BMJ Open

Self-Perceived Health and Quality of Life; - a one year follow-up study among new beginner exercisers in a fitness club setting

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-036250
Article Type:	Original research
Date Submitted by the Author:	11-Dec-2019
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Keywords:	SPORTS MEDICINE, PUBLIC HEALTH, MENTAL HEALTH

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Self-Perceived Health and Quality of Life;

- a one year follow-up study among new beginner exercisers

in a fitness club setting

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ABSTRACT

Objectives: It is growing interest for assessment of physical activity on modification of Self-Perceived Health (SPH) and Quality of life (QoL). This study investigated SPH and QoL at onset and after three, six and 12 months of fitness club membership. Also, we compared SPH and QoL between those who reported regular use of the fitness club (≥ two exercise sessions/week the last month) with those who did not (one exercise session/week, or no exercise the last month).

Methods: In total, 250 newly registered fitness club members (equal numbers of men and women, mean age = 36.4±11.3 years, mean BMI = 25.7± 4.4) were recruited. At onset of fitness club membership (n=250), and after three (n=225), six (n=213) and 12 months (n=187), the participants answered an electronic questionnaire, covering background variables, exercise involvement, perceived SPH and QoL. SPH was measured by a single item question, rating health status from poor to excellent on a five-point scale. High SPH was dichotomized as excellent or good, and low SPH as moderate, fair or poor. QoL was measured on a 7-item scale, rating five statements and dichotomized according to a total max sum score of 35, with low QoL ≤ 25 and high QoL >25. Chi-square analysis, Mc Nemars test, Cochrans Q, paired sample t-test, one way-repeated measures ANOVA and regression analysis was used as appropriate.

Results: At onset, most (66.4%) of the participants rated their SPH as high, whereas the opposite was found for QoL (35.2%). Throughout the initial year of fitness club membership, repeated measurements did not show any changes in SPH. In QoL, we observed an improvement in QoL sum score and a significant increase in mean scores for two out of five statements at 12 months follow-up: "*In most ways my life is close to my ideal*" (p=0.036) and "*If I could live my life over, I would change almost nothing*" (p=0.000). Reporting regular use of the fitness club was associated with high SPH (OR 3.532 [95% CI 1.60 to 7.82], p=0.002)

and high QoL (OR 1.914 [95% CI 0.95 to 3.86], p=0.069). The results were unchanged after adjusting for confounders.

Conclusions: Regular attendance at a fitness club was associated with high SPH and high QoL at 12 months follow-up.

Keywords: Exercise, Self-Perceived Health, Quality of Life, Fitness clubs.

STRENGHTS AND LIMITATIONS OF THIS STUDY

- The use of a prospective study design with 12 months follow-up.
- Valid and reliable measurement methods.
- The use of an electronic questionnaire based on previously validated surveys.
- Self-reported attendance at the fitness club.

INTRODUCTION

According to the World Health Organization (1), health is not only absence of somatic disease, but also includes mental and social well-being, putting emphasis on the usefulness and need for investigating individuals´ self-perception of overall health (SPH). Several studies have shown that low SPH may be a valid and robust predictor of morbidity and mortality of various diseases (2-5), as well as are associated with being sick-listed and frequent use of health care services (6,7). In different patient groups and among the elderly population, SPH has widely been used to evaluate the effect of health-care programs (8). The measure is a single item question, including rating of health status from poor to excellent on a five-point scale, and as such popular for its simplicity and cost-effectiveness (9).

It is growing interest for assessment of physical activity on modification of SPH, and studies have indicated a strong association between insufficient physical activity and lower SPH in adults, especially in older individuals (10,11). However, it is important to understand SPH not only between physically active and inactive people, but also if this differs between activity contexts and exercise involvement (12).

Quality of life (QoL) has also become an important measurement because it is a meaningful indicator of both mental and physical well-being (13,14), and its positive association with physical activity has been consistently reported in the systematic reviews and meta-analyses 15,16). Although there is limited data, it is suggested that QoL may be a key motivator for regular physical activity and exercise (17), meaning that individuals start and continue to be active because this contributes to their QoL. However, cross-sectional data precludes a conclusion regarding the nature of this association (18).

Throughout the 1990s, a new venue for physical activity and exercise gradually grew in popularity, the fitness clubs. Worldwide, the fitness club industry has about 183 million members and counts more than 210 000 clubs (19). Even though this arena has become a large and growing venue for activity, the scientific knowledge of those that choose to be a member is scant. No study has examined SPH and QoL-status of fitness club members, and changes from onset of fitness club membership to one-year follow-up.

Those who join a fitness club may be initially motivated to exercise, still previous studies have shown a high dropout-rate after only three months (20,21). This shows that maintaining regular exercise can be challenging even for motivated individuals. Thus, the primary aim of the present study was to investigate SPH and QoL at onset and after three, six and 12 months of fitness club membership. Secondary, we wanted to examine if SPH and QoL differed between those who reported regular use of the fitness club (≥ two exercise sessions/week the last month) with those who did not (one exercise session/week, or no exercise the last month).

MATERIALS AND METHODS

Study design and population

The present study was part of a longitudinal prospective study (21,22), aiming to investigate which factors that influence the probability of regularly exercise or exercise drop-out among new fitness club members.

The project was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1443 A), who concluded that, according to the act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The procedures followed the World Medical Association Declaration of Helsinki and was approved by the Norwegian Social Science Data Service (NSD 44135), financed and conducted at the Norwegian School of Sport Sciences (NSSS) (October 2015 - November 2018). No economic compensation was given to the participants.

New members at 25 fitness clubs in Oslo, Norway were contacted by an e-mail invitation. At first contact, the aims and implications of the study were explained, and the eligibility criteria checked. Due to the primary aim of the original study with assessment of VO2 max and one-repetition maximum strength (1RM), inclusion criteria were to be healthy (no chronic serious disease or pathology, i.e. heart disease or severe hypertension) and not pregnant. Moreover, only physically inactive individuals (exercising <60 min/week at moderate or vigorous intensity or brisk walking <150 min/week, the last six months), ≥18 years, with <4 weeks membership were eligible to partake in the study.

Sample size considerations for SPH was done together with a professor in bio statistics at NSSS, based on findings in another study (23). When an individual start exercising, it may be

that small changes occur in QoL, such as going from 23 (low QoL) to 26 (high QoL) on the 35 points Likert-scale for QoL. It was estimated that with 70 participants, we would be able to detect a 10% change in SPH over a one-year follow-up period. Similarly, with a power of 80% at the 0.05 level, we would be able to identify small changes in SPH, such as going from three to four on the five-point Likert-scale, with 93 participants. To account for losses to follow-up and be able to do subgroup analyses, we aimed to recruit all individuals who fulfilled the eligibility criteria. In total, 676 fitness club members wanted to participate in the study. We excluded those who already exercised regularly (n=270) or had cardiovascular disease, hypertension or asthma (n=8). In addition, 148 individuals did not respond after the first email, leaving 250 enrolling in the study (Figure 1).

Data-collection and measurements

A standardized electronic questionnaire was answered at onset and after three, six and 12 months´ fitness club membership. A pretest of the questionnaire was conducted by four members in the research group, as well as four volunteers. The final questionnaire contained 52 questions at onset and 65 questions at three, six and 12 months. At all time-points, the questionnaire took approximately 30 minutes to complete and was answered electronically.

SPH was assessed by answering a global single question: "*In general, how would you rate your health today?*". The response options were ranked from 1-5, with the following description: excellent, good, moderate, fair and poor. According to these five levels, we also divided the participants into two categories: high SPH (excellent and good) and low SPH (moderate, fair and poor) to investigate the association between SPH and exercise behavior, an approach adopted by other researchers (24,25).

QoL was measured by a Norwegian version of the Satisfaction of Life Scale (SWLS) (26). SWLS has widely been used to examine the subjective QoL of people experiencing different health concerns (25) and is considered to be a reliable and valid instrument (27, 28). QoL is measured on a 7-item scale, where the participants rate five different statements from "strongly disagree" = 1 to "strongly agree" = 7:

1. *"In most ways my life is close to my ideal"*
2. *"The conditions of my life are excellent"*
3. *"I am satisfied with my life"*
4. *"So far I have gotten the important things I want in life"*
5. *"If I could live my life over, I would change almost nothing"*

The results from QoL were analyzed separately for each statement and as a sum score (29-32). For the purpose of this study, we also dichotomized QoL into two main groups; low QoL (scores 5-25) and high QoL (scores 26-35).

To examine the role of regular exercise on SPH and QoL, we asked the participants to report exercise involvement at the fitness club the last four weeks: 1) *"Have you been a member?*": "yes" or "no", 2) *"Have you been exercising regularly?"*: "yes" or "no", 3) *"How often have you exercised per week on average?"*: "once a week", "twice a week", "three times a week", "four times a week", "five times a week", "six times a week" or "seven times a week or more". Regular use of the fitness club was defined as exercising ≥ two times a week, whereas non-regular use was defined as one exercise session/week, or no exercise the last month (33). Information related to demographic variables and socioeconomic status were obtained from the questionnaire answered at onset, covering age, gender, body weight, level of education, total household income, cohabitation, children and occupation.

Statistical analyses

Statistical Package for the Social Sciences (SPSS) – 25.0 for Windows was used for statistical analysis. Data are presented as numbers with percentages or means with standard deviations (SD), as well as Odds Ratio (OR) with 95% Confidence Intervals (CI) and p-values. Chi-square analysis was used to compare categorical variables and two-sided independent sample t-test for continuous variables (Table 1). In addition, Mc Nemars test, Cochrans Q, paired sample t-test and one way-repeated measures ANOVA were used to analyze changes in SPH and QoL. Data (Table 2 and 3) are reported for participants who completed the questionnaire at onset of fitness club membership (n=250), three months (n=225), six months (n=213) and 12 months (n=187), whereas p-values are shown for participants that completed the questionnaire at all measurements points only (n=184). Not all participants answered every question, as such individual questions may have varying response rate.

To assess the difference between those who reported regularly use of the fitness club (n=70), with those who did not (n=93) on SPH and QoL, we included prospective data obtained at 12 months. If there was pre-existing evidence or hypothesis that a factor could be a potential cofounder for the association between exercise and SPH or QoL, logistic regression was performed to explore group differences with adjustments for covariates. The final adjusted model contained seven variables: exercise, age, cohabitation, total household income, Body Mass Index (BMI), children and gender, all entered in step 1 in the above order.

RESULTS

General characteristic of all participants at onset of fitness club membership, divided into high and low SPH and QoL, is showed in Table 1. In total, 66.4% and 35.2% rated their SPH and QoL as high, respectively. There were no gender differences concerning SPH, but more women (41.9%) than men (28.8%) rated their QoL as high. The high SPH group had lower age, mean BMI and fewer were overweight or obese compared with the low SPH group. Participants with high QoL had higher age and were more likely to report high total household income, living with a partner and having children than the low QoL group (Table 1).

Table 1: General characteristics of the participants at onset of fitness club membership, divided into high and low SPH and QoL (n=250).

Background variable	**All** (n=250)	**SPH** **High** (n=166)	**Low** (n=83)	**p-value**	**QoL** **High** (n=88)	**Low** (n=161)	**p-value**
Norwegian descent [n (%)]	196 (78.4)	134 (80.7)	62 (74.7)	0.630	65 (73.9)	130 (80.7)	0.428
Gender: Men [n (%)]	125 (50.0)	83 (50.0)	42 (50.6)	1.000	36 (40.9)	89 (55.3)	0.042
Age (years) [mean (SD)]	36.4 (11.3)	34.5 (10.5)	40.1 (11.9)	0.000	38.5 (12.1)	35.2(10.6)	0.027
Age ≥ 40 years [n (%)]	81	43	37	0.010	33	47	0.230
BMI [mean (SD)]	25.7 (4.4)	25.2 (4.0)	26.6 (5.0)	0.017	25.3 (4.1)	25.9 (4.5)	0.263
BMI ≥ 25 (overweight or obese) [n (%)]	121 (48.4)	72 (43.4)	48 (57.8)	0.044	36 (40.9)	85 (52.8)	0.097
Education level: University ≥ 4 years [n (%)]	102 (40.8)	66 (39.8)	36 (44.4)		40 (45.5)	61 (37.9)	0.304
Total household income: High > 80500 $ [n (%)]	114 (45.6)	74 (47.4)	40 (51.3)		51 (62.2)	62 (40.8)	0.003
Living with a partner [n (%)]	153 (61.2)	102 (61.4)	50 (60.2)	0.963	70 (79.5)	82 (50.9)	0.000
Children	80 (32)	50 (31.1)	29 (34.9)	0.531	36 (40.9)	44 (27.3)	0.040
Employed outside of home [n (%)]	185 (74.0)	120 (72.3)	64 (77.1)	0.134	63 (71.6)	122 (75.8)	0.142

More details of study participants have been published previously (21,22). Throughout the initial year of fitness club membership, we found no changes in SPH (Table 2).

