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TITLE

Childhood Club Participation and All-cause Mortality in Adulthood: A 65-year Follow-up Study of a Population-representative Sample in Scotland

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Childhood Club Participation and Adult Mortality

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4 TABLES; 1 FIGURE

CONFLICTS OF INTEREST AND SOURCES OF FUNDING

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Abstract

Objective. Social participation in middle- and older-age is associated with lower mortality risk across many prospective cohort studies. However there is a paucity of evidence on social participation in youth in relation to mortality, which could help inform an understanding of the origin of the association, and give credence to causality. The present study investigates the relation of early life club membership—a proxy measure of social participation—with mortality risk in older age in a nationally representative sample.

Methods. We linked historical data collected on the 6-Day Sample of the Scottish Mental Survey 1947 during the period 1947-1963 with vital status records up to April 2014. Analyses were based on 1059 traced participants (446 deceased).

Results. Club membership at age 18 years was associated with lower mortality risk by age 78 years (hazard ratio=0.54, 95% CI 0.44 to 0.68, $p<.001$). Club membership remained a significant predictor in models that included early life health, socioeconomic status (SES), measured intelligence, and teachers' ratings of dependability in personality.

Conclusion. In a study which circumvented the problem of reverse causality, a proxy indicator of social participation in youth was related to lower mortality risk. The association may be mediated by several behavioural and neurobiological factors, which prospective ageing cohort studies could address.

Keywords: Club membership; Intelligence; Mortality risk; Personality; Social participation; Socioeconomic status.

Acronyms: CI = confidence interval; HR = hazard ratio; IQ = intelligence quotient; MI = multiple imputation; PCA = principal component analysis; SES = socioeconomic status; SMS1947 = Scottish Mental Survey 1947; SD = standard deviation

Introduction

There is now a wealth of studies from middle- and old-age populations reporting an association between types of social participation, i.e. active engagement in relationship networks and/or organised social groups, and reduced premature mortality. Recent evidence suggests that the magnitude of this association may be similar to established disease risk factors, including smoking, high blood pressure, high cholesterol, and obesity (1). Yet the lack of understanding and consensus on underlying mechanisms of this association prevent its utility as an established disease risk factor. One issue is that most of the existing evidence comes from a limited timeframe in the life course; that is, the large majority of published studies first measure social participation in mid- to late-adulthood and follow up for mortality over relatively short periods (2). Therefore, the prevailing assumption of a positive effect of social participation on longevity may be criticised, in some studies, for the risk of reverse causality (3), i.e. poor health causing the decline in social activity and elevated mortality risk. Importantly however, if a causal association is at play, then understanding when in the life course social participation begins to influence long-term morbidity and mortality risk, is crucial for preventative health policy interventions. Particularly with the rise in onset of chronic diseases such as obesity and type 2 diabetes among younger populations. There is currently a lack of evidence from prospective cohort studies that considers social engagement in youth and long-term mortality risk, which the present study attempts to address.

The first prospective study to report on the association between social ties and mortality risk was based on a random sample of 6928 Californian men and women, aged 30 to 69 years, surveyed in 1965 and followed up for nine years for mortality (4). The authors reported that close friendship, family ties, and church membership, were significantly associated with mortality in men and women, and that social group membership was additionally associated with mortality in women. Decades of research since that single study culminated in a recent meta-analysis of 143 studies that reported a significant positive association between social relationships and likelihood of survival, that is, a 50% increase in the likelihood of survival was associated with stronger social ties (2). However, with few exceptions, these studies measured social activity in adulthood (at a mean age of 64 years), when the burden of poor general health or a preclinical disease state may have already had a bearing on social behaviour. The proposition of a causal pathway from social engagement to mortality risk would be strengthened if studies obtained measures of social participation in earlier decades of life. Of the few studies to have reported on greater social relationships in youth in association with adult mortality risk, two out of three reported null findings (5, 6). These studies were of homogenous samples of high ability individuals, relative to the general population, and so their non-significant results may be subject to selection bias; particularly given that social participation has been positively associated with general cognitive ability (7, 8). A third study, of young urban-dwelling American adults, reported that a lack of social support in early adulthood was significantly associated with the increased risk of premature death (9). With follow up to around early middle age this study's mortality cases do not represent the leading causes of death over a lifetime, and therefore the study has limited generalisability.

