PERCEIVED WORK ABILITY IN THE LIGHT OF LONG-TERM AND STRESS-RELATED UNHEALTHY BEHAVIORS – A PROSPECTIVE COHORT STUDY

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Abstract

Background: Most of the few studies that exist on the longitudinal associations between health behaviors and work ability target to single health behaviors.

Purpose: To investigate how life time clusters of unhealthy behaviors associate with perceived work ability in early midlife.

Methods: The study population consisted of 46-year-old men and women (n=3107) born in Northern Finland in 1966. Their current perceived work ability compared to lifetime best, and their unhealthy behaviors (physical inactivity, smoking and alcohol consumption) were assessed by questionnaires. We determined clusters of unhealthy behaviors at the ages of 14, 31 and 46, and created life time development trajectories of health behaviors. We also assessed stress-related eating and drinking at the ages of 31 and 46.

Cross tabulations and multivariate logistic regression models were used to investigate the associations between clusters of health behaviors, stress-related eating and drinking, and work ability at 46 years. The analyses were controlled for basic education and physical strenuousness of work, psychosocial job characteristics, perceived work ability and BMI (kg/m^2) at 31 years.

Results: Four health behavior trajectories emerged: always healthy, moderate (reference group), deteriorated and always unhealthy. Among men, always unhealthy behaviors [OR (95% confidence interval) 2.81 (1.35, 5.86)], and among women, deteriorated health behaviors [1.67 (1.07, 2.58)] associated with poor perceived work ability at 46 years. In addition, stress-related eating and drinking associated independently with poor perceived work ability at 46 years [men 2.58(1.62, 4.12) and women 2.48(1.70, 3.61)].

Conclusion: Long-lasting and stress-related unhealthy behaviors increase the risk of poor work ability in midlife.

Key words: life time health behaviors, perceived work ability, prospective cohort study, stress-related eating and drinking

Introduction

Good work ability has been associated with high quality and productivity of work, commitment to one's job, later retirement and well-being in retirement [1-2]. Conversely, poor work ability has been associated with increased sickness absences, reduced productivity and early retirement [2-7]. For the benefit of both employees and employers, it is important to understand the factors that either promote or deteriorate good work ability.

Life style diseases such as coronary heart disease and diabetes are associated with lower perceived work ability [8]. Unhealthy behaviors increase the risk of these diseases but may also independently deteriorate work ability [9]. Unhealthy behaviors may decrease alertness at work and inhibit optimal recovery from work.

An earlier review reported that a lack of vigorous leisure-time physical activity, poor musculoskeletal capacity, obesity, high mental work demands and high physical work-load associated with poor work ability, defined by the Work Ability Index [9]. Physical activity has associated positively with work ability in both cross-sectional and longitudinal studies [9-14] whereas associations between smoking and work ability have not been consistent in cross-sectional studies [1, 8, 15-17]. Decreased smoking did not correlate with improved work ability in one longitudinal study [14]. One of three cross-sectional studies on alcohol consumption and perceived work ability found a negative association, whereas two of them did not [1,10,15]. In addition, one cross-sectional study found a linear association with alcohol consumption among 31-year-old women and non-significant u-shaped association among men [17]. In another study, a negative association was only found among older workers [18]. No longitudinal studies exist.

Stress-related eating and drinking increases the risk of obesity, alcohol consumption and eating fatty and sugary foods, and thus may be a risk for poor work ability [19-20]. Stress-related eating and drinking is one pattern of passive coping to relieve stress. Associations between stress-related eating and drinking and work ability have not been studied earlier, but avoidant coping has been associated with decreased work ability [21].

Health behaviors starting from childhood or teenage may have an effect on later health and health behaviors. In earlier study, childhood adversities predicted disability retirements in adulthood and this was partially mediated by health behaviors (such as alcohol consumption and smoking) [22]. Besides, smoking between ages 14 and 31 has associated with educational achievement [23].

In sum, earlier studies about the associations between health behaviors and work ability have mostly been cross-sectional. The few longitudinal studies that exist have only focused on people approaching pension age, although arguably, if working careers are to be extended, the promotion of work ability should be started already among young workers [13-14, 24-25]. Furthermore, it is mainly the effects of single health behaviors that have been investigated, but unhealthy behaviors often cluster, and this clustering may strengthen the harmful effects on work ability [26].

Therefore, the aim of this study was to evaluate the effects of the clustering of life time health behaviors on perceived work ability in early midlife in a prospective 1966 Northern Finland birth cohort study. We focused on perceived work ability at 46 years, and the development of this between the ages of 31 and 46. Health behaviors included were physical activity, alcohol consumption and smoking (14 to 46y), and stress-related eating and drinking (31 to 46y).

Methods

Study population and data collection

The ongoing 1966 Northern Finland Birth Cohort (NFBC 1966) started with a study population comprising 96.3 per cent of all births during 1966 in the areas of Oulu and Lapland in 1966, and has been followed up for 46 years [27-28] (*Figure 1*).

