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Use of Alcohol and Alcohol-related Morbidity in Finnish Former Elite Athletes

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ABSTRACT

Introduction: The impact of a history of competitive sports on later use of alcohol and occurrence of alcohol-related diseases is poorly known. We investigated how a history of elite level sports was associated with alcohol consumption in middle-age and with alcohol-related morbidity and mortality. **Methods:** Occurrence of alcohol-related diseases and deaths were followed using national registers from 1970 to 2008 among Finnish male former elite athletes (n=2202) and matched controls (n=1403) alive in 1970 (mean age 45.1 years). Hazard ratios (HRs) were calculated by Cox proportional hazards model. In 1985 surviving participants questionnaire-reported their alcohol consumption and engagement in physical activity/sports. **Results:** The risk of any alcohol-related diseases or deaths did not differ between former athletes and controls (HR 0.93; 95% CI 0.73-1.20, p=0.59), although, the risk was higher among both combat sports athletes and weightlifters compared to endurance sports athletes, shooters or jumpers & hurdlers ($p<0.05$). In 1985 athletes (417 grams/month; 95% CI 386-447) consumed more alcohol than controls (397grams/month; 95% CI 355-441) ($p<0.05$). Consumption was lower among endurance sports athletes than among controls ($p<0.05$). Team sports athletes consumed more alcohol ($p<0.05$), especially beer ($p<0.01$), compared to other athletes and controls. Athletes no longer engaged in leisure-time sports consumed more alcohol than those who continued to be physically active ($p<0.05$). **Conclusions:** Overall former athletes reported higher alcohol consumption than controls. There was no difference in alcohol-related morbidity, but the risk varied between different sports groups. Alcohol consumption after top-sports career was greater if participation in leisure-time sports was discontinued. Key words: ALCOHOL, CHRONIC DISEASE, COHORT STUDY, FORMER ATHLETE(S), PHYSICAL ACTIVITY.

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INTRODUCTION

The excessive use of alcohol is harmful globally and alcohol consumption is the world`s third largest risk factor for diseases (20,39). The increased mortality related to heavy alcohol consumption is associated with cirrhosis, pancreatitis, certain cancers, stroke, accidents and external causes of deaths (8,20). Use of alcohol is associated with an increasingly higher risk of sport injuries compared to other injuries (28), especially among women (11). Furthermore, studies have shown addictions, anxiety, depression, amnesia and insomnia to be associated with heavy alcohol consumption (5-6,33).

Some studies have emphasized sports participation as a possible protective factor against excessive alcohol and other substance use in young individuals (14,22), while many studies indicate that athletic participation is associated with more excessive alcohol consumption (9,23,25,27-28) and alcohol dependence (29). Athletes have reported more binge drinking episodes than non-athletes (27) and alcohol-related problems are more common among college athletes than non-athletes (7,27). Unfortunately, many studies are only focused on drinking habits among college or university athletes (4,7,21,23,27,29). An essential limitation of these cross-sectional studies is that they cannot differentiate the longitudinal course of risky drinking among individuals with variable degrees of athletic participation (23). Some studies have associated team sports athletes with higher levels of alcohol consumption compared to individual sports athletes (3,29), but there is no consistent evidence across different sports. Furthermore, team sports athletes seemed to have a higher mean AUDIT (the Alcohol Use Disorders Identification Test) score than those who took part in individual sports (29).

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Study on retirement from elite sports has recognized that sports career termination causes significant changes in athlete`s personal and social life, particularly high athletic identity has contributed to more problems in the adaptation process of retirement (1). Senior year students, who ended their participation in intercollegiate athletics, consumed less alcohol than consistent athletes (4). We know very little about how a history of competitive sports is related to later use of alcohol and occurrence of alcohol-related diseases.

Our study had three aims, the first of which was to examine how former competitive sports career was associated with the risk of alcohol-related diseases or deaths and with alcohol consumption among former athletes followed for several decades. Secondly, we compared the risk of alcohol-related diseases or deaths and alcohol consumption between different sports groups. Thirdly, we studied how different factors, such as physical activity, engagement to competitive or leisure-time sports and smoking status, were associated with alcohol consumption among former athletes after their active athletic career.

METHODS

Participants

An original cohort of former elite athletes (n=2657) was formed by identifying men who had represented Finland between 1920 and 1965 at least once at the Olympic Games, European or World championships, or international contests between two or three countries (32). A control cohort (n=1712) was selected from Finnish men who at the age of 20 years had been identified

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healthy in the medical inspection for enlisting in ordinary military service. The control cohort was formed by matching the same age groups and area of residence with the former elite athletes (32).

Participants who had died before the register-based follow-up started in January 1, 1970 were excluded from this study. Thus the final study population (n=3605) consisted of 2202 former male athletes and 1403 matched control participants (Table 1 and Figure 1). For the purpose of this study the former male athletes were classified according to sports and their specific physical loading types into the following groups: short & middle distance running (n=202), endurance sports (n=280, including long distance running and cross country skiing), jumping & hurdling (n=251, including high jump, pole vault, long jump and triple jump), throwing & decathlon (n=211, including javelin, discus, shotput and hammer), weightlifting (n=111), combat sports (n=487, including wrestling and boxing), team sports (n=488, including soccer, ice hockey and basketball) and shooting (n=171).

To adjust for occupational loading, the participants were classified into five occupational groups: executives, white collars, blue collars, unskilled workers and farmers (10) according to the occupation in which they had practiced the longest [for classification see Table, Supplemental Digital Content 1, Socioeconomic status % (n) among former athletes and controls, http://links.lww.com/MSS/A793]. This classification also reflects the socioeconomic status of the participants. The occupational group distribution of athletes differed from that of controls ($p<0.001$, χ^2 -test). Occupational data were collected partly from the Central Population Registry of Finland and partly from questionnaires.

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The register-based follow-up of hospitalizations started in January 1, 1970 and ended in December 31, 2008. Participants who had hospital admissions for alcohol-related diseases were identified from the National Hospital Discharge Register according to ICD-codes (ICD-8, ICD-9 or ICD-10). Alcohol-related diseases, which were strongly related to alcohol use, were categorized into five main groups: mental and behavioral disorders due to use of alcohol, alcohol dependence syndrome, alcoholic liver disease, alcoholic pancreatic diseases and other alcohol-related diseases [for all details see Table, Supplemental Digital Content 2, International Classification of Diseases (ICD) codes and main diagnostic categories, http://links.lww.com/MSS/A794]. The primary diagnosis was used to determine the reason for hospitalization, and the secondary diagnoses were ignored in the analysis. The overall correspondence in Finland between individual hospital discharge records and their written patient histories for different diagnoses has been reported to be 94.4% (16). Participants who had an alcohol-related death were identified from the National Death Register of Statistics Finland (cause of death alcohol-related diseases or accidental poisoning by alcohol, code 41; http://www.stat.fi/til/ksyyt/2005/ksyyt_2005_2006-10-31_luo_002.html).

Questionnaire study 1985

In 1985 a postal questionnaire eliciting information on discontinuation of sports career, socio-demographic factors (including occupational loading), physical activity, and health-related lifestyle habits, such as alcohol consumption and smoking, was sent to the surviving cohort members (total n=2528, athletes n=1518 and controls n=1010) (18). The response rate was 90% (n=1364) for athletes and 77% (n=777) for controls. Former elite athletes (n=1326) and controls

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(n=755), who answered the alcohol-related questions, were included in the statistical analysis. In epidemiological research those who are the heaviest alcohol users tend to have lower response rates to questionnaire studies. As hospital admission data covered all participants in this study, we were able to investigate such selection effects. The response rate was 52.5% (n=137) among those participants alive in 1985 who had admissions to hospital at any time for any alcohol-related disease or death, and among this subgroup the response rate was higher among former athletes 58.7% (n=91) than among controls 43.4% (n=46).

