

# Socioeconomic Position Across the Lifecourse and Cognitive Function in Late Middle Age

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**Objectives:** To examine the influence of childhood and adult socioeconomic position, socioeconomic mobility, and cumulative disadvantage across the lifecourse on cognitive function in late middle age.

**Methods:** Cross-sectional population-based study of 486 men age 58 and 64 from eastern Finland. Respondent's socioeconomic position in childhood was measured using parent's education and occupation, and respondent's position in adulthood was indicated by attained education and personal income. Cognitive function was assessed using five neuropsychological tests: Trail Making, Selective Reminding, Verbal Fluency, Visual Reproduction, and the Mini-Mental State Exam.

**Results:** Each indicator of socioeconomic position made statistically independent contributions to levels of cognitive function: Respondents from poor childhood backgrounds, and those who attained a limited education and earned a low income, performed worst on each test. Men who occupied a disadvantaged socioeconomic position in childhood and then experienced upward mobility over the lifecourse exhibited better cognitive performance than those with similar socioeconomic origins but limited or no upward mobility. Conversely, men from advantaged childhood backgrounds who later in life experienced downward mobility scored poorer on each cognitive test than their counterparts who remained in the most advantaged groups throughout the lifecourse. There was a strong, graded association between cumulative socioeconomic disadvantage and cognitive function: Men who occupied a low socioeconomic position during both childhood and adulthood scored worse on every test than those who occupied a high position at all points in their lives.

**Discussion:** Socioeconomic conditions across all stages of the lifecourse appear to make unique contributions to cognitive function in late middle age. These results also suggest that in terms of cognitive function, origin is not necessarily destiny, as disadvantaged socioeconomic circumstances in childhood may be overcome to some extent by upward mobility later in life.

A large and growing literature has documented the association between socioeconomic position and adult disease (Kaplan & Lynch, 1997). With few exceptions, the evidence shows that those who are socioeconomically disadvantaged have higher mortality rates for most major causes of death, and their morbidity profile indicates that they experience more ill health (Aiach & Curtis, 1990; Davey Smith & Egger 1992; Macintyre, 1997). Moreover, socioeconomic differences in adult health are evident for both men and women (Arber, 1997; Koskinen & Martelin, 1994), the relationship exists irrespective of how socioeconomic position and health are measured (Berkman & Macintyre, 1997), and the association is found in all countries for which there are data (Feinstein, 1993; Kunst & Mackenbach, 1994).

During the past few decades, researchers have attempted to understand the genesis of health inequalities in adulthood by examining socioeconomic conditions experienced in early life. Some, but not all, studies have shown that childhood socioeconomic position is an important determinant of disease risk in later life, with propensity for adverse health

in adulthood being greatest among those from disadvantaged backgrounds (Blane et al., 1996; Gilksman et al., 1995; Goya-Wannamethee, Whincup, Shaper, & Walker, 1996; Lynch et al., 1994; Nystrom-Peck, 1994; Vagero & Leon, 1994). In more recent times, research into the influence of childhood socioeconomic position on adult health has been extended (and complemented) by studies that have adopted a lifecourse perspective (Bartley, Blane, & Montgomery, 1997; Kuh & Ben-Schlomo, 1997; Lynch, Kaplan, & Salonen, 1997; Wadsworth, 1997). These studies (of which there are few) have shown that socioeconomic variability in adult disease is due to adverse exposures experienced in both early and later life, with the relative importance of each lifecourse stage depending on the health outcome (Davey Smith, Hart, Blane, Gillis, & Hawthorne, 1997). Lifecourse research has also demonstrated that adult disease is influenced by socioeconomic mobility (Hart et al., 1995; Mare, 1990; Power, Manor, & Matthews, 1999). Upward mobility appears to decrease risk and partially compensate for earlier disadvantage, whereas downward mobility increases risk. Moreover, the impact of socioeco-

conomic disadvantage may accumulate longitudinally, such that the poorest health is experienced by those who have the greatest cumulative exposure to social and economic adversity.

