RESEARCH REPORT

Socioeconomic position in early life, birth weight, childhood cognitive function, and adult mortality. A longitudinal study of Danish men born in 1953

M Osler, A-M N Andersen, P Due, R Lund, M T Damsgaard, B E Holstein

Objective: To examine the relation between socioeconomic position in early life and mortality in young adulthood, taking birth weight and childhood cognitive function into account.

Design: A longitudinal study with record linkage to the Civil Registration System and Cause of Death Registry. The data were analysed using Cox regression.

Setting: The metropolitan area of Copenhagen, Denmark.

Subjects: 7493 male singletons born in 1953, who completed a questionnaire with various cognitive measures, in school at age 12 years, and for whom birth certificates with data on birth and parental characteristics had been traced manually in 1965. This population was followed up from April 1968 to January 2002 for information on mortality.

Main outcome measures: Mortality from all causes, cardiovascular diseases, and violent deaths.

Results: Men whose fathers were working class or of unknown social class at time of birth had higher mortality rates compared with those whose fathers were high/middle class: hazard ratio 1.39 (95% CI 1.15 to 1.67) and 2.04 (95% CI 1.48 to 2.83) respectively. Birth weight and childhood cognitive function were both related to father’s social class and inversely associated with all cause mortality. The association between father’s social class and mortality attenuated (HRworking class 1.30 (1.08 to 1.56); HRlower class 1.81 (1.30 to 2.52)) after control for birth weight and cognitive function. Mortality from cardiovascular diseases and violent deaths was also significantly higher among men with fathers from the lower social classes.

Conclusion: The inverse association between father’s social class at time of birth and early adult mortality remains, however somewhat attenuated, after adjustment for birth weight and cognitive function.

Recently, we have experienced an increased research interest in early life origins of adult chronic disease, and a number of birth cohort studies have shown that social factors operating during early life are related to mortality in adult life. The social environment in early life has also been linked to birth weight and childhood cognitive function, which are both related to mortality later in life. Furthermore, some studies have related size at birth to cognitive function in childhood or adolescence. Thus, as figure 1 suggests low birth weight and impaired cognitive function are possible mediators of the relation between socioeconomic position in early life and adult mortality. So far, however, no study has examined whether this relation is accounted for by, or acts independently of, birth weight and childhood cognitive function.

In this study, we analyse the relation between socioeconomic position in early life (that is, father’s social class and mother’s marital status at time of birth) and mortality in young adulthood in a cohort of Danish men born in 1953. The data allow us to look at later all cause and cause specific mortality, taking information on birth weight and childhood cognitive function into account. We also examine whether early socioeconomic position modifies the effects of birth weight and cognitive function on adult mortality.

METHODS

Study population

According to official statistics, 12 270 boys were born within the metropolitan area of Copenhagen during 1953. These boys formed the study population of the Danish longitudinal study called Project Metropolit: a sociological study that was carried out at the Department of Sociology, University of Copenhagen, from 1965 to 1975, with the aim of examining social mobility.

In April 1968, the Danish Civil Registration System (CRS) was established, and a unique 10 digit personal identification number (which includes the day, month and year of birth of the person) was allocated to all persons alive and living in Denmark at that time. This register keeps updated information on vital status and emigration for each person.

A total of 11 532 of the males born in the Copenhagen region in 1953 were registered in the CRS (that is, alive and living in Denmark in 1968). Those not identified in the CRS in 1968 were either dead (n~500) or had emigrated from Denmark. We excluded 156 subjects from the dataset.
because they had requested that the CRS not disclose any information for research purposes. The remaining 11376 persons constituted the Metropolit2000 Cohort which is the study population in this study.

Data sources and variables
In Denmark, data from all births are thoroughly entered into registers and birth certificates. When Project Metropolit was established in 1965, all available information from such certificates and registers was collected manually for the entire study population. Information on date and place of birth, singleton or multiple birth, birth weight and length, father's occupation, and mother's age and marital status at birth, singleton or multiple birth, birth weight and length, was included.

The main reasons for non-participation in the survey were reported as general non-participation in the school survey. The main reasons for non-participation were reported as general non-participation in the school survey. The main reasons for non-participation in the school survey were reported as general non-participation.