The volume of physical activity (MET-hours/week) in 1985 was computed from the responses to three structured questions, using a previously validated method (37). MET-hours/week was categorized into tertiles of physical activity: MET-hours/week ≤6.0 (less active), 6.0< MET-hours/week ≤22.5 (moderate active) and MET-hours/week >22.5 (highly active). Engagement in competitive sports or leisure-time sports was dichotomized. The term "discontinued sports" means that the athlete had retired from competitive sports based on questions in the 1985 questionnaire (for more details see the items given in Supplemental Digital Content 3, Alcohol-related questions and sports career termination questions in the 1985 questionnaire, http://links.lww.com/MSS/A795).

Alcohol consumption was assessed by questions on beer, wine and spirits consumption, blackouts and heavy drinking occasions (HDO) (for the actual questions and response items, see Supplemental Digital Content 3, Alcohol-related questions and sports career termination questions in the 1985 questionnaire, http://links.lww.com/MSS/A795). Alcohol consumption based on quantity-frequency measures of beverage use was converted into grams of pure alcohol

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per month as previously reported (31). Responses formed three categories: abstainers and light (3 or fewer drinks per week), moderate (more than 3 but no more than 14 drinks per week) and heavy users (on average more than 2 drinks a day) (15). The Substance Abuse and Mental Health Services Administration (SAMHSA) defines heavy drinking occasions (HDO), as drinking 5 or more alcoholic drinks (>60 grams of pure alcohol) on a single occasion on at least 1 day in the past 30 days (35). Responses formed two categories: no HDO and at least one HDO. Blackouts were defined by the frequency of alcohol-related loss of consciousness or temporary amnesia during the past 12 months (13). Three response categories were formed for analysis: no blackouts in the past year, one, or 2 or more.

The tobacco smoking status of the participants was classified into four categories from responses to a detailed smoking history: never, ex-, current or occasional smokers. Never smokers were men who had smoked no more than 5 to 10 packs of cigarettes (or equivalent of other tobacco product) throughout their lifetime. Ex-smokers were participants who have smoked greater than 100 cigarettes in their lifetime but have not smoked during the last month. Participants were classified as current smokers according to whether they were smoking daily or almost daily at the time. Occasional smokers were men who had smoked no more than 2 cigarettes in a week or last smoked 2-30 days ago [for more details see Table, Supplemental Digital Content 4, Smoking status % (n) among former athletes and controls, http://links.lww.com/MSS/A796].

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Ethical Approval

This study was conducted according to good clinical and scientific practice and the Declaration of Helsinki. All the participants gave informed consent by returning the questionnaires, which were accompanied by a cover letter explaining the purpose of the study.

Statistical analysis

The descriptive data are presented as the mean and standard deviation (SD) or 95% confidence intervals (CI) if distributed normally; otherwise the results are shown as the median and range. The differences in the distributions of the categorical variables were examined using cross-tabulations with the Chi-square (χ^2) -test.

The follow-up of alcohol-related hospitalization started on January 1, 1970 and continued until the end of 2008, or until the date of hospitalization due to first alcohol-related disease, emigration or date of death, whichever date came first. The event was based on the first recorded hospital episode of any alcohol-related disease or alcohol-related death [for more details see Table, Supplemental Digital Content 5, Age- and SES-adjusted hazard ratios (HRs) for admissions to hospital for any alcohol-related diseases or deaths during January 1, 1970 to December 31, 2008 among former athletes compared to controls and mean (SD) age at first admission, http://links.lww.com/MSS/A797].

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A Cox proportional hazards model was used to calculate age-adjusted hazard ratios (HRs) with their 95% CIs for alcohol-related disease or death between former athletes and controls. Post hoc analysis taking into account the number of comparisons was used to compare statistical differences between specific sports groups. Participants still alive at the end of follow up, and those who died from any other cause, were censored. The Cox regression assumptions were tested by using Schoenfeld residuals (ph-test in Stata) and also by plotting.

The 1985 questionnaire data was analyzed using non-parametric Kruskal-Wallis-test and using the Dunn-Bonferroni approach for post hoc testing in pairwise comparisons for more than two groups ($p<0.05$), because some of the variables were not normally distributed and variances were not equal. The Mann-Whitney-U-test was used to compare differences between sports groups and controls ($p<0.05$). Homogeneity of variances were assessed using Levene`s test and normality using Kolmogorov-Smirnov`s test ($p<0.05$).

P-values <0.05 were considered statistically significant. Statistical analyses were performed using SPSS statistical software (version 22.0 for Windows; SPSS Inc., Chicago, IL) and Stata 14.0 (Stata Corp, College Station, Texas, USA).

RESULTS

Altogether, 6.2% (n=136) of former athletes and 7.1% (n=99) of controls were admitted to hospital for any alcohol-related disease during the 39-year follow-up period. The most common reasons for admissions were Mental and behavioral disorders due to use of alcohol (athletes 2.4% (n=53), controls 2.1% (n=34)), alcohol dependence syndrome (athletes 3.9% (n=85),

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controls 4.5% (n=72)) and alcoholic liver disease (athletes 0.8% (n=18), controls 0.7% (n=10)) (Table 2). The median total number of days in hospital was 12.0 (range 1-1442) in all former athletes and 17.0 (1-1365) in controls. The mean age at the first admission of any alcohol-related disease was 57.2 years (SD 14.7) for the former athletes and 51.5 years (SD 13.0) for the controls.

The age-adjusted hazard ratios (HRs) for admissions to hospital for any alcohol-related disease or death in former athletes was 0.93 (95% CI 0.73-1.20, p=0.59) compared to controls (Figure 2) [for more details see Table, Supplemental Digital Content 4, Smoking status % (n) among former athletes and controls, http://links.lww.com/MSS/A796]. The result persisted after adjustment for SES. No statistically significant SES differences were observed between former athletes and controls, and SES was not a significant covariate in this Cox regression model (p=0.26). Respectively, no statistically significant differences were observed between former athletes and controls in the analysis of different main diagnose groups separately.

In a secondary analysis, compared to weightlifters (the group with the highest risk) statistically significant HR for admissions to hospital for any alcohol-related disease or death was 0.42 (95% CI 0.19 - 0.93) for endurance sports athletes, 0.39 (95% CI 0.17 - 0.86) for jumpers & hurdles and 0.32 (95% CI 0.11 - 0.91) for shooters. Accordingly, compared to combat sports athletes the HR was 0.46 (95% CI 0.25 - 0.85) for endurance sports athletes, 0.42 (95% CI 0.22 - 0.79) for jumpers & hurdles and 0.35 (95% CI 0.14 - 0.87) for shooters.

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Furthermore, the risk of any alcohol-related disease or death was higher among those who did not respond to 1985 questionnaire study compared to respondents, both among all participants (HR=2.34, 95% CI 1.72-3.18, p<0.001), among former athletes (HR=1.74, 95% CI 1.11-2.73, p=0.016) and among controls (HR=3.14, 95% CI 2.02-4.87, p<0.001).

Compared to controls, former athletes consumed significantly more beer (p<0.01), and wine (p<0.001), and their total alcohol consumption (g/month) was significantly higher (p<0.05). Furthermore, team sports athletes consumed significantly more alcohol (p<0.05), especially beer (p<0.01), and had significantly more heavy drinking occasions (HDO) than controls (p<0.001) (Table 3).

Total alcohol and beer consumption (g/month) was higher in team sports athletes compared to all other sports groups (p<0.05) (Figure 3). Accordingly, spirits consumption was significantly higher in team sports athletes compared to shooters (p<0.01), endurance sports athletes (p<0.01), jumpers & hurdles (p<0.01) and throwers & decathlonists (p<0.01). Wine consumption was significantly lower in both endurance sports athletes and combat sports athletes compared to jumpers & hurdles (p<0.01), short & middle distance runners (p<0.001), shooters (p<0.001) and team sports athletes (p<0.01).

