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Childhood socioeconomic status and lifetime health behaviors: The Young Finns Study

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ABSTRACT

Background: Differences in health behaviors partly explain the socioeconomic gap in cardiovascular health. We prospectively examined the association between childhood socioeconomic status (SES) and lifestyle factors in adulthood, and the difference of lifestyle factors according to childhood SES in multiple time points from childhood to adulthood.

Methods and results: The sample comprised 3453 participants aged 3–18 years at baseline (1980) from the longitudinal Young Finns Study. The participants were followed up for 31 years ($N = 1675–1930$). SES in childhood was characterized as reported annual family income and classified on an 8-point scale. Diet, smoking, alcohol intake and physical activity were used as adult and life course lifestyle factors. Higher childhood SES predicted a healthier diet in adulthood in terms of lower consumption of meat ($\beta \pm SE$ $-3.6 \pm 0.99, p < 0.001$), higher consumption of fish (1.1 ± 0.5, $p = 0.04$) and higher diet score (0.14 ± 0.044, $p = 0.01$). Childhood SES was also directly associated with physical activity index (0.059 ± 0.023, $p = 0.009$) and inversely with the risk of being a smoker (RR 0.90 95%CI 0.85–0.95, $p < 0.001$) and the amount of pack years (-0.47 ± 0.18, $p = 0.01$). Life course level of smoking was significantly higher and physical activity index lower among those below the median childhood SES when compared with those above the median SES.

Conclusions: These results show that childhood SES associates with several lifestyle factors 31 years later in adulthood. Therefore, attention could be paid to lifestyle behaviors of children of low SES families to promote cardiovascular health.

1. Introduction

Direct association between socioeconomic status (SES) and cardiovascular health has repeatedly been shown and one of the contributors is suggested to be health behaviors [1,2,3]. SES has been consistently shown to be related to multiple lifestyle factors such as diet choices,

Abbreviations: FFQ, food frequency questionnaire; PAI, physical activity index; SES, socioeconomic status.

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smoking and physical activity [4,5], that, in turn, associate with the risk of numerous morbidity and mortality outcomes, both as single factors and combined [6,7,8,9]. The results of the studies showing the association between health behaviors and socioeconomic differences in mortality vary, but they typically explain 30–50% of the differences [10,11,12,13]. Despite knowledge of the socioeconomic divide in risk factors, and trends toward healthier lifestyles over time across SES groups, the socioeconomic gap in various risk factors has still widened [14,15].

Lifestyle factors are modifiable and thus suitable target for health promotion and disease prevention [16]. Interventions that begin in childhood, as health behaviors are being established, may be more beneficial than those that target adults. Therefore, it is important to find out whether SES differences in health behaviors start already in childhood and whether they persist all the way into the adulthood. The reports from the Cardiovascular Risk in Young Finns Study have previously examined the association between childhood SES and health behaviors among other conventional cardiovascular risk factors in youth, but not in adulthood [17,18,19]. The association of childhood SES with smoking and physical activity in adulthood has been shown in few other cohorts [20,21,22]. However, prospective data on the association between childhood SES and a wide variety of health behaviors in adulthood are missing.

Using data from the longitudinal Cardiovascular Risk in Young Finns Study cohort, we examined the independent association of childhood family SES with diet, smoking, alcohol consumption and physical activity in adulthood after 31 years of follow-up. Additionally, we investigated the differences in health behaviors between children with low or high family SES in multiple time points from childhood to adulthood.

2. Methods

2.1. Participants

The Cardiovascular Risk in Young Finns Study cohort and methods have been previously described in detail [23]. The cohort comprised 3596 participants aged 3–18 years at baseline in 1980. Thereafter, the cohort has been followed up in 1983, 1986, 2007 and 2011, with 2991, 2779, 2204 and 2060 participants from the original cohort, respectively. The present study sample comprised 3453 participants aged 3–18 years at baseline (1980), who provided data on their SES and lifestyle risk factors. In the follow-ups, sample sizes varied 1604–3432, depending on the outcome variable. All participants provided written informed consent, and the study was approved by local ethics committees.