In the present study we report on the association between club membership at age 18 years — as a proxy indicator of social participation — and risk of all-cause mortality risk by 78 years. This design minimizes the possibility of reverse causation by the prospective measurement of club membership at a pre-morbid stage of life and provides data over a 60-year follow-up period. We also consider the confounding potential of other early life risk factors in the association between social club membership and survival, as well as mediation by socioeconomic status (SES) attainment.

Method

Study sample

The 6-Day Sample is a nationally-representative birth cohort with rich contemporaneous data from childhood. It derives from a nationwide 1936 birth cohort that sat an intelligence test on 4th June 1947—the Scottish Mental Survey 1947 (SMS1947)—representing 88% of people born in 1936 (N = 70,805) (10, 11). Those children born on the first day of the even numbered months of 1936 were recruited in to a prospective follow-up study that lasted 16 years to 1963. This subsample of n = 1208 (618 girls and 590 boys) were representative of the full SMS1947 in terms of geographical spread and mean intelligence (12). In addition to taking the Moray House Test No. 12 test of intelligence as part of the SMS1947, members of the 6-Day Sample completed an individually-administered intelligence test (the Terman-Merrill revision of the Binet Test) in 1947. They were assessed annually thereafter up to age 27 years, either by trained home visitors, teachers, or via self-report questionnaire. The collected data included aspects of education, family and home life, leisure activities, health, and occupations (10).

Assessments

Club membership was recorded in a 1954 home schedule in which study members were asked whether or not they regularly attended clubs or organisations (a dichotomous item), and if they did, were asked to specify the nature or name of the club. At the same schedule participants answered an equivalent item about sports participation, stating whether or not they participated in physical activity on a regular basis.

General intelligence was measured in 1947 using an adapted version of the Binet-Simon test: Terman-Merill, Form L (13). A total of 129 items of verbal and non-verbal reasoning were included in the test, and the number of correctly answered items were converted to standardised scores (M=100, SD=15).

A conscientiousness-like personality component—which we have named 'dependability' (14)—was derived from teachers' ratings of six personal characteristics during 1950-1. The characteristics, rated from 1 (marked lack of [the characteristic]) to 5 (very [characteristic]), were: conscientiousness, desire to excel, originality, perseverance, self-confidence, and stability of mood. Standardised residuals of these categorical scores, were adjusted for intelligence test performance, and entered into principal component analysis (PCA) using direct oblimin rotation. The first component—'dependability'—explained 46% of total variance, with high factor loadings from conscientiousness (.91), desire to excel (.65), perseverance (.84), and stability of mood (.69).

Four indicators of background socioeconomic status (SES) indicators are used in the present study, given that multiple indicators of SES explain more variance in models predicting mortality, compared to a single SES indicator (15, 16): father's occupational level, family size, home overcrowding, and home condition. The first three of these were recorded in a 1947 sociological survey which was part of the SMS1947 (10). Home overcrowding was the ratio of number of rooms at home to number of people living at home. Fathers' or main guardians' occupations were coded in to a five-level categorical variable using the 1951 Classification of Occupations (17): unskilled - 5, semi-skilled - 4, manual or non-manual skilled - 3, intermediate - 2, professional - 1. Home condition was a component score derived from observational data collected in 1950 and 1951 by trained home visitors.[1] These included six items scored from 1 to 3 (higher scores being favourable) of: mother's intelligence, home cleanliness, emotional atmosphere of the home ('happy and contented' versus 'unhappy'), cultural interests (i.e. material evidence of books, music, art, or media interest), mother's personality (estimate of 'degree of stability'), and mother's attitude to her child's potential career ('anxious to do best for child' / 'uninterested in child's future'). The four background SES variables were then reduced to an underlying component score using PCA, to lower the risk of over-adjusted effect estimates due to covariance of related measures. For this, family size and overcrowding were log-transformed. A single background SES component explaining 50.8% variance was retained for analysis. Individual loadings were: overcrowding (.80), family size (.73), home condition (.70), and father's occupational status (.61).

The level of educational exposure is indicated using three measures: school absenteeism, class in school, and parental education. Absenteeism was calculated from the percentage of days absent from school out of the total number of days in an academic year (1946-7). The class in school in to which each pupil was placed was determined by their educational attainment, and for the purposes of data analyses we have allocated scores from 1 through to 6 for the lowest (Primary I) to highest (Primary VI or above) attainment level of class. Parental education is the total combined number of years completed at school by both parents. These three variables did not correlate sufficiently to allow reduction to a single underlying component in PCA, and are therefore treated separately in the analysis.

