn campaign road
136 tour. Physical fitness was evaluated with the Body Fitness Index (BFI)^{29,60}. The measurements included hand
137 grip strength (Saehan's dynamometer), the Polar OwnIndex Test (Polar Electro, Kempele, Finland) and the
138 InBody 720 body composition analysis. The BFI was calculated from five test variables: body fat (%), visceral
139 fat area (VFA) (cm²), maximal oxygen consumption (VO₂max) (ml/kg/min), skeletal muscle mass (SMM)
140 (kg/m) and hand grip strength (kg/kg)²⁹. The BFI ranges from '-5 to +5'. The men were classified into three
141 BFI groups: low (<-1) (n=163), moderate (≤ 1) (n=363) and high (>1) (n=324). The study was approved by the
142 ethical committee of the University of Jyväskylä and participants gave their written consent at the time of
143 data collection in 2011.

144 Selection of the post-campaign study participants was based on a low BFI²⁹. Those who had a
145 low (<-1) or moderate (<1) BFI, were overweight (Body mass index (BMI)>25 kg/m²) and showed indications
146 of abdominal obesity (VFA>100 cm²) were included in the follow-up group⁴⁸. Seventy-five per cent (n=241)
147 of the men in this group had expressed willingness at baseline to participate in the further research. They
148 were contacted by phone during May-September 2014. A maximum of three phone calls was made to each
149 prospective participant. Finally, 161 men (45%, N=361) were reached. These men were asked to answer an
150 e-mail/postal questionnaire and participate in the forthcoming (2014) road tour fitness tests. The post-
151 campaign questionnaire was completed by 102 participants (28%, N=361). Of these, only 28 participated in
152 the 2014 fitness tests. Therefore, this study evaluated changes in psychosocial factors and self-reported PA
153 only.

154

155 **Self-reported measures**

156 Self-reported PA was used as the measure of overall moderate-to-vigorous PA⁶¹. Participants self-evaluated
157 their level of PA according to 4 response categories (1= over 5 h/week (wk), 2 =3-5 h/wk, 3=1-3 h/wk and 4=

158 1 or 0 h/wk). The final categories used in the statistical analyses were low PA= less than 1h/week, moderate
159 PA= 1-3 h/week and high PA= more than 3h/week. PA included both leisure time and other activities, such
160 as commuting to work on foot or by bicycle. For further analysis, a new variable, measuring PA change, was
161 computed by comparing the 2011 activity categories with those in 2014. Participants who reported a higher
162 category at follow-up than at baseline were assigned to category 1 (Positive PA behavior=1). Those whose
163 activity had fallen to or been maintained at less than 3h/wk were assigned to category 0 (Negative PA
164 behavior=0). All participants who had maintained a high level of activity (PA \geq 3h/wk) were assigned to
165 category 1.

166 Psychosocial factors were evaluated with a 22-item questionnaire⁴⁷. Participants were asked
167 to evaluate on a five-point Likert scale how well each statement described their personal situation. Sum
168 scores were calculated for PA knowledge (Cronbach's α = 0.80), planning skills (Cronbach's α = 0.62), social
169 support (Cronbach's α = 0.78), goal setting (Cronbach's α = 0.70) and self-efficacy (Cronbach's α = 0.81). The
170 validity of the sum scores used here has been described elsewhere^{29,59}. The sum score for planning skills
171 showed the lowest Cronbach's alpha. The alpha was below 0.70, but it is likely that it was negatively
172 influenced by the low number of items⁶². For all the sum scores, the items were computed in reverse order
173 (0= don't know, 1=strongly disagree – 4= strongly agree). Both "planning skills" and "goal setting" referred
174 to self-regulatory skills; however, owing to different factor loadings they were analyzed separately. Some
175 items did not load on any factor⁵⁹. In the descriptive analyses, these items were labeled "beliefs" and
176 excluded from the sum scores. For further analysis, new variables measuring changes in psychosocial factors
177 (2011-2014) were computed. A higher score in 2014 indicated positive change and these values were recoded
178 as "positive change".

179 Readiness for PA change was elicited with the question "Have you increased your PA during
180 the past year?" (1 = No, and I have no intention to change, 2= No, but I intend to change in the near future,
181 3 = I have tried to change, 4 = I have made some changes, and 5= I have been permanently active"). In the
182 further analyses, the responses were classified into two phase-of-change categories: 0 =intention (stages 1-
183 3) and 1 = action (stages 4-5).