2.2. Classification of socioeconomic status

Annual income was considered as an indicator of SES both in childhood (family income) and adulthood (participant's own income) [24,25]. Values of annual family income in childhood were corrected for time. Annual income strata were determined on an 8-point scale: in childhood from 1 (<2500 euros) to 8 (>16,800 euros) and in adulthood from 1 (<10,000 euros) to 8 (>70,000 euros). In addition, we made sensitivity analyses, where childhood SES was defined according to the parental educational years [26].

2.3. Lifestyle factors

Data on dietary habits, smoking and physical activity were obtained with questionnaires [27]. In 1980, 1983 and 1986, information on dietary habits was obtained with a non-quantitative food frequency questionnaire (FFQ) on the consumption of selected foods relevant to the development of cardiovascular disease (e.g. vegetables, fruits, fish and meat). For participants aged 3 to 9 years, the data were requested from the parents. Older participants answered the questions themselves, assisted by their parents when necessary. Consumption of these foods during last month was assessed on a 6-point scale: from 1 (daily) to 6 (only occasionally or never) [28]. The response categories were converted into times of consumption per week as previously described [29]. In 2007 and 2011, a more detailed quantitative FFQ providing an estimate of food consumption during the last 12 months in grams per day was used [29,30]. In this study, we used data on vegetable, fruit, fish and meat (including meat dish, sausage and cold cuts) consumption that were available both at baseline and the subsequent follow-ups, thus providing longitudinal data from childhood to adulthood. Using the quantitative FFQ in 2007 and in 2011, the total energy intake per day was also calculated.

To complement the longitudinal dietary data, we also used a diet score calculated from the FFQ data obtained in 2007. The score describes the diet as entirety, defined based on the intakes of 9 food groups. In the score, whole grains, fish, fruits, vegetables, and nuts/seeds were designated as favorable, healthy foods, whereas red and processed meats, sweets, sugar-sweetened beverages, and fried potatoes were designated as unfavorable. Intake of each food group was categorized into quartiles and assigned ascending values (0, 1, 2, 3) for favorable foods and descending values (3, 2, 1, 0) for unfavorable foods. These values were summed to generate a diet score (range: 0–27 points), with higher scores representing healthier diets [31].

The FFQ in 2007 and 2011 also provided an estimate on the consumption of beer, wine, spirits and other alcohol beverages (g/day), from which the mean amount of drinks per day was calculated.

Prospective data on cigarette smoking was self-reported by participants beginning of age 12 years or older in 1980, in 1983, in 1986, in 2007 and in 2011. Individuals who had reported daily smoking were defined as smokers. The number of pack years of smoking were also calculated [27].

A physical activity index (PAI) indicating habitual physical activity was calculated at baseline and repeatedly during the follow-ups.Separate questionnaires were used for the younger children (3–6 years of age, a parent-completed questionnaire), older children (9–18 years of age, self-completed questionnaire with the help of parents, if needed) and adults [32]. Due to the different scaling of the PAI during follow-up, the PAI values were age-standardized [32].

2.4. Clinical characteristics

Height, weight, and waist circumference were measured at all examinations [23]. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared [27].

2.5. Statistical analyses

To examine differences between baseline characteristics of males and females, we used age-adjusted linear regression for continuous outcomes and logistic regression for binary outcomes. Continuous variables were described by mean $\pm$ SD and binary variables as percentages. Associations of family SES in childhood with diet, alcohol consumption, physical activity and pack years of smoking in adulthood (2011) were studied using linear regression ($\beta \pm$ SE). To study the association of childhood SES and smoking status (smoker/non-smoker) in adulthood (2011) we examined risk ratios (RR) using logistic regression. The analyses were adjusted for age and sex (Model 1) and additionally for participant's own SES in adulthood (Model 2). We also made additional analyses for diet variables adjusting for daily energy intake. To study the association between childhood SES and life-course levels of consumption of fruit, vegetable, fish, meat, and PAI, the study population was classified into 2 groups according to their SES status in childhood: Group 1; SES below median in childhood and Group 2; SES above median in childhood. We then analyzed the differences of mean values in these groups in 1980, 1983, 1986, 2007 and 2011, using pairwise comparisons adjusted for age and sex. The consumption of fruit, vegetable, fish and meat was defined as mean frequency per week in 1980, 1983 and 1986, and amount per day (g/day) in 2007 and 2011. The prevalences of smoking across the life course in childhood SES groups were examined using cross-tabulation. The differences in prevalence of smoking between SES-groups were analyzed adjusting with age and sex. All statistical tests were performed using SAS version 9.4(SAS institute, Inc., Cary, NC) with statistical significance inferred at a 2-tailed p-value <0.05.