Physical disability was recorded in the 1947 sociological schedule if a child had chorea, congenital paralysis, defective vision, deafness, encephalitis, epilepsy, or meningitis. This is used as a dichotomous item in the present study, with '1' indicating presence of disability. A school medical record of illness during 1950-1 was recoded as '1' in a

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[1] In PCA a single principal home condition component (unrotated) explained 55% of the variance in six home visitor ratings.

dichotomous health variable if the condition posed long-term health risk, and which may have affected participation in extracurricular and social activities in youth.

Three variables indicate SES attainment by 1963, when study members were age 27: occupational level, years in education, and post-school qualification. Occupational attainment was derived from the highest level of occupation recorded by the time of the final schedule in 1963. This was recoded to a five-level categorical variable, using the identical method for coding fathers' occupations, except that scores were reversed, so that higher scores meant greater SES attainment. The number of years spent in full-time education was either recorded in the final school schedule, or from subsequent home schedules up to 1963. These same schedules asked about the completion of post-school qualifications. The highest attained qualification was recoded according to a five-level categorical variable: none or low - 1, trade etc. - 2, City & Guilds, Ordinary National Certificate, or Higher National Certificate - 3, nursing or non-graduate-teaching - 4, high professional or degree - 5. PCA (unrotated) resulted in a single component explaining 66.1% of the variance in these three variables. Factor loadings were: years in education (.80), post-school qualifications (.85), and occupational attainment (.79). This component variable is retained for assessing potential mediation by SES attainment in multivariable models.

Data linkage to mortality records

Approval for the study was granted by the Scotland-A Research Ethics Committee (Ref: 12/SS/0024). The National Services Scotland NHS Privacy Advisory Committee gave approval and the Confidentiality Advisory Group of the Health Research Authority gave support under section 251 of the NHS Act 2006 for linkage without consent of the original 6-Day Sample study data with members' mortality records, including cause of death, up to

April 2014. Tracing and linkage were conducted by the National Records of Scotland (NRS), with permission of the Registrar General of Scotland, using the National Health Service Central Register (NHSCR) for members traceable in Scotland, and the MRIS Integrated Database and Administration System (MIDAS) for those in England and Wales. We were unable to trace members resident in Northern Ireland, and so these would have been excluded from the analyses on the basis of having emigrated or been cancelled from the system. If individuals' data were not auto-matched by date of birth, surname, and forename, or NHS number where available, then NRS employees used manual matching methods.

Of the 1208 study members, 149 were lost to follow up due to: emigration, $n = 89$; cancelled from system, $n = 50$; lost trace having joined Armed Forces, $n = 6$; no status, $n = 4$. This left 1059 traced and linked study members of whom 446 were recorded as deceased by 30th April 2014. This mortality rate is consistent with Scottish population statistics for 78 year old survival rates in 2010 (18). The 1059 traceable participants were similar to the 149 untraceable study members on the majority of independent variables with a few notable exceptions. Those lost to follow up were significantly higher on intelligence (M = 106.7, SD = 20.6 versus M = 102.0, SD = 20.0, t = 2.72, df = 1206, $p = .007$), school class level (M = 3.93, SD = 0.69 versus M = 3.80, SD = 0.72, t = 1.98, df = 1147, $p = .048$) and adult SES (M = 2.92, SD = 0.85 versus M = 3.15, SD = 0.90, t = -2.94, df = 1194, $p = .003$), and they were lower on school absenteeism (M = 0.07, SD = 0.06 versus M = 0.09, SD = 0.10, t = 2.51, df = 1164, $p = .012$).

Statistical analysis

Participants whose deaths occurred prior to 1963 (the end of the historical follow-up study) were excluded from the analyses ($n = 5$), because no follow-up data were available. Cases with missing data on social participation were also excluded from the analysis.

Group comparisons of club members versus non-members, and living versus deceased, were made for independent variables using ANOVA or Pearson's chi-squared tests.

In survival analysis using IBM SPSS Statistics 21, the assumption for proportional hazards was assessed using inspection of the log-minus-log plot, and Cox proportional hazards regression models ('Enter' method) produced hazard ratios (HRs) and 95% confidence intervals (CIs) for the risk of mortality according to club membership status, controlled for sex. We tested for a sex interaction effect with club membership given that sex is a significant predictor of mortality. Furthermore, we conducted sensitivity analyses by running the models according to type of club activity.