Table 2: SPH at onset, three, six and 12 months of fitness club membership. Results are shown in mean and standard deviation (SD) or numbers (n) and %. P-values are shown for participants that completed the questionnaire at all measurement points (n=184).

Outcomes	**Onset** n=249 (men=125, women=124)	**Three months** n=225 (men=109, women=116)	**Six months** n=213 (men=106, women=107)	**12 months** n=187 (men=96, women=91)	**p-value**
SPH:					
Mean score (SD)	2.3 (0.7)	2.2 (0.8)	2.1 (0.7)	2.2 (0.7)	0.313
High SPH [n (%)]	166 (66.7)	158 (70.2)	158 (74.2)	128 (68.4)	0.359
Low SPH n [(%)]	83 (33.3)	67 (29.8)	55 (25.8)	59 (31.6)	
- Excellent [n (%)]	31 (12.4)	31 (13.8)	37 (17.4)	27 (14.4)	0.532
- Good [n (%)]	135 (54.0)	127 (56.4)	121 (56.8)	101 (54.0)	0.841
- Moderate [n (%)]	73 (29.2)	54 (24)	48 (22.5)	51 (27.3)	0.430
- Fair [n (%)]	8 (3.2)	11 (4.9)	6 (2.8)	8 (4.3)	0.943
- Poor [n (%)]	2 (0.8)	2 (0.9)	1 (0.5)	0 (0.0)	0.300

In QoL measurements, we observed an increase in mean scores for all five statements, a significant increase in two out of five statements: "*In most ways my life is close to my ideal*" (p=0.036) and "*If I could live my life over, I would change almost nothing*" (p=0.000), and also an improvement in sum score (p = 0.071) (Table 3).

Table 3: QoL at onset, three, six and 12 months of fitness club membership. Results are shown in mean and standard deviation (SD) or numbers (n) and %. P-value are shown for participants that completed the questionnaire at all measurement points (n=184).

Outcomes	**Onset** n=249 (men=125, women=124)	**Three months** n=225 (men=109, women=116)	**Six months** n=213 (men=106, women=107)	**12 months** n=187 (men=96, women=91)	**p-value**
QoL:					

Sum score QoL [mean (SD)]	22.2(6.7)	22.2(7.1)	22.5(6.9)	23.2(6.8)	0.071
High QoL [n (%)]	88 (35.3)	76 (34.2)	79 (37.1)	76 (41.1)	0.263
Low QoL [n (%)]	161 (64.7)	146 (65.8)	134 (62.9)	109 (58.9)	
«In most ways my life is close to my ideal» [mean (SD)]	4.1 (1.5)	4.3 (1.6)	4.3 (1.6)	4.4 (1.6)	0.036 (onset to 12 months; p=0.025)
«The conditions of my life are excellent» [mean (SD)]	4.7 (1.5)	4.7 (1.5)	4.7 (1.5)	4.8 (1.5)	0.356
«I am satisfied with my life» [mean (SD)]	4.9 (1.6)	4.8 (1.6)	4.9 (1.5)	5.0 (1.5)	0.216
«So far I have gotten the important things I want in life» [mean (SD)]	4.5 (1.7)	4.4 (1.7)	4.5 (1.6)	4.7 (1.6)	0.068
«If I could live my life over, I would change almost nothing» [mean (SD)]	4.0 (1.9)	4.0 (1.8)	4.1 (1.8)	4.3 (1.8)	0.000 (onset to 12 months; p=0.000, 3 to 12 months; p=0.001, 6 to 12 months; p=0.001)

At all measurements, frequent use of the fitness club was associated with high SPH, as well as higher sum scores on QoL at 12 months follow-up (Table 4).

Table 4: SPH and QoL compared in participants reporting regular and non -regular use at a fitness center at three, six and 12 months. Results are shown in mean and standard deviation (SD) or numbers (n) and %.

	Three months			**Six months**			**12 months**		
	Regular use (n=116)	Non-regular use (n=106)	p-value	Regular use (n=82)	Non-regular use (n=125)	p-value	Regular use (n=70)	Non-regular use (n=93)	p-value
SPH:									
Mean score (SD)	2.1 (0.7)	2.4 (0.8)	0.001	1.9 (0.7)	2.3 (0.8)	0.001	1.9 (0.7)	2.4 (0.7)	0.000
High SPH [n (%)]	91 (78.4)	67 (63.2)	0.018	69 (84.1)	85 (68.0)	0.015	59 (84.3)	57 (61.3)	0.002
Low SPH [n (%)]	25 (21.6)	39 (36.7)		13 (15.8)	40 (32.0)		11 (15.8)	36 (38.7)	
QoL:									
Sum score QoL [mean (SD)]	22.5 (6)	21.8 (7.6)	0.469	22.6 (7.2)	22.5 (6.8)	0.954	25.1 (5.5)	22.0 (7.0)	0.002
High QoL [n (%)]	39 (34.2)	36 (34.0)	1.000	36 (43.9)	42 (33.6)	0.177	34 (49.3)	34 (36.6)	0.144
Low QoL [n (%)]	75 (65.8%)	70 (66.0)		46 56.1)	83 (66.4)		35 (50.7)	59 (63.4)	

In Table 4, losses to follow-up (n=38 at three months, n=43 at 6 months and n=87 at 12 months) is categorized in the same group as participants not reporting regular use of the fitness club.

Also after adjusting for confounders (age, cohabitation, total household income, BMI, children and gender, regular use of the fitness club ≥ two times weekly was associated with reporting high SPH (OR 3.532 [95% CI 1.60 to 7.82], p=0.002) and QoL (OR 1.914 [95% CI 0.95 to 3.86], p=0.069) (Table 5).

Table 5: The association between use of a fitness club and High SPH / QoL at 12 months, controlled for age, cohabitation, total household income, BMI, children and gender.

Outcomes	**High SPH** (n=128 (68.4%))				**High QoL** (n=76 (40.6))			
	%	Odds Ratio (OR)	95%CI for OR, lower-upper	p-value	%	Odds Ratio (OR)	95%CI for OR, lower-upper	p-value
Regular use (frequency ≥ two times weekly)	59 (50.9%)	3.532	1.595-7.821	0.002	34 (44.7%)	1.914	0.950-3.856	0.069
Age (> 40 years)	44 (34.4%)	1.150	0.506-2.613	0.738	23 (30.3%)	1.388	0.636-3.032	0.410
Living with a partner (yes)	83 (64.8%)	0.644	0.274-1.509	0.311	57 (75%)	0.369	0.161-0.849	0.019
High household income (≥ 80500 $ per year)	59 (48.8%)	0.972	0.405-2.332	0.950	39 (51.3%)	1.214	0.540-2.726	0.639
Body Mass Index (BMI) (≥25kg/m^2)	66 (51.6%)	1.120	0.524-2.392	0.770	31 (40.8%)	1.985	0.983-4.010	0.056
Children (yes)	37 (28.9%)	0.833	0.353-1.964	0.676	24 (31.6%)	1.072	0.480-2.395	0.866
Gender (man)	70 (54.7%)	0.733	0.348-1.546	0.415	36 (47.4%)	1.387	0.688-2.796	0.360

To evaluate if the participants were representative of our initial study population, a comparison analysis was performed with the 63 participants lost to follow-up at 12 months. No differences were found with respect to SPH and QoL, nor demographic and socioeconomic variables (data not shown).

DISCUSSION

To our knowledge, this is the first study that has investigated SPH and QoL among new beginner exercisers in a fitness club setting. Main findings were an increase in mean scores for all five statements in QoL and an improvement in QoL sum score throughout the follow-up period. No changes were observed for SPH the initial year of fitness club membership. Regularly fitness club users rated SPH higher at all measurement points, as well as perceived their QoL higher than non-regular users at 12 months follow-up.

We found no changes in SPH throughout the follow-up period, which is contrary to another study investigating SPH among healthy adults (3). One explanation to this may be that more than half of the participants (66.7%) in our study rated their SPH as high already at onset of fitness club membership, which caused less opportunity for further improvement. Also, very few (4%) rated their SPH fair or poor at onset. As such, the ceiling effect in SPH might be a cause for our results. Previous research on the association between exercise and SPH have primarily been done among sick or elderly populations, reporting that regular physical activity, and even a small dose of regular exercise (defined as engaging in activities more than once a week, in line with our definition of regular use of the gym) may improve SPH (34,35).

Precise definitions of QoL are scant and measures varies greatly (36). Still, research including systematic reviews and meta-analysis have suggested that regular exercise may enhance QoL and contribute to emotional wellbeing (15,16,36). This is consistent with the present study, where regular exercise at the fitness club was associated with higher scores in perceived QoL. Our data also give some support for a dose–response curve and a threshold of at least twice weekly to achieve benefits in SPH and QoL. However, we cannot conclude that exercise contributes to QoL, or if it is the other way around. We found, however, that QoL score

increased from onset of membership to 12 months follow-up, lending credibility to the hypothesis that improvement in QoL might be a key motivator for sustained exercise (37). However, social and cognitive factors (such as social interactions while exercising, group cohesion and self-efficacy) may confound the association between regular use of a fitness club and QoL. In line with others, we believe that these factors might have a mediating role, rather than being real confounding factors (37,38).

Participants

Few participants managed to maintain long-term fitness club attendance, and there was a large drop in participants visiting the fitness club twice weekly or more from baseline to three (54%) six (67%) and 12 (72%) months. Others have also reported a drop-out rate from regular use of the fitness club around 50% within the first 6-12 months of membership (39,40). A retrospective study found that only 10% of fitness club members reported regular gym attendance (at least four visits monthly) after six months (41). In our study, this number was higher. Nevertheless, this shows that maintaining an active lifestyle can be challenging even for motivated individuals, and it highlight the need to develop strategies and interventions to facilitate exercise behavior in a fitness club setting. It may be useful to understand that regular exercise can contribute to increased SPH and QoL. Finding time is vital if regular use is to be adhered to. Even though most fitness clubs are located where people live and travel, have flexible opening hours, many also offering childcares, former physically inactive individuals may have had problems getting into a weekly routine (42).

Outcomes

Both SPH and QoL were measured by a standardized electronic questionnaire at all time-points. The use of an electronic questionnaire based on previously validated surveys made it

easy to gather responses quickly, and eliminate the costs associated with printing and distributing paper-based questionnaires. Self-report is inexpensive, takes up little time to conduct and is practical. Anyway, due to social desirability, the risk of over-reporting may be high. For instance, individuals may report more socially acceptable answers rather than being honest and may interpret the wording of questions differently (43). However, assessment of SPH and QoL depends on the individual, subjective perception. Hence, self-report may be an appropriate measurement method for measuring SPH and QoL.

SPH was assessed by answering a global single question used in numerous other studies and subjective assessment of health has been found to highly correlate with results of its objective assessment and health status indices (44). QoL was measured by a Norwegian version of SWLS which is considered to be a reliable and valid instrument and has been widely used to examine the subjective QoL of people experiencing different health concerns (30,31).

Strengths and limitations

A strength of the present study was the use of a prospective study design with 12 months follow-up. Also, inclusion of data concerning personal health behaviors (BMI and exercise) and demographics (age, cohabitation, total household income, having children) is considered strengths. Hence, we were able to adjust for these factors in the analyses. All participants were untrained at study enrollment and may as such be considered representative for new members at fitness clubs (22), as well as comparable to the general adult population (45). There were equal number of men and women and we used valid and reliable measurement methods (24,26). Despite a high dropout from the study itself, we had a sufficient number of participants at all measurement points regarding a priory power calculation for SPH and QoL.