3. Results

3.1. Baseline characteristics

The participants were on average 10.4 years old at baseline and there were slightly more females than males in the study cohort (Supplement Table 1). Females on average consumed more vegetables, had lower PAI and smoked less compared with males.

3.2. Childhood SES and diet

Higher SES in childhood was associated with higher consumption of fish and lower consumption of meat in adulthood in 2011, adjusted for age and sex (Model 1, Table 1). After additional adjustment for own SES in adulthood, the association remained between childhood SES and meat (Model 2, Table 1). Childhood SES was not associated with fruit or vegetable consumption in adulthood after 31 years of follow-up (Table 1).

Childhood SES was also associated with the diet score in adulthood (Model 1, Table 1), higher childhood SES predicting higher diet score indicative of a healthier diet. This association persisted when the analysis was additionally adjusted for participant's own SES in adulthood (Model 2, Table 1).

In additional analyses that further adjusted for daily energy intake (kcal/day), the results concerning associations of childhood SES and adulthood measures of fish, meat, vegetable and fruit consumption in

Table 1
Association of childhood SES on diet, alcohol, smoking and physical activity in adulthood (in 2011, diet score in 2007).

(N for Model 1/N for Model 2)	Model 1	Model 2
	β ± SE (*RR 95%CI for being a current smoker)	β ± SE (*RR 95%CI for being a current smoker)
Diet (g/day)		
Vegetable (N = 1675/1514)	2.9 ± 2.3, p = 0.21	−0.13 ± 2.5, p = 0.96
Fruit (N = 1675/1514)	−2.05 ± 2.0, p = 0.30	−3.8 ± 2.0, p = 0.06
Meat (N = 1675/1514)	−3.6 ± 0.99, p < 0.001	−2.8 ± 1.0, p = 0.007
Fish (N = 1675/1514)	1.1 ± 0.5, p = 0.04	0.73 ± 0.54, p = 0.18
Diet score (N = 1898/1825)	0.14 ± 0.044, p = 0.01	0.10 ± 0.046, p = 0.03
Alcohol (drinks/day) (N = 1900/1868)	-0.002 ± 0.01, P = 0.99	0.008 ± 0.01, P = 0.95
Smoking		
Being a current smoker* (N = 1930/N = 1897)	0.90, 0.85–0.95, p < 0.001	0.92, 0.87–0.98, p = 0.006
Pack years (N = 817/N = 799)	−0.47 ± 0.18, p = 0.01	−0.31 ± 0.18, p = 0.09
Physical activity index (z-score) (N = 1820/1847)	0.059 ± 0.023, p = 0.009	0.039 ± 0.023, p = 0.09

Model 1 = adjusted for age and sex.
Model 2 = additionally adjusted for own SES in adulthood.

2011, and diet score in 2007, remained essentially similar (data not shown).

In addition, we analyzed the life course levels of fruit, vegetable, fish and meat consumption in the childhood SES groups (above or below the median) (Fig. 1). The consumption of meat differed between the groups throughout the follow-up; in 1980, 1983 and 1986 meat consumption was higher among high SES group, but in contrast in 2007 and 2011, the consumption was higher among those having childhood SES below the median. The consumption of vegetables and fruits were higher among those having SES above median until 2007 and until 2011, respectively. Regarding the consumption of fish, the differences between the SES groups were not significant.

3.3. Childhood SES and alcohol consumption

Childhood SES was not associated with alcohol consumption in adulthood after 31 years of follow-up (Table 1).

3.4. Childhood SES and smoking

Higher childhood SES was associated with a lower risk of being a current smoker in adulthood (Model 1, Table 1). The association remained after additional adjustment for own SES in adulthood (Model 2, Table 1). Furthermore, among current and former smokers childhood SES was inversely associated with pack years of smoking in adulthood (Model 1, Table 1), but the association attenuated after additional adjustment for own SES in adulthood (Model 2, Table 1). With the exception of smoking at baseline, there was a higher proportion of smokers in the low SES group throughout the life course (Fig. 2).