In this article, we contribute to an understanding of how socioeconomic position across the lifecourse influences adult health by focusing on cognitive function in late middle age. There is now a well-established literature showing that neurological conditions such as poor cognitive function (Cerhan et al., 1998; Elias, Elias, D'Agostino, Sibershatz, & Wolf, 1997; Elwood et al., 1999; Freidl et al., 1996), dementia (De Ronchi et al., 1998; Medical Research Council Cognitive Function & Aging Study, 1998), and Alzheimer's disease (Stern et al., 1994; Stern, Tang, Denaro, & Mayeux, 1995) are more common among socioeconomically disadvantaged adults. Studies have also shown that children from disadvantaged backgrounds exhibit poorer cognitive performance than their more advantaged counterparts (Andersson, Sommerfelt, Sonnander, & Ahlsten, 1996; Auerbach, Lerner, Barasch, & Palti, 1992; Duncan, Brooks-Gunn, & Klebanov, 1994; Gottfried, 1984; Guidubaldi & Perry, 1984). To our knowledge, however, no study has investigated whether and to what extent socioeconomic mobility over the lifecourse, and accumulated adverse exposure, affect cognitive function in later life. Information about these issues will have important implications for public health interventions and for public policy more broadly.

## METHODS

Participants took part in the Kuopio Ischemic Heart Disease Risk Factor Study, an ongoing population-based investigation of heart disease risk factors, mortality, and other health-related outcomes among middle-aged eastern Finnish men (Salonen, 1988). Between 1986 and 1989, an age-stratified random population sample of 1,516 men was recruited for a baseline examination. The men were ages 42 ( $n = 334$ ), 48 ( $n = 358$ ), 54 ( $n = 426$ ), or 60 years ( $n = 398$ ) and constituted 83% of eligible participants. Partway through the baseline data collection period, ultrasound technology became available, and this was subsequently added to the study protocol in February 1987. Those men who entered the baseline study on or after this date ( $n = 1,229$ ) underwent an ultrasound examination of the right and left carotid arteries. Between 1991 and 1993, these 1,229 men were invited to participate in a follow-up study; however, 52 could not take part because of death, serious illness, or migration, leaving 1,177 eligible participants. Of this eligible group, 1,038 (88%) participated, 107 refused, and 32 could not be contacted.

The focus of this present analysis is on the two oldest groups of men who were age 58 or 64 years at the follow-up study; participation rates were 86% (284 of 300) and 89% (271 of 305), respectively. During follow-up, these men undertook a series of neuropsychological tests, and 98% ( $n = 545$ ) completed at least one test. For this analysis, participants were excluded if they reported having no father or mother ( $n = 31$ ) or if they provided insufficient information on their socioeconomic position ( $n = 28$ ), leaving 486 men with complete data (58 years old,  $n = 249$ ; 64 years old,  $n = 237$ ).

## Measurement of Socioeconomic Position

*Socioeconomic position in childhood.*—During the baseline examination, respondents were asked to report on aspects of their family's socioeconomic position at age 10, including parents' education and principal occupation. Mother's and father's education were categorized as (a) did not complete primary school and (b) primary school or more. This categorization reflects the fact that the participants' parents were educated in the early 1900s, and few attained a high level. Parents' occupation was coded as (a) unskilled manual, (b) lower white collar and skilled manual, and (c) upper white collar and professional. If the respondent's mother was a homemaker, her socioeconomic position was coded in accordance with her husband's occupation. The parental socioeconomic measures for both parents were summed to form an index that was subsequently categorized into approximate tertiles: low socioeconomic position ( $n = 173$ , 36%), middle socioeconomic position ( $n = 156$ , 32%), and high socioeconomic position ( $n = 157$ , 32%).

*Socioeconomic position in adulthood.*—This was measured by using respondent's education and personal income received in the preceding year. Education was grouped into two categories: (a) did not complete elementary school or completed elementary school plus some junior high school ( $n = 260$ , 54%) and (b) completed elementary school plus vocational training (at least 1 year) or junior high or more ( $n = 226$ , 47%). The mean number of formal years of education for these two groups was 6.5 and 10.4, respectively ( $p = .0001$ ). Personal income was initially modeled using quintiles and tertiles, and both showed a similar graded association with cognitive function. For the purposes of this study, income was subsequently measured as the bottom 40% of earners ( $n = 186$ ) and the top 60% ( $n = 300$ ). We also considered using respondent's occupation; however, preliminary analyses indicated that this measure added little to our understanding of how socioeconomic position related to cognitive function over and above that captured by education and income; thus, it was not included in the study.