In the 14-year follow-up in 1980, 93.6% (n=11010) of the study population returned a postal questionnaire [29-30]. In the 31-year follow-up in 1997, a postal questionnaire was sent to participants who were alive and had a known address (n=11541), and 75.3% of these responded. Cohort members who lived in Northern Finland or in the metropolitan area (n=8463) were invited to clinical examinations, during which they were asked to reply to a questionnaire about work life. Of these, 67.5% (n=5713) responded. In the 46-year follow-up, 10 300 participants were alive and traced, and asked by letter to fill in questionnaires on the internet. If the subjects had no computer or preferred answering on paper, they were sent a postal inquiry. Answers were received from 66.4% (n=6835) of all invited participants. This study includes the first release data of the 46-year-olds.

Those finally included in the analyses were the participants whose data on the studied variables between 14 and 46 years were available (n=3107). The effect of potential selection bias was studied by comparing some of the results of those included to the results of those excluded from the analyses due to missing data.

All participants gave written informed consent according to the Declaration of Helsinki at each stage of the study. The study was approved by the Ethics Committee of the Northern Ostrobothnia Hospital District and by the Coordinating Ethics Committee of Helsinki University Hospital.

Outcome and explanatory measures

Current perceived work ability compared to life time best was used as an outcome measure. The participants evaluated their current work ability on a scale of 0 to 10 at the ages of 31 and 46, ten indicating lifetime best work ability. The question used for this was the first item of the Work Ability Index [31].

Current perceived work ability was first classified into two groups: good (8−10) and poor (0−7). Second, to describe perceived work ability from 31 to 46 years, the item was divided into

four groups: always good (8−10), deteriorated (from 8−10 to 0−7), improved (from 0−7 to 8−10), and always poor (0−7).

Clusters of unhealthy behaviors at the ages of 14, 31 and 46 were used as explanatory variables (Table 1). We used sum scores to study the associations of unhealthy behaviors with perceived work ability at a certain age, and trajectories to describe the effect of the longitudinal exposure of unhealthy behaviors. Unhealthy behaviors included were physical inactivity (14, 31 and 46 y), smoking (14, 31 and 46 y), alcohol consumption (14, 31 and 46 y) and stress-related eating (31 and 46 y). This selection was based on the results of earlier Finnish population based study by Laaksonen et al. (26).

At the ages of 14, 31 and 46, three groups of health behaviors were formed on the bases of the tertiles of the sum scores (physical inactivity, smoking, alcohol consumption): healthy, average and unhealthy. Health behavior trajectories were created through trajectory analysis between the ages of 14 and 46 (see statistical analysis). We then calculated the sum score of stress-related eating and drinking at the ages of 31 and 46.

Physical activity at the age of 14 was evaluated by eliciting the frequency of participation in sports outside school time and was classified into three groups and scored from 0 to 2: daily or almost daily (0, active), weekly or monthly (1, moderately active) and normally not at all (2, inactive). At the ages of 31 and 46, physical activity was evaluated by eliciting the participation in light and brisk leisure time physical activity/exercise. Physical activity was classified into three groups: inactive (brisk physical activity less than once a week and light activity less often than four times a week), moderately active (brisk physical activity at least once a week but less than 20 minutes at a time or light physical activity at least four times a week) and active/very active (brisk physical activity at least two times a week at least 20 minutes at a time) [32]. The groups at ages 31 and 46 both time points were scored as 0 (active/very active), 1 (moderately active) and 2 (inactive).

Smoking at the age of 14 was classified into three groups based on the frequency of smoking; non-smoking/never smoked, occasional smoker (occasionally or about twice a week) and regular smoker (daily smoking) [30]. The groups were scored 0 (non-smoking/never smoked) to 2. At the ages of 31 and 46 the classes were: ex-smoker/never smoked, occasional smoker (five to six days a week or occasionally) and smoke (daily smoking). The groups were scored 0 (ex-smoker/never smoked) to 2.

Alcohol consumption at the age of 14 was evaluated by asking how often the adolescent had been drunk. The answers were scored into the three groups: never drunk (0), mildly drunk at least once (1) and very drunk at least once (2). At the ages of 31 and 46, alcohol consumption was evaluated on the basis of the frequency of alcohol use (daily to once a year or never) and the usual amount of each alcoholic beverages [beer/cider/long-drink (a Finnish beverage, equal in strength to beer and cider), light wine, table wine and spirits] per drinking occasion. From these, we calculated the weekly consumption (portions/week) and formed three groups on the bases of the tertile cut offs at the ages of 31 and 46. The cut points were <1.5, ≥1.5 to <10 and ≥10 for men and <1, ≥1 to <5 and ≥5 portions /week for women.