3.5. Childhood SES and physical activity

Higher SES in childhood was associated with higher PAI in adulthood in 2011 (Model 1, Table 1). The association attenuated after additional adjustment for own SES in adulthood (Model 2, Table 1). When the life course levels of PAI were compared between the high and low SES groups, the differences were significant throughout the follow-up, with higher childhood SES predicting higher PAI (Fig. 3).

3.6. Sensitivity analyses using education as a marker of SES

In the sensitivity analyses using parental educational years instead of income as an indicator of childhood SES, the results for the associations between childhood SES and the lifestyle factors were essentially similar (Supplement Table 2).

4. Discussion

This prospective study indicates that low family SES in childhood predicts less healthy lifestyle up to 31 years later in adulthood. Our

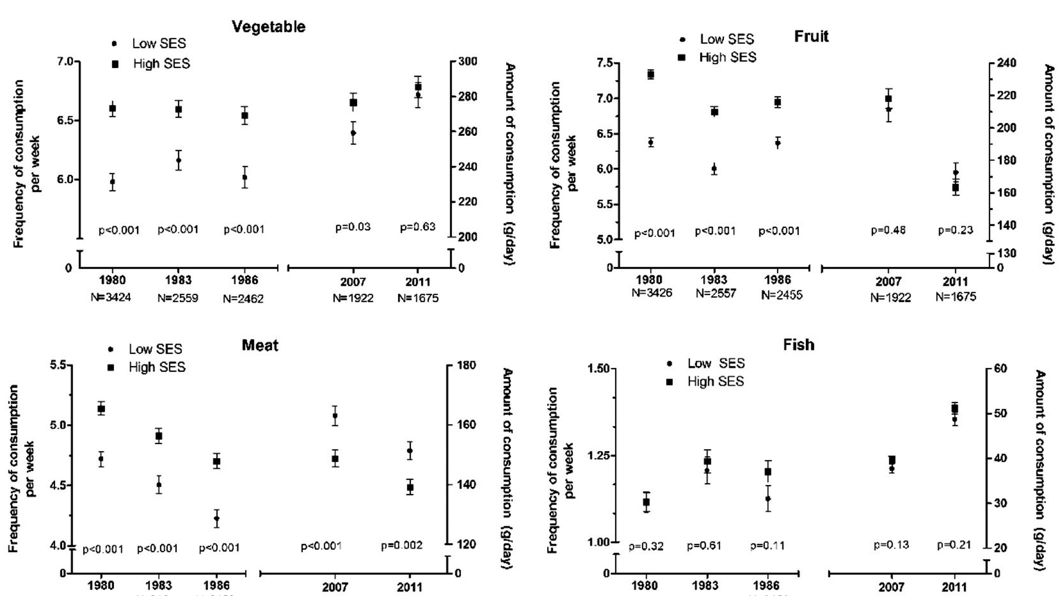

Fig. 1. Life course levels of consumption of vegetable (N = 1675–3426), fruit (N = 1675–3424), meat (N = 1675–3418) and fish (N = 1675–3432) in childhood SES groups (above and below median). p-Values are for pairwise comparisons adjusted for age and sex.

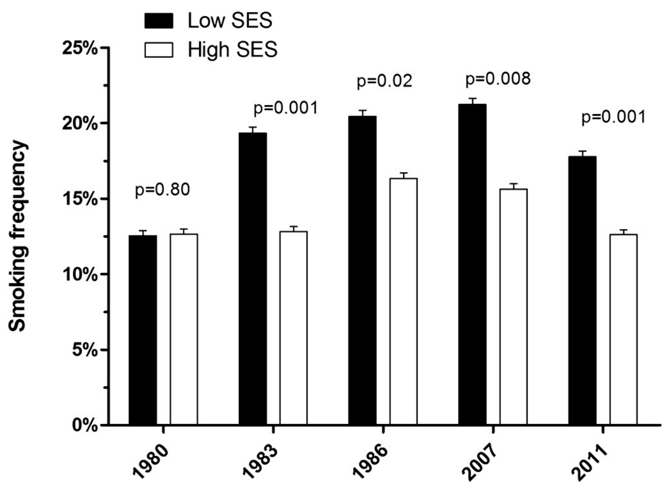

Fig. 2. Smoking frequency throughout the life course in childhood SES groups (above and below median) (N(1980) = 1604, N(1983) = 1720, N(1986) = 1923, N(2007) = 2143, N(2011) = 1930). p-Values are adjusted for age and sex.

analyses in multiple time points from childhood to adulthood suggest that socioeconomic differences in lifestyle factors are present already in childhood and especially for meat consumption, smoking and physical activity, they persist throughout the life course into the adulthood.