184 The post-campaign questionnaire comprised a single item: “Have you changed your physical
185 activity behavior during the past year?” Response alternatives were yes/no. Those answering yes were asked
186 to describe changes in an open-ended question. Finally, participants’ recall of meaningful experiences in the
187 campaign event at baseline was elicited by an open-ended question: “*What is the most meaningful thing that*
188 *you can remember from the campaign fitness test event (2011)?*”

189 Data were analyzed with IBM SPSS statistics 20.0. Descriptive statistics and differences
190 between participants were examined with cross tabulations and nonparametric tests (Kruskall-Wallis, Mann-
191 Whitney’s test and Wilcoxon’s signed rank test). The same methods were used to examine differences in
192 baseline and post-campaign values for psychosocial factors between and within the PA groups. Significances
193 ($p<0.05$) and medians with interquartile range (IQR) were reported for group differences. Bonferroni
194 corrections for the alpha level were applied when presenting results for multiple comparisons (Kruskall-
195 Wallis test). At baseline, the proportion of missing questionnaire data was less than 2%. Missing values (N=1)
196 for psychosocial factors were assigned to the same category as the “don’t know” responses.

197 The open-ended question was analyzed by reviewing all the answers (N=100) and classifying
198 these into two categories. The first category comprised answers where the respondent’s most meaningful
199 memory was that his fitness test result in 2011 was poorer than expected (e.g. “My muscular fitness was
200 surprisingly poor though I expected it to be OK”). Memories related to more general factors (e.g. “nice
201 atmosphere”, “interesting tests”, “fitness tests in general”) were assigned to the second category. The
202 likelihood of reporting change (positive or negative) in PA was examined with logistic regression analysis. The
203 results were reported as odds ratios (OR) and 95 % confidence intervals (CI). Associations between
204 meaningful memories and positive changes in PA and psychosocial factors were examined with chi-square
205 test.

206

207 **RESULTS**

208 The majority of the follow-up respondents (N=102) were age 50 (M_{age} 49.7 SD 11.1, range 23-68 years),
209 employed (77%), living with a partner (75%) and did not have a university degree (65%). Dropout analysis

210 indicated that neither baseline PA, self-reported physical fitness nor phase of change differentiated post-
 211 campaign survey responders from non-responders. Twenty-five percent of both groups were inactive
 212 (PA<1h/week) and 65% were in the intention phase of PA change. However, the post-campaign participants
 213 were older (M_{age} 45.7 vs. 49.7, $p<0.05$), scored higher on planning skills ($M=2.92$ ($SD=0.90$) vs. 3.12 (0.74,
 214 $p<0.05$) and reported more social support at baseline than non-participants ($M=2.93$ ($SD=0.91$) vs. 3.21
 215 (0.70), $p<0.05$).

216

217 **Changes in self-reported physical activity**

218 At baseline, one-fourth ($n=26$) of the men were in the lowest (PA<1h/wk), one-half ($n=50$; 50%) in the
 219 moderate (PA 1-3h/wk) and 25% in the highest (PA>3h/wk) PA category. The least active men reported more
 220 chronic diseases at follow-up than those in the moderate and highly active groups (44, 10 and 19 %,
 221 respectively $\chi^2=9.74(2)$, $p=0.008$). More than one-half ($n=16$, 64 %) of the least active (PA<1h/wk) men
 222 increased their PA to the next level (PA \geq 1-3h/wk) ($\Delta M_{PA}=0.72$, range [1-3], $Z=-3.82$, $p<0.001$). Only five men
 223 (8%) in the moderate and 10 (38%) in the high PA group had reduced their PA ($\Delta M_{PA}=-0.77$, range [-1, 3], $Z=-$
 224 3.34, $p<0.001$). However, no change was observed in median activity or the overall proportion of men who
 225 engaged in PA at least 3 hours/week.

226

227 **Psychosocial factors at baseline and post-campaign**

228 All participants (100 %) had good general knowledge on the health benefits of PA (Table 1). More than one-
 229 third (36%) reported no source of social support and most of the changes in sum scores were in the self-
 230 efficacy items. The proportion of men who were confident of their ability to exercise when in a bad mood,
 231 without social encouragement or after a break had increased. Changes also occurred in social support and
 232 other PA-related beliefs. A greater proportion of the participants in 2014 reported receiving support for PA
 233 from close people (82 vs. 94%), exercised sufficiently (35 vs. 51%) and had good exercise skills (78 vs. 86%).