Stress-related eating and drinking was measured by asking the participants to evaluate if they had tried to relief feelings of stress by eating, drinking, using medication, etc. the last time they had felt stressed [33-34]. This one item of the Ways of Coping Checklist has been used in earlier studies among adolescents and adults [19-20]. The answers were classified into two groups; no=0 (not at all, somewhat) and yes=1 (quite a lot or a great deal) [19]. The sum score including stress-related eating at 31- and 46-years was calculated (sum received values 0,1,2) and divided into two groups; no (sum=0) and yes (sum=1-2).

Covariates

Basic education (completed matriculation yes/no), psychosocial job characteristics, physical job strenuousness, perceived work ability and body mass index [BMI (kg/m^2)] at the age of 31 were used as controlling factors.

Psychosocial job characteristics (i.e. job demands and job control) were evaluated using questions from the Job Content Questionnaire [35]. Job demands (11 items) and job control (15) were evaluated on a scale of 1 (very little) to 5 (very much), like a previously reported [7]. The scores of both characteristics were summed and divided into two groups (high/low) based on median splits. Four further groups were created; high demands and high control (active), high demands and low control (high-strain), low demands and high control (low-strain), and low demands and low control (passive) [35].

Levels of physical job strenuousness were evaluated using the question “To what extent are the following tasks and postures part of your job”. The participants had to evaluate the extent of certain tasks (e.g. “heavy physical work in which the body has to struggle”, “lifting loads over 15kg”) and postures (e.g. “standing”, “bending”) in their work, through nine questions altogether. The response scale was from 1 (not at all or very rarely) to 5 (very often). We summed and divided the scores into three groups on the basis of the tertile cut-offs (low, moderate and high).

Weight and height were measured at the age of 31 and the missing values were replaced with self-reported values. BMI (kg/m^2) at the age of 31 was calculated on the basis of these values.

Employment status [employed versus all non-working population (including unemployed, student, retired etc.)] and marital status were also assessed through questionnaires at the age of 46y.

Statistical analysis

The statistical analyses were mainly performed using IBM SPSS Statistics 20 for Windows (IBM Corp., Armonk, NY, USA). The differences between the mean values of perceived work ability and health behaviors were investigated by reporting 95% CI and using the Mann-

Whitney-U test. We used cross-tabulation and chi-square tests to investigate the univariate associations between explanatory variables and perceived work ability. Multivariate logistic regression analyses were used to calculate odds ratios and their 95% CI for poor work ability at 46 years. Health behavior trajectories and stress-related eating and drinking were used as explanatory variables, and models were adjusted with the potential confounders.

Health behavior trajectories were created using group-based semi-parametric mixture modeling by the PROC TRAJ application [36-38], designed by SAS (SAS Institute, Cary, NC, USA). The Bayesian Information Criterion (BIC) and the average posterior probabilities of group membership were used to select the best model and number of trajectories. The model with the lowest BIC was selected from the different trajectory models. The probability of belonging to a one group was calculated for each participant: to be able to set an individual into a certain trajectory, the participant had to have the highest mean probability of belonging to this group and low probability of belonging into other groups. A mean value of at least 0.7 is considered to indicate a good model fit [39]. In this study, the lowest mean value was 0.77. All in all, the final model was selected on the basis of the BIC value, mean probabilities, and interpretability. The trajectory analysis was first conducted separately among men and women, and after that among both genders combined because the trajectories were the same for both genders.

Results

Mean perceived work ability [mean (95% confidence interval, CI)] was higher at the age of 31 [men 8.9 (8.8, 9.0), women 8.8 (8.8, 8.9)] than at the age of 46 [men and women 8.3 (8.2, 8.4)] among both genders. We observed no difference between the perceived work ability of men and women.

Of men, 80% and of women, 78% were married or cohabiting at the age of 46. Altogether, 90% of men and 87% of women were employed. Mean BMIs (kg/m^2, 95% CI) at the age of 31 were 25.9 (24.9, 25.3) for men and 24.0 (23.8, 24.2) for women. The characteristics of

the participants' health behaviors, education and work-related variables are presented in *Table 2*.

The mean values and frequencies of those included and those excluded due to missing data were compared in order to detect possible selection bias. Mean values (95% CI) of unhealthy behaviors were higher among the excluded than the included participants at 31 years [excluded 2.49 (2.45, 2.53) and included 2.31 (2.26, 2.36) $p<0.001$] and 46y [excluded 2.21 (2.15, 2.27) and included 2.09 (2.03, 2.14), $p=0.003$]. Excluded participants also had a higher frequency of stress-related eating and drinking at the age of 31 (13%, $p=0.04$) and had less often completed their matriculation (38.8%, $p<0.001$). No differences were discovered in unhealthy behaviors at 14 years [excluded 1.36 (1.33, 1.39) and included 1.35 (1.31, 1.40)].

Trajectory analysis

We selected the model with four health behavior trajectories, and this was the same for both genders. The trajectories were: always healthy, moderate, deteriorated and always unhealthy (Figure 2). All trajectories had a quadratic shape. The greatest variation was found in the *"deteriorated"* group in which unhealthy behaviors increased considerably between the ages of 14 and 31. The other groups were quite stable. The most of the participants belonged to the *"moderate"* group (71.3%).