Limitations were that the investigation was carried out in Norwegian only, excluding participants from other ethnic groups, as well as that attendance at the fitness club was self-reported. Studies are consistent in showing that individuals have a tendency to overestimate what they do (46,47). Nevertheless, if this was the case, the results of the present study provide a conservative calculation of exercise involvement at the fitness club. The questionnaire took approximately 30 minutes to complete and was answered electronically. Such a time-consuming questionnaire might cause more losses to follow-up. Further, participation was voluntary, and it may be possible that the data contain a certain level of volunteer-bias, questioning the representativeness of the results.

Conclusion

We found an increase in all five statements in QoL and an improvement in QoL sum score, whereas no changes were observed in SPH the first year of fitness club membership. Our results add to the literature that regular attendance at a fitness club after 12 months was associated with a high SPH and QoL.

Acknowledgments

The authors thank Ingar Holme and Morten Fagerland, professors in biostatistics, Norwegian School of Sports Sciences, for guidance with power considerations and statistical analysis.

Footnotes

- **Contributors** HH outlined the manuscript. CG plotted all data and developed the questionnaire together with LAHH. CG and LAHH were responsible for data collection and recruited the participants. HH, CG and LAHH did the testing. LAHH originated the idea for the present study and supervised the project. All authors participated in discussing the design of the study, read and corrected draft versions of the manuscript and approved the final manuscript.
- **Competing interests** None declared.
- **Funding** The project was financed by and conducted at the Norwegian School of Sports Sciences.
- **Ethics approval** The project was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1443 A), who concluded that, according to the Act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The project was approved by the Norwegian Social Science Data Service (NSD 44135).
- **Data sharing statement** All data are fully available without restriction. Data are from the 'Physical activity at fitness clubs. -A venue for public health'-study whose authors may be contacted at the Norwegian School of Sports Sciences. Hege.heiestad@nih.no.
- **Patient consent for publication** Not required.

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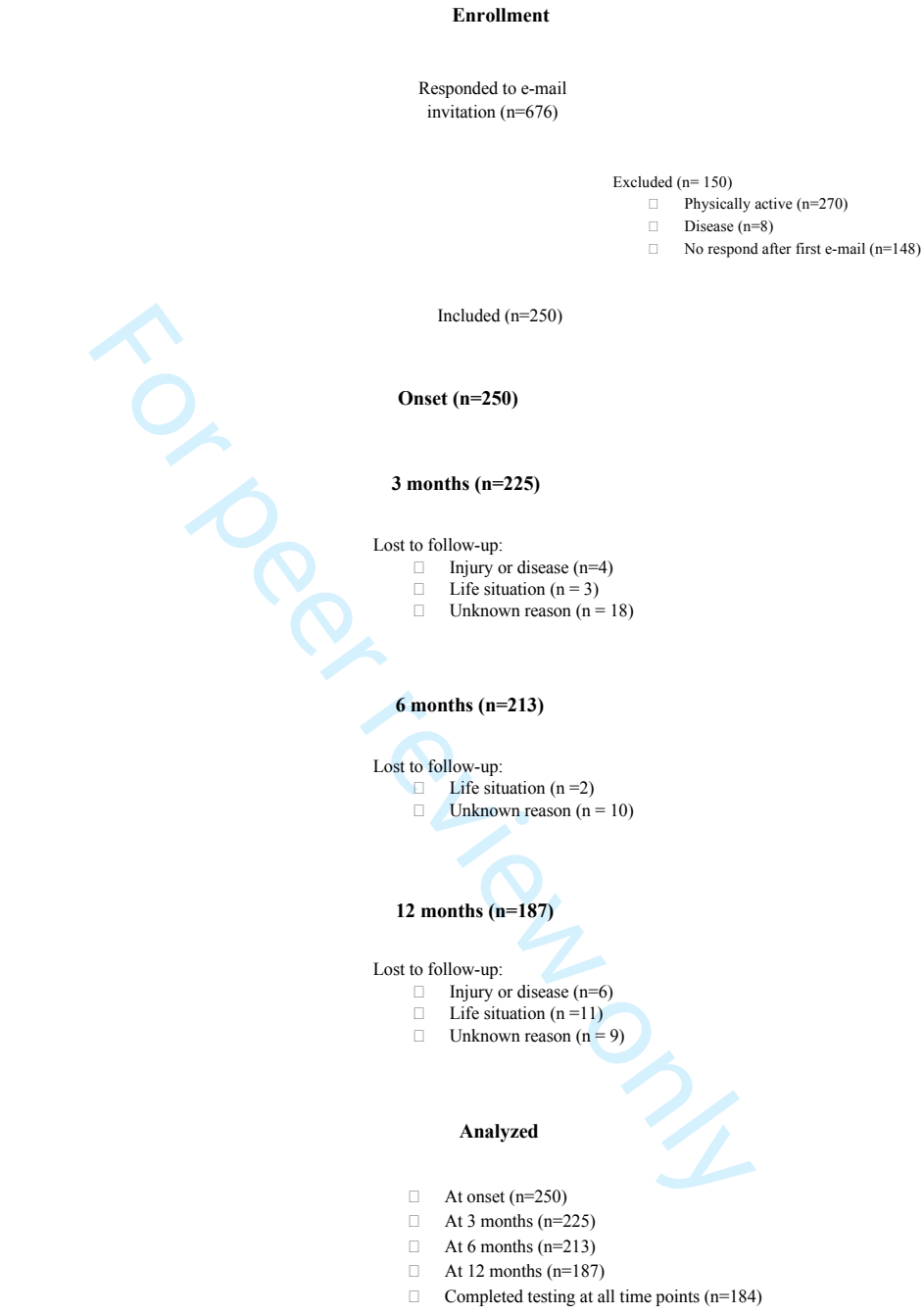

Figure 1: Flow diagram of the participants throughout the study.

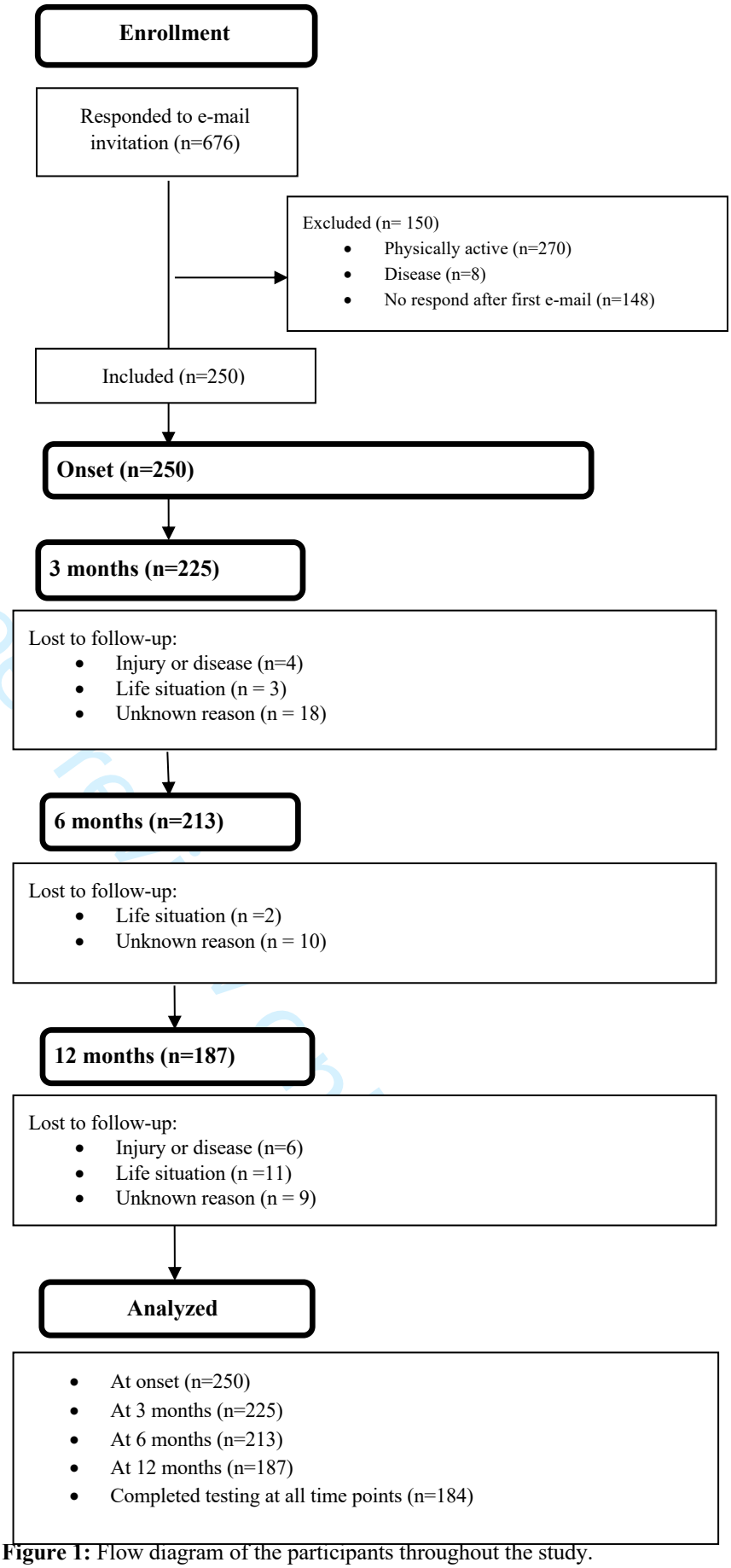

Figure 1: Flow diagram of the participants throughout the study.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	4
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9 and Figure1
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	Table 2-3
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make	10-13

		clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Investigating Self-Perceived Health and Quality of Life; -a longitudinal prospective study among new beginner exercisers in a fitness club setting

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-036250.R1
Article Type:	Original research
Date Submitted by the Author:	18-Mar-2020
Complete List of Authors:	Heiestad, Hege; Norwegian Shcool of Sports Science Gjestvang, Christina; Norwegian School of Sports Sciences, Department of Sports Medicine Haakstad, Lene; Norwegian School of Sport Sciences, Sport Medicine
Primary Subject Heading:	Sports and exercise medicine
Secondary Subject Heading:	Public health
Keywords:	SPORTS MEDICINE, PUBLIC HEALTH, MENTAL HEALTH

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Investigating Self-Perceived Health and Quality of Life; -a longitudinal prospective study among new beginner exercisers in a fitness club setting

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ABSTRACT

Objectives: This study investigated SPH and QoL at onset and after three, six and 12 months of fitness club membership. Also, we compared SPH and QoL between those who reported regular use of the fitness club (≥ two exercise sessions/week the last month) with those who did not (one exercise session/week, or no exercise the last month).

Design: Longitudinal prospective study.

Setting: 25 fitness clubs in Oslo, Norway.

Participants: In total, 250 newly registered fitness club members (equal numbers of men and women, mean age=36.4±11.3 years, mean BMI=25.7±4.4) were recruited. At onset (n=250), after three (n=225), six (n=213) and 12 months (n=187), the participants answered an electronic questionnaire, covering background variables, exercise involvement, perceived SPH and QoL.

Outcome measures: SPH was measured by a single item question, rating health status from poor to excellent on a five-point scale. High SPH was dichotomized as excellent or good, and low SPH as moderate, fair or poor. QoL was measured on a 7-item scale, rating five statements and dichotomized according to a total max sum score of 35, with low QoL≤ 25 and high QoL>25.

Results: Repeated measurements did not show any changes in SPH. In QoL, we observed an improvement in QoL sum score and a significant increase in mean scores for two out of five statements at 12 months follow-up: "*In most ways*, *my life is close to my ideal*" (p=0.036) and "*If I could live my life over, I would change almost nothing*" (p<0.001). Regular use of the fitness club was associated with high SPH (OR 3.532 [95% CI 1.60 to 7.82], p=0.002) and high QoL (OR1.914 [95% CI 0.95 to 3.86], p=0.069). The results were unchanged after adjusting for confounders.