Only few studies have previously described the relation between childhood SES and health behaviors in adulthood. Lower SES in childhood has been associated with smoking, binge drinking and lower levels of physical exercise in adulthood [20,21,22]. In the majority of the studies, childhood SES has, however, been assessed retrospectively and the reports have not focused on health behaviors but assessed them only sporadically. We have previously shown higher childhood SES to be independently associated with adulthood ideal cardiovascular health, defined as the simultaneous presence of four health behaviors (smoking, BMI, diet and physical activity) and three clinical health factors (blood pressure, serum total cholesterol, plasma glucose) [33]. In addition, we have reported that childhood SES is associated with e.g. diet in young adulthood [17,18,19]. However, there has been a lack of comprehensive knowledge concerning the association between childhood SES and behavioral factors later in adulthood. Thus, this study provides novel data on association between SES in childhood and individually assessed health behaviors in adulthood, which has remained poorly understood.

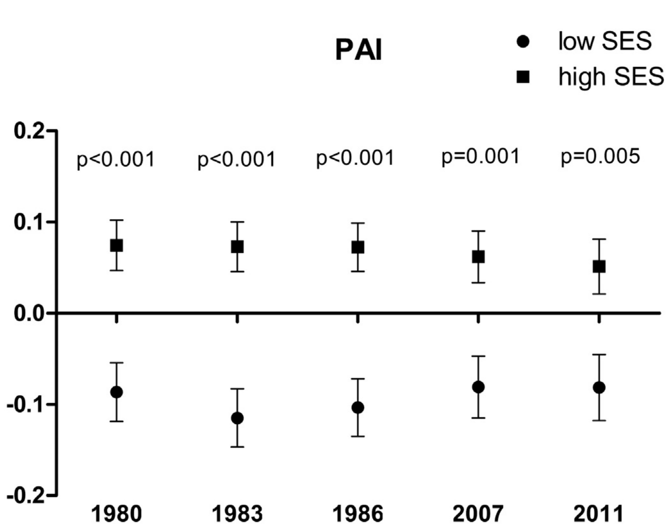

Fig. 3. Life course levels of physical activity index (z-scored for age) in childhood SES groups (above and below median) (N(1980) = 2213, N(1983) = 2261, N(1986) = 2395, N(2007) = 2088, N(2011) = 1847). p-Values are for pairwise comparisons adjusted for age and sex.

Our study suggests that lower SES in childhood predicts poorer diet, smoking and physical inactivity, which are strongly associated with cardiovascular and all-cause and mortality [6,7,8,9], up to 31 years later in adulthood. A diet associated with better cardiometabolic health contains plenty of vegetables and fruit, fat derived from plant and marine sources, and limited amount of red or processed meats, highly refined grains or food high in sugar and salt [34]. In the current study, high SES in childhood predicted higher diet score in adulthood, indicative of diet preferring these favorable foods to unfavorable ones. Furthermore in our study, from the dietary factors the most pronounced association was found between childhood SES and meat consumption. Childhood SES was inversely associated with meat consumption in adulthood and the association persisted after adjustment for participant's own adulthood SES. In several prior studies, consumption of red/processed meat has been reported to be one of the most important dietary factors affecting the cardiometabolic health [35,36,37].