In multivariable Cox regression the risk of all-cause mortality according to club membership was tested for confounding by cognitive ability (intelligence, IQ), dependability (conscientiousness-related trait), childhood illness, physical activity, and background SES; their significant associations with all-cause mortality have previously been validated by systematic or meta-analytic review (19-22), or they are established risk factor relating to mortality (23). Their positive relationship to social participation is also reported across several previous studies (7, 8, 24), with one exception. Whereas the trait conscientiousness is not always associated with measures of social participation (25), we include it as a potential confounder in the present study given that conscientiousness might increase one's commitment to regularly attending a club or organisation.

In a final multivariate model SES attainment by age 27 was added to test if it mediated the association between club membership and mortality risk.

Missing data

Among the 1208 sample 36.2% of participants had missing data on one or more variables and 13.2% (n = 159) had missing club membership status. On the assumption of data missing at random, multiple imputation (MI) was conducted using the Markov Chain Monte Carlo method, to estimate missing values among the covariates. All independent variables listed in this paper were included in the imputation models; that is, all covariates in the multivariable Cox models, additional covariates of the incomplete predictor variables to increase the plausibility of the missing-at-random assumption, and, the outcome variables (vital status and log-transformed survival time) (26).

Among the covariates used in multivariable models, there were no missing data on sex or intelligence as measured by the Terman-Merrill test. Dependability and school absenteeism had ≤10% missing data, physical activity had 13% missing data, and there were 22.8% cases missing data on background SES.

Pooled parameter estimates from 20 iterations of the data were used in the final analysis. Descriptive statistics on all variables remained stable across these 20 iterations. Sensitivity analyses were also carried out to see if 5 or 40 iterations of imputed data had any bearing on the results.

Results

There were 369 (33.9%) out of 923 sample members who reported taking part in club activities at the age of 18. Table 1 gives descriptive data on the types of clubs these were and the frequency of their attendance among club attendees. Half of club members attended generic youth and/or community clubs, and about one third attended regular church groups. A smaller proportion (20%) attended sports clubs, and even more select groups attended cultural-interest clubs or societies (9.4%), or craft and hobby clubs (9.4%), or were members of government services for youths (8.7%; e.g. Army Cadet Forces).

Table 2 presents group differences in personal characteristics of club members and non-members. There was a greater proportion of boys (55.6%) relative to girls among club members, and club members were also more likely to participate in regular sports activities (68% versus 35%). Club members scored significantly higher on general intelligence at age 11 than non-members (over a 10 point mean difference); they were from higher SES backgrounds and showed lower mean rates of absenteeism from school; they also showed significantly greater social attainments than their non-club member peers by the age of 26 years. Although they scored higher on teacher-rated dependability, and they showed a lower rate of serious health problems than non-members (3.8% versus 6.8%), these associations did not reach conventional levels of statistical significance ($p>.05$). These differences between club members and non-members suggest potential confounders in any likely association between club membership and mortality, and a potential mediator in SES attainment, all of which could be formally tested in multivariable analysis.

Table 3 presents childhood differences between those of the sample who were traced as living or deceased by follow up in April 2014. There was a greater proportion of childhood club members among those alive by follow up relative to those deceased (47% versus 31%). As expected and consistent with the literature, compared to deceased members of the 6-Day Sample, those living in April 2014 had higher mean scores on intelligence (>7 point difference) and dependability (0.2 SD difference); they had higher background SES and more advantageous educational exposure in childhood, and had attained higher mean SES by age 27. Physical activity in childhood did not distinguish living from deceased at follow up; nor did physical disability or medical health risk.

Survival analysis

Cox regression models of the association between club membership and mortality risk included covariates that were related to both exposure and outcome variable according to results presented in Tables 2 and 3. Table 4 presents these resulting HRs and the 95% CIs. Club membership at age 18 was associated with a 46% lower mortality risk, in a sex-adjusted model (HR=0.54, 95% CI 0.44 to 0.67, $p<.001$). There was a non-significant sex interaction effect of club membership in predicting mortality ($p=.89$). The assumption of proportional hazards was met; that is, survival curves were clearly parallel for club members versus non-members according to the log minus log plot.