Conclusions: Regular attendance at a fitness club was associated with high SPH and high

QoL at 12 months follow-up.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The use of prospective study design with 12 months follow-up.
- Valid and reliable measurement methods.
- The use of an electronic questionnaire based on previously validated surveys.
- Self-reported attendance at the fitness club.

INTRODUCTION

According to the World Health Organization (1), health is not only the absence of somatic disease but also includes mental and social well-being, putting emphasis on the usefulness and need for investigating individuals´ self-perception of overall health (SPH). Up to date, several studies have shown that low SPH may be a valid and robust predictor of morbidity and mortality of various diseases, such as cancer, cardiovascular disease, stress, diabetes and other chronic health conditions (2-5). Low SPH is as well associated with being sick-listed and frequent use of health care services (6,7). In different patient groups and among the elderly population, SPH has widely been used to evaluate the effect of health-care programs (8). The measure is a single-item question, including rating of health status from poor to excellent on a five-point scale, and as such popular for its simplicity and cost-effectiveness (9).

It is growing interest in the assessment of physical activity on modification of SPH, and studies have indicated a strong association between insufficient physical activity and lower SPH in adults, especially in older individuals (10,11). However, it is important to investigate SPH not only between individuals that are active or inactive according to current physical activity recommendations (12), but also if this differs between activity contexts (organized sports clubs, public spaces and fitness clubs) and exercise involvement (frequency, duration, intensity, and modes) (13).

Quality of life (QoL) has also become an important measurement because it is a meaningful indicator of both mental and physical well-being (14,15), and its positive association with physical activity has been consistently reported in the systematic reviews and meta-analyses 16,17). Although there is limited data, it is suggested that QoL may be a key motivator for

regular physical activity and exercise (18), meaning that individuals start and continue to be active because this contributes to their QoL. However, cross-sectional data precludes a conclusion regarding the nature of this association (19).

Throughout the 1990s, a new venue for physical activity and exercise gradually grew in popularity, the fitness clubs. Worldwide, the fitness club industry has about 183 million members and counts more than 210 000 clubs (20). Those who join a fitness club may be initially motivated to exercise, still, previous studies have shown a high dropout-rate after only three months (21,22). This shows that maintaining regular exercise can be challenging even for motivated individuals. Even though this arena has become a large and growing venue for activity, the scientific knowledge of those that choose to be a member is scant. Research has not yet investigated how fitness club membership relates to SPH and QoL-status among beginner recreational exercisers. Hence, the primary aim of the present study was to report longitudinal data of SPH and QoL in an age-diverse group of men and women across the first year of fitness club membership. Secondary, we wanted to examine if SPH and QoL differed between those who reported regular use of the fitness club (≥ two exercise sessions/week the last month) with those who did not (one exercise session/week, or no exercise the last month).

MATERIALS AND METHODS

Study design and population

This is a secondary analysis of data collected as part of the research project "Fitness clubs - a venue for public health?" (22-25), a longitudinal prospective study, aiming to investigate which factors that influence exercise adherence in beginner recreational exercisers.

The project was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1443 A), who concluded, according to the act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The procedures followed the World Medical Association Declaration of Helsinki and were approved by the Norwegian Social Science Data Service (NSD 44135), financed and conducted at the Norwegian School of Sport Sciences (NSSS) (October 2015 - November 2018). No economic compensation was given to the participants.

New members at 25 fitness clubs in Oslo, Norway were contacted by an e-mail invitation. At first contact, the aims and implications of the study were explained, and the eligibility criteria checked. Enrollment was limited to adults (≥18 years), <four weeks membership, healthy (no disease considered to hinder physical activity, e.g., severe heart disease or hypertension), and physically inactive (exercising <60 min/week at a moderate or vigorous intensity or brisk walking <150 min/week, the last six months) (12,26).

Sample size considerations for SPH and QoL was done together with a professor in biostatistics at NSSS, based on findings in other studies (27-29). When an individual starts exercising, it may be that small changes occur in QoL, such as going from 23 (low QoL) to 26 (high QoL) on the total sum score for QoL (35 points). It was estimated that with 70

participants, we would be able to detect a 10% change in QoL over a one-year follow-up period. Similarly, with a power of 80% at the 0.05 level, we would be able to identify small changes in SPH, such as going from three to four on the five-point Likert-scale, with 93 participants. To account for losses to follow-up and be able to do subgroup analyses, we aimed to recruit all individuals who fulfilled the eligibility criteria. In total, 676 fitness club members wanted to participate in the study. We excluded those who already exercised regularly (n=270) or had cardiovascular disease, hypertension or asthma (n=8). Besides, 148 individuals did not respond after the first e-mail, leaving 250 enrolling in the study (Figure 1).

Patient and Public involvement

Four volunteers completed a pilot test of the whole electronic questionnaire, which led to minor changes in wording and format. Otherwise, participants and the public have not been involved in the development of research questions, study design or recruitment.

Data-collection and measurements

A standardized electronic questionnaire was answered at onset and after three, six and 12 months´ fitness club membership. A pretest of the questionnaire was conducted by four members in the research group, as well as four volunteers. The final questionnaire contained 52 questions at onset and 65 questions at three, six and 12 months. At all time-points, the questionnaire took approximately 30 minutes to complete and was answered electronically.

SPH was assessed by answering a global single question: "*In general, how would you rate your health today?*". The response options were ranked from 1-5, with the following description: excellent, good, moderate, fair and poor. According to these five levels, we also

divided the participants into two categories: high SPH (excellent and good) and low SPH (moderate, fair and poor) to investigate the association between SPH and exercise behavior, an approach adopted by other researchers (30,31).

QoL was measured by a Norwegian version of the Satisfaction of Life Scale (SWLS) (32). Because of multiple assessment-points, and a comprehensive questionnaire covering several factors influencing exercise adherence (22-25), we decided after discussion in the project group to use SWLS. The SWLS is shorter and includes five statements only. Several studies have also supported the validity and reliability of the scale (33-36). QoL is measured on a 7-item scale, where the participants rate five different statements from “strongly disagree” = 1 to ”strongly agree” = 7:

1. *“In most ways, my life is close to my ideal”*
2. *“The conditions of my life are excellent”*
3. *“I am satisfied with my life”*
4. *“So far I have gotten the important things I want in life”*
5. *“If I could live my life over, I would change almost nothing”*

The results from QoL were analyzed separately for each statement and as a sum score (28,37-39), and we also dichotomized QoL into two main groups; low QoL (scores 5-25) and high QoL (scores 26-35).

To examine the role of regular exercise on SPH and QoL, we asked the participants to report exercise involvement at the fitness club in the last four weeks: 1) *"Have you been a member?*": "yes" or "no", 2) *"Have you been exercising regularly?"*: "yes" or "no", 3) *"How often have you exercised per week on average?"*: "once a week", "twice a week", "three times

a week", "four times a week", "five times a week", "six times a week" or "seven times a week or more". Regular use of the fitness club was defined as exercising ≥ two times a week, whereas non-regular use was defined as one exercise session/week, or no exercise the last month (12). Information related to demographic variables and socioeconomic status were obtained from the questionnaire answered at onset, covering age, gender, body weight, level of education, total household income, cohabitation, children and occupation.

Statistical analyses

Statistical Package for the Social Sciences (SPSS) – 25.0 for Windows was used for statistical analysis. Data are presented as numbers with percentages or means with standard deviations (SD), as well as Odds Ratio (OR) with 95% Confidence Intervals (CI) and p-values. Chronbach`s α for the SWLS was 0.87, 0.91, 0.90 and 0.91 at baseline, and after three, six and 12 months, respectively. Chi-square analysis was used to compare categorical variables and two-sided independent sample t-test for continuous variables (Table 1). In addition, Mc Nemars test, Cochran's Q, paired sample t-test and one way repeated measure ANOVA were used to analyze changes in SPH and QoL. Data (Table 2 and 3) are reported for participants who completed the questionnaire at onset of fitness club membership (n=250), three months (n=225), six months (n=213) and 12 months (n=187), whereas p-values are shown for participants that completed the questionnaire at all measurements points only (n=184). Also, due to the ethics of mandatory questionnaire responses, we included “I do not want to answer” or “Not relevant” as response options, which in the SPSS data set were treated as missing values, so individual questions may have varying response rates.

To assess the difference between those who reported regular use of the fitness club (n=70), with those who did not (n=93) on SPH and QoL, we included prospective data obtained at 12

months (Table 4). Based on crude analysis comparing demographic and health factors between high and low SPH, and high and low QoL, all seven variables (exercise, age, cohabitation, total household income, Body Mass Index (BMI), children and gender) with p-values ≤0.05 (Table 1), were all entered in the above order in the adjusted model (Table 5) (40-42).

RESULTS

General characteristic of all participants at onset of fitness club membership, divided into high and low SPH and QoL, is shown in Table 1. In total, 66.4% and 35.2% rated their SPH and QoL as high, respectively. There were no gender differences concerning SPH, but more women (41.9%) than men (28.8%) rated their QoL as high. The high SPH group had lower age, mean BMI and fewer were overweight or obese compared with the low SPH group. Participants with high QoL had higher age and were more likely to report high total household income, living with a partner and having children than the low QoL group (Table 1).

Table 1: General characteristics of the participants at onset of fitness club membership, divided into high and low SPH and QoL (n=250).

Background variable	All (n=250)	SPH High (n=166)	SPH Low (n=83)	p-value	QoL High (n=88)	QoL Low (n=161)	p-value
Norwegian descent [n (%)]	196 (78.4)	134 (80.7)	62 (74.7)	0.630	65 (73.9)	130 (80.7)	0.428
Gender: Men [n (%)]	125 (50.0)	83 (50.0)	42 (50.6)	1.000	36 (40.9)	89 (55.3)	0.042
Age (years) [mean (SD)]	36.4 (11.3)	34.5 (10.5)	40.1 (11.9)	<0.001	38.5 (12.1)	35.2(10.6)	0.027
Age ≥ 40 years [n (%)]	81	43	37	0.010	33	47	0.230
BMI [mean (SD)]	25.7 (4.4)	25.2 (4.0)	26.6 (5.0)	0.017	25.3 (4.1)	25.9 (4.5)	0.263
BMI ≥ 25 (overweight or obese) [n (%)]	121 (48.4)	72 (43.4)	48 (57.8)	0.044	36 (40.9)	85 (52.8)	0.097
Education level: University ≥ 4 years [n (%)]	102 (40.8)	66 (39.8)	36 (44.4)		40 (45.5)	61 (37.9)	0.304
Total household income: High > 87 500$ [n (%)]	114 (45.6)	74 (47.4)	40 (51.3)		51 (62.2)	62 (40.8)	0.003
Living with a partner [n (%)]	153 (61.2)	102 (61.4)	50 (60.2)	0.963	70 (79.5)	82 (50.9)	<0.001
Children	80 (32)	50 (31.1)	29 (34.9)	0.531	36 (40.9)	44 (27.3)	0.040
Employed outside of home [n (%)]	185 (74.0)	120 (72.3)	64 (77.1)	0.134	63 (71.6)	122 (75.8)	0.142

At onset, more men than women had a household income ≥87 500 US dollar (52.0% versus 39.2%), worked outside the home (86.4% versus 61.6%), were overweight or obese (BMI ≥25 kg/m2, 58.4% versus 38.7%) and older (38.5 years versus 34.3 years). More details of the study participants have been published previously (22-25). Throughout the initial year of fitness club membership, we found no changes in SPH (Table 2).

Table 2: SPH at onset, three, six and 12 months of fitness club membership. Results are shown in mean and standard deviation (SD) or numbers (n) and %. P-values are shown for participants that completed the questionnaire at all measurement points (n=184).