Mean MET-hours/week in 1985 were significantly higher among former athletes than controls (p<0.001). One sixth (16.0%, n=200) of former athletes and 12.1% (n=33) of controls participated in competitive sports in 1985 (p<0.001) [for more details see Table, Supplemental Digital Content 6, Characteristic of participants who were responding alcohol-related questions

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in 1985 questionnaire: overall physical activity (MET-hours/week), current engagement in competitive sports and smoking status, http://links.lww.com/MSS/A798].There was no significant difference in total alcohol consumption between competitive athletes and those athletes who had discontinued competitive sports, but latter consumed significantly more beer ($p<0.05$). Athletes, who had discontinued competitive sports and after that were not engaged in leisure-time sports, consumed more alcohol than those who were engaged in leisure-time sports or physical activities after active sports career ($p<0.05$).

Former athletes smoked less than controls ($p<0.001$). Among controls 27.7% and former athletes 48.5% were never smokers; 60.8% endurance sports athletes and 55.7% throwers and decathlonists were never smokers. On the other hand, current smoking was more common in team sports and weightlifting than other sports [For more details see Tables, Supplemental Digital Content 4, Smoking status % (n) among former athletes and controls, http://links.lww.com/MSS/A796; and Supplemental Digital Content 6, Characteristic of participants who were responding alcohol-related questions in 1985 questionnaire: overall physical activity (MET-hours/week), current engagement in competitive sports and smoking status, http://links.lww.com/MSS/A798]. Alcohol consumption (g/month) was the most common among current smokers, while never smokers used least alcohol. Current smokers consumed more alcohol than ex- and never smokers ($p<0.001$), and occasional smokers ($p=0.029$).

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DISCUSSION

Principal findings

There was no significant difference in the risk of any alcohol-related disease or death between all former athletes and controls. However, the risk was higher among both combat sports athletes and weightlifters compared to endurance sports athletes, shooters or jumpers & hurdlers. Former athletes consumed more alcohol than controls, but consumption was lower among endurance sports athletes than controls. Team sports athletes consumed significantly more alcohol, especially beer, compared to other athletes and controls. Athletes who were not engaged in leisure-time sports after their active sports career consumed more alcohol than those who were engaged in leisure-time sports or physical activities.

Strengths and limitations of our study

This long-term follow-up study revealed new information on the risk of alcohol-related diseases and alcohol consumption among former athletes. The use of the valid register data covering all participants was the strength of this study. Though there may be some variation of assigning alcohol-related diagnoses by physicians, this is unlikely to be related to a history of elite athleticism, and hence not a source of bias. Self-reported data on health-related behaviors include known limitations. The self-reported smoking status has shown to be valid and reliable (36). Though heavy alcohol users may underestimate their use of alcohol (30), self-report alcohol-use data are generally valid in ranking persons as light, moderate or heavy users (26). The response

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rate was lower among controls compared to former elite athletes. Although questionnaire response rates were lower in individuals with alcohol-related hospitalizations, the risk for bias in comparing the athlete group to non-athlete group was low. Also, the format of alcohol-related questions was optimal to avoid misclassification by study groups (for the actual questions and response items see Supplemental Digital Content 3, Alcohol-related questions and sports career termination questions in the 1985 questionnaire, http://links.lww.com/MSS/A795).

Furthermore, former athletes are a selected group and they competed at top-level before 1965 and we do not know exactly how well the results can be generalized to today's elite athletes or athletes who had competed in lower level or non-athletes or women.

Comparisons with other studies

There is lack of studies focused on the risk of alcohol-related diseases or alcohol consumption among former athletes several decades after their peak sporting performance. But our findings were consistent with other studies that have shown current athletes consumed more alcohol than non-athletes (9,23,25,27-28), and alcohol consumption was more common among team sports athletes than other sports (3,29). Our study showed that combat and team sports athletes consumed alcohol most, while jumpers & hurdlers, shooters and endurance sports athletes consumed less alcohol than other groups. Endurance athletes do not appear to engage in an excessive and risky alcohol use (11,25).

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The same factors, especially personal and psychological factors, may be related to heavy drinking during and after an active athletic career. Furthermore, it has been observed that if an individual has a high athletic identity and their active sports career ends unexpectedly, adaptation to athletic retirement will be challenging (1) and it might predispose to alcohol-related problems. Presumably most alcohol-related risk factors, such as sociodemographic and familial factors, among the general population are also applicable to athletes (23). There is limited evidence on why athletes use more alcohol than non-athletes (38,40), but there are some motivational factors behind athletes and their reasons for engaging in risky alcohol consumption behaviors (24). Sports-induced anxiety or pressure, competitive nature of athletes, peer- or teammate-induced influence, and cultural relations between athletes and alcohol, might be related to risky alcohol consumption (7,23). Furthermore, it is generally known that alcohol, especially beer, distributors support sports and commercials for alcohol are commonly used (23). Some personality traits, such as histrionism, antisocial behavior may associate with higher alcohol consumption and alcohol dependence (12), but there is no consistent evidence. Studies have suggested that team sports athletes are more extraverted and neurotic than endurance sports athletes (2), whereas contact sports athletes have got high scores in the antisocial and histrionic scales (34).

Although, overall former athletes reported higher alcohol consumption than controls in our study, the risk of alcohol-related diseases was not increased in the former athletes group. The response rates of those participants, who had alcohol-related diseases, were lower among controls than athletes, and heavy alcohol users underestimate their use of alcohol (30). It may be that former athletes are more receptive to medical advice and reduce alcohol consumption at the

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first signs of harmful consumption and therefore are hospitalized less often; studies on alcohol-related disease biomarkers would be needed. Furthermore, it could be speculated, whether physical activity protects against some of the harmful consequences of alcohol consumption, such as abdominal adiposity and liver fat accumulation (19).

Finally, it seems that engagement to sports does not become replaced with either binge drinking or alcohol dependence among former athletes after an active sports career. Former athletes' overall better health habits (such as less tobacco use), and the directly or indirectly subsequent biological factors are likely to explain our observation that there was no difference in the risk of alcohol-related diseases among former elite athletes compared to controls. This was found despite the greater use of alcohol among former elite athletes than among controls.

Future directions

There is lack of studies focused on assessing the effect of interventions implemented in sports settings on the use of alcohol and alcohol-related harms (17). A deeper understanding of the relationships between alcohol consumption and the risk of alcohol-related diseases and sports is necessary to determine the true consequences of alcohol on health and well-being in athletes. Models should be developed how to avoid an excessive alcohol consumption among risk sports during career termination.

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CONCLUSIONS

Former athletes reported higher alcohol consumption than controls, but there was no difference in the risk of alcohol-related diseases or deaths between former athletes and controls. The risk varied between different sports groups being highest in combat sports athletes and weightlifters. Total alcohol and heavy drinking occasions seemed to be significantly more common in team sports than other sports. It is important to notice that the risk of excessive alcohol consumption may increase in individuals, who do not continue leisure-time sports after elite level sports career termination. Finally, current and ex-smokers consumed more alcohol than non-smokers.

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SS, JK and UMK collected the data. TKK and UMK analyzed the data. TKK drafted the manuscript. All authors contributed to study design, and the revision of the manuscript, and accepted the final version. The authors apologize for not being able to site all the noteworthy work in this area because of constraints on space.