Univariate analyses

The cross-tabulations showed that the prevalence of poor perceived work ability at 46 years was highest among men and women who had a cluster of unhealthy behaviors at the ages of 14 and 31 years, and who had stress-related eating and drinking (Table 2).

We discovered a higher prevalence of poor work ability among men in the *"always unhealthy"* behaviors trajectory, and among women in the *"deteriorated"* health behaviors trajectory

(Table 2). Furthermore, poor perceived work ability was more common among men and women with stress-related eating and drinking.

The univariate associations between clusters of unhealthy behaviors at ages 14 and 31 and longitudinal perceived work ability between ages 31 and 46 are shown in Figure 3. Longitudinally, good work ability was more common among those with healthy behaviors. Among men, a slight but clear dose-response-like pattern was seen between healthy behaviors and the probability of good work ability (Figure 3a). The proportion of men with good work ability from 31 to 46 years was lower among those with unhealthy behaviors [at 14y (69.3%) and at 31y (67.4%)] than among men with healthy behaviors [14y (81.9%) and 31y (85.6%)] (Figure 3a). Among women health behaviors at 14 years did not associate with future work ability (Figure 3b). At 31 -years of age, women with healthy behaviors (80.7%) had a higher prevalence of good work ability than those with average (70.8%) and unhealthy (72.7%) behaviors. Among men those with stress-related eating and drinking at 31 years more often had good work ability. However, among women the difference between groups was not statistically significant.

Multivariate analyses

The results of logistic regression analyses to predict poor (0−7) perceived work ability at the age of 46 years are presented in Table 3. Among men *"always unhealthy"* behaviors from 14 to 46 years and stress-related eating and drinking predicted poor perceived work ability independently after adjusting for covariates. Among women *"deteriorated"* health behaviors and stress-related eating and drinking were independent predictors of poor perceived work ability at the age of 46 years.

Discussion

This study showed that long-lasting cluster of unhealthy behaviors independently increased the risk of poor perceived work ability in midlife. A novel finding was that stress-related eating and drinking also predicted a risk of poor work ability among both genders. The results

suggest that the promotion of healthy habits and coping styles, initiated already in adolescence and young adulthood, would be beneficial for work ability in midlife and thus a key issue for extending working careers.

Among women, a cluster of unhealthy behaviors in adulthood only had an effect on work ability, and even belonging to the *"always unhealthy"* behaviors trajectory did not significantly decrease work ability in early midlife. The number of participants in the *"always unhealthy"* trajectory was small, which may be due to the fact that these women discontinued participation in data collection at all ages. Excluded participants had higher scores of unhealthy behaviors in adulthood. Smoking, risky drinking and physical inactivity may predict unemployment and disability pensions [22, 40-42]. Moreover, most of the participants were employed at the time of the 46-year survey. The non-working population included forms of being outside the workforce other than merely being unemployed (e.g. students). When compared to all the unemployed seeking work in the area of Northern Finland in 2012 (14−15%), the prevalence in the studied population was smaller. It is also possible that other factors, such as eating behaviors and obesity, are more common among women in adolescence − a possibility that warrants future study [17, 20].

The finding that stress-related eating and drinking is independently associated with poor perceived work ability is important, since stress-related eaters often make unhealthy dietary choices and are at risk of developing obesity [19-20]. Future studies are needed to determine the associations between food, energy and nutrient intake, meal frequency, and work ability [8, 16]. Furthermore, the stress-related eating and drinking is learnt is societal context and a passive way to cope and try to relief feelings of stress [19-20]. Stress-related eating and drinking is easy to evaluate by a single question in health examinations; it could be used as an early indicator of potentially decreasing work ability. Healthy and active coping mechanisms to handle stress should also be taught early to prevent stress-related eating and drinking, and to further promote work ability later in life.

Four health behavior trajectories were created. The reasons for the unhealthy trajectories may be multifold: work, school and life strain can cause unhealthy coping behaviors, hamper possibilities or vitality to exercise, and increase proneness to use alcohol regularly and excessively [19-20, 43-45]. These may partially explain the trajectory of deteriorated health behaviors. It is possible that the independent deterioration of work ability and the unhealthy behaviors are due to a reason that is common for both, and thus further studies are needed. Decline in physical activity has been discovered among Finnish adolescents from 12 to 18 years which describes the change from teenage to young adulthood [46]. However physical activity in adolescence increases the probability of physical activity in adulthood [32]. Recent review article showed that workplace health promotion programs have a greater effect on the younger population when the outcomes are health, sickness absence, work productivity and work ability [47]. The overall effects of these programs should be developed further to extend to people of all ages.

Strengths and weaknesses of the study

The outcome measure, the first item of the Work Ability Index, has been proven to be a valid indicator of work ability. It has associated strongly with the whole Work Ability Index and predicted mental and physical work strain in midlife and disability after retirement [5, 48-52].