In sensitivity analyses, the risk estimates for mortality in association with youth and church clubs respectively, while controlling for all other club types, followed equivalent patterns of association to the main results for total club membership, and were statistically significant. While there were also inverse associations between each of the other four club types and mortality risk, their results are inconclusive due to low statistical power (see Supplemental Digital Material 1 for effect estimates). We also excluded participants from the total club members group, if they attended clubs where social activity was not considered the primary focus, namely, active sports and service-type clubs; this had negligible effect on the mortality risk (HR=0.54, 95% CI 0.43 to 0.69, $p<.001$).

Membership of a club at 18 was associated with a 32% lower risk of mortality, when the potentially confounding variables of cognitive ability, the personality trait of dependability, background SES, physical activity and school absenteeism were included in the model (HR=0.68, 95% CI 0.53 to 0.86, $p=.001$ – see Table 4, and Figure 1 for illustrative purposes). Therefore, the inclusion of available confounders attenuated the sex-adjusted association between club membership and mortality risk by 36%. In this model, intelligence and dependability also had significant associations with mortality (HR=0.83, 95% CI 0.73 to 0.94, $p=.003$, and HR=0.89, 95% CI 0.80 to 0.99, $p=.035$ respectively).

The magnitude of the HR for mortality as predicted by club membership saw no change after including SES attainment in the model, ruling it out as a potential mediator.

The effect estimates from the above Cox regression models were similar in sign and magnitude to those from an equivalent model using complete cases only (see Table, Supplemental Digital Material 2, for effect estimates using non-imputed data). Furthermore, sensitivity analyses revealed similar HRs whether 5, 20, or 40 iterations were used of imputed data (data not shown).

Discussion

This is the first nationally-representative cohort study to report on club membership—and more generally, social participation—in childhood in association with mortality risk in older adulthood. We found that membership of a club at age 18, was associated with a 32% lower risk of death by age 76, even after accounting for sex differences and individual differences in childhood health factors, baseline SES, educational exposures, intelligence test performance, a dependability personality trait, and participation in sports. In the same model, mortality risk was significantly inversely associated with a one SD advantage in intelligence, dependability, and background SES.

The advantage of using the 6-Day Sample in exploring childhood predictors of old age mortality is that it is a representative birth cohort of a nation's children (10), and therefore our results are most likely generalizable to mortality risk throughout the entire adult life course. Another main strength of the present study is its rich dataset from childhood. This not only included indicators of social participation and physical activity in youth, but it allowed for the control of pre-existing medical conditions, background SES, and educational exposures. These were each measured using multiple indicators. The combination of personality, intelligence, and background SES, in predicting mortality risk, has only appeared in a few prospective cohort studies (16, 27, 28), despite the frequency of publications reporting significant effect sizes for these measures in childhood, in association with adult mortality risk (19, 20). There is strong validity for the measure of intelligence used in this study (14), and, although we were restricted to using a conscientiousness-type personality trait, a recent review of large-scale prospective studies on the five-factor personality model traits and mortality risk revealed high conscientiousness to be the trait most consistently related to low all-cause mortality risk across studies (29). We were fortunate that, for a relatively small longitudinal cohort study, there were very low rates of attrition in the historical follow up study from age 11 to 27 years, and, we achieved very high tracing rates of participants in 2014. The timing of the linkage to vital status in 2014 is advantageous for a birth cohort of this age, when follow-up was at average life expectancy for the population. The finding of a significant association between childhood club participation and older adult mortality risk is therefore relevant to the general population, rather than restricted to those at high risk of premature death. Reverse causation is unlikely in the prospective association between club membership and mortality risk, due to the present study's measure of this social participation proxy indicator at a premorbid stage of life, the necessary exclusion of deaths occurring during the original data collection period (1947 to 1963) due to a lack of follow-up data, and, the very long follow up period.

A main limitation of the present study was the simple rating of club membership to indicate social participation. Although previous studies of mortality risk have used organisational membership or club activity as an indicator of social participation in adulthood (2, 30-32), other aspects of club membership may have contributed to greater longevity in our sample. These might have included a feeling of productivity, a sense of purpose, or, increased cognitive stimulation. We were therefore unable fully to assess the mechanistic possibilities underlying this association, despite our best attempts to assess the role of potential confounders with the measures available to us and SES attainment as a potential mediator. The similar pattern of association by membership of various club types suggests that specific interests were not the confounding factor (i.e. cultural pursuits, religious affiliations, physical activity), and that the association might be due more generally to a tendency to participate in group activity. The use of multidimensional complex measures of social relationships in childhood (i.e. with psychometric validity) could have provided more definitive and informative results, particularly as these are shown to hold stronger associations with mortality risk in older community samples, relative to studies using binary proxy indicators of social participation (2). Furthermore, multiple measures of social participation would allow an investigation into the specificity of the association; for example, some forms of social engagement may in fact increase in the context of declining health or long-term illness, such as social contacts with close relatives or friends, or the encouraged practice of mutual befriending in the case of some cancer patients.