*Socioeconomic mobility over the lifecourse.*—The socioeconomic lifecourse measure was constructed by cross-classifying the three-level childhood socioeconomic position variable with respondent's education and income to produce 12 pathways. This measure reflected the respondent's socioeconomic trajectory from approximately age 10, through adolescence and early adulthood, to late middle age.

*Cumulative socioeconomic exposure.*—The variable measuring cumulative socioeconomic exposure across the lifecourse was created by dividing the parental socioeconomic index into two categories based on a median split and then summing this and the education and income variables to derive eight combinations of socioeconomic position. These combinations were subsequently grouped into four categories reflecting similar levels of cumulative disadvantage: high socioeconomic position at all three points over the lifecourse ( $n = 120$ , 25%); high position at two points, low at

one ( $n = 116, 24\%$ ); low position at two points, high at one ( $n = 164, 34\%$ ); and low socioeconomic position at all three points ( $n = 86, 18\%$ ).

### Measurement of Cognitive Function

Cognitive function was measured using five neuropsychological tests: the Trail Making Test (Reitan, 1958), the Selective Reminding Test (Buschke & Altman Fuld, 1974), the Verbal Fluency Test (Borkowski, Benton, & Spreen, 1967), Russell's adaptation of the Visual Reproduction Test (Russell, 1975), and the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975). Interviewers trained in neuropsychological assessment administered the tests. These five tests were chosen because they assess a range of cognitive abilities and function and have established reliability and validity (Borkowski et al., 1967; Buschke & Altman Fuld, 1974; Butters, Granholm, Salmon & Grant, 1987; Folstein et al., 1975; Greencliff, Margolis, & Erker, 1985; Reitan, 1958; Russell, 1975). Moreover, the Finnish language versions of these tests have been used successfully in a population-wide dementia screening program conducted in eastern Finland (Koivisto et al., 1992).

The Trail Making Test is a test of frontal lobe functioning (Hänninen et al., 1997) as indicated by visual searching and sequencing, perceptual motor speed, and the ability to make alternating conceptual shifts (Strub & Black, 1985). The original Trail Making Test includes two parts in which participants are asked to sequence on paper and in ascending order the numbers 1–25 (Part A) or the numbers 1–13 and the letters of the alphabet A–L in alternating fashion (Part B). A respondent's task was to draw a connecting line from item to item without lifting the pencil from the paper and as rapidly as possible. In the present study, we also administered an alternate form of Part B in which letters of the alphabet were replaced with names of the months and respondents were asked to sequence the items, alternating between numbers and months. This version of the test was developed for use in elderly Finnish populations as part of a population-wide dementia screening program (Koivisto et al., 1992) and was shown to differentiate normotensive and hypertensive individuals in a sample of older Finnish adults (Kuusisto et al., 1993). The correlation between scores on the original Trail Making Test, Part B, and the alternate form of Part B was .67 ( $p < .0001$ ) in the present study. Owing to a higher proportion of missing data on the original Part B (23%), we chose to report results from the alternate version of Part B, which had less than 3% missing data. Performance on the Trail Making Test was judged in terms of the number of seconds required to complete the sequencing ( $M = 125.9, SD = 66.3$ ).

The Selective Reminding Test examines learning ability and storage, retention, and retrieval of information from short- and long-term memory. Participants were initially read 10 unrelated words in approximately 20 s and asked to recall the entire list in any order. Participants were then read only those words that they failed to recall after the first reading and were again asked to recall the entire list of 10 words. This procedure was repeated six times, and the participant's score was the total number of words cor-

rectly recalled (potential maximum score of 60,  $M = 34.2, SD = 8.3$ ).

The Verbal Fluency Test is a test of language performance that assesses the participant's ability to spontaneously produce words under the restrictions of a limited letter category (Strub & Black, 1985) and is also a test of frontal lobe functioning. Participants were asked to generate as many words as possible beginning with the letters P, A, and S; 60 s was allocated for each letter. Different forms of the same word and proper names of persons or places were not counted as correct. Performance was measured by counting the number of words produced during the 3-min period, with higher scores indicating better language facility ( $M = 32.1, SD = 12.8$ ).