Outcomes	**Onset** n=249 (men=125, women=124)	**Three months** n=225 (men=109, women=116)	**Six months** n=213 (men=106, women=107)	**12 months** n=187 (men=96, women=91)	**p-value**
SPH:					
Mean score (SD)	2.3 (0.7)	2.2 (0.8)	2.1 (0.7)	2.2 (0.7)	0.313
High SPH [n (%)]	166 (66.7)	158 (70.2)	158 (74.2)	128 (68.4)	0.359
Low SPH n [(%)]	83 (33.3)	67 (29.8)	55 (25.8)	59 (31.6)	
- Excellent [n (%)]	31 (12.4)	31 (13.8)	37 (17.4)	27 (14.4)	0.532
- Good [n (%)]	135 (54.0)	127 (56.4)	121 (56.8)	101 (54.0)	0.841
- Moderate [n (%)]	73 (29.2)	54 (24)	48 (22.5)	51 (27.3)	0.430
- Fair [n (%)]	8 (3.2)	11 (4.9)	6 (2.8)	8 (4.3)	0.943
- Poor [n (%)]	2 (0.8)	2 (0.9)	1 (0.5)	0 (0.0)	0.300

In QoL measurements, we observed an increase in mean scores for all five statements, a significant increase in two out of five statements: "*In most ways, my life is close to my ideal*" (p=0.036) and "*If I could live my life over, I would change almost nothing*" (p<0.001), and also an improvement in sum score (p = 0.071) (Table 3).

Table 3: QoL at onset, three, six and 12 months of fitness club membership. Results are shown in mean and standard deviation (SD) or numbers (n) and %. P-value is shown for participants that completed the questionnaire at all measurement points (n=184).

Outcomes	**Onset** n=249 (men=125, women=124)	**Three months** n=225 (men=109, women=116)	**Six months** n=213 (men=106, women=107)	**12 months** n=187 (men=96, women=91)	**p-value**
QoL:					
Sum score QoL [mean (SD)]	22.2(6.7)	22.2(7.1)	22.5(6.9)	23.2(6.8)	0.071
High QoL [n (%)]	88 (35.3)	76 (34.2)	79 (37.1)	76 (41.1)	0.263
Low QoL [n (%)]	161 (64.7)	146 (65.8)	134 (62.9)	109 (58.9)	
«In most ways my life is close to my ideal» [mean (SD)]	4.1 (1.5)	4.3 (1.6)	4.3 (1.6)	4.4 (1.6)	0.036 (onset to 12 months; p=0.025)
«The conditions of my life are excellent» [mean (SD)]	4.7 (1.5)	4.7 (1.5)	4.7 (1.5)	4.8 (1.5)	0.356
«I am satisfied with my life» [mean (SD)]	4.9 (1.6)	4.8 (1.6)	4.9 (1.5)	5.0 (1.5)	0.216
«So far I have gotten the important things I want in life» [mean (SD)]	4.5 (1.7)	4.4 (1.7)	4.5 (1.6)	4.7 (1.6)	0.068
«If I could live my life over, I would change almost nothing» [mean (SD)]	4.0 (1.9)	4.0 (1.8)	4.1 (1.8)	4.3 (1.8)	<0.001 (onset to 12 months; p<0.001, 3 to 12 months; p=0.001, 6 to 12 months; p=0.001)

At all measurements, regular use of the fitness club was associated with high SPH, as well as higher sum scores on QoL at 12 months follow-up (Table 4). There was a large drop in participants visiting the fitness club twice weekly or more from baseline to three (54%), six (67%) and 12 (72%) months. More details of exercise behavior at the gym are previously reported (22-25).

Table 4: SPH and QoL compared in participants reporting regular and non -regular use at a fitness center at three, six and 12 months. Results are shown in mean and standard deviation (SD) or numbers (n) and %.

	Three months			**Six months**			**12 months**		
	Regular use (n=116)	Non-regular use (n=106)	p-value	Regular use (n=82)	Non-regular use (n=125)	p-value	Regular use (n=70)	Non-regular use (n=93)	p-value
SPH:									
Mean score (SD)	2.1 (0.7)	2.4 (0.8)	0.001	1.9 (0.7)	2.3 (0.8)	0.001	1.9 (0.7)	2.4 (0.7)	<0.001
High SPH [n (%)]	91 (78.4)	67 (63.2)	0.018	69 (84.1)	85 (68.0)	0.015	59 (84.3)	57 (61.3)	0.002
Low SPH [n (%)]	25 (21.6)	39 (36.7)		13 (15.8)	40 (32.0)		11 (15.8)	36 (38.7)	
QoL:									
Sum score QoL [mean (SD)]	22.5 (6)	21.8 (7.6)	0.469	22.6 (7.2)	22.5 (6.8)	0.954	25.1 (5.5)	22.0(7.0)	0.002
High QoL [n (%)]	39 (34.2)	36 (34.0)	1.000	36 (43.9)	42 (33.6)	0.177	34 (49.3)	34 (36.6)	0.144
Low QoL [n (%)]	75 (65.8%)	70 (66.0)		46 56.1)	83 (66.4)		35 (50.7)	59 (63.4)	

In Table 4, losses to follow-up (n=38 at three months, n=43 at 6 months and n=87 at 12 months) are categorized in the same group as participants not reporting regular use of the fitness club.

Also after adjusting for confounders (age, cohabitation, total household income, BMI, children and gender, regular use of the fitness club ≥ two times weekly was associated with reporting high SPH (OR 3.532 [95% CI 1.60 to 7.82], p=0.002) and QoL (OR 1.914 [95% CI 0.95 to 3.86], p=0.069) (Table 5).

Table 5: The association between use of a fitness club and High SPH / QoL at 12 months, controlled for age, cohabitation, total household income, BMI, children, and gender.

Outcomes	**High SPH** (n=128 (68.4%))				**High QoL** (n=76 (40.6))			
	%	Odds Ratio (OR)	95%CI for OR, lower-upper	p-value	%	Odds Ratio (OR)	95%CI for OR, lower-upper	p-value
Regular use (frequency ≥ two times weekly)	59 (50.9%)	3.532	1.595-7.821	0.002	34 (44.7%)	1.914	0.950-3.856	0.069
Age (> 40 years)	44 (34.4%)	1.150	0.506-2.613	0.738	23 (30.3%)	1.388	0.636-3.032	0.410
Living with a partner (yes)	83 (64.8%)	0.644	0.274-1.509	0.311	57 (75%)	0.369	0.161-0.849	0.019
High household income (≥ 87 500$ per year)	59 (48.8%)	0.972	0.405-2.332	0.950	39 (51.3%)	1.214	0.540-2.726	0.639
Body Mass Index (BMI) (≥25kg/m^2)	66 (51.6%)	1.120	0.524-2.392	0.770	31 (40.8%)	1.985	0.983-4.010	0.056
Children (yes)	37 (28.9%)	0.833	0.353-1.964	0.676	24 (31.6%)	1.072	0.480-2.395	0.866
Gender (man)	70 (54.7%)	0.733	0.348-1.546	0.415	36 (47.4%)	1.387	0.688-2.796	0.360

To evaluate if the participants were representative of our initial study population, a comparison analysis was performed with the 63 participants lost to follow-up at 12 months. No differences were found concerning SPH and QoL, nor demographic and socioeconomic variables (data not shown).

DISCUSSION

To our knowledge, this is the first study that has investigated SPH and QoL among new beginner exercisers in a fitness club setting. The main findings were an increase in mean scores for all five statements in QoL, even if only two of the statements reached statistical significance. We also found an improvement in QoL sum score throughout the one-year follow-up period. No changes were observed for SPH during the initial year of fitness club membership. Regularly fitness club users rated SPH higher at all measurement points, as well as perceived their QoL higher than non-regular users at 12 months follow-up.

We found no changes in SPH throughout the follow-up period, which is contrary to another study investigating SPH among healthy adults (3). One explanation to this may be that more than half of the participants (66.7%) in our study rated their SPH as high already at onset of fitness club membership, which caused less opportunity for further improvement. Also, very few (4%) rated their SPH fair or poor at onset. As such, the ceiling effect in SPH might be a cause for our results. Previous research on the association between exercise and SPH have primarily been done among sick or elderly populations, reporting that regular physical activity and even a small dose of regular exercise (defined as engaging in activities more than once a week, in line with our definition of regular use of the gym) may improve SPH (43,44).

Precise definitions of QoL are scant and measures vary greatly (45). Still, research including systematic reviews and meta-analysis has suggested that regular exercise may enhance QoL and contribute to emotional wellbeing (16,17,45). This is consistent with the present study, where regular exercise at the fitness club was associated with higher scores in perceived QoL. Our data also give some support for a dose-response curve and a threshold of at least twice weekly to achieve benefits in SPH and QoL. However, we cannot conclude that exercise

contributes to QoL, or if it is the other way around. We found, however, that QoL score increased from onset of membership to 12 months follow-up, lending credibility to the hypothesis that improvement in QoL might be a key motivator for sustained exercise (46). However, social and cognitive factors (such as social interactions while exercising, group cohesion and self-efficacy) may confound the association between regular use of a fitness club and QoL. In line with others, we believe that these factors might have a mediating role, rather than being real confounding factors (46,47). Throughout the follow-up period, there was an increase in two out of five statements of QoL and an improvement in the total sum score. The three non-significant statements could be explained by a higher rating already at onset, and a possible ceiling effect, which we also discussed earlier regarding SPH. Besides, the SWLS focuses to a large extent on how the participants feel and think with respect to several important aspects from a life-long perspective (from birth and up to date). Hence, it can be difficult to rationalize our results and the influence of joining a fitness club, whatever the findings.

Participants

More than half of the participants did not manage to visit the fitness club regularly throughout the initial year of membership. Others have also reported a drop-out rate from regular use of the fitness club around 50% within the first 6-12 months of membership (48,49). A retrospective study found that only 10% of fitness club members reported regular gym attendance (at least four visits monthly) after six months (50). In our study, this number was higher. Nevertheless, this shows that maintaining an active lifestyle can be challenging even for motivated individuals, and it highlights the need to develop strategies and interventions to facilitate exercise behavior in a fitness club setting. It may be useful to understand that regular exercise can contribute to increased SPH and QoL. Finding time is vital if regular use is to be

adhered to. Even though most fitness clubs are located where people live and travel, have flexible opening hours, many also offering childcare, former physically inactive individuals may have had problems getting into a weekly routine (51).

Outcomes

Both SPH and QoL were measured by a standardized electronic questionnaire at all time-points. The use of an electronic questionnaire based on previously validated surveys made it easy to gather responses quickly and eliminate the costs associated with printing and distributing paper-based questionnaires. Self-report is inexpensive, takes up little time to conduct and is practical. Anyway, due to social desirability, the risk of over-reporting may be high. For instance, individuals may report more socially acceptable answers rather than being honest and may interpret the wording of questions differently (52). However, assessment of SPH and QoL depends on the individual, subjective perception. Hence, self-report may be an appropriate measurement method for measuring SPH and QoL.

SPH was assessed by answering a global single question used in numerous other studies and subjective assessment of health has been found to highly correlate with results of its objective assessment and health status indices (53). QoL was measured by a Norwegian version of SWLS which is considered to be a reliable and valid instrument and has been widely used to examine the subjective QoL of people experiencing different health concerns (28,38).

Strengths and limitations

A strength of the present study was the use of prospective study design with 12 months follow-up. Also, the inclusion of data concerning personal health behaviors (BMI and exercise) and demographics (age, cohabitation, total household income, having children) is

considered strengths. Hence, we were able to adjust for these factors in the analyses. All participants were untrained at study enrollment and may as such be considered representative for new members at fitness clubs (25), as well as comparable to the general adult population (54). There was an equal number of men and women and we used valid and reliable measurement methods (28,30). Despite a high dropout from the study itself, we had a sufficient number of participants at all measurement points regarding a priory power calculation for SPH and QoL.

Limitations were that the investigation was carried out in Norwegian only, excluding participants from other ethnic groups, as well as that attendance at the fitness club was self-reported. Studies are consistent in showing that individuals tend to overestimate what they do (55,56). Nevertheless, if this was the case, the results of the present study provide a conservative calculation of exercise involvement at the fitness club. The questionnaire took approximately 30 minutes to complete and was answered electronically. Such a time-consuming questionnaire might cause more losses to follow-up. Further, participation was voluntary, and it may be possible that the data contain a certain level of volunteer-bias, questioning the representativeness of the results.

Conclusion

We found an increase in all five statements in QoL, while only two of the items reached statistical significance. We also found an improvement in the QoL sum score, whereas no changes were observed in SPH during the first year of fitness club membership. Our results add to the literature that regular attendance at the fitness club after 12 months was associated with a high SPH and QoL.