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- **Figure 2**. Age-adjusted HR (95% CI) for alcohol-related diseases or deaths among former athletes compared to controls

- **Figure 3**. Mean of total alcohol consumption (95% CI) among former athletes and controls

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Figure 1

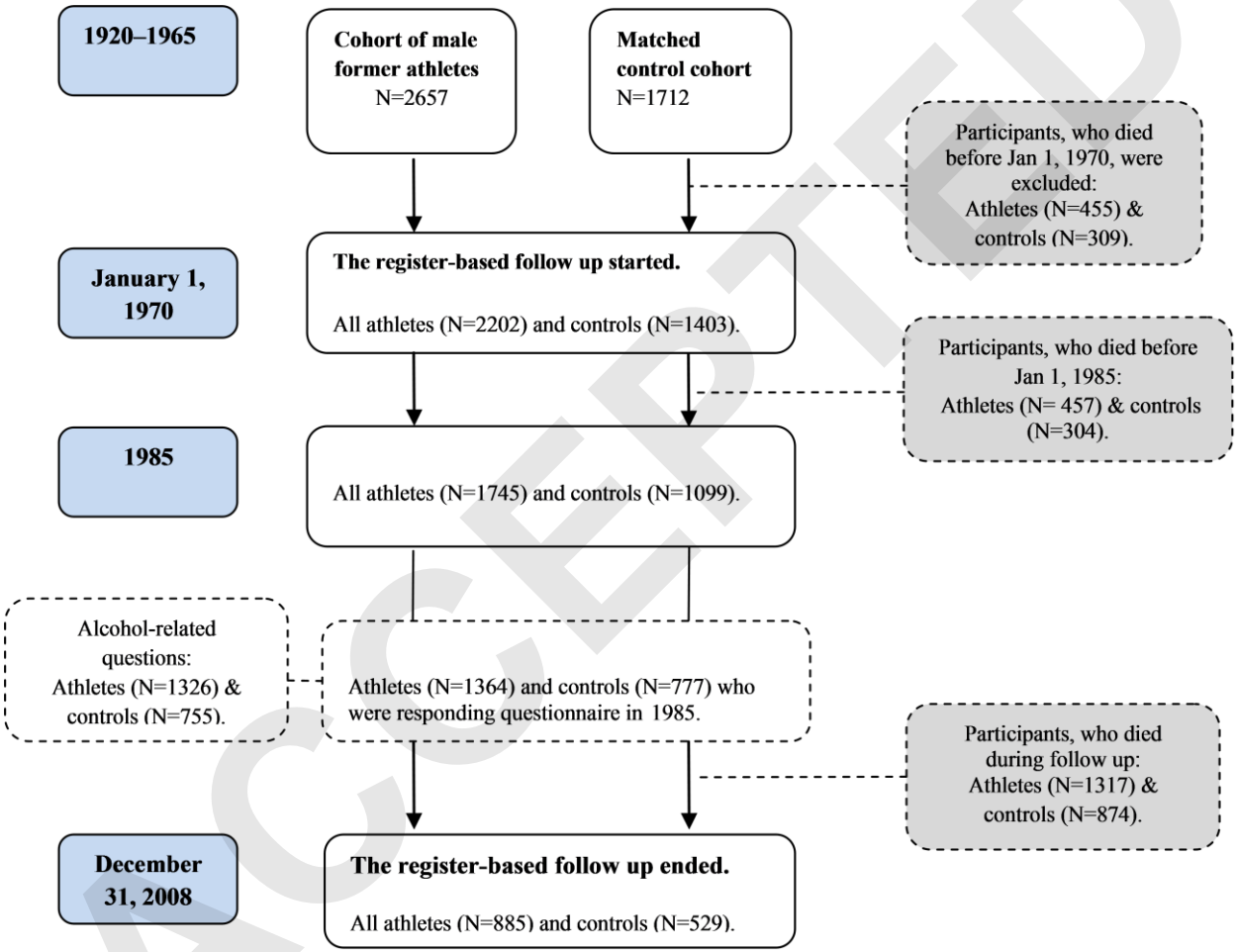

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Figure 2

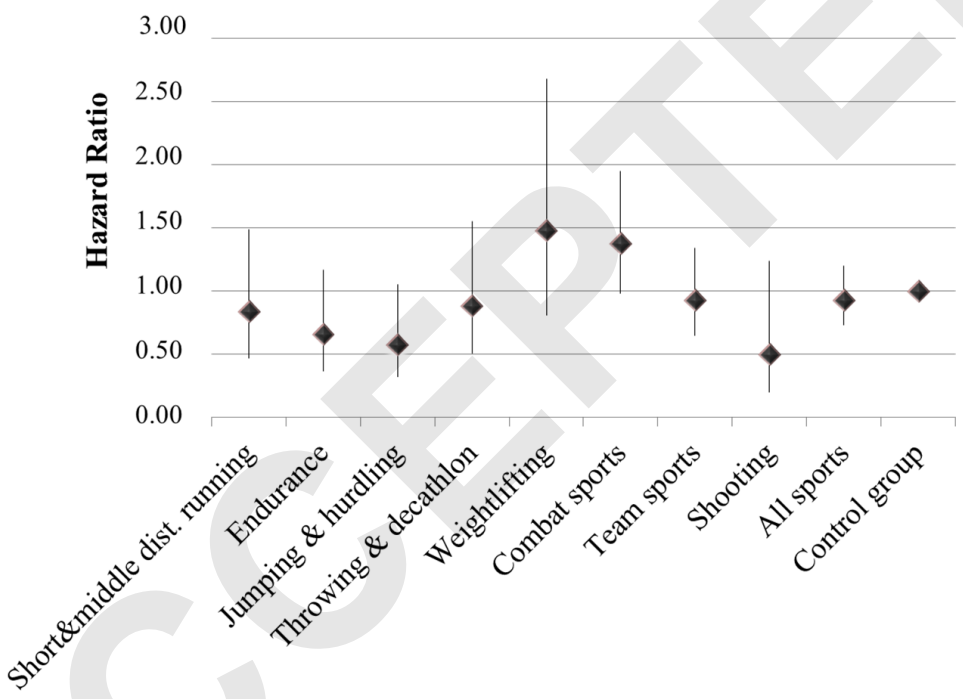

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Figure 3

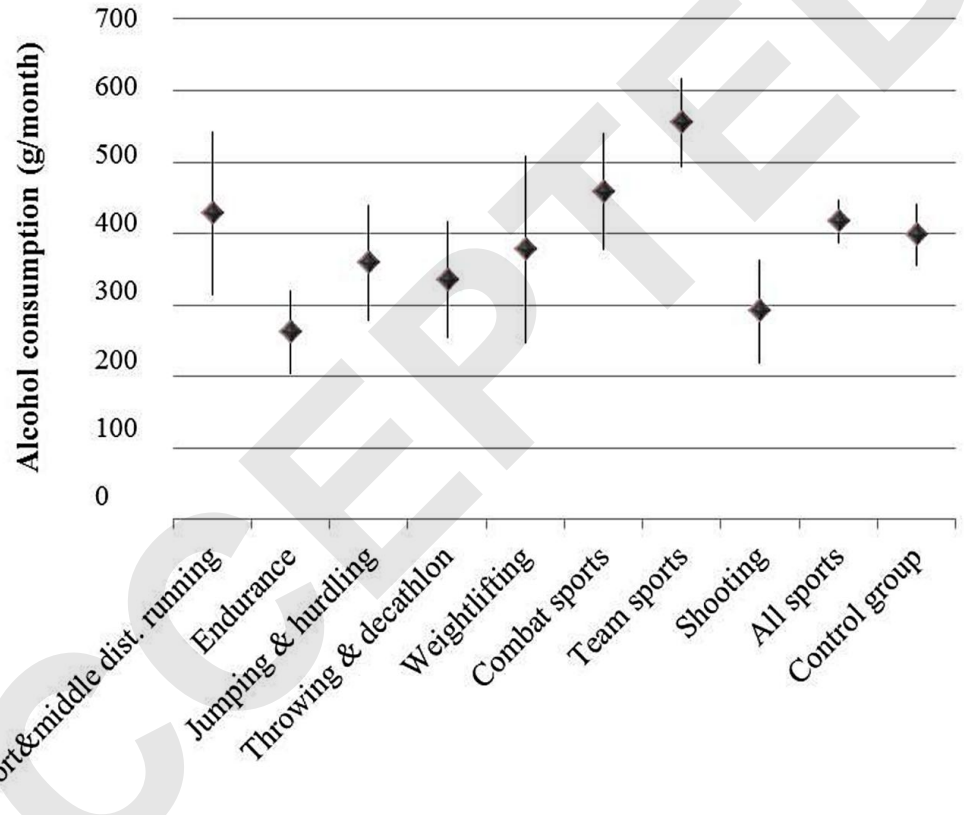

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Table Socioeconomic status % (n) among former athletes and controls.