Whereas individual differences in intelligence, dependability, and background SES accounted for approximately one third of the association between our indicator of social participation and survival, club membership— despite its simple rating—was one of the strongest childhood predictors of mortality in the most complex model. This suggests that club membership was not simply a proxy indicator for dependability or intelligence (i.e. more dependable and/or more intelligent people are more likely to endorse questions asking about their club membership). Nor was it an indicator for SES, flagging those children from higher socioeconomic backgrounds who might put greater value on the pursuit of organised social activity in late adolescence. Without discounting the possibility of unmeasured confounding, it remains conceivable that seeking regular social participation through mutual interests shared with others, in early decades of life, may be indicative of an enduring behavioural trend in seeking out positive relationships, which has direct effects on lifelong health trajectories and longevity. Indeed, there is preliminary evidence showing moderate stability of individuals' social participation over a decade or two of follow-up, with baseline from late adolescence or early-to-mid adulthood (35, 36). Furthermore, recent studies of social relationships measured in youth have reported associations with CVD risk factors in midlife, including BMI, waist circumference, and inflammatory biomarkers (33, 34), with those experiencing social isolation or negative social relationships at increased risk. An equivalent 47% increase in mortality risk associated with non-club membership in childhood in the present study, whilst controlling for a range of childhood risk factor, is a similar effect estimate to that reported by an earlier American study in which young urban-dwelling adults were followed up for mortality for 16 years (9); the least socially supported group in this cohort (tertiles) showed a 64% increased risk of mortality after adjustment for potential confounders, including socioeconomic status and physical health indicators. This is perhaps unexpected given the likely differences in primary causes of death, and age by follow-up, between the studies, and it cannot be assumed that the mechanisms relating social participation to mortality risk are the same. The significant association between intelligence and club membership observed in the present study, might help to explain the null findings of the only two additional studies we are aware of to report on social participation indicators in youth and adult mortality risk (5, 6); that is, if social participation had a narrower range in these two cohorts, because of their high cognitive ability selection.

The present study provides positive evidence from the longest follow-up study to date of the prospective association between an indicator of social participation and adult mortality risk. It therefore emphasises the importance of social relationships in earlier life—not just older age—when considering health interventions to protect longevity and wellbeing. While we feel it would be premature to propose health and/or educational policies that would encourage everyone to join a club *per se*—given that we were unable to assess the mechanistic pathways in this longitudinal association—we would encourage social participation in general to feature more prominently in research on, and policy discussions surrounding, the promotion of population health and wellbeing. There are likely to be several mediating mechanisms at play, including the psychological support of social networks and the positive self-esteem that comes from being a contributing club member, the transmission of healthcare messages and lifestyle behaviours via social contact, and the potential positive and stress-related neurobiological mechanisms that accompany the presence or lack of social contact. These could not be assessed in the present study and would be fruitful areas for investigation in future replication studies. The work could also be extended to include more detailed measures of social participation, as well as functional aspects of social networking and other dimensions of social capital that have been recently related to health behaviours and outcomes (37). The determinants and longitudinal stability of club membership, and in general social participation, in childhood and over the life course could also be better understood. Indicators of social participation may be important to consider in future life course epidemiological studies.

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Table 1 Types of clubs and their frequency attended by 6-Day Sample club members (N = 368*)

Type of club or organisation	**N (% of club members)**	**Examples of clubs**
Community	220 (52.9)	Youth, Youth Fellowship, Scouts/Brownies/Girl Guides, Boys' or Girls' Club/Guild(ry)/Brigade, social clubs/unions/institutes, Young Famers, Former Pupils' club
Church	148 (35.6)	Church club or choir, Sunday school teacher, Boys' or Girls' Guild(ry)/Brigade, Church/Youth Fellowship, Salvation Army
Active sports	85 (20.4)	Swimming, football, tennis, skating, boxing, dancing, cycling, athletics, badminton, rowing
Cultural	39 (9.4)	Drama club, literature society, debating society, theatre club, choir, pipe band, orchestra, opera society
Hobbies	39 (9.4)	Mechanics, whist, golf, Youth Hostel Association, angling, motorcycling, Sea Rangers, rifle shooting, model flying.
Service	36 (8.7)	RAF, Air Training Corps, life boy, Army Cadet Forces/Corps, Territorial Army, Ambulance Association, Royal Navy Volunteer Reserve

Note. Club members (N) in the second column total > 359 as some participants were members of more than one club.