Acknowledgments

The authors thank Ingar Holme and Morten Fagerland, professors in biostatistics, Norwegian School of Sports Sciences, for guidance with power considerations and statistical analysis.

Footnotes

· **Contributors** HH outlined the manuscript. CG plotted all data and developed the questionnaire together with LAHH. CG and LAHH were responsible for data collection and recruited the participants. HH, CG and LAHH did the testing. LAHH originated the idea for the present study and supervised the project. All authors participated in discussing the design of the study, read and corrected draft versions of the manuscript and approved the final manuscript.

· **Competing interests** None declared.

· **Funding** The project was financed by and conducted at the Norwegian School of Sports Sciences.

· **Ethics approval** The project was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1443 A), who concluded that, according to the Act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The project was approved by the Norwegian Social Science Data Service (NSD 44135).

· **Data sharing statement** All data are fully available without restriction. Data are from the 'Physical activity at fitness clubs. -A venue for public health'-a study whose authors may be contacted at the Norwegian School of Sports Sciences. Hege.heiestad@nih.no.

· **Patient consent for publication** Not required.

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Figure 1. The flow chart of the participants throughout the data-collection.

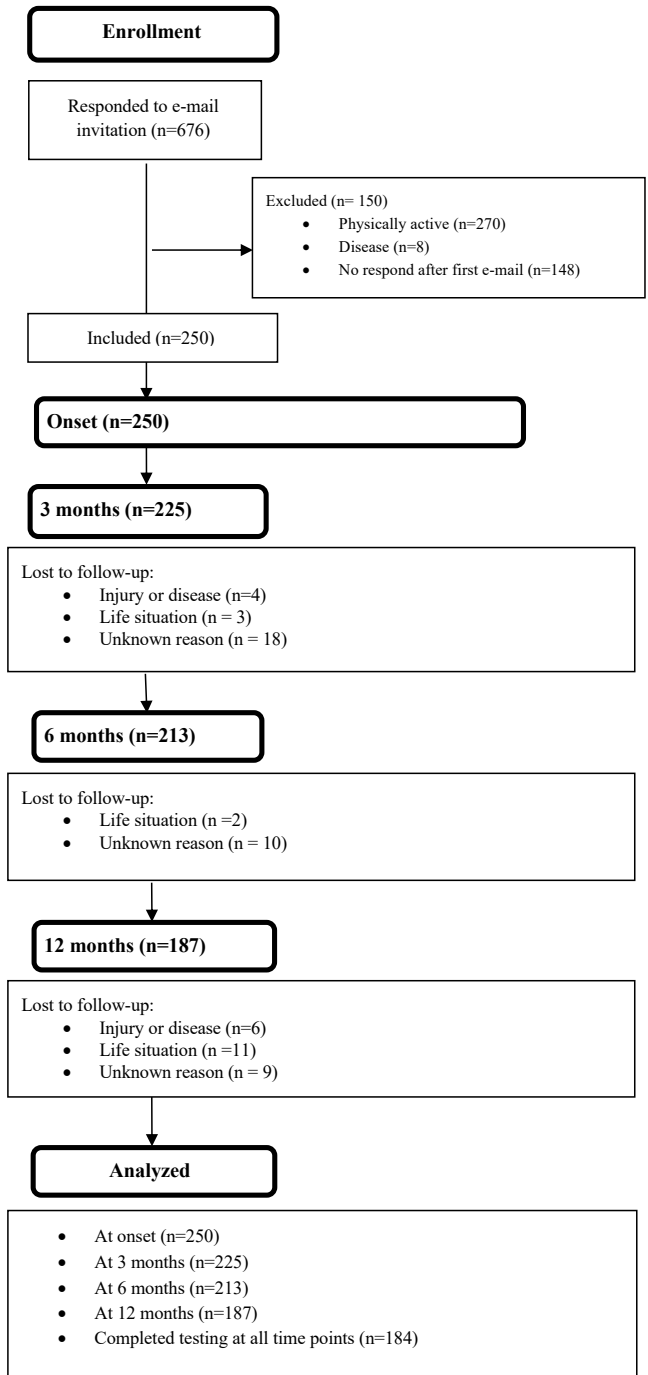

Figure 1: Flow diagram of the participants throughout the study.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	4
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9 and Figure1
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	Table 2-3
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make	10-13

		clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Investigating Self-Perceived Health and Quality of Life; -a longitudinal prospective study among beginner recreational exercisers in a fitness club setting

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-036250.R2
Article Type:	Original research
Date Submitted by the Author:	24-Apr-2020
Complete List of Authors:	Heiestad, Hege; Norwegian Shcool of Sports Science Gjestvang, Christina; Norwegian School of Sports Sciences, Department of Sports Medicine Haakstad, Lene; Norwegian School of Sport Sciences, Sport Medicine
Primary Subject Heading:	Sports and exercise medicine
Secondary Subject Heading:	Public health
Keywords:	SPORTS MEDICINE, PUBLIC HEALTH, MENTAL HEALTH

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Investigating Self-Perceived Health and Quality of Life; -a longitudinal prospective study among beginner recreational exercisers in a fitness club setting

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ABSTRACT

Objectives: This study investigated SPH and QoL at onset and after three, six and 12 months of fitness club membership. Also, we compared SPH and QoL between those who reported regular use of the fitness club (≥ two exercise sessions/week the last month) with those who did not (one exercise session/week, or no exercise the last month).

Design: Longitudinal prospective study.

Setting: 25 fitness clubs in Oslo, Norway.

Participants: In total, 250 newly registered fitness club members (equal numbers of men and women, mean age=36.4±11.3 years, mean BMI=25.7±4.4) were recruited. At onset (n=250), after three (n=224), six (n=213) and 12 months (n=187), the participants answered an electronic questionnaire, covering background variables, exercise involvement, perceived SPH and QoL.

Outcome measures: SPH was measured by a single item question, rating health status from poor to excellent on a five-point scale. High SPH was dichotomized as excellent or good, and low SPH as moderate, fair or poor. QoL was measured on a 7-item scale, rating five statements and dichotomized according to a total max sum score of 35, with low QoL≤ 25 and high QoL>25.

Results: Repeated measurements did not show any changes in SPH. In QoL, we observed an improvement in QoL sum score and a significant increase in mean scores for two out of five statements at 12 months follow-up: "*In most ways*, *my life is close to my ideal*" (p=0.036) and "*If I could live my life over, I would change almost nothing*" (p<0.001). Regular use of the fitness club was associated with high SPH (OR 3.532 [95% CI 1.60 to 7.82], p=0.002) and high QoL (OR1.914 [95% CI 0.95 to 3.86], p=0.069). The results were unchanged after adjusting for confounders.

Conclusions: Regular attendance at a fitness club was associated with high SPH and high

QoL at 12 months follow-up.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The use of prospective study design with 12 months follow-up.
- Valid and reliable measurement methods.
- The use of an electronic questionnaire based on previously validated surveys.
- Self-reported attendance at the fitness club.

INTRODUCTION

Physical activity is a complex behavior influenced by several different determinants (1). Much research has focused on the main factors that may lead to regular exercise or dropout. There is consensus that enjoyment (intrinsic motives), social support, and access to exercise facilities (environmental factors) may positively influence exercise behavior. On the other side, lack of time and motivation (internal barriers) may inhibit exercise adherence (2).

According to the World Health Organization (3), health is not only the absence of somatic disease but also includes mental and social well-being, putting emphasis on the usefulness and need for investigating individuals´ self-perception of overall health (SPH). Up to date, several studies have shown that low SPH may be a valid and robust predictor of morbidity and mortality of various diseases, such as cancer, cardiovascular disease, stress, diabetes and other chronic health conditions (4-7). Low SPH is as well associated with being sick-listed and frequent use of health care services (8,9). In different patient groups and among the elderly population, SPH has widely been used to evaluate the effect of health-care programs (10). The measure is a single-item question, including rating of health status from poor to excellent on a five-point scale, and as such popular for its simplicity and cost-effectiveness (11).

It is growing interest in the assessment of physical activity on modification of SPH, and studies have indicated a strong association between insufficient physical activity and lower SPH in adults, especially in older individuals (12,13). However, it is important to investigate SPH not only between individuals that are active or inactive according to current physical activity recommendations (14), but also if this differs between activity contexts (organized

sports clubs, public spaces and fitness clubs) and exercise involvement (frequency, duration, intensity, and modes) (15).

Quality of life (QoL) has also become an important measurement because it is a meaningful indicator of both mental and physical well-being (16,17), and its positive association with physical activity has been consistently reported in the systematic reviews and meta-analyses 18,19). Although there is limited data, it is suggested that QoL may be a key motivator for regular physical activity and exercise (20), meaning that individuals start and continue to be active because this contributes to their QoL. However, cross-sectional data precludes a conclusion regarding the nature of this association (21).

Throughout the 1990s, a new venue for physical activity and exercise gradually grew in popularity, the fitness clubs. Worldwide, the fitness club industry has about 183 million members and counts more than 210 000 clubs (22). Those who join a fitness club may be initially motivated to exercise, still, previous studies have shown a high dropout-rate after only three months (23,24). This shows that maintaining regular exercise can be challenging even for motivated individuals. Even though this arena has become a large and growing venue for activity, the scientific knowledge of those that choose to be a member is scant. Research has not yet investigated how fitness club membership relates to SPH and QoL-status among beginner recreational exercisers. Hence, the primary aim of the present study was to report longitudinal data of SPH and QoL in an age-diverse group of men and women across the first year of fitness club membership. Secondary, we wanted to examine if SPH and QoL differed between those who reported regular use of the fitness club (≥ two exercise sessions/week the last month) with those who did not (one exercise session/week, or no exercise the last month).

MATERIALS AND METHODS

Study design and population

This is a secondary analysis of data collected as part of the research project "Fitness clubs - a venue for public health?" (24-27), a longitudinal prospective study, aiming to investigate which factors that influence exercise adherence in beginner recreational exercisers.

The project was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1443 A), who concluded, according to the act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The procedures followed the World Medical Association Declaration of Helsinki and were approved by the Norwegian Social Science Data Service (NSD 44135), financed and conducted at the Norwegian School of Sport Sciences (NSSS) (October 2015 - November 2018). No economic compensation was given to the participants.

New members at 25 fitness clubs in Oslo, Norway were contacted by an e-mail invitation. At first contact, the aims and implications of the study were explained, and the eligibility criteria checked. Enrollment was limited to adults (≥18 years), <four weeks membership, healthy (no disease considered to hinder physical activity, e.g., severe heart disease or hypertension), and physically inactive (exercising <60 min/week at a moderate or vigorous intensity or brisk walking <150 min/week, the last six months) (14,28).

Sample size considerations for SPH and QoL was done together with a professor in biostatistics at NSSS, based on findings in other studies (29-31). When an individual starts exercising, it may be that small changes occur in QoL, such as going from 23 (low QoL) to 26 (high QoL) on the total sum score for QoL (35 points). It was estimated that with 70

participants, we would be able to detect a 10% change in QoL over a one-year follow-up period. Similarly, with a power of 80% at the 0.05 level, we would be able to identify small changes in SPH, such as going from three to four on the five-point Likert-scale, with 93 participants. To account for losses to follow-up and be able to do subgroup analyses, we aimed to recruit all individuals who fulfilled the eligibility criteria. In total, 676 fitness club members wanted to participate in the study. We excluded those who already exercised regularly (n=270) or had cardiovascular disease, hypertension or asthma (n=8). Besides, 148 individuals did not respond after the first e-mail, leaving 250 enrolling in the study (Figure 1).

Patient and Public involvement

Four volunteers completed a pilot test of the whole electronic questionnaire, which led to minor changes in wording and format. Otherwise, participants and the public have not been involved in the development of research questions, study design or recruitment.

Data-collection and measurements

A standardized electronic questionnaire was answered at onset and after three, six and 12 months´ fitness club membership. A pretest of the questionnaire was conducted by four members in the research group, as well as four volunteers. The final questionnaire contained 52 questions at onset and 65 questions at three, six and 12 months. At all time-points, the questionnaire took approximately 30 minutes to complete and was answered electronically.