Socioeconomic status (SES)*	Short & middle distance running	Endurance	Jumping & hurdling	Throwing & decathlon	Weightlifting	Combat sports	Team sports	Shooting	All athletes	Controls
1. Executive	6.2 (17)	46.7 (91)	50.2 (124)	29.3 (61)	8.1 (9)	7.8 (37)	34.7 (166)	52.1 (88)	27.4 (593)	9.5 (123)
2. White collar	49.6 (137)	30.8 (60)	34.0 (84)	39.9 (83)	34.2 (38)	30.2 (144)	42.2 (202)	36.1 (61)	37.4 (809)	22.0 (286)
3. Blue collar	25.5 (69)	17.4 (34)	12.6 (31)	19.2 (40)	54.1 (60)	53.0 (253)	22.8 (109)	8.9 (15)	28.3 (611)	39.7 (516)
4. Unskilled worker	4.7 (13)	0.5 (1)	0.4 (1)	2.4 (5)	2.7 (3)	4.4 (21)	0.4 (2)	0	2.1 (46)	9.9 (129)
5. Farmer	14.5 (40)	4.0 (8)	2.4 (6)	8.2 (17)	0.9 (1)	4.6 (22)	0	2.4 (4)	4.5 (98)	18.5 (240)
6. Other (unknown)	0	0.5 (1)	0.4 (1)	1.0 (2)	0	0	0	0.6 (1)	0.2 (5)	0.4 (5)

*All participants, there are 146 missing values, $p<0.001$ for group differences in socioeconomic status by χ^2 -test.

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Table International Classification of Diseases (ICD) codes and main diagnostic categories.

Diagnostic categories	ICD8 1969-1986	ICD9 1987-1995	ICD10 1996-	No of participants in diagnostic categories (N)*
Mental and behavioural disorders due to use of alcohol (except alcohol dependence F10.2)	291 Alcoholic psychosis 291.00-291.30, 291.98-291.99	291 Alcoholic psychoses 291A-2914A, 2918A	F10 Mental and behavioural disorders due to use of alcohol F10.0-F10.9 (except F10.2)	87
Alcohol dependence syndrome	303 Alcoholism 303.00-303.20, 303.98-303.99	303 Alcohol dependence syndrome 303, 3039X, 980.01, 980.98	F10.2 Alcohol dependence syndrome F10.20-10.29	157
Alcoholic liver disease	571.00 Alcoholic cirrhosis of liver 571.01 Alcoholic fatty liver	571 Chronic liver disease and cirrhosis 5710A,5711A,5712A 5713X	K70 Alcoholic liver disease K70.0-70.4, 70.9	28
Diseases of pancreas		577 Diseases of pancreas Acute Pancreatitis 5770D-F Chronic Pancreatitis 5771C-D	K 86 Other diseases of pancreas K86.00 Alcohol-induced acute pancreatitis K86.01 Recidivans K86.08 Alcohol-induced chronic pancreatitis	13
Other alcohol-related diseases		3573 Alcoholic polyneuropathy 4255 Alcoholic cardiomyopathy 5353 Alcoholic gastritis	G31.2 Degeneration of nervous system due to alcohol G40.51 Epileptic seizures related to alcohol G62.1 Alcoholic polyneuropathy G72.1 Alcoholic myopathy I42.6 Alcoholic cardiomyopathy K29.2 Alcoholic gastritis	7

*One person could have more than one diagnosis if there are several admissions for alcohol-related diseases.

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Table Smoking status % (n) among former athletes and controls.

Smoking status*	Short & middle distance running	Endurance	Jumping & hurdling	Throwing & decathlon	Weightlifting	Combat sports	Team sports	Shooting	All athletes	Controls
1. Never smoker	53.6 (67)	60.8 (96)	51.6 (83)	55.7 (68)	46.9 (30)	47.2 (126)	40.9 (132)	36.1 (30)	48.5 (632)	27.7 (205)
2. Ex-smoker	33.6 (42)	19.6 (31)	32.9 (53)	25.4 (31)	29.7 (19)	31.5 (84)	31.0 (100)	54.2 (45)	31.1 (405)	41.4 (307)
3. Occasional smoker	3.2 (4)	8.2 (13)	4.3 (7)	4.9 (6)	0	3.0 (8)	5.9 (19)	2.4 (2)	4.5 (59)	2.6 (19)
4. Current smoker	9.6 (12)	11.4 (18)	11.2 (18)	13.9 (17)	23.4 (15)	18.4 (49)	22.3 (72)	7.2 (6)	15.9 (207)	28.3 (210)

* $p<0.001$ for group differences in smoking status by χ^2 -test.

The tobacco smoking status of the subjects was classified into four categories from responses to a detailed smoking history: never, ex-, current or occasional smokers. Never smokers were men who had smoked no more than 5 to 10 packs of cigarettes (or equivalent of other tobacco product) throughout their lifetime. Ex-smokers were participants who have smoked greater than 100 cigarettes in their lifetime but have not smoked during the last month. Participants were classified as current smokers according to whether they were smoking daily or almost daily at the time (1). Occasional smokers were men who had smoked no more than 2 cigarettes in a week (3) or last smoked 2-30 days ago (2).

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Table Age- and SES-adjusted hazard ratios (HRs) for admissions to hospital for any alcohol-related diseases or deaths during January 1, 1970 to December 31, 2008 among former athletes compared to controls and mean (SD) age at first admission.

Sports groups	N of participants with alcohol-related disease or death	Mean age (SD) at first admission	Age-adjusted HR	95.0% Confidence Interval		P-value*	SES-adjusted HR	95.0% Confidence Interval		P-value*
				Lower	Upper			Lower	Upper	
Short & middle distance running	13	51.3 (11.7)	0.839	0.471	1.492	0.549	0.919	0.508	1.660	0.779
Endurance	13	62.4 (15.4)	0.655	0.366	1.170	0.152	0.673	0.375	1.206	0.183
Jumping & hurdling	12	58.7 (18.8)	0.579	0.319	1.052	0.073	0.631	0.340	1.170	0.144
Throwing & decathlon	14	60.8 (20.1)	0.888	0.509	1.551	0.677	0.933	0.529	1.644	0.810
Weightlifting	12	56.9 (14.3)	1.475	0.812	2.682	0.202	1.504	0.823	2.746	0.184
Combat sports	46	54.6 (13.1)	1.380	0.975	1.953	0.069	1.369	0.956	1.960	0.086
Team sports	40	56.6 (12.5)	0.931	0.647	1.341	0.702	1.006	0.681	1.486	0.977
Shooting	5	73.7 (15.7)	0.501	0.204	1.235	0.133	0.544	0.218	1.357	0.192
All athletes	155	57.2 (14.7)	0.934	0.729	1.197	0.591	1.001	0.765	1.310	0.995
Controls	106	51.5 (13.0)	1.000	-	-	-	1.000	-	-	-
Total	261	54.8 (14.3)	-	-	-	-	-	-	-	-

*p-values for statistical differences between sports groups and controls by Cox regression analysis.

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Table Characteristic of participants who were responding alcohol-related questions in 1985 questionnaire: overall physical activity (MET-hours/week), current engagement in competitive sports and smoking status.