This study enables a wider understanding of the role of health behaviors in long term work ability, because earlier studies have mostly included single health behaviors in cross-sectional settings [9-15, 17-18]. As the trajectory analyses showed, unhealthy behaviors may cluster and affect, one another, which is why it is relevant to investigate the cumulative effects [47]. Due to a lack of information regarding stress-related eating and drinking in adolescence we were not able to add this to the trajectory analysis. However, the odds ratios only slightly changed when health behavior trajectories and stress-related eating and drinking were in the same model.

The questions used to evaluate drinking, smoking and physical activity at 14 years were different to those used at 31 and 46 years, which may raise questions as to their comparability and usability in the same trajectory analysis. However, we found it necessary

to tailor the questions for different age groups, because the use of alcohol and tobacco are different (they are often forbidden and not so easily accessible) during adolescence.

The data were obtained from a large birth cohort and the prospective study setting allowed us to investigate long-term associations. It was also possible to use several covariates. However, a loss of participants occurred, as explained by the structure of the 31-year data when only those living in northern Finland and metropolitan area were invited to reply to the work-related questions. Some selection occurred, as those excluded from the analyses more often had unhealthy habits in adulthood than the participants included. Thus, it is possible that the results of this study are attenuated.

In conclusion, a cluster of unhealthy behaviors from adolescence until early midlife is a risk factor for poor work ability. In addition, stress-related eating and drinking were associated with an increased risk of poor work ability in early midlife. Furthermore, health behavior may improve or deteriorate during the life course. Thus, early promotion of healthy behaviors and learning active coping skills are important at all ages. This is an important message for policy makers, the professionals of health care and occupational health care, schools, workplaces and individuals.

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All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki

Declaration of 1975, as revised in 2000. Informed consent was obtained from all patients for being included in the study.

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Table 1. Description of health behaviors that were used as explanatory variables.

Health behaviors		
14y	31y	46y
Physical inactivity (0-2) Smoking (0-2) Alcohol consumption (0-2)	Physical inactivity (0-2) Smoking (0-2) Alcohol consumption (0-2)	Physical inactivity (0-2) Smoking (0-2) Alcohol consumption (0-2)
Sum score (0-6)	Sum score (0-6)	Sum score (0-6)
1) Health behavior clusters at 14 and 31y (healthy, average and unhealthy) 2) Health behavior trajectories from 14 to 46y		
	Stress-related eating and drinking (no/yes)	Stress-related eating and drinking (no/yes)
	Stress-related eating and drinking at 31 and 46y (no/yes)	

Table 2. Characteristics of participants and frequencies of those with perceived poor work ability (WA) at 46y by health behaviors and confounding variables among men (n=1349) and women (n=1758).

		All (n=3107)	Poor (0-7) perceived WA 46y n (%)	
			Men	Women
Cluster of health behaviors				
14y	unhealthy	34.0	93 (24.0)	145 (21.6)
	average	38.4	89 (19.2)	127 (17.4)
	healthy	27.6	70 (14.1)	50 (13.9)
p-value[b]			0.001	0.007
31y	unhealthy	33.0	99 (25.8)	132 (20.6)
	average	32.8	108 (18.8)	88 (19.8)
	healthy	34.2	45 (11.5)	102 (15.2)
p-value[b]			<0.001	0.026
		All (n=2813)[a]		
Stress-related eating and drinking				
31y	no	92.3	199 (17.8)	183 (16.2)
	yes	7.7	19 (26)	116 (23.4)
p-value[b]			0.045	<0.001
Health behavior trajectories				
14 to 46y	always healthy	5.5	7 (15.9)	16 (14.3)
	moderate	71.3	129 (15.9)	201 (16.8)
	deteriorated	16.8	58 (21.2)	54 (27.1)
	always unhealthy	6.4	24 (40.7)	28 (23.3)
p-value[b]			<0.001	0.002
Stress-related eating and drinking				
31 and 46y	no	78.2	156 (15.8)	178 (14.7)
	yes	21.8	62 (31.0)	121 (29.3)
p-value[b]			<0.001	<0.001
Basic education				
31 y	yes	47.8	57 (12.8)	132 (14.5)
	no	52.2	161 (21.6)	167 (23.5)
p-value[b]			<0.001	<0.001
Psychosocial job characteristics[c]				
31y	active	34.6	54 (14.8)	45 (11.9)
	high-strain	17.0	22 (21.6)	45 (17.2)
	low-strain	17.4	31 (14.1)	29 (19.0)
	passive	31.0	65 (20.4)	78 (22.4)
p-value[b]			n.s.	0.003
Physical strenuousness of work[c]				
31y	Low	40.1	56 (12.8)	56 (12.9)
	Moderate	34.9	66 (18.9)	72 (17.6)
	High	25.0	53 (22.6)	71 (22.9)
p-value[b]			0.003	0.002

[a] Numbers of men (n=1189) and women (n=1624) at this point forward were smaller.

[b] Chi-square test for difference between groups based on cross-tabulation between 46y work ability groups [good (8-10) and poor (0-7)] and explanatory variables.

