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Original research

Early adulthood determinants of mid-life leisure-time physical inactivity stability and change: Findings from a prospective birth cohort

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ABSTRACT

Objectives: Physical inactivity is highly prevalent. Knowledge is needed of influences on inactive lifestyles. We aimed to establish whether early adult factors predict subsequent inactivity patterns in mid-adulthood.
Design: Leisure-time inactivity (activity frequency < 1/week) was assessed at 33y and 50y in the 1958 British Birth cohort (N = 12,271).
Methods: We assessed associations of early adult (23–33y) physical status, mental function, social, family and neighbourhood circumstances with four 33–50y patterns (never inactive, persistently inactive, deteriorating or improving) using multinomial logistic regression with and without adjustment for childhood factors (e.g. social class).
Results: Inactivity prevalence was similar at 33y and 50y (~31%), but 17% deteriorated and 18% improved with age. Factors associated with persistent vs never inactive were: limiting illness (relative risk ratio (RRR):1.21(1.04,1.42) per number of ages exposed (0,1 or 2 times across ages 23y and 33y), obesity (1.33(1.16,1.54) per number of ages exposed), height (0.93(0.89,0.98) per 5 cm), depression (1.32(1.19,1.47) per number of ages exposed); education (1.28(1.20,1.38) per decrease on 5-point scale) and neighbourhood (1.59(1.37,1.86) in 'industrial/local authority housing areas' and 1.33(1.12,1.58) in 'growth/metropolitan inner areas' vs 'suburbs, service, rural or seaside areas'). Associations were broadly similar for inactivity deterioration. Industrial/local authority housing areas (0.75(0.61,0.91)) and longer obesity exposure (0.78(0.64,0.95)) were associated with lower RRRs for improvement. Number of children was associated with improvement, although associations varied by age. Associations remained after adjustment for childhood factors.
Conclusions: Several early adult factors are associated with inactivity persistence and deterioration; fewer with improvement. Obesity duration and neighbourhood lived in during young adulthood had long-lasting associations with inactivity patterns in mid-life.

1. Introduction

Physical inactivity is highly prevalent[1] and associated with substantial economic[2] and health burdens.[3] Inactivity, defined as activity frequency < 1/week, is associated with unfavourable health outcomes such as psychological distress[4] and mortality.[5,6] With such high costs, preventing inactivity is particularly important, especially given evidence suggesting that even low activity levels (i.e. avoidance of inactivity) protects against mortality.[7] An improved understanding of influences on inactivity is therefore needed.

Influences on physical (in)activity are many, and one challenge in interpreting current evidence is that most studies, being cross-sectional, examine contemporary correlates of physical activity.[8] Such studies do not take a life-course approach, and ignore the fact that factors specific to particular life-stages could be important for future inactivity levels. For example, life events typically occurring in early adulthood, such as family formation, may alter physical (in)activity levels[9,10] and contribute to gender differences[10,11] in subsequent inactivity patterns. Early adulthood is a life-stage of many important transitions such as parenthood and job entry and may be a pivotal period for developing lifestyles, both protective and risk-laden.[12] Within the context of macro-

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to micro-level influences, early adult physical factors (e.g. health status[13]), mental function (e.g. depression[14]), social circumstances (e.g. employment[13]), family circumstances (e.g. parenthood[10]) and neighbourhood characteristics (e.g. access to recreational facilities[15]) could influence subsequent inactivity status. However, few prospective studies examine whether early adulthood is a key life-stage when several influences may affect subsequent inactivity levels and patterns, including stability and changes. Moreover, it is important to account for putative influences from early-life, such as physical development and co-ordination.[16] In this respect, a life-course approach has the possibility to shed light on the added contribution of early adulthood influences over and above those from prior life-stages.

Therefore, in a nationwide general population sample we aimed to establish whether factors in early adulthood are associated with inactivity patterns subsequently in midlife. We examine inactivity patterns in terms of stability and change because adult inactivity is only moderately stable[16] and, knowledge of influences on these inactivity patterns may inform the development of intervention strategies. Specific objectives were to (i) examine whether physical, mental function, social, family and neighbourhood circumstances in early adulthood (at 23y and/or 33y) were associated with later inactivity stability and change 33y to 50y, and (ii) examine associations after accounting for potential influences from prior life-stages.

2. Methods

The 1958 British Birth Cohort is an ongoing longitudinal study of all babies born during one week, March 1958 across England, Scotland and Wales (N = 17,638) and a further 920 immigrants with the same birth week.[17] Information was collected in childhood (birth, 7, 11 and 16y) and adulthood (23, 33, 42, 45 and 50y). Ethical approval was given for various sweeps, including at 50y by the London Multi-centre Research Ethics Committee; informed consent was obtained from participants at various ages. Respondents in mid-adulthood are broadly representative of the total surviving cohort[18]; the sample for this study consists of those alive and living in Britain at 50y with information on inactivity at either 33y or 50y (N = 12,271).