Sports groups	Mean MET-hours/ week (95% CI)*	Physical Activity tertiles† % (n)***			Currently engaged in competitive sports % (n)***	Smoking status‡ % (n)***	
		1	2	3		current smoker	never smoker
Short & middle distance running	28.5 (22.2-34.7)	25.4 (32)	34.9 (44)	39.7 (50)	12.9 (16)	9.6 (12)	53.6 (67)
Endurance	36.1 (29.6-42.6)	23.2 (38)	32.3 (53)	44.5 (73)	18.8 (29)	11.4 (18)	60.8 (96)
Jumping & hurdling	27.9 (23.1-32.6)	28.7 (47)	33.5 (55)	37.8 (62)	12.1 (19)	11.2 (18)	51.6 (83)
Throwing & decathlon	37.3 (29.0-45.7)	26.0 (32)	31.7 (39)	42.3 (52)	23.3 (27)	13.9 (17)	55.7 (68)
Weightlifting	26.9 (18.6-35.2)	34.8 (23)	28.8 (19)	36.4 (24)	6.5 (4)	23.4 (15)	46.9 (30)
Combat sports	28.2 (24.0-32.5)	31.4 (85)	30.3 (82)	38.4 (104)	7.4 (19)	18.4 (49)	47.2 (126)
Team sports	28.9 (25.7-32.1)	22.3 (73)	33.3 (109)	44.3 (145)	22.0 (69)	22.3 (72)	40.9 (132)
Shooting	19.3 (14.9-23.8)	37.2 (32)	37.2 (32)	25.6 (22)	25.0 (17)	7.2 (6)	36.1 (30)
All athletes	29.5 (27.7-31.4)	27.3 (362)	32.6 (433)	40.1 (532)	16.0 (200)	15.9 (207)	48.5 (632)
Controls	14.5 (12.8-16.1)	53.1 (401)	29.0 (219)	17.9 (135)	12.1 (33)	28.3 (210)	27.7 (205)

* $p<0.001$for statistical differences between sports groups and controls by Mann-Whitney-U-test.
† Overall physical activity (MET-hours/week): 1=MET-hours/week ≤6.0 (less active), 2= 6.0< MET-hours/week ≤22.5 (moderate active), 3= MET-hours/week >22.5 (highly active).
‡ Smoking status, see more details in Supplementary table 3.
*** $p<0.001$ for sports group differences in physical activity tertiles, currently engaged in competitive sports or smoking status by χ^2 -test.

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Table 1. Number of participants at entry to study and still alive in January 1, 1970, 1985 and December 31, 2008.

Sports groups	Participants at entry	Participants in 1970		Participants in 1985		Questionnaire responders in 1985		Participants in 2008	
	(N)	(N)	Mean age (SD)	(N)	Mean age (SD)	(N)	Mean age (SD)	(N)	Mean age (SD)
1. Short & middle distance running	228	202	45.2 (13.1)	165	57.1 (11.5)	128	57.4(11.3)	84	73.8 (6.9)
2. Endurance	341	280*	50.0 (12.9)	221	61.9 (11.2)	175	61.6 (11.0)	98	79.0 (7.0)
3. Jumping & hurdling	291	251†	44.8 (13.1)	212	57.3 (11.9)	169	57.1 (11.6)	118	74.7 (7.9)
4. Throwing & decathlon	247	211‡	46.4 (14.3)	162	57.0 (11.8)	125	56.4 (11.3)	85	74.4 (7.0)
5.Weightlifting	122	111	43,9 (10.1)	91	57.2 (9.2)	67	57.0 (8.7)	35	76.4 (6.9)
6.Combat sports	626	487§	47.0 (13.4)	359	58.5 (11.7)	277	57.9 (10.8)	161	74.8 (6.8)
7. Team sports	569	488¶	41.0 (12.6)	423	53.4 (10.4)	334	53.0 (9.8)	262	73.0 (6.6)
8. Shooting	233	171	54.6 (14.2)	112	63.9 (13.1)	89	64.2 (12.5)	42	75.8 (8.4)
All athletes	2657	2202	46.0 (13.6)	1745	57.6 (11.7)	1364	55.0 (10.3)	885	74.7 (7.2)
Controls	1712	1403	43.7 (12.6)	1099	55.3 (10.6)	777	57.3 (11.3)	529	73.6 (6.5)
Total	**4369**	**3605**	**45.1 (13.2)**	**2844**	**56.7 (11.3)**	**2141**	**56.5(11.0)**	**1414**	**74.3 (7.0)**

Data are numbers in 1970.
* Long distance running 162, cross country skiing 118.
† High jump 45, pole vault 53, long jump 34, triple jump 34, hurdling 85.
‡ Shot put 38, discus 35, javelin 56, hammer 37, decathlon 45.
§ Boxing 234, wrestling 254.
¶ Soccer 250, ice hockey 154, basketball 84.

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Table 2. Number of participants in alcohol-related main diagnosis groups, total days in hospital, median of days in hospital, mean of exposure time and total days in hospital/total exposure time among former athletes and controls.

Sports groups	Mental & behavioural disorders due to use of alcohol*	Alcohol dependence syndrome*	Alcoholic liver disease*	Alcoholic pancreatitis*	Other alcohol-related diseases*	Any alcohol-related disease*	Alcohol-related death (no alcohol-related hospitali-zation before)	Any alcohol-related disease or death	Total days in hospital for any alcohol-related disease	Median of days in hospital for any alcohol-related disease (range)	Mean of exposure time, years (95% CI)	Total days in hospital / Total exposure years (days / 100 exposure years)†
Short & middle distance running	7	7	1	0	0	12	1	13	701	38.5 (1-227)	27.3 (25.5-29.1)	13
Endurance	4	8	1	0	2	11	2	13	1136	11.0 (1-1001)	26.9 (25.5-28.3)	15
Jumping & hurdling	4	7	0	0	0	9	3	12	224	8.0 (1-84)	29.4 (27.9-30.8)	3
Throwing & decathlon	7	6	4	0	1	13	1	14	1783	17.0 (2-1276)	26.4 (24.6-28.2)	32
Weightlifting	3	9	3	0	0	12	0	12	276	8.0 (1-89)	26.7 (24.4-29.0)	9
Combat sports	15	26	3	3	0	40	6	46	805	11.5 (1-98)	24.5 (23.3-25.7)	7
Team sports	12	21	4	5	2	34	6	40	2410	13.5 (1-1442)	30.1 (29.0-31.2)	16
Shooting	1	1	2	0	1	5	0	5	393	7.0 (3-336)	22.5 (20.5-24.5)	10
All athletes	53	85	18	8	6	136	19	155	7782	12.0 (1-1442)	27.0 (26.5-27.5)	13
Controls	34	72	10	5	1	99	7	106	4914	17.0 (1-1365)	26.4 (25.7-27.0)	13
Total*	87	157	28	13	7	235	26	261	12642	14.0 (1-1442)	26.7 (26.3-27.2)	13

*Number of participants who have any alcohol-related disease. One participant may have more than one alcohol-related main diagnosis if there are more than 1 hospital admissions.

†$p<0.001$ for statistical differences between specific sports groups and controls by Mann-Whitney-U-test.

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Table 3. Mean (95% CI) of alcohol consumption (beer, wine, spirits & total alcohol, g/month), alcohol-induced blackouts and heavy drinking occasions among former athletes and controls.