The Visual Reproduction Test examines constructional ability and visual memory for nonrepresentative figures (right temporal lobe functioning). Participants were initially shown a single geometric figure for 10 s, after which it was removed from view; the participant was then asked to draw the figure from memory. This procedure was repeated with a figure of greater complexity, and then for a third time, although on this occasion the participant was required to draw two figures. Scoring was based on the degree to which the participant was able to accurately and correctly replicate the figures (potential maximum score of 21;  $M = 11.2, SD = 3.7$ ).

The Mini-Mental State Exam has been widely used in both clinical and population-based studies (Brayne & Callo-way, 1990; Escobar et al., 1986) to test for the presence of cognitive impairment and as a screening tool for dementia (O'Connor, Pollitt, & Treasure, 1991). The test examines orientation (10 items), registration (3 items), attention and calculation (5 items), recall (3 items), and language (9 items). A correct response to each item scores 1 (incorrect = 0); scores are then summed to give a potential maximum score of 30. Higher scores indicate better cognitive function ( $M = 27.0, SD = 2.2$ ).

### Data Analyses

The influence of socioeconomic position, changes in position across the lifecourse, and cumulative disadvantage on cognitive ability were investigated using the general linear models procedure in SAS (SAS Institute, 1990). This procedure produces cognitive function means and 95% confidence intervals for the levels of each socioeconomic indicator. Three sets of analyses were conducted. The first set examined the association between respondent's childhood socioeconomic position, education, and income and performance on each of the cognitive tests. The results are initially presented only with age adjustment and then with simultaneous adjustment for age and each measure of socioeconomic position. The second set examined how each of the 12 lifecourse pathways related to cognitive function score and also how changes in socioeconomic position from childhood to adulthood affected these scores. The third set investigated the association between cumulative socioeconomic disadvantage and cognitive performance. Importantly, when undertaking the analyses models were adjusted for morbidity indicators that were likely to represent pathways through which socioeconomic factors affected cognitive function. These indicators included disease measures

(history and incidence of stroke, ischemic heart disease, atherosclerosis, and diabetes), risk markers for these diseases (hypertension, blood lipids, fibrinogen, glucose, and insulin), and pharmacological agents (medications for control of hypertension and cholesterol). These measures were modeled in numerous ways—both separately and simultaneously, using single indicators and composite indexes—however, their inclusion in the general linear models analysis did not change the relationship between socioeconomic position and cognitive function. In short, the patterning and magnitude of association between socioeconomic position and score on each of the neuropsychological tests was the same prior to and after adjustment for the morbidity indicators. In light of this, we report only the age-adjusted results.

## RESULTS

### *Child and Adult Socioeconomic Position and Cognitive Function*

Table 1 presents the respondents' mean scores for each neuropsychological test according to their childhood socioeconomic position, education, and personal income. The age-adjusted associations (Model 1) show significant and consistently graded relationships between socioeconomic position and all indicators of cognitive function in adulthood. After simultaneously adjusting for age and the other measures of socioeconomic position (Model 2), these associations were attenuated somewhat, but remained graded. In every case, those in the bottom socioeconomic category performed worst and those in the top group did best. Overall, these results show that each indicator of socioeconomic position—childhood, education, and income—made indepen-

dent contributions to levels of cognitive functioning in adulthood.

### *Socioeconomic Mobility and Cognitive Function*

Table 2 presents age-adjusted mean scores for each cognitive function test according to different socioeconomic pathways from childhood to adulthood. The strong and consistent patterning of results in this table attests to the impact of socioeconomic mobility across the lifecourse on cognitive function in late middle age. Those who occupied a disadvantaged childhood position and then experienced upward mobility over the lifecourse had better adult cognitive performance than those with similar socioeconomic origins but with limited or no upward mobility. Respondents in the low childhood category who subsequently attained a high education and income, for example, produced an average of 33.8 words during the 3-min duration of the Verbal Fluency Test compared with 24.1 words ( $p < .0001$ ) for those who occupied a disadvantaged position at all three lifecourse stages. A near identical trend is observed for each of the other four tests. Further, respondents who occupied an advantaged socioeconomic position in childhood but then later in life experienced downward mobility scored poorer on each cognitive function test than their counterparts who remained in the most advantaged groups throughout the lifecourse. The mean score on the Trail Making Test, for example, was 91.5 s for those who experienced an advantaged childhood, were better educated, and were among the top 60% of income earners; their counterparts, who also experienced an advantaged childhood but then later attained a low education and earned a lower income, took an average of 151.1 s ( $p < .0001$ ).