SPH was assessed by answering a global single question: "*In general, how would you rate your health today?*". The response options were ranked from 1-5, with the following description: excellent, good, moderate, fair and poor. According to these five levels, we also

divided the participants into two categories: high SPH (excellent and good) and low SPH (moderate, fair and poor) to investigate the association between SPH and exercise behavior, an approach adopted by other researchers (32,33).

QoL was measured by a Norwegian version of the Satisfaction of Life Scale (SWLS) (34). Because of multiple assessment-points, and a comprehensive questionnaire covering several factors influencing exercise adherence (24-27), we decided after discussion in the project group to use SWLS. The SWLS is short and includes five statements only. Several studies have also supported the validity and reliability of the scale (35-38). QoL is measured on a 7-item scale, where the participants rate five different statements from “strongly disagree” = 1 to ”strongly agree” = 7:

1. *“In most ways, my life is close to my ideal”*
2. *“The conditions of my life are excellent”*
3. *“I am satisfied with my life”*
4. *“So far I have gotten the important things I want in life”*
5. *“If I could live my life over, I would change almost nothing”*

The results from QoL were analyzed separately for each statement and as a sum score (31,39-41), and we also dichotomized QoL into two main groups; low QoL (scores 5-25) and high QoL (scores 26-35).

To examine the role of regular exercise on SPH and QoL, we asked the participants to report exercise involvement at the fitness club in the last four weeks: 1) *"Have you been a member?*": "yes" or "no", 2) *"Have you been exercising regularly?"*: "yes" or "no", 3) *"How often have you exercised per week on average?"*: "once a week", "twice a week", "three times

a week", "four times a week", "five times a week", "six times a week" or "seven times a week or more". In line with Garber et al. (14), non-regular use was defined as exercising one session/week, or no exercise the last month, whereas regular use of the fitness club was defined as exercising ≥ 2 times a week. Hence, membership dropouts were counted in the non-regular users of the gym.

Information related to demographic variables and socioeconomic status were obtained from the questionnaire answered at onset, covering age, gender, body weight, level of education, total household income, cohabitation, children and occupation.

Statistical analyses

Statistical Package for the Social Sciences (SPSS) – 25.0 for Windows was used for statistical analysis. Data are presented as numbers with percentages or means with standard deviations (SD), as well as Odds Ratio (OR) with 95% Confidence Intervals (CI) and p-values. Chronbach`s α for the SWLS was 0.87, 0.91, 0.90 and 0.91 at baseline, and after three, six and 12 months, respectively. Chi-square analysis was used to compare categorical variables and two-sided independent sample t-test for continuous variables (Table 1). In addition, Mc Nemars test, Cochran's Q, paired sample t-test and one way repeated measure ANOVA were used to analyze changes in SPH and QoL. Data (Table 2 and 3) are reported for participants who completed the questionnaire at onset of fitness club membership (n=250), three months (n=224), six months (n=213) and 12 months (n=187), whereas p-values are shown for participants that completed the questionnaire at all measurements points only (n=184). Also, due to the ethics of mandatory questionnaire responses, we included “I do not want to answer” or “Not relevant” as response options, which in the SPSS data set were treated as missing values, so individual questions may have varying response rates.

To assess the difference between those who reported regular use of the fitness club (n=70), with those who did not (n=93) on SPH and QoL, we included prospective data obtained at 12 months (Table 4). Based on previous literature (42-44) and crude analysis comparing demographic and health factors between high and low SPH, and high and low QoL, seven variables (exercise, age, cohabitation, total household income, Body Mass Index (BMI), children and gender) with p-values ≤0.05 (Table 1), were all entered in the above order in the adjusted model (Table 5).

RESULTS

General characteristic of all participants at onset of fitness club membership, divided into high and low SPH and QoL, is shown in Table 1. In total, 66.4% and 35.2% rated their SPH and QoL as high, respectively. There were no gender differences concerning SPH, but more women (41.9%) than men (28.8%) rated their QoL as high. The high SPH group had lower age, mean BMI and fewer were overweight or obese compared with the low SPH group. Participants with high QoL had higher age and were more likely to report high total household income, living with a partner and having children than the low QoL group (Table 1).

Table 1: General characteristics of the participants at onset of fitness club membership, divided into high and low SPH and QoL (n=250).

Background variable	All (n=250)	SPH High (n=166)	SPH Low (n=83)	p-value	QoL High (n=88)	QoL Low (n=161)	p-value
Norwegian descent [n (%)]	196 (78.4)	134 (80.7)	62 (74.7)	0.630	65 (73.9)	130 (80.7)	0.428
Gender: Men [n (%)]	125 (50.0)	83 (50.0)	42 (50.6)	1.000	36 (40.9)	89 (55.3)	0.042
Age (years) [mean (SD)]	36.4 (11.3)	34.5 (10.5)	40.1 (11.9)	<0.001	38.5 (12.1)	35.2(10.6)	0.027
Age ≥ 40 years [n (%)]	81	43	37	0.010	33	47	0.230
BMI [mean (SD)]	25.7 (4.4)	25.2 (4.0)	26.6 (5.0)	0.017	25.3 (4.1)	25.9 (4.5)	0.263
BMI ≥ 25 (overweight or obese) [n (%)]	121 (48.4)	72 (43.4)	48 (57.8)	0.044	36 (40.9)	85 (52.8)	0.097
Education level: University ≥ 4 years [n (%)]	102 (40.8)	66 (39.8)	36 (44.4)		40 (45.5)	61 (37.9)	0.304
Total household income: High > 87 500$ [n (%)]	114 (45.6)	74 (47.4)	40 (51.3)		51 (62.2)	62 (40.8)	0.003
Living with a partner [n (%)]	153 (61.2)	102 (61.4)	50 (60.2)	0.963	70 (79.5)	82 (50.9)	<0.001
Children	80 (32)	50 (31.1)	29 (34.9)	0.531	36 (40.9)	44 (27.3)	0.040
Employed outside of home [n (%)]	185 (74.0)	120 (72.3)	64 (77.1)	0.134	63 (71.6)	122 (75.8)	0.142

At onset, more men than women had a household income ≥87 500 US dollar (52.0% versus 39.2%), worked outside the home (86.4% versus 61.6%), were overweight or obese (BMI ≥25 kg/m2, 58.4% versus 38.7%) and older (38.5 years versus 34.3 years). More details of the study participants have been published previously (22-25). Throughout the initial year of fitness club membership, we found no changes in SPH (Table 2).

Table 2: SPH at onset, three, six and 12 months of fitness club membership. Results are shown in mean and standard deviation (SD) or numbers (n) and %. P-values are shown for participants that completed the questionnaire at all measurement points (n=184).

Outcomes	**Onset** n=250 (men=125, women=125)	**Three months** n=224 (men=108, women=116)	**Six months** n=213 (men=106, women=107)	**12 months** n=187 (men=96, women=91)	**p-value**
SPH:					
Mean score (SD)	2.3 (0.7)	2.2 (0.8)	2.1 (0.7)	2.2 (0.7)	0.313
High SPH [n (%)]	166 (66.7)	158 (70.5)	158 (74.2)	128 (68.4)	0.359
Low SPH n [(%)]	83 (33.3)	66 (29.5)	55 (25.8)	59 (31.6)	
- Excellent [n (%)]	31 (12.4)	31 (13.8)	37 (17.4)	27 (14.4)	0.532
- Good [n (%)]	135 (54.0)	127 (56.7)	121 (56.8)	101 (54.0)	0.841
- Moderate [n (%)]	73 (29.2)	54 (24.1)	48 (22.5)	51 (27.3)	0.430
- Fair [n (%)]	8 (3.2)	10 (4.5)	6 (2.8)	8 (4.3)	0.943
- Poor [n (%)]	2 (0.8)	2 (0.9)	1 (0.5)	0 (0.0)	0.300
*Missing [n (%)]	1 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	-

In QoL measurements, we observed an increase in mean scores for all five statements, a significant increase in two out of five statements: "*In most ways, my life is close to my ideal*" (p=0.036) and "*If I could live my life over, I would change almost nothing*" (p<0.001), and also an improvement in sum score (p = 0.071) (Table 3).

Table 3: QoL at onset, three, six and 12 months of fitness club membership. Results are shown in mean and standard deviation (SD) or numbers (n) and %. P-value is shown for participants that completed the questionnaire at all measurement points (n=184).

Outcomes	**Onset** n=250 (men=125, women=125)	**Three months** n=224 (men=108, women=116)	**Six months** n=213 (men=106, women=107)	**12 months** n=187 (men=96, women=91)	**p-value**
QoL:					
Sum score QoL [mean (SD)]	22.2(6.7)	22.2(7.1)	22.5(6.9)	23.2(6.8)	0.071
High QoL [n (%)]	88 (35.3)	76 (34.2)	79 (37.1)	76 (41.1)	0.263
Low QoL [n (%)]	161 (64.7)	146 (65.8)	134 (62.9)	109 (58.9)	
«In most ways my life is close to my ideal» [mean (SD)]	4.1 (1.5)	4.3 (1.6)	4.3 (1.6)	4.4 (1.6)	0.036 (onset to 12 months; p=0.025)
«The conditions of my life are excellent» [mean (SD)]	4.7 (1.5)	4.7 (1.5)	4.7 (1.5)	4.8 (1.5)	0.356
«I am satisfied with my life» [mean (SD)]	4.9 (1.6)	4.8 (1.6)	4.9 (1.5)	5.0 (1.5)	0.216
«So far I have gotten the important things I want in life» [mean (SD)]	4.5 (1.7)	4.4 (1.7)	4.5 (1.6)	4.7 (1.6)	0.068
«If I could live my life over, I would change almost nothing» [mean (SD)]	4.0 (1.9)	4.0 (1.8)	4.1 (1.8)	4.3 (1.8)	<0.001 (onset to 12 months; p<0.001, 3 to 12 months; p=0.001, 6 to 12 months; p=0.001)

At all measurements, regular use of the fitness club was associated with high SPH, as well as higher sum scores on QoL at 12 months follow-up (Table 4). There was a large drop in participants reporting regular use of the fitness club (≥2 times a week) from three (51.8%) to six (37.6%) and 12 (37.4%) months (p = 0.003), with no gender or age differences. More details of exercise behavior at the gym are previously reported (21-24).

Table 4: SPH and QoL compared in participants reporting regular and non -regular use at a fitness center at three, six and 12 months. Results are shown in mean and standard deviation (SD) or numbers (n) and %.

	Three months			**Six months**			**12 months**		
	Regular use (n=116)	Non-regular use (n=106)	p-value	Regular use (n=80)	Non-regular use (n=125)	p-value	Regular use (n=70)	Non-regular use (n=93)	p-value
SPH:									
Mean score (SD)	2.1 (0.7)	2.4 (0.8)	0.001	1.9 (0.7)	2.3 (0.8)	0.001	1.9 (0.7)	2.4 (0.7)	<0.001
High SPH [n (%)]	91 (78.4)	67 (63.2)	0.018	67 (83.8)	85 (68.0)	0.015	59 (84.3)	57 (61.3)	0.002
Low SPH [n (%)]	25 (21.6)	39 (36.7)		13 (16.2)	40 (32.0)		11 (15.8)	36 (38.7)	
QoL:									
Sum score QoL [mean (SD)]	22.5 (6)	21.8 (7.6)	0.469	22.6 (7.2)	22.5 (6.8)	0.954	25.1 (5.5)	22.0(7.0)	0.002
High QoL [n (%)]	39 (34.2)	36 (34.0)	1.000	35 (43.8)	42 (33.6)	0.177	34 (49.3)	34 (36.6)	0.144
Low QoL [n (%)]	75 (65.8%)	70 (66.0)		45 (56.2)	83 (66.4)		35 (50.7)	59 (63.4)	

Participants not reporting regular use of the fitness club were n = 2, n = 8, and n = 24 at three, six and 12 months, respectively.

Also after adjusting for confounders (age, cohabitation, total household income, BMI, children and gender), regular use of the fitness club ≥ two times weekly was associated with reporting high SPH (OR 3.532 [95% CI 1.60 to 7.82], p=0.002) and QoL (OR 1.914 [95% CI 0.95 to 3.86], p=0.069) (Table 5).