The ability to study the association of childhood SES with several lifestyle factors in a longitudinal setting importantly distinguishes this study from previous reports [2]. We observed that the difference in many of the health behaviors between the two childhood SES groups seems to exist already in childhood, persist through adolescence into adulthood especially regarding smoking habits and physical activity. This highlights that people having low childhood SES smoked more and exercised less throughout their whole life course. These results are in line with previous studies, which have shown that suboptimal lifestyles tend to persist from childhood into adulthood. [38] Regarding the dietary habits in childhood and adolescence, there was a difference in fruit, vegetable and meat consumption suggesting a higher intake in the high SES group, but in adulthood the differences between groups in fruit and vegetable consumption diminished. For meat consumption the difference persisted also in the adulthood, but in contrast to childhood, the consumption of meat in adulthood was higher among those with lower SES. This might indicate that due to the overall increase in the Finnish national income since the 1980s, meat has become more accessible to the wider population and lost its status as a luxurious grocery symbolizing economical welfare [39]. The diminishing consumption of meat from childhood to adulthood among those having high SES in childhood might also reflect their greater health consciousness and conscious reduction in meat consumption, when over time people have become more aware of the risks concerning the consumption of high amounts of meat.

The underlying reasons for the differences in health behaviors according to childhood SES are complex. People with higher SES have for instance been shown to have higher skills and knowledge about a healthy lifestyle [40]. Those with higher SES may also have profited more of health improving interventions which were initially targeted to the whole population. Further, SES might affect the differences in health behaviors through the attitudes and expectations about life and health [41]. Lower SES has also been shown to associate with less health consciousness and weaker beliefs about internal control, which might affect the desire to take up health promoting messages [41]. Another possible explanatory factor is the physical environment, since the places where poorer people live, do not always provide much local facilities which enable people live healthy e.g. places to exercise and to buy and eat healthy food [40]. Also the cultural norms (e.g. eating and smoking habits) and material factors, through the costs of healthier products, might differ between SES groups and affect the health behaviors adopted already early in life.

Because health behaviors are usually learned from parents through modeling processes, low parental SES has been shown to associate with the more adverse health behavior models in the children [42]. Dietary habits, physical activity and smoking have also been shown to track from childhood to adulthood [28,32,43]. Our study also indicates the importance of childhood environment, since in this study the associations between childhood SES and some of the lifestyle factors, e.g. smoking, remained after adjustment for participant's own SES in adulthood. This finding links to the critical period hypothesis [44], which is conventionally seen as biological factors having long-lasting effects on adult health, but in this situation the long-lasting effects associate with attitudes adopted in childhood [45]. These may persist throughout lifetime affecting the lifestyle still in adulthood. In contrast to the critical period hypothesis, a previous study suggested that the association of childhood SES with adult health and health behaviors is mediated through education and participant's own SES in adulthood [46]. This mechanism is also partly supported by our study, since the adjustment for the participant's own SES attenuated the association between childhood SES and health behaviors in some factors but maintained it in the others. The mechanism is commonly described as the family economic resources affecting the access to education and therefore participant's own SES in adulthood. However, the current study population is from Finland, where education is free of costs even in the university level, suggesting the pathway might not be this straight forward.

4.1. Study limitations

This study has limitations. First, misclassification of the childhood SES might have been possible given that annual family income could be temporally impacted by unemployment, poor health, and other life circumstances that may have affected the level of income in the catchment year. Second, the diet was measured using both non-quantitative and quantitative FFQs. However, we have analyzed and presented the data from these two different FFQs separately. Third, the generalizability of our study is limited to white Caucasian populations since our study cohort was racially homogenous. Additionally, there is the chance of bias due to differential loss to follow-up. However, the Young Finns cohort has been dynamic with non-participants in one follow-up re-entering at a future follow-up, and baseline risk factor levels were essentially similar among those who did and did not participate at adult follow-ups [47]. Thus, the study population is likely representative of the original population. The major strengths of this study include the longitudinal study design that was initiated in childhood and the 31-year follow-up of the participants who were well phenotyped both in childhood and adulthood.

5. Conclusions

In conclusion, our study suggests that low SES in childhood predicts less healthy lifestyle in adulthood and that the socioeconomic differences in lifestyle factors are already evident in childhood, where from they appear to persist into adulthood. This knowledge may help in breaking the chains of risks as early as possible by targeting the interventions to the vulnerable people and also to the lifestyle factors which are a result of socioeconomic differences in childhood. This would be a step closer to diminishing the socioeconomic differences in health behaviors but also the socioeconomic gap in health and mortality.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcard.2018.01.088.

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Conflict of interest

The authors report no relationships that could be construed as a conflict of interest.

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