From birth records, we used information on birth weight and the two available indicators of socioeconomic position in early life: father's social class and mother's marital status at the time of delivery. Father's social class was classified according to the father's position in the occupational structure of the society. Subjects were assigned, on the basis of father's occupation, into 23 strata: non-urban self employed (4 strata); urban self employed (6 strata); white collar workers (5 strata); blue collar workers (5 strata); pensioners; students; and unknown. The preliminary data analyses showed that the estimates for self employed and white collar workers were very close, and they were consequently combined, leaving three categories: high/middle class, which included self employed and salaried employed; working class, which included skilled and unskilled workers; unknown, which also included the small groups of pensioners (n=1); and students (n=44). When the analyses were stratified according to social class, we combined working class and unknown in one category, termed "low social class." Marital status of mothers was treated

Table 1 Characteristics of 7319 male singletons in the cohort. Percentage with birth weight below 2500 g, percentage in the lowest quartile of cognitive tests, and crude risk of all cause mortality between age 15–49 years (95% confidence intervals) according to characteristics

<table>
<thead>
<tr>
<th>Socioeconomic position in early life</th>
<th>N (%)</th>
<th>Birth weight below 2500 g (%)</th>
<th>Lowest IQ test quartile (%)</th>
<th>Lowest creativity test quartile (%)</th>
<th>Crude hazard ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father's social class at time of birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High/middle class</td>
<td>3331 (45.5)</td>
<td>3.0</td>
<td>17.9</td>
<td>22.9</td>
<td>1.00 (ref)</td>
</tr>
<tr>
<td>Working class</td>
<td>3543 (48.4)</td>
<td>4.1*</td>
<td>33.1*</td>
<td>34.5*</td>
<td>1.41 (1.17 to 1.69)</td>
</tr>
<tr>
<td>Unknown</td>
<td>445 (6.0)</td>
<td>3.8*</td>
<td>36.9*</td>
<td>32.9*</td>
<td>2.00 (1.46 to 2.74)</td>
</tr>
<tr>
<td>Mother's marital status at time of birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>6821 (93.3)</td>
<td>3.5</td>
<td>25.4</td>
<td>28.6</td>
<td>1.00 (ref)</td>
</tr>
<tr>
<td>Unmarried</td>
<td>481 (6.7)</td>
<td>6.5*</td>
<td>39.3*</td>
<td>33.8*</td>
<td>1.56 (1.17 to 2.07)</td>
</tr>
<tr>
<td>Unknown</td>
<td>7 (0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth weight</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤2499 g</td>
<td>269 (3.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2500–3499 g</td>
<td>3644 (49.8)</td>
<td>6.6</td>
<td>26.6</td>
<td>28.4</td>
<td>1.23 (1.03 to 1.47)</td>
</tr>
<tr>
<td>≥3500 g</td>
<td>3402 (46.5)</td>
<td></td>
<td>25.4</td>
<td>28.9</td>
<td>1.00 (ref)</td>
</tr>
<tr>
<td>Unknown</td>
<td>4 (0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cognitive function at age 12 years