234 (Insert Table 1 here)

235

236 Differences in psychosocial factors between physical activity groups

237 The Kruskal-Wallis test revealed that those who were highly active (PA>3h/wk) at baseline reported higher
238 self-efficacy in 2011 than the other PA groups (Z=13.24, p=0.001) (Table 2). Post-campaign scores for social
239 support (Z=8.08, p=0.018) and self-efficacy (Z=6.76, p=0.034) were also higher in the highly than least active
240 men (PA<1h/wk). Those who were highly active at follow-up reported higher goals (Z=19.22, p<0.001) and
241 self-efficacy (Z=8.76, p=0.013) in both 2011 and 2014 (Self-efficacy 2014: Z=9.94, p=0.007; Goal setting 2014:
242 Z=14.17, df=2, p<0.001) than those in the other two PA groups.

243 (Insert Table 2 here)

244

245 Differences in psychosocial factors within the physical activity groups

246 Social support increased among those who were highly active at baseline (Z=-2.24, p=0.036). Self-efficacy
247 also increased between baseline and follow-up in the highly active (Z=-2.10, p=0.036) but not in the other
248 two PA groups. Goal-setting scores decreased over time in the low active group (Z=-2.15, p=0.032) (Table 2).

249

250 Changes in physical activity and psychosocial factors

251 The median test revealed that the participants who were in the highest PA group at both measurement times
252 or had adopted a higher activity level (=positive PA behavior) reported higher PA goals at baseline than those
253 who had reduced their PA or remained at a low PA level (Table 3). Positive PA behavior was related to better
254 post-campaign planning skills, goal setting and self-efficacy. Moreover, self-efficacy increased in the positive
255 PA group (Z=-2.05, p=0.041).

256 (Insert Table 3 here)

257

258 Experience of fitness test event and change in PA

259 Classification of the open-ended question revealed that 26 % of men (n=26) reported remembering that their
260 baseline fitness test result in 2011 was poor or surprisingly poor (Table 4). These men were assigned to the
261 category "awakened by poor fitness". The other category was named "various memories". The odds

262 (OR=2.75, 95 % CI=1.03-6.40) for reporting change in PA at follow-up were greater in the “awakened by poor
263 fitness” than “various memories” group. However, only one-half (n=14, 54 %) of the changes reported were
264 a higher level of PA. Neither group showed any associations with increased knowledge, planning skills, goal-
265 setting or self-efficacy. However, social support had increased more often in the “awakened by poor fitness”
266 than “various memories” group.

267 (Insert Table 4 here)

268

269 **DISCUSSION**

270 The study evaluated changes in psychosocial factors and self-reported PA among a sample Finnish men in the
271 Adventures of Joe Finn health campaign. The main finding was that participants who expressed positive
272 changes in PA or maintenance of high activity, reported higher scores for self-efficacy and self-regulatory
273 skills (i.e. planning and goal setting). Another notable result was that self-efficacy increased only among those
274 in the highly active PA group. A third interesting finding was that over one-fourth of participants recalled
275 being surprised that their fitness rating was so poor four years earlier. This experience was not related to
276 positive PA change although the number of the least active men (PA<1h/wk) decreased among the
277 participating men.

278 A previous Joe Finn cross-sectional study found that the low-fit participants had
279 misperceptions about their physical fitness²⁹. In the present study, no conclusions on changes in physical
280 fitness can be drawn as fitness was not evaluated at follow-up. However, the participants at follow-up should
281 have been aware of their fitness, and recognize the need for health behavior change. As a reference to that,
282 all the men reported high awareness of the benefits of PA, and most participants at baseline expressed
283 intentions to change their level of PA. Nevertheless 60 % remained on or regressed to a PA level below PA
284 recommendations (1-3 hours a week or less). Moreover, participants who were “awakened by poor fitness”
285 did not report positive changes in PA, knowledge, self-regulatory skills or self-efficacy.

286 Increased awareness may not help to increase PA if one does not have sufficient social
287 support, self-regulatory skills and self-efficacy^{11,12}. Those who reported positive PA change showed higher

288 levels in the aforementioned psychosocial factors. One explanation for the minor changes in PA may be
289 related to tiredness and health problems. The low-active men reported more adverse health conditions at
290 follow-up than those in the higher PA groups. Given that the descriptive analysis revealed no change in
291 exercise self-efficacy when feeling tired or being busy, better understanding the sources of low self-efficacy
292 would promote PA change among less active participants. Previous reports suggest that self-efficacy interacts
293 differently with goal setting at the beginning of a new behavior than during the maintenance of that behavior
294 ^{63,64}. This may explain the finding that although more than half of the least-active men increased their PA,
295 their self-efficacy did not change. Furthermore, the qualitative analysis indicated that goal setting did not
296 increase as a result of the awakening feedback by the test. It is, however, likely that while the test feedback
297 gave personally relevant information for goal setting, it may not have been a sufficient incentive for long-
298 term PA change.