[c] Numbers of those with available information about psychosocial job characteristics (n=2145) and physical strenuousness of work (n=2175) were smaller.

Table 3. Logistic regression models to predict poor work ability (WA 0-7) 46y by health behavior trajectories and stress-related eating and drinking among men (n=1005) and women (n=1138).

			Crude			Model 1[a]			Model 2[b]		
Men		n	Unadj. OR	95% CI	p	Adj. OR	95% CI	p	Adj. OR	95% CI	p
Health behavior trajectory	always healthy	30	1.17	0.44, 3.12	n.s.	1.15	0.43, 3.08	n.s.	0.98	0.345, 2.82	n.s.
	moderate	705	1.00			1.00			1.00		
	deteriorated	231	1.53	1.05, 2.24	0.028	1.46	0.99, 2.14	0.055	1.20	0.80, 1.80	n.s.
	always unhealthy	39	4.07	2.08, 7.96	<0.001	4.19	2.13, 8.25	<0.001	2.81	1.35, 5.86	0.006
Stress-related eating and drinking at 31 and 46y	no	848	1.00			1.00			1.00		
	yes	157	2.99	2.05, 4.37	<0.001	2.68	1.71, 4.19	<0.001	2.58	1.62, 4.12	<0.001
Women											
Health behavior trajectory	always healthy	68	0.63	0.28, 1.41	n.s.	0.64	0.28, 1.44	n.s.	0.64	0.27, 1.48	n.s.
	moderate	843	1.00			1.00			1.00		
	deteriorated	148	2.10	1.40, 3.15	<0.001	2.03	1.35, 3.06	0.001	1.67	1.07, 2.58	0.023
	always unhealthy	79	1.62	0.93, 2.83	n.s.	1.66	0.94, 2.92	n.s.	1.46	0.79, 2.70	n.s.
Stress-related eating and drinking at 31 and 46y	no	854	1.00			1.00			1.00		
	yes	284	2.90	2.19, 3.85	<0.001	2.79	1.97, 3.96	<0.001	2.48	1.70, 3.61	<0.001

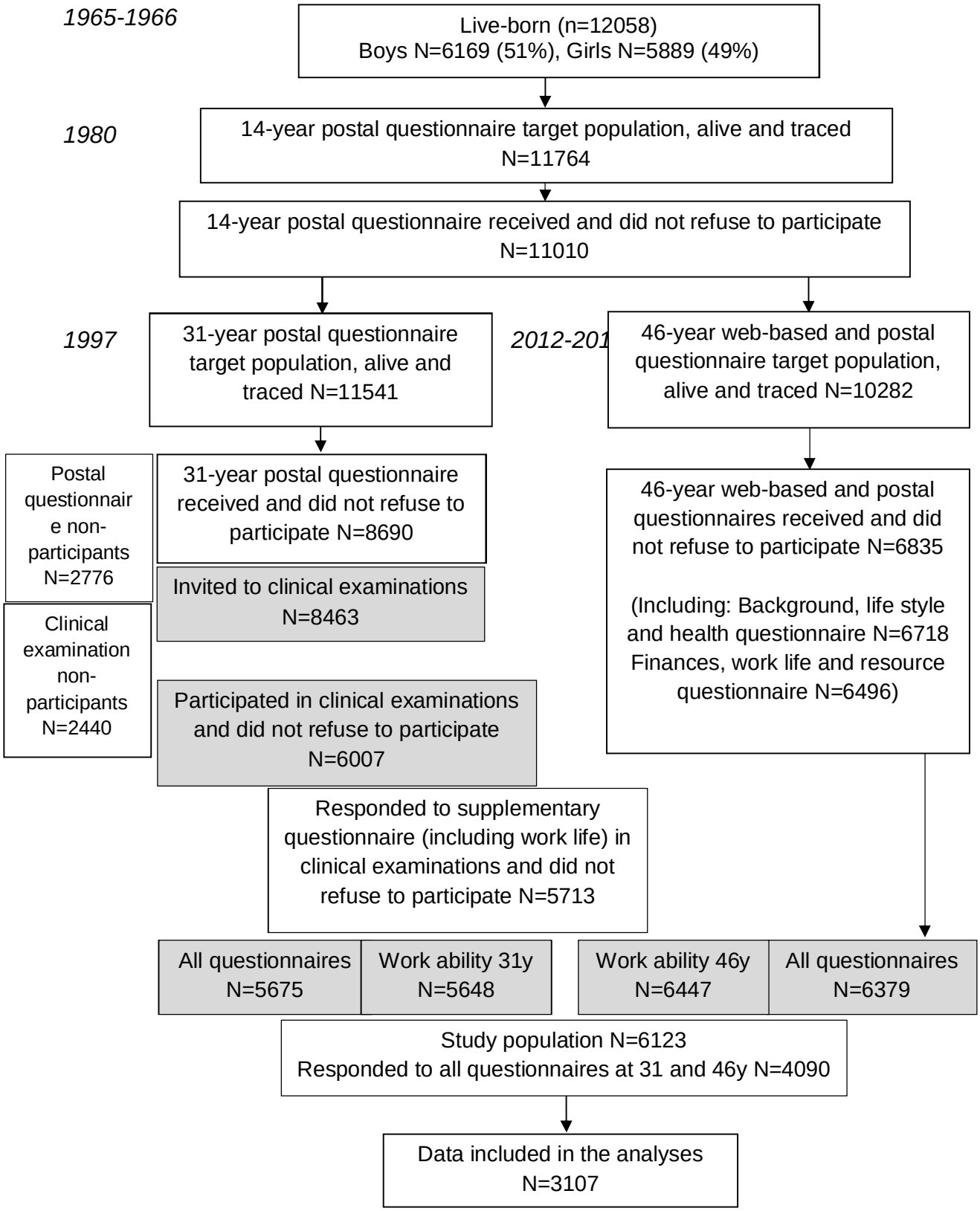
[a] health trajectories and stress-related eating and drinking in the model
[b] controlled for basic education, psychosocial job characteristics, physical strenuousness of work, perceived work ability and BMI (kg/m^2) at 31y