<table>
<thead>
<tr>
<th>IQ test</th>
<th>N (%)</th>
<th>Birth weight below 2500 g (%)</th>
<th>Lowest quartile (%)</th>
<th>Lowest creativity quartile (%)</th>
<th>Crude hazard ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamquist IQ test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest quartile</td>
<td>1924 (26.3)</td>
<td>4.7*</td>
<td>54.7*</td>
<td>1.71 (1.34 to 2.19)</td>
<td></td>
</tr>
<tr>
<td>Second quartile</td>
<td>1840 (25.1)</td>
<td>4.6*</td>
<td>32.4*</td>
<td>1.30 (1.00 to 1.69)</td>
<td></td>
</tr>
<tr>
<td>Third quartile</td>
<td>1784 (24.4)</td>
<td>3.3*</td>
<td>17.8*</td>
<td>1.12 (0.83 to 1.47)</td>
<td></td>
</tr>
<tr>
<td>Highest quartile</td>
<td>1771 (24.2)</td>
<td>1.9</td>
<td>9.0</td>
<td>1.00 (ref)</td>
<td></td>
</tr>
<tr>
<td>Creativity test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest quartile</td>
<td>2126 (29.1)</td>
<td>5.1*</td>
<td>49.5*</td>
<td>1.48 (1.16 to 1.82)</td>
<td></td>
</tr>
<tr>
<td>Second quartile</td>
<td>1753 (24.0)</td>
<td>3.8*</td>
<td>27.8*</td>
<td>1.27 (0.98 to 1.65)</td>
<td></td>
</tr>
<tr>
<td>Third quartile</td>
<td>1618 (22.1)</td>
<td>3.2*</td>
<td>17.6*</td>
<td>1.23 (0.95 to 1.61)</td>
<td></td>
</tr>
<tr>
<td>Highest quartile</td>
<td>1820 (24.9)</td>
<td>2.3</td>
<td>5.5</td>
<td>1.00 (ref)</td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05, test of β coefficients from logistic regression. Unmarked category reference. Similar differences were found for mean values tested in linear regression.

From birth records, we used information on birth weight and the two available indicators of socioeconomic position in early life: father's social class and mother's marital status at the time of delivery. Father's social class was classified according to the father's position in the occupational structure of the society. Subjects were assigned, on the basis of father's occupation, into 23 strata: non-urban self employed (4 strata); urban self employed (6 strata); white collar workers (5 strata); blue collar workers (5 strata); pensioners; students; and unknown. The preliminary data analyses showed that the estimates for self employed and white collar workers were very close, and they were consequently combined, leaving three categories: high/middle class, which included self employed and salaried employed; working class, which included skilled and unskilled workers; unknown, which also included the small groups of pensioners (n=1); and students (n=44). When the analyses were stratified according to social class, we combined working class and unknown in one category, termed "low social class." Marital status of mothers was treated in two categories: married, and unmarried (that is, single, divorced, widowed). Birth weight was recorded in 100 gram groups and was analysed both as a continuous variable and in each of the five categories: ≤2500; 2500–2999; 3000–3499; 3500–3999; and ≥4000 g. The initial data analyses showed that the estimates were nearly the same for the second and third and for the two largest categories, and, consequently, they were combined.

From the school questionnaire, we used the information on IQ and creative potential. The IQ test consisted of spatial, arithmetic and verbal sub-tests. In the spatial test, students were asked to choose one out of four alternative three dimensional figures, corresponding to a flat, two dimensional template. In the arithmetic test, students were to determine the logical sequences for a series of six numbers. In the verbal test, students were to identify, out of four alternatives, the antonym of a given word. Each sub-test included 40 problems, with a correct answer counting for one point, resulting in a range of 0–40 points. The overall test ranged from 0 to 120 points, with
Table 2 Hazard ratios for all cause mortality between ages 15 and 49 (95% confidence intervals) in relation to paternal social position, adjusted for birth weight and cognitive function for 7308 male singletons born in 1953