Table 5: The association between use of a fitness club and High SPH / QoL at 12 months, controlled for age, cohabitation, total household income, BMI, children, and gender.

Outcomes	**High SPH** (n=128 (68.4%))				**High QoL** (n=76 (40.6))			
	%	Odds Ratio (OR)	95%CI for OR, lower-upper	p-value	%	Odds Ratio (OR)	95%CI for OR, lower-upper	p-value
Regular use (frequency ≥ two times weekly)	59 (50.9%)	3.532	1.595-7.821	0.002	34 (44.7%)	1.914	0.950-3.856	0.069
Age (> 40 years)	44 (34.4%)	1.150	0.506-2.613	0.738	23 (30.3%)	1.388	0.636-3.032	0.410
Living with a partner (yes)	83 (64.8%)	0.644	0.274-1.509	0.311	57 (75%)	0.369	0.161-0.849	0.019
High household income (≥ 87 500$ per year)	59 (48.8%)	0.972	0.405-2.332	0.950	39 (51.3%)	1.214	0.540-2.726	0.639
Body Mass Index (BMI) (≥25kg/m^2)	66 (51.6%)	1.120	0.524-2.392	0.770	31 (40.8%)	1.985	0.983-4.010	0.056
Children (yes)	37 (28.9%)	0.833	0.353-1.964	0.676	24 (31.6%)	1.072	0.480-2.395	0.866
Gender (man)	70 (54.7%)	0.733	0.348-1.546	0.415	36 (47.4%)	1.387	0.688-2.796	0.360

To evaluate if the participants were representative of our initial study population, a comparison analysis was performed with the 63 participants lost to follow-up at 12 months. Mean scores at onset were 2.3 ± 0.7 (all) and 2.4 ± 0.9 (lost to follow-up), and 22.2 ± 6.7 (all) and 21.4 ± 6.5 (lost to follow-up) for SPH and QoL, respectively. No differences were found in demographic and socioeconomic variables (data not shown).

DISCUSSION

To our knowledge, this is the first study that has investigated SPH and QoL among beginner recreational exercisers in a fitness club setting. The main findings were an increase in mean scores for all five statements in QoL, even if only two of the statements reached statistical significance. We also found an improvement in QoL sum score throughout the one-year follow-up period. No changes were observed for SPH during the initial year of fitness club membership. Regularly fitness club users rated SPH higher at all measurement points, as well as perceived their QoL higher than non-regular users at 12 months follow-up.

We found no changes in SPH throughout the follow-up period, which is contrary to another study investigating SPH among healthy adults (5). One explanation to this may be that more than half of the participants (66.7%) in our study rated their SPH as high already at onset of fitness club membership, which caused less opportunity for further improvement. Also, very few (4%) rated their SPH fair or poor at onset. As such, the ceiling effect in SPH might be a cause for our results. Previous research on the association between exercise and SPH have primarily been done among sick or elderly populations, reporting that regular physical activity and even a small dose of regular exercise (defined as engaging in activities more than once a week, in line with our definition of regular use of the gym) may improve SPH (45,46).

Precise definitions of QoL are scant and measures vary greatly (47). Still, research including systematic reviews and meta-analysis has suggested that regular exercise may enhance QoL and contribute to emotional wellbeing (18,19,47). This is consistent with the present study, where regular exercise at the fitness club was associated with higher scores in perceived QoL. Our data also give some support for a dose-response curve and a threshold of at least twice weekly to achieve benefits in SPH and QoL. However, we cannot conclude that exercise

contributes to QoL, or if it is the other way around. We found, however, that QoL score increased from onset of membership to 12 months follow-up, lending credibility to the hypothesis that improvement in QoL might be a key motivator for sustained exercise (48). However, social and cognitive factors (such as social interactions while exercising, group cohesion and self-efficacy) may confound the association between regular use of a fitness club and QoL. In line with others, we believe that these factors might have a mediating role, rather than being real confounding factors (48,49). Throughout the follow-up period, there was an increase in two out of five statements of QoL and an improvement in the total sum score. The three non-significant statements could be explained by a higher rating already at onset, and a possible ceiling effect, which we also discussed earlier regarding SPH. Besides, the SWLS focuses to a large extent on how the participants feel and think with respect to several important aspects from a life-long perspective (from birth and up to date). Hence, it can be difficult to rationalize our results and the influence of joining a fitness club, whatever the findings.

Participants

More than 60% of the participants did not manage to visit the fitness club regularly after six and 12 months the initial year of membership. Others have also reported a high drop-out rate (50%) from regular use of the fitness club within the first six to 12 months of membership (50,51). A retrospective study found that only 10% of fitness club members reported regular gym attendance (at least four visits monthly) after six months (52). In our study, this number was higher. Nevertheless, this shows that maintaining an active lifestyle can be challenging even for motivated individuals, and it highlights the need to develop strategies and interventions to facilitate exercise behavior in a fitness club setting. It may be useful to understand that regular exercise can contribute to increased SPH and QoL. Finding time is

vital if regular use is to be adhered to. Even though most fitness clubs are located where people live and travel, have flexible opening hours, many also offering childcare, former physically inactive individuals may have had problems getting into a weekly routine (53).

Outcomes

Both SPH and QoL were measured by a standardized electronic questionnaire at all time-points. The use of an electronic questionnaire based on previously validated surveys made it easy to gather responses quickly and eliminate the costs associated with printing and distributing paper-based questionnaires. Self-report is inexpensive, takes up little time to conduct and is practical. Anyway, due to social desirability, the risk of over-reporting may be high. For instance, individuals may report more socially acceptable answers rather than being honest and may interpret the wording of questions differently (54). However, assessment of SPH and QoL depends on the individual, subjective perception. Hence, self-report may be an appropriate measurement method for measuring SPH and QoL.

SPH was assessed by answering a global single question used in numerous other studies and subjective assessment of health has been found to highly correlate with results of its objective assessment and health status indices (55). QoL was measured by a Norwegian version of SWLS which is considered to be a reliable and valid instrument and has been widely used to examine the subjective QoL of people experiencing different health concerns (30,40).

Strengths and limitations

A strength of the present study was the use of prospective study design with 12 months follow-up. Also, the inclusion of data concerning personal health behaviors (BMI and exercise) and demographics (age, cohabitation, total household income, having children) is

considered strengths. Hence, we were able to adjust for these factors in the analyses. All participants were untrained at study enrollment and may as such be considered representative for new members at fitness clubs (27), as well as comparable to the general adult population (56). There was an equal number of men and women and we used valid and reliable measurement methods (30,32). Despite a high dropout from the study itself, we had a sufficient number of participants at all measurement points regarding a priory power calculation for SPH and QoL.

Limitations were that the investigation was carried out in Norwegian only, excluding participants from other ethnic groups, as well as that attendance at the fitness club was self-reported. Studies are consistent in showing that individuals tend to overestimate what they do (57,58). Nevertheless, if this was the case, the results of the present study provide a conservative calculation of exercise involvement at the fitness club. The questionnaire took approximately 30 minutes to complete and was answered electronically. Such a time-consuming questionnaire might cause more losses to follow-up. Further, participation was voluntary, and it may be possible that the data contain a certain level of volunteer-bias, questioning the representativeness of the results.

Conclusion

We found an increase in all five statements in QoL, while only two of the items reached statistical significance. We also found an improvement in the QoL sum score, whereas no changes were observed in SPH during the first year of fitness club membership. Our results add to the literature that regular attendance at the fitness club after 12 months was associated with a high SPH and QoL.

Acknowledgments

The authors thank Ingar Holme and Morten Fagerland, professors in biostatistics, Norwegian School of Sports Sciences, for guidance with power considerations and statistical analysis.

Footnotes

· **Contributors** HH outlined the manuscript. CG plotted all data and developed the questionnaire together with LAHH. CG and LAHH were responsible for data collection and recruited the participants. HH, CG and LAHH did the testing. LAHH originated the idea for the present study and supervised the project. All authors participated in discussing the design of the study, read and corrected draft versions of the manuscript and approved the final manuscript.

· **Competing interests** None declared.

· **Funding** The project was financed by and conducted at the Norwegian School of Sports Sciences.

· **Ethics approval** The project was reviewed by the Regional Committee for Medical and Health Research Ethics (REK 2015/1443 A), who concluded that, according to the Act on medical and health research (the Health Research Act 2008), the study did not require full review by REK. The project was approved by the Norwegian Social Science Data Service (NSD 44135).

· **Data sharing statement** All data are fully available without restriction. Data are from the 'Physical activity at fitness clubs. -A venue for public health'-a study whose authors may be contacted at the Norwegian School of Sports Sciences. Hege.heiestad@nih.no.

· **Patient consent for publication** Not required.

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Figure 1. The flow chart of the participants throughout the data-collection.

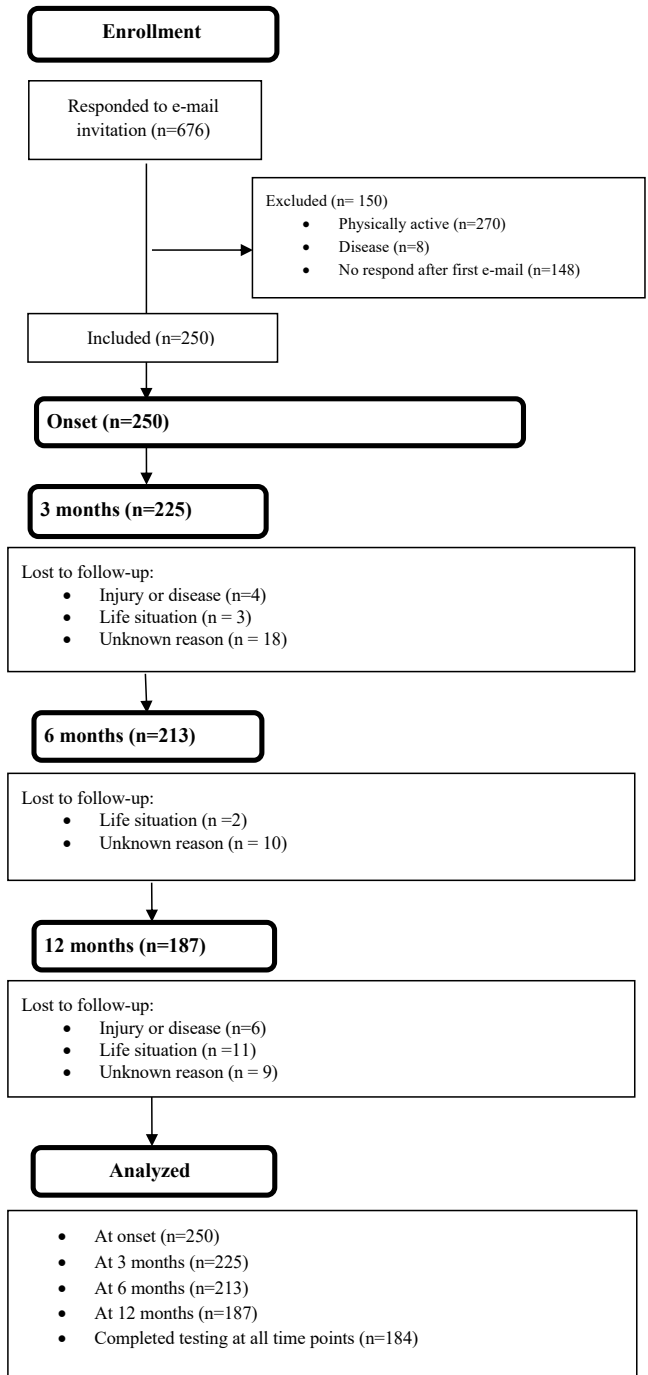

Figure 1: Flow diagram of the participants throughout the study.

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	4
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	3
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*6-8*
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	6-7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7-8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	9
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9 and Figure1
		(b) Give reasons for non-participation at each stage	Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	Table 2-3
Outcome data	15*	Report numbers of outcome events or summary measures	10-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make	10-13

		clear which confounders were adjusted for and why they were included	
		(*b*) Report category boundaries when continuous variables were categorized	
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	10-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	6

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.