299 Social environment seemed to be a factor encouraging PA among the post-campaign
300 participants. Perceived social support also improved among those who were awakened by poor fitness at
301 baseline. Social factors are previously considered as mediators of change ⁶⁵. Therefore, enabling access to PA
302 groups and providing self-monitoring tools may facilitate PA change later on. Tips for goal setting, self-
303 monitoring and different PA activities are freely available on the Joe Finn Campaign websites
304 (www.suomimies.fi), so the participants should have been able to make use of these resources. Again, self-
305 monitoring without regular feedback and accountability to other people seemed not to promote self-efficacy,
306 and hence behavioral change ⁶⁶.

307 Importance of self-efficacy and self-regulatory skills for PA change has been proven in previous
308 studies ^{12,13}. Understanding on the effectiveness of campaigns, to promote sustained changes in these
309 factors, is still poor ^{42,44}. The present results suggest that the campaign has reached its goal of increasing
310 men's awareness of their need to improve low physical fitness. However, the evidence on impacts to
311 behavioral changes remained unclear. As previous research suggests, to go beyond awareness and cognitions
312 and induce people to change their behavior, other interventions than mass media communication and stand-
313 alone interventions are needed ^{18,44}. Later contact with professionals or post-campaign peer support would

314 be beneficial⁶⁷. Local partners, such as workplaces, sport clubs and peer groups that provide easy access to
315 PA services may encourage low-active individuals to commit to permanent behavioral change. Where
316 barriers to PA among inactive men are related to health problems, co-operation with occupational health
317 services and health associations is also important. To increase utilization of campaign materials and
318 resources, there may be a need to re-target communication both at fitness test events, communities and in
319 the mass media. The present results suggest that further interventions would be needed to enable
320 continuous support for behavior changes. Technology-based interventions have been well-accepted among
321 men⁶⁸, so for example, “The Adventures of Joe Finn”-mobile app could be a convenient and cost-effective
322 way to deliver long-term support after a fitness test.

323 The study has its limitations. First, the group sizes were small due to the high dropout rate
324 during the follow-up recruitment phase. Less than one-third (28%) of potential respondents completed the
325 post-campaign survey. Younger men, especially, and those with low skills or low social support tended to
326 decline participation. The challenges of recruiting men for the follow-up showed that a road tour may reach
327 most men only once. Participants were likely to represent the most health-conscious segment of the target
328 population. Social norms, life situation or negative PA history may have reduced willingness to engage in the
329 follow-up study. Low fitness can reduce self-efficacy and willingness to engage in public PA events^{67,69,70}.
330 According to Thøgersen-Ntoumani (2015), fitter persons are more likely to adhere to exercise programs and
331 be intrinsically motivated to engage in PA⁷¹.

332 A second limitation is that objectively measured physical fitness could not be used as an
333 outcome variable. Only a few men completed the post-campaign questionnaire and fitness tests (n=28).
334 Therefore, the outcome variable was self-reported PA. This may increase risk for misclassification and bias.
335 A recent study found that men tended to overestimate their PA in self-reports, especially when PA is socially
336 valued⁷². The present study used self-reported categorical measures of PA. Many of the statistical analyses
337 were also descriptive in nature and focused on mean rank comparisons. In future, more accurate and
338 objective measures are needed.

339 A third reliability issue concerns the evaluation of psychosocial factors. The psychometric
340 properties of the scales used were examined in a previous study⁵⁹. However, the test-re-test reliability of
341 these scores has not been evaluated. Knowledge on the sensitivity of the measures to detect changes over
342 time is lacking. A fourth issue is the long interval between the fitness tests and post-campaign survey. This
343 may have decreased interest in participation. Post-baseline personal reminders would likely have increased
344 recall to the post-campaign study. On the other hand, issuing reminders would have confounded the
345 naturalistic setting.

346 Unlike in this study, most campaign studies have evaluated behavioral changes soon after
347 intervention end⁷³. A common problem in behavioral change interventions is that participants tend to
348 regress to baseline behaviors when the program ends⁷⁴. This study examined changes in psychosocial factors
349 and self-reported PA over four years. However, it is possible that, men, in particular those awakened by poor
350 fitness, have implemented some changes soon after the baseline feedback. Due to lack of regular follow-up,
351 the study cannot evaluate relapses or fluctuations in behavior changes. This emphasizes the need for long-
352 term observational studies of natural PA change and within-person change¹⁵. A comprehensive qualitative
353 study would increase understanding on personal barriers to PA and motivators of PA among men.