Sports groups	Beer g/month (95% CI)	Wine g/month (95% CI)	Spirits g/month (95% CI)	Total alcohol g/month (95% CI)	Type of alcohol drinker % (n)† 1	2	3	Alcohol-induced blackouts % (n)‡ 1	2	3	Heavy drinking occasions (HDO) % (n)§
Short & middle distance running	163.7 (97.5-229.9)	75.2 (53.3-97.0)***	189.6 (120.8-258.4)	428.5 (314.1-542.9)	42.9 (54)	43.7 (55)	13.5 (17)	89.3 (109)	8.2 (10)	2.5 (3)	22.6 (28)
Endurance	76.1 (54.3-97.9)	36.6 (19.6-53.5)	150.0 (107.4-192.5)	262.6 (205.0-320.3)*	56.1 (92)	36.6 (60)	7.3 (12)	87.8 (129)	8.8 (13)	3.4 (5)	21.9 (34)
Jumping & hurdling	97.8 (71.1-124.5)	110.9 (71.9-149.9)***	150.5 (105.9-195.1)	359.2 (278.8-439.5)	45.7 (75)	38.4 (63)	15.9 (26)	93.6 (146)	4.5 (7)	1.9 (3)	23.6 (38)
Throwing & decathlon	108.9 (68.8-148.9)	60.3 (38.1-82.5)	166.1 (116.9-215.4)	335.3 (254.2-416.4)	49.6 (61)	36.6 (45)	13.8 (17)	93.0 (107)	5.2 (6)	1.7 (4)	26.7 (32)
Weightlifting	118.2 (67.0-169.3)	54.3 (24.1-84.4)	204.9 (108.1-301.6)	377.3 (246.3-508.2)	48.5 (32)	31.8 (21)	19.7 (13)	90.0 (54)	3.3 (2)	6.7 (4)	30.6 (19)
Combat sports	119.2 (91.6-146.9)	83.6 (48.9-118.3)	255.9 (204.5-307.3)	458.7 (377.4-540.0)	43.2 (117)	38.0 (103)	18.8 (51)	88.5 (223)	6.3 (16)	5.2 (13)	32.8 (87)
Team sports	229.4 (193.0-265.9)***	114.9 (91.4-138.4)***	210.3 (179.0-241.7)***	554.7 (492.9-616.6)***	25.4 (83)	48.0 (157)	26.6 (87)	87.7 (265)	9.3 (28)	3.0 (9)	49.7 (161)
Shooting	79.8 (53.7-105.9)	87.3 (56.3-118.3)***	124.2 (81.1-167.2)*	291.3 (219.4-363.2)	51.2 (44)	33.7 (29)	15.1 (13)	97.6 (81)	2.4 (2)	0 (0)	14.0 (12)
All athletes	139.1 (124.9-153.2)**	84.7 (73.5-96.0)***	192.9 (174.9-210.8)	416.6 (386.4-446.8)*	42.0 (558)	40.2 (533)	17.8 (236)	90.1 (1114)	6.8 (84)	3.2 (39)	31.7 (411)
Controls	132.6 (111.5-153.7)	69.0 (54.1-83.8)	195.9 (173.9-218.0)	397.5 (354.5-440.5)	44.5 (336)	38.9 (294)	16.6 (125)	87.7 (615)	7.4 (52)	4.9 (34)	31.8 (234)

*p<0.05 **p<0.01 ***p<0.001 for statistical differences between sports groups and controls by Mann-Whitney-U-test.
†1=abstainers or light user, 2=moderate user, 3=heavy user, p<0.001, χ^2 -test.
‡1=no blackouts, 2=one blackout, 3=2 or more blackouts.
§p<0.001 for sports group differences in HDO by χ^2 -test.

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List of Supplemental Digital Content

- **Supplemental Digital Content 1:** Table, Socioeconomic status % (n) among former athletes and controls.
- **Supplemental Digital Content 2:** Table, International Classification of Diseases (ICD) codes and main diagnostic categories.
- **Supplemental Digital Content 3**: Alcohol-related questions and sports career termination questions in the 1985 questionnaire.
- **Supplemental Digital Content 4:** Table, Smoking status % (n) among former athletes and controls.
- **Supplemental Digital Content 5:** Table, Age- and SES-adjusted hazard ratios (HRs) for admissions to hospital for any alcohol-related diseases or deaths during January 1, 1970 to December 31, 2008 among former athletes compared to controls and mean (SD) age at first admission.
- **Supplemental Digital Content 6:** Table, Characteristic of participants who were responding alcohol-related questions in 1985 questionnaire: overall physical activity (MET-hours/week), current engagement in competitive sports and smoking status.

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Table Socioeconomic status % (n) among former athletes and controls.

Socioeconomic status (SES)*	Short & middle distance running	Endurance	Jumping & hurdling	Throwing & decathlon	Weightlifting	Combat sports	Team sports	Shooting	All athletes	Controls
1. Executive	6.2 (17)	46.7 (91)	50.2 (124)	29.3 (61)	8.1 (9)	7.8 (37)	34.7 (166)	52.1 (88)	27.4 (593)	9.5 (123)
2. White collar	49.6 (137)	30.8 (60)	34.0 (84)	39.9 (83)	34.2 (38)	30.2 (144)	42.2 (202)	36.1 (61)	37.4 (809)	22.0 (286)
3. Blue collar	25.5 (69)	17.4 (34)	12.6 (31)	19.2 (40)	54.1 (60)	53.0 (253)	22.8 (109)	8.9 (15)	28.3 (611)	39.7 (516)
4. Unskilled worker	4.7 (13)	0.5 (1)	0.4 (1)	2.4 (5)	2.7 (3)	4.4 (21)	0.4 (2)	0	2.1 (46)	9.9 (129)
5. Farmer	14.5 (40)	4.0 (8)	2.4 (6)	8.2 (17)	0.9 (1)	4.6 (22)	0	2.4 (4)	4.5 (98)	18.5 (240)
6. Other (unknown)	0	0.5 (1)	0.4 (1)	1.0 (2)	0	0	0	0.6 (1)	0.2 (5)	0.4 (5)

*All participants, there are 146 missing values, $p<0.001$ for group differences in socioeconomic status by χ^2 -test.

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Table International Classification of Diseases (ICD) codes and main diagnostic categories.

Diagnostic categories	ICD8 1969-1986	ICD9 1987-1995	ICD10 1996-	No of participants in diagnostic categories (N)*
Mental and behavioural disorders due to use of alcohol (except alcohol dependence F10.2)	**291 Alcoholic psychosis 291.00-291.30, 291.98-291.99**	**291 Alcoholic psychoses 291A-2914A, 2918A**	**F10 Mental and behavioural disorders due to use of alcohol F10.0-F10.9 (except F10.2)**	**87**
Alcohol dependence syndrome	**303 Alcoholism 303.00-303.20, 303.98-303.99**	**303 Alcohol dependence syndrome 303, 3039X, 980.01, 980.98**	**F10.2 Alcohol dependence syndrome F10.20-10.29**	**157**
Alcoholic liver disease	**571.00 Alcoholic cirrhosis of liver 571.01 Alcoholic fatty liver**	**571 Chronic liver disease and cirrhosis 5710A,5711A,5712A 5713X**	**K70 Alcoholic liver disease K70.0-70.4, 70.9**	**28**
Diseases of pancreas		**577 Diseases of pancreas Acute Pancreatitis 5770D-F Chronic Pancreatitis 5771C-D**	**K 86 Other diseases of pancreas K86.00 Alcohol-induced acute pancreatitis K86.01 Recidivans K86.08 Alcohol-induced chronic pancreatitis**	**13**
Other alcohol-related diseases		**3573 Alcoholic polyneuropathy 4255 Alcoholic cardiomyopathy 5353 Alcoholic gastritis**	**G31.2 Degeneration of nervous system due to alcohol G40.51 Epileptic seizures related to alcohol G62.1 Alcoholic polyneuropathy G72.1 Alcoholic myopathy I42.6 Alcoholic cardiomyopathy K29.2 Alcoholic gastritis**	**7**

*One person could have more than one diagnosis if there are several admissions for alcohol-related diseases.

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Supplemental Digital Content 3: Alcohol-related questions and sports career termination questions in questionnaire 1985.

Use of alcohol

1. **How much of the following alcoholic beverages do you drink on average?**

Beer

1) Never

2) Less than a bottle a week

3) 1-4 bottles on a week

4) 5-12 bottles on a week

5) 13-24 bottles a week

6) 25-47 bottles a week

7) More than 48 bottles a week

Wine or other mild alcoholic beverages

1) Never
2) Less than a glass a week
3) A glass to 4 glasses a week
4) 1-2.5 bottles a week
5) 3-4.5 bottles a week
6) 5-9 bottles a week
7) More than 10 bottles a week

Hard liquor

1) Never
2) Less than a half bottle per month
3) A half bottle to a bottle and a half per month
4) 2-3.5 bottles a month
5) 4-9 bottles a month
6) 10-19 bottles a month
7) More than 20 bottles a month

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2. **How often do you use alcohol? Which of the following alternatives best describes your use of beer, wine and hard liquor?**

	Never	On less than two days a month	On 3-8 days a month	On 9-16 days a month	Over than 16 days a month
Beer	1	2	3	4	5
Wine	1	2	3	4	5
Liquor	1	2	3	4	5

3. **Does it happen that at least once a month and on the same occasion you drink more than five bottles of beer or more than bottle of wine or more than half a bottle of hard liquor?**

   1=No

   2=Yes

4. **How often have you passed out while using alcohol during the last year?**

   0=Not once

   1=Once

   2=Two - three times

   3=Four - six times

   4=Seven times or more

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***Notice: Continuous variables (wine, beer, spirits and total alcohol consumption, g/month) based on quantity-frequency measures of beverage use was converted into grams of pure alcohol per month as previously reported (Romanov et al 1987). One drink includes 12 g of pure alcohol; it means 33 cl beer, 12 cl wine or 4 cl spirits.