Table 1. Respondent's Childhood and Adult Socioeconomic Position and Cognitive Function Score

Measure	Trail Making Test (No. Seconds)		Selective Reminding Test (No. Words)		Verbal Fluency Test (No. Words)		Visual Reproduction Test (No. Correct)		Mini-Mental State Exam (Score)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Childhood socioeconomic position										
High	108.8	120.4	35.8	35.0	36.0	34.2	12.0	11.5	27.5	27.2
Middle	122.2	123.9	34.4	34.2	32.4*	32.4	11.4	11.3	27.1	27.0
Low	146.1*	139.4*	32.7*	33.2	28.4*	30.0*	10.3*	10.7*	26.5*	26.6*
$p^a$	.0001	.01	.003	.15	.0001	.007	.0002	.08	.0001	.03
Education <sup>b</sup>										
Elementary school plus vocational, or junior high or more	100.1	109.2	36.2	35.5	37.6	36.4	12.4	12.1	27.6	27.4
Part of elementary school, or elementary school plus part of junior high	149.6*	146.9*	32.4*	32.7*	27.3*	27.9*	10.2*	10.3*	26.4*	26.5*
$p^a$	.0001	.0001	.0001	.0005	.0001	.0001	.0001	.0001	.0001	.0001
Personal income <sup>b</sup>										
Top 60%	110.9	115.1	35.4	35.1	34.4	33.5	11.8	11.6	27.3	27.2
Bottom 40%	151.4*	140.7*	32.3*	33.1*	28.6*	30.9*	10.2*	10.7*	26.4*	26.7*
$p^a$	.0001	.0001	.0001	.01	.0001	.03	.0001	.006	.0001	.007
No. respondents <sup>c</sup>	474		468		483		486		485	

Note: Least square means adjusted for age (Model 1), and age and each measure of socioeconomic position (Model 2).

<sup>a</sup> $p$  value ( $F$  test) for the association between socioeconomic position and cognitive function simultaneously adjusted for age and each measure of socioeconomic position.

<sup>b</sup>Respondent's highest attained education and personal income.

<sup>c</sup>Population-based sample of men aged 58 and 64 years.

<sup>\*</sup> $p \leq .05$  for comparison with the high socioeconomic group (high childhood, elementary school plus vocational or junior high or more, top 60% of income).

Table 2. Socioeconomic Mobility and Cognitive Function Score

Socioeconomic Mobility			n	Trail Making Test	Selective Reminding Test	Verbal Fluency Test	Visual Reproduction Test	Mini-Mental State Exam
Childhood	Education	Income		(No. Seconds)	(No. Words)	(No. Words)	(No. Correct)	(Score)
High	high	high	88	91.5 (79.3-103.7)	37.5 (35.7-39.2)	41.5 (39.0-43.9)	12.9 (12.1-13.6)	28.0 (27.6-28.4)
High	high	low	14	100.4 (69.8-131.0)	39.3 (35.1-43.5)	36.1 (30.1-42.2)	11.9 (10.1-13.7)	27.4 (26.2-28.5)
High	low	high	23	126.3 (102.4-150.1)	33.3 (29.9-36.6)	27.1 (22.3-31.8)	11.1 (9.7-12.5)	26.9 (26.0-27.8)
High	low	low	32	151.1 (129.8-172.3)	31.6 (28.7-34.4)	27.3 (23.3-31.4)	10.2 (9.0-11.4)	26.5 (25.8-27.3)
Middle	high	high	51	89.7 (73.5-105.9)	37.4 (35.2-39.6)	37.1 (33.9-40.2)	13.1 (12.2-14.0)	27.6 (27.0-28.2)
Middle	high	low	21	126.0 (100.4-151.6)	33.0 (29.5-36.4)	35.7 (30.8-40.7)	11.0 (9.5-12.4)	27.5 (26.6-28.4)
Middle	low	high	48	131.2 (114.3-148.0)	33.1 (30.8-35.4)	27.7 (24.4-31.0)	10.7 (9.7-11.7)	26.8 (26.2-27.4)
Middle	low	low	36	152.9 (133.8-172.0)	32.4 (29.7-35.2)	30.0 (26.2-33.8)	10.2 (9.0-11.3)	26.5 (25.9-27.2)
Low	high	high	36	109.5 (90.3-128.6)	34.9 (32.2-37.5)	33.8 (30.0-37.6)	12.3 (11.2-13.5)	27.6 (26.9-28.3)
Low	high	low	16	126.0 (96.3-155.8)	30.9 (26.9-34.8)	30.5 (24.8-36.2)	10.3 (8.6-12.0)	26.2 (25.1-27.2)
Low	low	high	54	141.3 (125.3-157.4)	33.4 (31.3-35.6)	29.3 (26.2-32.5)	9.9 (9.0-10.8)	26.6 (26.0-27.1)
Low	low	low	67	175.0 (160.7-189.3)	31.3 (29.3-33.2)	24.1 (21.3-26.9)	9.7 (8.8-10.5)	25.8 (25.3-26.3)
p value <sup>a</sup>				.0001	.0001	.0001	.0001	.0001
No. of respondents <sup>b</sup>			486	474	468	483	486	485