354

355 **Conclusions**

356 The low-active men increased their activity level over time but the proportion of highly active men did not
357 change. High baseline PA goals, post-campaign self-regulatory skills and self-efficacy were related to positive
358 change in PA. Men who remembered being surprised at baseline by their poor fitness test results were likely
359 to report changes in PA; however, increased awareness was not related to positive PA change or to greater
360 effort in PA planning and goal-setting. The results suggest that future campaigns should emphasize strategies
361 that promote self-efficacy and self-regulatory skills. However, it remained unclear to what extent one-time
362 participation in a fitness test can influence later PA and fitness. Public fitness test events can be one way to
363 facilitate social marketing and provide peer support for inactive men. Further research with objective
364 measures and more representative samples is needed to evaluate campaign effects on fitness outcomes.

365

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535
 536 **Table 1. Psychosocial factors at baseline (2011) and post-campaign (2014).**

	2011# (%) n=102	2014\$ (%) n=102
Knowledge	Agree/Strongly agree	
I know the health benefits of PA	99	100
I know how often I should exercise	96	96
I know how many hours in a week I should exercise	90	91
I know the intensity at which I should exercise	78	78
I know where I can get social support for exercise	68	64
Goal setting		
I have set goals for exercise	59	57
I can achieve my exercise goals	75	69
Planning skills		
I can seek different exercise alternatives	80	79
I have found an agreeable way to exercise	82	86
Social support		
People close to me support my PA	82	94*
People close to me have a high regard for PA	88	86
Self-efficacy		
I am able to exercise when I am tired	49	50
I am able to exercise when I am bad tempered	63	83*
I am able to exercise when I am busy	43	43
I am able to exercise although people close to me do not highly regard PA	86	91*
I am able to restart exercise after an inactive period	89	94*
Beliefs		
I have a high regard for PA	97	99
I have good exercise skills	78	86*
I exercise sufficiently	35	51*
I have sought information on exercise	60	63
I have good possibilities to exercise	94	90
I believe that by being active I can contribute to the PA of people close to me	80	81

537 *Wilcoxon's -test: Statistically significant increase in median scores between 2011 and 2014, $p < 0.05$. Bolded text indicates statistical
 538 significance. #Cronbach's α 2011 (N=102): knowledge (Cronbach's $\alpha = 0.79$), planning skills (Cronbach's $\alpha = 0.75$), social support
 539 (Cronbach's $\alpha = 0.82$), goal setting (Cronbach's $\alpha = 0.83$) and self-efficacy (Cronbach's $\alpha = 0.86$). \$Cronbach's α 2014 (N=102):
 540 knowledge (Cronbach's $\alpha = 0.77$), planning skills (Cronbach's $\alpha = 0.40$), social support (Cronbach's $\alpha = 0.53$), goal setting (Cronbach's
 541 $\alpha = 0.78$) and self-efficacy (Cronbach's $\alpha = 0.79$).
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546 **Table 2. Differences in self-reported physical fitness and psychosocial factors at baseline and post-**
 547 **campaign (N=102).**

Psychosocial factors	Physical Activity 2011			post-hoc [§]	Physical Activity 2014			post-hoc [§]
	Low (n=26)	Mod (n=50)	High (n=26)		Low (n=16)	Mod (n=61)	High (n=26)	
2011	Median (IQR)	Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)	Median (IQR)	
Knowledge	3.0 (0.8)	3.2 (0.5)	3.2 (0.6)	-	3.0 (1.1)	3.2 (0.4)	3.2 (0.6)	-
Planning skills	2.8 (0.5)	3.0 (0.5)	3.5 (1.0)	-	3.0 (1.0)	3.0 (0.5)	3.5 (1.0)	-
Social support	3.0 (0.9)	3.0 (1.0)	3.0 (1.0)	-	3.0 (1.0)	3.5 (1.0)	3.0 (0.6)	-
Goal setting	2.5 (1.0)	3.0 (1.0)	3.0 (1.5)	-	3.0 (0.5)	3.0 (1.0)	3.3 (1.5)	L<H&M<H
Self-efficacy	2.6 (0.6)	2.8 (0.8)	3.0 (0.8)	L<H&M<H	2.5 (0.8)	2.8 (0.6)	3.2 (1.1)	L<H&M<H
2014								
Knowledge	3.2 (0.8)	3.2 (0.7)	3.4 (0.7)	-	3.3 (0.8)	3.2 (0.6)	3.1 (0.9)	-
Planning skills	3.0 (1.0)	3.0 (0.5)	3.5 (1.0)	-	2.5 (1.5)	3.0 (0.5)	3.5 (1.0)	-
Social support	3.0 (1.0)	3.5 (0.6)	3.5 (1.0)	L<H	2.8 (0.5)	3.5 (1.0)	3.5 (1.0)	-
Goal setting	2.0 (2.0)	3.0 (0.5)	3.0 (1.0)	-	2.0 (1.4)	2.5 (0.5)	3.0 (1.0)	L<H&M<H
Self-efficacy	2.6 (0.7)	2.9 (0.6)	3.0 (0.8)	L<H	2.5 (0.7)	2.8 (0.6)	3.3 (0.6)	L<H