Physical inactivity at 33y and 50y was ascertained, using the same questions, asking participants about regular leisure-time activity frequency; 'regular' was defined as ≥1/month for most of the year (or over the part of the year when they did the activity) and, to aid recall, a list of example activities (e.g. swimming or going for walks) was provided. Those responding affirmatively, reported activity frequency ranging from every/most days to <2–3 times/month.[19] Participants reported frequency of all activities together. Consistent with previous work,[4–6] low activity frequency was identified as <1/week (including no 'regular' activity), hereafter referred to as inactivity. From binary inactivity measures at 33y and 50y, we identified four groups: (i) 'never inactive' (≥1/week at 33y and 50y) (ii) 'persistently inactive' (active <1/week at both ages) and two change groups, (iii) deteriorating status (≥1/week at 33y, <1/week at 50y) and (iv) improving status (<1/week at 33y, ≥1/week at 50y). Thus, deteriorating status refers to deterioration in activity (i.e. changing to inactivity); improving status refers to improvement in activity (i.e. changing from inactivity).

Early adult factors (main exposures), identified from previous studies,[10,20,21] were assessed prospectively and categorised into five broad domains: physical status (limiting illness, obesity, height), mental function (depression, education level), social circumstances (social class, employment), family circumstances (co-habitation, number of children), and neighbourhood type. Neighbourhood represented a meso-level characteristic, whereas the physical, mental function, social and family domains mostly represented individual-level characteristics (details in Table 1).

Early-life factors (covariates) identified previously[16] include pre-pubertal stature, hand control/co-ordination problems, cognitive ability, social class at birth, household amenities, parental education, parental divorce and 16y activity (frequency and aptitude) (details in Table 1). Other factors, for sensitivity analyses, include 16y body mass index (BMI; from measured heights and weights), mental health (16y internalizing and externalising behaviours from the Rutter scale[22]) and 23y physical activity (self-reported frequency[19]).

Statistical analysis: We examined whether factors in early adulthood (23–33y) were associated with later inactivity stability and change (33–50y) by fitting two multinomial logistic regression models, which provided Relative Risk Ratios (RRRs) and 95% confidence intervals (CIs). We first compared the persistently inactive relative to the never inactive (i.e. most vs. least adverse behaviour 33–50y) and those with deteriorating status relative to the never inactive (i.e. changing vs. remaining the same over the age range). Second, we compared those with improving status relative to the persistently inactive. Initially, associations between factors and inactivity patterns were examined separately and gender differences in associations were assessed using an interaction term (gender*factor); where interactions were found results are presented separately by gender. We conducted domain specific multivariable models including all factors (from each domain) in one model. Next, to assess associations for domains simultaneously, we combined all factors associated with inactivity patterns in the first stage of analysis into one model. Finally, we included adjustments for early-life factors. To account for potential bi-directional associations of inactivity with adiposity or mental health[14,23,24] and to further control for previous activity levels, we conducted sensitivity analyses that included further adjustment for 16y BMI and mental health and 23y activity.

To minimize data loss, multiple imputation using chained equations was used to impute missing data on inactivity (11% at 33y; 21% at 50y), early adult factors (1% (33y height) to 22% (23y children)) and early-life factors (1% (cognition) to 30% (16y weight)). Imputation models included all model variables, including previously identified key predictors of missingness.[18] Regression analyses were run across 10 imputed datasets; overall estimates were attained using Rubin's rules. Imputed results (presented here) were broadly similar to those using observed values (Table S1). Analyses were conducted in STATA v13.1.

3. Results

Inactivity prevalence was similar (31%) at 33y and 50y. Between these ages, 51% were never inactive, 14% were persistently inactive and 35% changed their inactivity status (17% deteriorating and 18% improving).

Domain specific associations: In univariable analyses, all physical factors (limiting illness, obesity, height) were associated with persistent inactivity (versus never inactive); all except limiting illness were related to deteriorating status (versus never inactive) and all except height were associated with improving status (vs persistent inactivity) (Table 2). Both mental function factors (depression, lower education level) were associated with persistent inactivity and deterioration, and, in the opposite direction, with improvement. For social factors, lower social class (23y and 33y) and not in paid employment at 23y (but not at 33y) were associated with inactivity persistence and deterioration. Social class (23y and 33y) were also associated, in the opposite direction, with improvement. In the family domain, higher number of children at 23y was associated with inactivity persistence and deterioration and, in the opposite direction, with improvement. Only one gender-interaction was found ($p_{interation} = 0.01$): for children at 33y, the direction of