<table>
<thead>
<tr>
<th>Mortality risk ages 15 to 49</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father’s social class</td>
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<td></td>
</tr>
<tr>
<td>High/middle class</td>
<td>1.00 [ref]</td>
<td>1.00 [ref]</td>
<td>1.00 [ref]</td>
<td>1.00 [ref]</td>
<td></td>
</tr>
<tr>
<td>Working class</td>
<td>1.40 [1.17 to 1.63]</td>
<td>1.31 [1.07 to 1.57]</td>
<td>1.32 [1.12 to 1.62]</td>
<td>1.30 [1.08 to 1.57]</td>
<td>1.30 [1.08 to 1.57]</td>
</tr>
<tr>
<td>Unknown</td>
<td>1.94 [1.42 to 2.66]</td>
<td>1.85 [1.32 to 2.60]</td>
<td>1.98 [1.42 to 2.74]</td>
<td>1.83 [1.32 to 2.51]</td>
<td>1.81 [1.32 to 2.49]</td>
</tr>
<tr>
<td>Birth weight</td>
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<tr>
<td>2500–3400 g</td>
<td>1.22 [1.02 to 1.45]</td>
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<tr>
<td>Härnquist IQ test</td>
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<td></td>
</tr>
<tr>
<td>Lowest quartile</td>
<td>1.55 [1.21 to 2.00]</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second quartile</td>
<td>1.22 [0.94 to 1.59]</td>
<td>1.16 [0.88 to 1.54]</td>
<td>1.16 [0.88 to 1.54]</td>
<td>1.20 [0.92 to 1.51]</td>
<td></td>
</tr>
<tr>
<td>Third quartile</td>
<td>1.08 [0.82 to 1.43]</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Highest quartile</td>
<td>1.00 [ref]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity test</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Lowest quartile</td>
<td>1.40 [1.09 to 1.78]</td>
<td>1.17 [0.89 to 1.54]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second quartile</td>
<td>1.22 [0.94 to 1.59]</td>
<td>1.10 [0.83 to 1.44]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third quartile</td>
<td>1.21 [0.93 to 1.58]</td>
<td>1.14 [0.86 to 1.49]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Besides paternal social class, model 1 includes birth weight; model 2 includes Härnquist IQ test; model 3 includes the Mednick Creativity test; model 4 includes both cognitive tests, and the final model 5 includes paternal social class, birth weight, and Härnquist IQ test.

RESULTS

During follow up, 541 men had died, and 275 were censored due to emigration (n=264) and disappearance or change of identity (n=11). The 300 censored subjects did not differ from the remaining cohort with respect to mean birth weight (3400 g) or percentage unmarried mothers, but they had a higher mean IQ (72.2 points versus 67.6 points) and their fathers were more often high/middle class (56.2% versus 45.7%).

The distribution of socioeconomic position in early life, birth weight, and results of the cognitive function tests at age 12 years for the cohort, is shown in table 1. The unadjusted relative death intensity ratios, according to these characteristics, are also shown. We found a higher risk of death from age 15–49 years in sons of unmarried mothers, and sons of fathers in the working class or of unknown social class. Sons of unmarried mothers and sons of fathers in the two lower social classes also had a higher prevalence of low birth weight, compared with those with married mothers, and of low cognitive performance, compared with those with fathers from high/middle class. Birth weight and the two cognitive tests were inversely associated with mortality later in life, and the proportion of a low cognitive test score decreased with an increase in birth weight category.

The effect of mother’s single status on mortality attenuated considerably in all models when father’s social class was entered, and, therefore, marital status was not included in the multivariable analyses. The association between father’s social class and mortality was slightly reduced after controlling for birth weight, while the inclusion of IQ in the model caused a larger reduction of the social class estimate (table 2; model 1 and 2). The IQ and creativity tests were correlated (r=0.53); and when both variables were present in the model, the effect of the creativity test became insignificant (model 4). This was also seen in all other models, and, consequently, we excluded the creativity test from the final models. The inclusion of birth weight in the model with IQ did not affect the estimates for father’s social class or IQ, while the effect of birth weight was attenuated. However, social class, birth weight, and IQ remained significantly associated with mortality in the final model (table 2, model 5).

The hazard ratio for birth weight below 2500 g seemed to be higher for the low social class (HR 1.69 [1.07 to 2.64]) than for the high social class (HR 1.07 [0.46 to 2.45]). The second estimate, however, was only based on 15 deaths, and the risk estimates for the intermediate birth weight category showed the opposite tendency. Thus, the test for statistical interaction between father’s social class and birth weight was not significant (p=0.15). Visual inspection of mortality rates for each category of birth weight and IQ in the different social strata did not indicate any additive modifications of effects.

Although log-log plots and tests of zero slope gave no indication of violation of the proportional hazard assumption, the relations seemed to differ slightly, when the analyses were
subdivided into early (age 15–34 years) and later (age 35–49 years) deaths (table 3). Father’s social class was associated with mortality before and after age 35 years, while the inverse relations with birth weight and IQ remained persuasive for the later deaths. The adjusted associations between covariates and mortality from specific causes are given in table 4. Father’s social class was significantly associated with deaths from CVD, violent, and other causes, before and after adjustment. When birth weight or IQ were controlled for, however, the effects were attenuated.