Note: Least square means and 95% confidence intervals adjusted for age.

<sup>a</sup>p value (F test) for the association between the socioeconomic trajectory measure and each cognitive function test adjusted for age.

<sup>b</sup>Population-based sample of men aged 58 and 64 years.

Cumulative Socioeconomic Position and Cognitive Function

Figure 1 shows the age-adjusted association between cumulative socioeconomic disadvantage and cognitive function.

Strong and finely graded associations between cumulative disadvantage and each indicator of cognitive performance were observed. The poorest scores were always found among men who occupied a disadvantaged socioeconomic

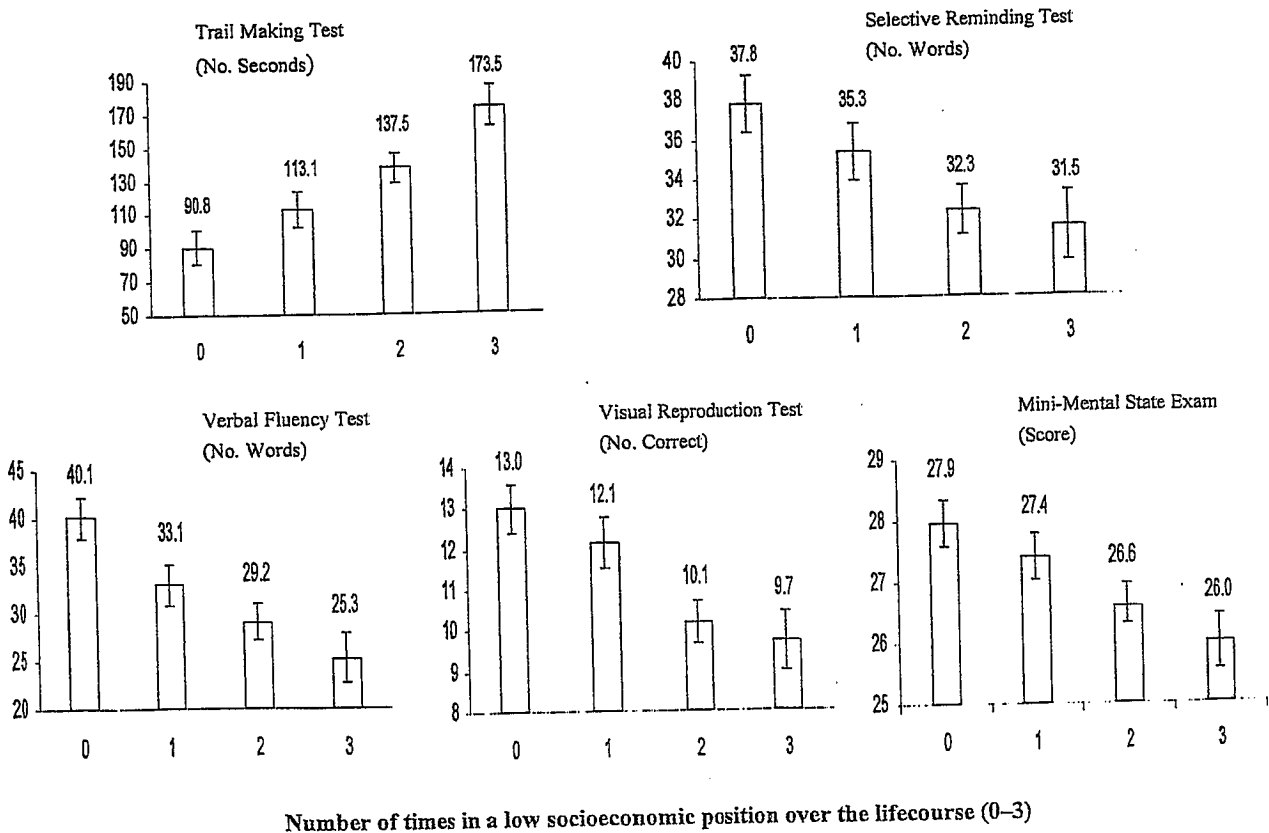


Figure 1. Cumulative socioeconomic position across the lifecourse and cognitive function in late middle age (mean test score and 95% confidence intervals).

position at all three life stages, whereas the best performance was observed among those who occupied a high position at all points.

## DISCUSSION

In this sample of eastern Finnish men, cognitive function in late middle age was independently associated with childhood socioeconomic position and adult education and income. Those who experienced a socioeconomically disadvantaged childhood, attained a limited education, or received a low income exhibited the poorest cognitive performance. These results add to existing evidence showing independent effects of child and adult socioeconomic position on a variety of health outcomes (Blane et al., 1996; Brunner et al., 1996; Nystrom-Peck, 1994; Vagero & Leon, 1994) and are indicative of the influence of cumulative disadvantage in the chronic disease process. It should be noted that due to selective survival, these and all other associations between socioeconomic position and cognitive function reported in this article are probably smaller than they otherwise would have been if all socioeconomic groups had the same probability of living to late middle age. Men in this study needed to survive to ages 58 and 64 years to be included in our analysis, and it has been well established in earlier papers based on the Kuopio Ischemic Heart Disease cohort that men from lower socioeconomic groups experience the highest premature mortality (Lynch et al., 1994, 1996). This disproportionate attrition of men from the most disadvantaged backgrounds resulting from selective survival will therefore very likely bias against our findings.

This study found that socioeconomic mobility across the lifecourse was an important determinant of adult cognitive functioning. Respondents in the high childhood group who experienced downward mobility into low education and/or income exhibited a poorer cognitive profile than those who had the same socioeconomic origins and retained a high (or a similar) position at each lifecourse stage. An identical (but reverse) pattern was evident for those who were upwardly mobile. Those