Alcohol (g/month): 12 g/drink x Number of drinks /month

Reference: Romanov K, Rose RJ, Kaprio J, Koskenvuo M, Langinvainio H, Sarna S. Self-reported alcohol use: a longitudinal study of 12954 adults. Alcohol Alcohol Suppl. 1987;1:619-23.

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Sports career termination

1. **Why did you retired from competitive sports?**
   1) Lack of enthusiasm
   2) Injury/injuries
   3) Work or studying
   4) Family reasons
   5) Other reasons, which_____

2. **Have you continued exercising after active sports career?**
   1) No

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2) Yes
    a. Did you have a break of exercising after active sports career
        i. No
        ii. Yes → _____years

3. Are you still into competitive sports?

1) No

2) Yes → Write in the first line sport which you mostly do:

1._____

2._____

3._____

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Table Smoking status % (n) among former athletes and controls.

Smoking status*	Short & middle distance running	Endurance	Jumping & hurdling	Throwing & decathlon	Weightlifting	Combat sports	Team sports	Shooting	All athletes	Controls
1. Never smoker	53.6 (67)	60.8 (96)	51.6 (83)	55.7 (68)	46.9 (30)	47.2 (126)	40.9 (132)	36.1 (30)	48.5 (632)	27.7 (205)
2. Ex-smoker	33.6 (42)	19.6 (31)	32.9 (53)	25.4 (31)	29.7 (19)	31.5 (84)	31.0 (100)	54.2 (45)	31.1 (405)	41.4 (307)
3. Occasional smoker	3.2 (4)	8.2 (13)	4.3 (7)	4.9 (6)	0	3.0 (8)	5.9 (19)	2.4 (2)	4.5 (59)	2.6 (19)
4. Current smoker	9.6 (12)	11.4 (18)	11.2 (18)	13.9 (17)	23.4 (15)	18.4 (49)	22.3 (72)	7.2 (6)	15.9 (207)	28.3 (210)

* $p<0.001$ for group differences in smoking status by χ^2 -test.

The tobacco smoking status of the subjects was classified into four categories from responses to a detailed smoking history: never, ex-, current or occasional smokers. Never smokers were men who had smoked no more than 5 to 10 packs of cigarettes (or equivalent of other tobacco product) throughout their lifetime. Ex-smokers were participants who have smoked greater than 100 cigarettes in their lifetime but have not smoked during the last month. Participants were classified as current smokers according to whether they were smoking daily or almost daily at the time (1). Occasional smokers were men who had smoked no more than 2 cigarettes in a week (3) or last smoked 2-30 days ago (2).

References:

1. Kaprio J, Koskenvuo MA. prospective study of psychological and socioeconomic characteristics, health behaviour and morbidity in cigarette smokers prior to quitting compared to persistent smokers and non-smokers. *J Clin Epidemiol*.1988;41:139-50.
2 Luoto R, Uutela A , Puska P. Occasional smoking increases total and cardiovascular mortality among men. *Nicotine Tob Res* 2000;2:133-9.
3. Paavola M, Vartiainen E, Puska P. Smoking cessation between teenage years and adulthood. *Health Educ Res* 2001;16:49-57.

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Table Age- and SES-adjusted hazard ratios (HRs) for admissions to hospital for any alcohol-related diseases or deaths during January 1, 1970 to December 31, 2008 among former athletes compared to controls and mean (SD) age at first admission.

Sports groups	N of participants with alcohol-related disease or death	Mean age (SD) at first admission	Age-adjusted HR	95.0% Confidence Interval		P-value*	SES-adjusted HR	95.0% Confidence Interval		P-value*
				Lower	Upper			Lower	Upper	
Short & middle distance running	13	51.3 (11.7)	0.839	0.471	1.492	0.549	0.919	0.508	1.660	0.779
Endurance	13	62.4 (15.4)	0.655	0.366	1.170	0.152	0.673	0.375	1.206	0.183
Jumping & hurdling	12	58.7 (18.8)	0.579	0.319	1.052	0.073	0.631	0.340	1.170	0.144
Throwing & decathlon	14	60.8 (20.1)	0.888	0.509	1.551	0.677	0.933	0.529	1.644	0.810
Weightlifting	12	56.9 (14.3)	1.475	0.812	2.682	0.202	1.504	0.823	2.746	0.184
Combat sports	46	54.6 (13.1)	1.380	0.975	1.953	0.069	1.369	0.956	1.960	0.086
Team sports	40	56.6 (12.5)	0.931	0.647	1.341	0.702	1.006	0.681	1.486	0.977
Shooting	5	73.7 (15.7)	0.501	0.204	1.235	0.133	0.544	0.218	1.357	0.192
All athletes	155	57.2 (14.7)	0.934	0.729	1.197	0.591	1.001	0.765	1.310	0.995
Controls	106	51.5 (13.0)	1.000	-	-	-	1.000	-	-	-
Total	261	54.8 (14.3)	-	-	-	-	-	-	-	-

*p-values for statistical differences between sports groups and controls by Cox regression analysis.

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Table Characteristic of participants who were responding alcohol-related questions in 1985 questionnaire: overall physical activity (MET-hours/week), current engagement in competitive sports and smoking status.

Sports groups	Mean MET-hours/ week (95% CI)*	Physical Activity tertiles† % (n)***			Currently engaged in competitive sports % (n)***	Smoking status‡ % (n)***	
		1	2	3		current smoker	never smoker
Short & middle distance running	28.5 (22.2-34.7)	25.4 (32)	34.9 (44)	39.7 (50)	12.9 (16)	9.6 (12)	53.6 (67)
Endurance	36.1 (29.6-42.6)	23.2 (38)	32.3 (53)	44.5 (73)	18.8 (29)	11.4 (18)	60.8 (96)
Jumping & hurdling	27.9 (23.1-32.6)	28.7 (47)	33.5 (55)	37.8 (62)	12.1 (19)	11.2 (18)	51.6 (83)
Throwing & decathlon	37.3 (29.0-45.7)	26.0 (32)	31.7 (39)	42.3 (52)	23.3 (27)	13.9 (17)	55.7 (68)
Weightlifting	26.9 (18.6-35.2)	34.8 (23)	28.8 (19)	36.4 (24)	6.5 (4)	23.4 (15)	46.9 (30)
Combat sports	28.2 (24.0-32.5)	31.4 (85)	30.3 (82)	38.4 (104)	7.4 (19)	18.4 (49)	47.2 (126)
Team sports	28.9 (25.7-32.1)	22.3 (73)	33.3 (109)	44.3 (145)	22.0 (69)	22.3 (72)	40.9 (132)
Shooting	19.3 (14.9-23.8)	37.2 (32)	37.2 (32)	25.6 (22)	25.0 (17)	7.2 (6)	36.1 (30)
All athletes	29.5 (27.7-31.4)	27.3 (362)	32.6 (433)	40.1 (532)	16.0 (200)	15.9 (207)	48.5 (632)
Controls	14.5 (12.8-16.1)	53.1 (401)	29.0 (219)	17.9 (135)	12.1 (33)	28.3 (210)	27.7 (205)

* $p<0.001$for statistical differences between sports groups and controls by Mann-Whitney-U-test.
† Overall physical activity (MET-hours/week): 1=MET-hours/week ≤6.0 (less active), 2= 6.0< MET-hours/week ≤22.5 (moderate active), 3= MET-hours/week >22.5 (highly active).
‡ Smoking status, see more details in Supplementary table 3.
*** $p<0.001$ for sports group differences in physical activity tertiles, currently engaged in competitive sports or smoking status by χ^2 -test.

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