As a sensitivity analysis, all the reported analyses were repeated for all 7493 men, with cognitive test scores, in tertiles and including an additional category for those with missing data. This approach gave essentially the same results as those based on the subjects with complete information on all variables reported above.

**DISCUSSION**

In this cohort of Danish men born in 1953, we found a clear relation between adverse socioeconomic position in early life and increased mortality in young adulthood. Low birth weight and low childhood IQ were both associated with social disadvantage and increased adult mortality. Adjustment for birth weight and IQ somewhat decreased the hazard ratios for the indicator of childhood socioeconomic position (father’s social class at time of birth), but the estimates for all three variables remained significant. Analyses of cause-specific mortality revealed consistent, positive associations with father’s social class.

One of the strengths of our study is follow up for mortality, which covered all cohort members. Losses to follow up, therefore, did not seem to result in a serious bias. Non-participants, however, included more boys from lower social classes, and, as special schools were not included in the school survey, it is most likely that this group also represents more boys with impaired mental skills. Thus, our conclusions might not apply to these disadvantaged groups. It should also be noted, in this context, that women were not present in the dataset. The information on social circumstances in early life was collected from birth registers of high quality, rather than relying on recall from the offspring in childhood or middle age. This might minimise subjective and biased classification of exposure status. Furthermore, cognitive function was assessed using two different measures in late childhood, at an age when test scores are assumed to be stable. On the other hand, we must admit that it could also be a study limitation to rely on data collected in another era; the current usefulness of measures of IQ and socioeconomic position in 1953 may fairly be questioned. In addition, we only had information on a few of the many other factors, such as adult socioeconomic position and behaviour, which might also confound and/or mediate the relation between socioeconomic position in early life and later mortality. However, looking at health in the long term by use of existing cohorts, while increasing the understanding of early life origins of adult chronic disease, will always have this problem. A few other study limitations should be considered. We showed that creative potential had no independent effect besides what was obtained by the IQ test, which measured three different cognitive skills. A possible explanation is that

**Table 3** Hazard ratios for all cause mortality in young adulthood and early middle age (95% confidence intervals) in relation to paternal social class, adjusted for birth weight and childhood IQ, for 7308 male singletons born in 1953

<table>
<thead>
<tr>
<th>Father’s social class at birth</th>
<th>Mortality risk in age groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 15–34 years (n=212)</td>
</tr>
<tr>
<td></td>
<td>1.00 [ref]</td>
</tr>
<tr>
<td>High/middle class</td>
<td></td>
</tr>
<tr>
<td>Working class</td>
<td>1.32 [0.97 to 1.82]</td>
</tr>
<tr>
<td>Unknown</td>
<td>1.96 [1.19 to 3.23]</td>
</tr>
<tr>
<td>Birth weight</td>
<td></td>
</tr>
<tr>
<td>−2400 g</td>
<td>1.10 [0.53 to 2.27]</td>
</tr>
<tr>
<td>2500–3400 g</td>
<td>1.09 [0.84 to 1.78]</td>
</tr>
<tr>
<td>3500 g+</td>
<td>1.00 [ref]</td>
</tr>
<tr>
<td>Härnquist IQ test at age 12 years</td>
<td></td>
</tr>
<tr>
<td>Lowest quartile</td>
<td>1.29 [0.86 to 1.92]</td>
</tr>
<tr>
<td>Second quartile</td>
<td>1.26 [0.84 to 1.88]</td>
</tr>
<tr>
<td>Third quartile</td>
<td>1.02 [0.67 to 1.55]</td>
</tr>
<tr>
<td>Highest quartile</td>
<td>1.00 [ref]</td>
</tr>
</tbody>
</table>