*One out of 369 club members had missing data on club type.

Table 2 Childhood characteristics according to club membership.

	Club membership		No membership		P value for difference
	N	M (SD)	*N*	M (SD)	
Sex (% f)	369 (44.4)		554 (54.5)		.003
Physical activity (% y)	366 (68.3)		551 (35.2)		<.001
IQ score	369	109.1 (21.7)	554	98.2 (17.8)	<.001
Dependability component	364	0.09 (0.98)	549	-0.03 (0.96)	.072
Physical disability (% y)	355 (9.9)		543 (8.3)		.42
Medical health risk (% y)	365 (3.8)		541 (6.8)		.054
Low background SES component	289	-0.33 (0.99)	438	0.20 (0.96)	<.001
School absenteeism, %	352	7.99 (8.76)	537	9.50 (9.58)	.018
Class in school, 1-6	347	3.95 (0.67)	531	3.74 (0.74)	<.001
Parental education, yr	338	28.4 (2.47)	503	28.1 (1.58)	.043
SES attainment component	364	0.31 (1.14)	553	-0.19 (0.85)	<.001

Note. Descriptive results are based upon those available data for each variable. *Abbreviations*: CI = confidence interval; M = mean; SD = standard deviation; y = yes; yr = years.

Table 3 Descriptive results for independent variables by vital status group.

	Living		Deceased		P value for
	N	M (SD)	*N*	M (SD)	difference
Sex (% f)	535 (57.2)		388 (41.2)		<.001
Club membership (% y)	535 (46.7)		388 (30.7)		<.001
Physical activity (% y)	534 (50.4)		383 (45.7)		.16
IQ score	535	105.7 (20.7)	388	98.2 (18.6)	<.001
Dependability component	529	0.11 (0.93)	384	-0.10 (1.01)	.002
Physical disability (% y)	512 (8.4)		386 (9.6)		.54
Medical health risk (% y)	523 (5.2)		383 (6.3)		.48
Low background SES component	420	-0.18 (1.00)	307	0.23 (0.96)	<.001
School absenteeism, %	508	8.38 (9.30)	381	9.58 (9.24)	.056
Class in school, 1-6	502	3.90 (0.67)	376	3.73 (0.76)	.001
Parental education, yr	493	28.4 (2.02)	348	28.0 (1.92)	.012
SES attainment component	529	0.18 (1.09)	338	-0.22 (0.81)	<.001

Note. Descriptive results are based upon those available data for each variable, where club membership (exposure) and outcome are complete (N=923). *Abbreviations*: CI = confidence interval; M = mean; SD = standard deviation; y = yes; yr = years.

Table 4 HRs (and 95% CIs) for all-cause mortality risk according to club membership.

	Sex adjusted model	Adjustment for confounding	Adjustment for mediation
Club membership	0.54 (0.44, 0.67)	0.68 (0.53, 0.86)	0.67 (0.53, 0.86)
Confounding factors			
Cognitive ability		0.83 (0.73, 0.94)	0.90 (0.78, 1.03)
Dependability		0.89 (0.80, 0.99)	0.91 (0.81, 1.02)
Low background SES		1.17 (1.04, 1.32)	1.13 (0.97, 1.28)
Physical activity		0.99 (0.79, 1.24)	1.02 (0.81, 1.29)
School absenteeism		1.09 (0.98, 1.20)	1.08 (0.99, 1.20)
Mediating factor			
SES attainment			0.83 (0.71, 0.97)
X^2, *p*-value [a]	57.0, $p<.001$	40.2, $p<.001$	6.0, $p=.014$

Note. Models use imputed data [deceased/N]: 384 (41.8%)/919. Four cases were excluded due to missing survival data. [a]Chi-square statistics and significance values for improvement in model fit relative to previous model.

Figure 1 Probability of survival as a function of survival time and social club membership. The probabilities are adjusted for covariates as listed in Table 4.