Figure captions

Fig 1. Flow chart of study population of 1966 Northern Finland Birth Cohort and selection of study sample

Fig 2. Health behavior trajectories from 14 to 46y. The proportions of participants (n=3107) in different trajectories were: always healthy 5.5%, moderate 71.3%, deteriorated 16.8% and always unhealthy 6.4%.

Fig 3. Work ability from 31 to 46y by clusters of health behaviors (at 14 and 31y, n=3107) and by stress-related eating and drinking at 31y (n=2813) among men (Fig 3a) and women (Fig 3b)


1965-1966
Live-born (n=12058)
Boys N=6169 (51%), Girls N=5889 (49%)
1980
14-year postal questionnaire target population, alive and traced N=11764
14-year postal questionnaire received and did not refuse to participate N=11010
1997
31-year postal questionnaire target population, alive and traced N=11541
2012-201
46-year web-based and postal questionnaire target population, alive and traced N=10282
Postal questionnaire non-participants N=2776
31-year postal questionnaire received and did not refuse to participate N=8690
Invited to clinical examinations N=8463
Clinical examination non-participants N=2440
Participated in clinical examinations and did not refuse to participate N=6007
46-year web-based and postal questionnaires received and did not refuse to participate N=6835
(Including: Background, life style and health questionnaire N=6718 Finances, work life and resource questionnaire N=6496)
Responded to supplementary questionnaire (including work life) in clinical examinations and did not refuse to participate N=5713
All questionnaires N=5675
Work ability 31y N=5648
Work ability 46y N=6447
All questionnaires N=6379
Study population N=6123
Responded to all questionnaires at 31 and 46y N=4090
Data included in the analyses N=3107

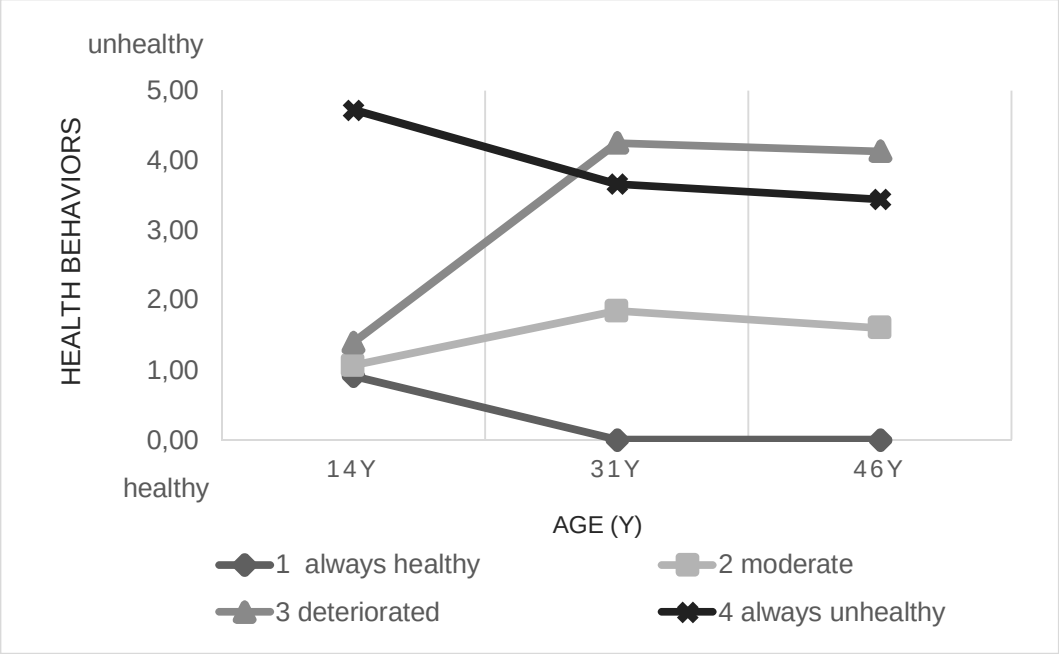

unhealthy
5,00
4,00
3,00
2,00
1,00
0,00
healthy
HEALTH BEHAVIORS
14Y
31Y
46Y
AGE (Y)
1 always healthy
2 moderate
3 deteriorated
4 always unhealthy