One of the strengths of our study is follow up for mortality, which covered all cohort members. Losses to follow up, therefore, did not seem to result in a serious bias. Non-participants, however, included more boys from lower social classes, and, as special schools were not included in the school survey, it is most likely that this group also represents more boys with impaired mental skills. Thus, our conclusions might not apply to these disadvantaged groups. It should also be noted, in this context, that women were not present in the dataset. The information on social circumstances in early life was collected from birth registers of high quality, rather than relying on recall from the offspring in childhood or middle age. This might minimise subjective and biased classification of exposure status. Furthermore, cognitive function was assessed using two different measures in late childhood, at an age when test scores are assumed to be stable. On the other hand, we must admit that it could also be a study limitation to rely on data collected in another era; the current usefulness of measures of IQ and socioeconomic position in 1953 may fairly be questioned. In addition, we only had information on a few of the many other factors, such as adult socioeconomic position and behaviour, which might also confound and/or mediate the relation between socioeconomic position in early life and later mortality. However, looking at health in the long term by use of existing cohorts, while increasing the understanding of early life origins of adult chronic disease, will always have this problem. A few other study limitations should be considered. We showed that creative potential had no independent effect besides what was obtained by the IQ test, which measured three different cognitive skills. A possible explanation is that

**Table 4** Hazard ratios for death between ages 15 and 45* (95% confidence intervals) from cardiovascular diseases, accidents/suicide, and other causes, in relation to father’s social class, adjusted for birth weight and childhood IQ, for 7308 male singletons born in 1953

<table>
<thead>
<tr>
<th>Cardiac problems (n=70)</th>
<th>Injuries and suicides (n=162)</th>
<th>Death from other causes (n=215)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Father’s social class at birth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High/middle class</td>
<td>1.00 [ref]</td>
<td>1.00 [ref]</td>
</tr>
<tr>
<td>Working class</td>
<td>1.54 [0.91 to 2.64]</td>
<td>1.09 [0.78 to 1.53]</td>
</tr>
<tr>
<td>Unknown</td>
<td>3.64 [1.75 to 7.53]</td>
<td>1.94 [1.14 to 3.28]</td>
</tr>
<tr>
<td>Birth weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>−2499 g</td>
<td>1.75 [0.68 to 4.52]</td>
<td>1.87 [0.95 to 3.66]</td>
</tr>
<tr>
<td>2500–3499 g</td>
<td>0.96 [0.60 to 1.56]</td>
<td>1.33 [0.95 to 1.83]</td>
</tr>
<tr>
<td>3500 g+</td>
<td>1.00 [ref]</td>
<td>1.00 [ref]</td>
</tr>
<tr>
<td>Härnquist IQ test score at age 12 per quartile decrease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest quartile</td>
<td>1.10 [0.88 to 1.35]</td>
<td>1.16 [1.01 to 1.35]</td>
</tr>
</tbody>
</table>

*Participants were followed up for specific causes until 1998.
the tests were correlated, and, given the sample size of our study, the independent effects of both variables could not be separated. It should also be noted that questions have been raised as to what IQ tests actually measure. Furthermore, the small number of cause specific deaths reduce statistical power and allow no firm conclusions to be drawn from these data.

These analyses only included a single measure of socioeconomic position in early life. We had information on participants’ occupation at age 20 years, but these data were incomplete and consequently not used in this study. On the other hand, the association between social position in early life and adult mortality has been shown in a variety of studies, even after taking account of socioeconomic circumstances in adulthood. A recent study from a cohort born in 1946, in the UK, demonstrated that mortality between ages 26 and 54 was strongly influenced by social circumstances in childhood as well as in early adulthood. A trivial effect of entering adult social indicators into models of childhood social position upon mortality indicated that these influences operate through different pathways, and that childhood social position is not simply a proxy for adult living conditions. We have no reasons to believe that the findings from the 1946 cohort should not apply for the Danish cohort, which in many respects is comparable with the UK cohort.