who started life in a socioeconomically disadvantaged position and then attained a high education and/or income performed better on every test than their less upwardly mobile counterparts. We should also note that those who experienced a high socioeconomic position in childhood and then attained a low education and income performed significantly worse on four tests than those who experienced a disadvantaged childhood and subsequently attained a high education and income. Implicit in this interpretation of the evidence is a presumed causal link between socioeconomic position across the lifecourse and cognitive function in adulthood. It must be acknowledged, however, that a reverse causal interpretation of these findings is possible. Specifically, if cognitive function were in some way innately determined or set in early life, then this could conceivably influence later socioeconomic position and adult cognitive functioning. Given the cross-sectional design of this study, we were unable to disentangle the causal and reverse-causation interpretations as these relate to cognitive function, although it should be noted that studies examining reverse causation for other types of health outcomes find

that this process makes only a relatively minor contribution to socioeconomic health inequalities (Blane, Davey Smith, & Bartley, 1993; Independent Inquiry into Inequalities in Health, 1998).

Taken together, a causal interpretation of these results suggests a number of things. First, in terms of adult cognitive function, origin is not necessarily destiny. Disadvantaged socioeconomic circumstances in childhood may be overcome to some extent by upward mobility later in life. Similar mobility effects have been shown for mortality (Hart et al., 1995; Mare, 1990), self-rated health (Power, Manor, & Matthews, 1999), and some health behaviors (Lynch, 2000). The converse and more sobering aspect of this process, however, is that positive foundations established in childhood may be undermined by events that result in downward mobility over the lifecourse. Importantly, in this study we were not able to ascertain why some men were socioeconomically mobile (either up or down), nor did we have any information about the cognitive status of these men in early life. Thus, the strongly patterned association between socioeconomic mobility and cognitive function may in part reflect the upward and downward movement of cognitively healthy and impaired men, respectively. This notwithstanding, however, data from longitudinal studies have shown that socioeconomic health inequalities are primarily the result of socioeconomic factors impacting on health. Clearly, for some people, poor health contributes to downward mobility or makes upward mobility difficult; however, its overall contribution to population disease gradients is estimated to be small (Blane et al., 1993; Lynch, Kaplan, & Shema, 1997; Power, Matthews, & Manor, 1996).