Fig 3a

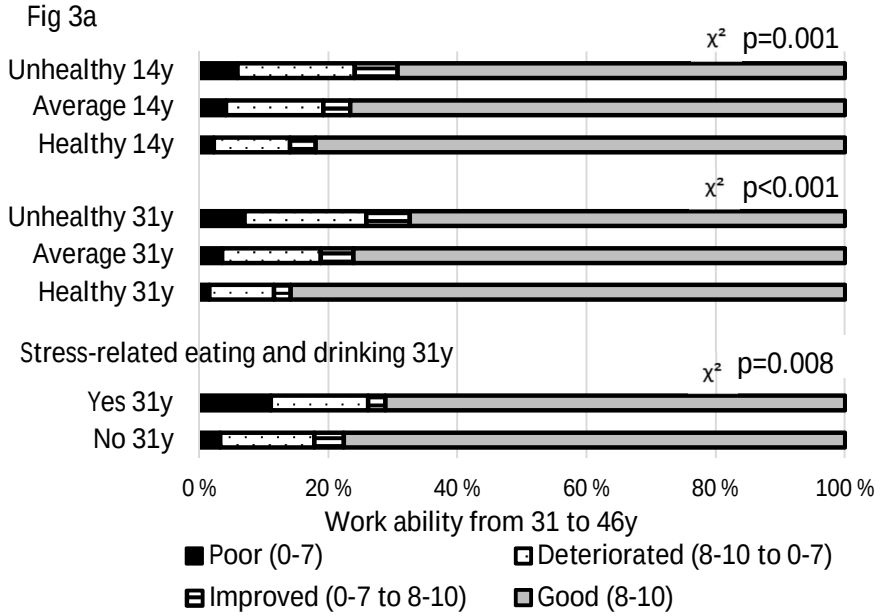
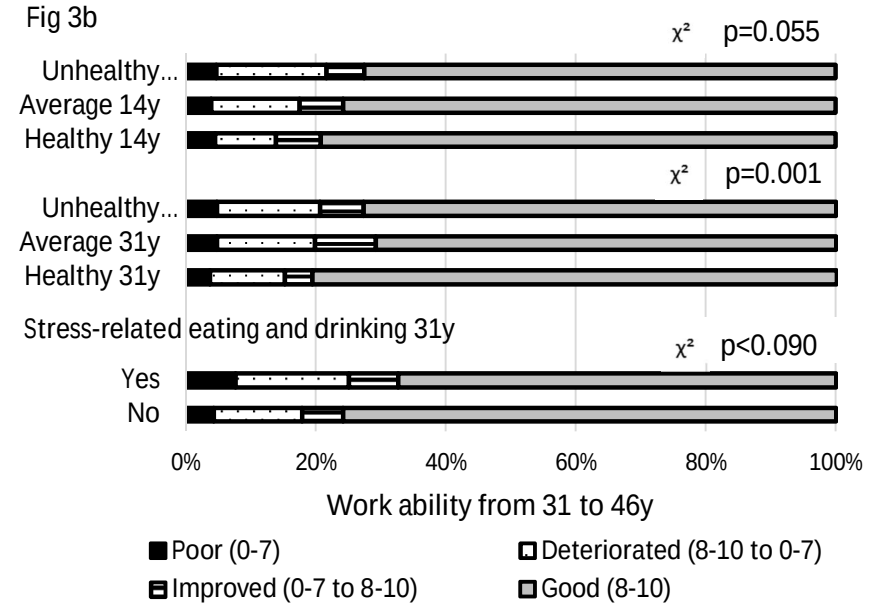

χ² p=0.001
Unhealthy 14y
Average 14y
Healthy 14y
χ² p<0.001
Unhealthy 31y
Average 31y
Healthy 31y
Stress-related eating and drinking 31y
χ² p=0.008
Yes 31y
No 31y
0 %
20 %
40 %
60 %
80 %
100 %
Work ability from 31 to 46y
Poor (0-7)
Deteriorated (8-10 to 0-7)
Improved (0-7 to 8-10)
Good (8-10)

Fig 3b


χ² p=0.055
Unhealthy...
Average 14y
Healthy 14y
χ² p=0.001
Unhealthy...
Average 31y
Healthy 31y
Stress-related eating and drinking 31y
χ² p<0.090
Yes
No
0%
20%
40%
60%
80%
100%
Work ability from 31 to 46y
Poor (0-7)
Deteriorated (8-10 to 0-7)
Improved (0-7 to 8-10)
Good (8-10)