548 [§]Differences tested by Kruskal-Wallis test (between groups), significances adjusted using the Bonferroni error correction.

549 [#]Statistically significant difference within group (p<0.05), Differences tested by Wilcoxon's test.

550

551 **Table 3. Differences in psychosocial factors at baseline and post-campaign between groups of positive**
 552 **and negative PA behavior (N=102).**

	Negative PA behavior (n=62)	Positive PA behavior (n=40)	p-value [§]
	Median (IQR)	Median (IQR)	
Psychosocial factors 2011			
Knowledge	3.2 (0.5)	3.2 (0.5)	0.370
Planning skills	3.0 (0.5)	3.2 (1.5)	0.937
Social support	3.5 (1.5)	3.0 (0.5)	0.401
Goal setting	3.0 (0.5)	3.0 (1.5)	0.032
Self-efficacy	2.8 (0.6)	2.9 (1.0)	0.255
Psychosocial factors 2014			
Knowledge	3.2 (0.6)	3.2 (0.9)	0.693
Planning skills	3.0 (1.0)	3.5 (1.0)	0.025
Social support	3.0 (0.8)	3.5 (0.9)	0.557
Goal setting	2.5 (1.0)	3.0 (1.0)	0.010
Self-efficacy	2.8 (0.6)	3.0 (1.0) [#]	0.018

553 [§]Differences tested by Mann-Whitney's test (Between groups). [#]Statistically significant difference within group (p<0.05), Differences
 554 tested by Wilcoxon's test (2011-2014). Negative PA behavior=those who reduced or maintained their activity over time. Positive PA
 555 behavior =those who reported higher PA group post-campaign than at baseline + those who maintained high activity (PA≥3h/wk)
 556 over time.

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559 **Table 4. Analysis of open-ended question of memorable experiences and PA changes**

<i>"What is the most meaningful thing that you can remember from the campaign fitness test event (2011)?"</i>			
Example of classification the contents of open-ended question	Group		
	Awaken by poor fitness (N=26)	Various memories (N=74)	
"Interesting event"		x	
"My fitness was under average"	x		
"I was surprised at my poor fitness though I regularly engage in everyday activities"	x		
"Nice event"		x	
"My poor fitness"	x		
"Body composition test" (in general)		x	
"Good event, nice feedback"		x	
Positive PA behavior (2011-2014)#	f (%)	f (%)	p-value, χ^2 (df)
Yes	14 (54)	26 (35)	0.085, 2.96 (1)
No	12 (46)	49 (65)	
Total	26 (26)	75 (74)	
Positive changes in psychosocial factors	f (%)	f (%)	
Knowledge (2011-2014)	6 (23)	33 (44)	ns
Social support (2011-2014)	13 (50)	21 (28)	0.041, 4.18 (1)
Planning skills (2011-2014)	12 (46)	23 (30)	ns
Goal-setting (2011-2014)	7 (27)	24 (32)	ns
Self-efficacy (2011-2014)	13 (50)	13 (50)	ns
	OR	ref.	p-value, (95% CI)
Odds ratio (OR) for reporting PA changes [§]	2.57	1.00	0.042, (1.03-6.39)
Odds ratio (OR) for reporting positive PA behavior [#]	2.20	1.00	0.088, (0.89-5.44)

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#Positive PA behavior =those who reported higher PA group post-campaign than at baseline + those who maintained high activity (PA \geq 3h/wk) over time. §=Self-reported PA changes including both negative and positive changes, ns=non-significant. ref.=reference category.

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