Second, the results of the mobility analysis are consistent with the idea that not all types of adult chronic disease are inevitably set or programmed in childhood (Barker, 1992; Davey Smith, Gunnell, & Ben-Shlomo, 2000; Joseph & Kramer, 1996). Clearly, childhood is important, but childhood status is not the sole determinant of adult cognitive functioning. Indeed, although our study was not able to ascertain the men's cognitive status in childhood, a causal interpretation of our findings suggests that cognitive state may be malleable and responsive to changing socioeconomic conditions, including those that occur well beyond the childhood stage of physiological development. This situation may also pertain to other outcomes such as dementia and Alzheimer's disease, which are seen by some researchers as different points along the same disease continuum as cognitive function, and not discrete diseases with unique etiologies (Brayne & Calloway, 1988). At present, we know very little about the mechanisms and processes that link socioeconomic position at each lifecourse stage with adult cognitive function. It seems plausible, however, that being in a high socioeconomic position at any point is associated with greater exposure to more stimulating environments, resulting in more extensive brain development as indicated by increased cortical thickness and dendritic branching and improved communication among neuron networks, which in turn may reduce one's propensity to experience dementia or Alzheimer's disease in later life. Recent reviews of the relationship between education, cognitive function, and dement-

tia provide some support for this process (Albert, 1995; Katzman, 1993; Orrell & Sahakian, 1995), as do a number of animal studies (Mohammed, Winblad, Ebendal, & Larkfors, 1990; Swaab, 1991).

The fact that childhood socioeconomic position had an enduring effect on test performance separate from the impact of more proximate (and strongly determinative) influences such as formal education, attests to the importance of early life circumstances and environments in shaping and circumscribing human cognitive development. Moreover, this result underscores and extends evidence from the child development literature showing poorer cognitive function and school performance among children from socioeconomically disadvantaged backgrounds. The unique contribution made by education and income to adult cognitive function also serves to further illustrate that although these constructs are used widely and often interchangeably in the health inequalities literature, they constitute distinct socioeconomic domains that may demand different policy responses and intervention options. The independent contribution of education and income to socioeconomic variability in health outcomes has also been shown for physical functioning and mobility limitation. (Kaplan, 1992; Kaplan, Strawbridge, Camacho, & Cohen, 1993).

In the last section of this study, we examined the impact of cumulative socioeconomic disadvantage on cognitive function and found a direct correspondence between the duration of disadvantage over the lifecourse and test performance in adulthood. The group who experienced the longest exposure to socioeconomic disadvantage recorded the worst scores, and those who remained in a high socioeconomic position at all three lifecourse stages did best. Using U.S. data, Lynch, Kaplan, and Shema (1997) found a similar association between sustained economic hardship and self-reported cognitive problems, and other studies have shown that duration of adverse socioeconomic exposure increases risk for premature death and morbidity (Wadsworth, 1997) and poor/fair self-rated health at age 33 (Power et al., 1999). These earlier studies and our present results indicate that an understanding of the genesis of adult disease and functioning will not be greatly furthered by research that focuses on socioeconomic position at any single timepoint. Moreover, this evidence highlights the need for future cross-sectional and longitudinal research to collect data on socioeconomic conditions that span the lifecourse. In addition, an important question for future research is whether women's socioeconomic position over the lifecourse influences their cognitive function in late middle age in ways similar to or different from those observed here for their male counterparts. We were not able to address this issue because our sample consisted solely of men.

In sum, the results of this study suggest that cognitive function in late middle age is both shaped by and sensitive to socioeconomic conditions experienced during childhood and adulthood, as well as changes in socioeconomic position over the lifecourse and cumulative disadvantage. Thus, all stages of the lifecourse play a role in influencing adult cognitive function, indicating that intervention efforts be directed at both early and later life. Importantly, there is now a well-established literature showing that timely and appro-

priately targeted interventions can make a measurable difference to cognitive and socioemotional functioning (Power & Hertzman, 1997).

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