In this study, inclusion of birth weight and childhood IQ in the model reduced the risk estimates for father’s social class, indicating that these two variables mediate some of the effect. We also found the expected positive association between birth weight and IQ, and, in addition, our study showed that the effect of birth weight on mortality was attenuated when IQ was entered into the model. The latter finding suggests that IQ might be one of the pathways through which birth weight exerts its effect on mortality in adulthood. Thus, our study seems to support the postulated model (fig 1). We compared a Cox model that contained the intermediate variables to one that did not. This approach could be used to assess how much of the association between socioeconomic position and mortality could be accounted for by birth weight and IQ. We must admit, however, that such a measure depends on the chosen cut off points and reference category used, and there is no way to judge its precision. It is also advisable to use more complex models, such as structural equation models, to quantify the direct and indirect causal pathways postulated in a given lifecourse model. In the follow up study of children born in Aberdeen, Scotland, structural equation modelling was used to test direct effects of IQ at age 11, and of father’s occupation at age at death. The most fitting model interpreted IQ as a mediating factor between father’s occupation and age at death, while the models that assumed a direct effect of the social factor on age at death were not acceptable. It should be noted, however, that the Scottish analysis was restricted to those who died during follow up. The reason may be that the empirical model that treats social position in early life as a direct and mediating variable (through IQ) cannot easily be implemented in the Cox model.

Similar to the findings from a Finnish cohort study of 4630 men, our data suggested that the relation between birth weight and adult health is particularly strong in the lower social classes. This result indicates that social influences that alter growth also may change the risk of disease in adult life, and this supports a critical period model with modification of later effects.

CVD mortality was inversely related to father’s social class. The same was true of violent deaths, although to a smaller extent. Clear effects of childhood socioeconomic position have also been seen for CVD in a number of previous studies. This seems to support the postulated mechanisms related to accumulation of socially patterned risk factors for CVD. A number of non-exclusive explanations, however, exist for the association of socioeconomic position in early life with adult mortality. Birth weight and IQ may reflect genetic factors for early mortality, but could also be considered as proxy measures of a number of different environmental and behavioral factors that tend to cluster in families—primarily for social reasons—and this would influence the health of the members of these families. The relation between birth weight and childhood IQ could also support the hypothesis of a biological pathway, which suggests that malnutrition in early life affects the development of the brain and later cognitive function. IQ has also been related to final qualifications and adult behaviour, such as smoking, thus supporting the notion that this psychometric characteristic may influence health. The potential health effects of socioenvironmental exposures over a lifetime have been described in different lifecourse models. The sensitive period model states that the environment in early life influences later susceptibility to disease, while the cumulative effect model suggests an added influence of the number and/or duration of health damaging exposures, across the life course, on disease risk. Low birth weight and low IQ were most prevalent in sons of fathers in the lower social classes and each exposure exerted an independent effect on mortality. The risk increased with the number of unhealthy exposures, and, consequently, our study seems to demonstrate a cumulative influence of socially patterned exposures, across the life course, on mortality risk. Adjustment for the social class difference in birth weight and IQ, however, only explained a part of the observed social variation in mortality. This finding suggests that a sensitive period model also plays a part, although it should be noted that we only addressed a subset of the health related factors linked to socioeconomic position in early life.

In conclusion, this study provides support for the existence of a relation between socioeconomic position in early life and adult mortality in men, which cannot be fully accounted for by birth weight or childhood cognitive function.

ACKNOWLEDGEMENTS

We thank all those who initiated and/or continued the study from 1965 to 1983—K Svalastoga, E Hogh, P Wold, T Rishøj, G Strande-Sørensen, E Manniche, B Holten, I A Weibull, and A Ortmann—for their thorough work on the project. Thanks to Knud Juel for providing data on causes of death.

Key points

- Men with adverse socioeconomic position in early life have higher rates of mortality in young adulthood, even after control for birth weight and childhood cognitive function.
- Low birth weight and low IQ are both related to adverse socioeconomic position in early life, and to increased mortality in young adulthood. This suggests a cumulative influence of socially patterned exposures across childhood, on mortality.
- The relation between birth weight and adult health seems to be particularly strong in those with adverse socioeconomic position in early life.

Policy implications

- The mechanisms mediating the association between childhood social position and health later in life have scarcely been investigated, but this knowledge is important for the prevention of such inequities. Birth weight and childhood cognitive function seem to be modifiable links.
- This points out the importance of prevention strategies to improve the health of socioeconomically disadvantaged families, even before they have children.
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Conflicts of interest: none declared.

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Socioeconomic position in early life, birth weight, childhood cognitive function, and adult mortality. A longitudinal study of Danish men born in 1953

M Osler, A-M N Andersen, P Due, R Lund, M T Damsgaard and B E Holstein

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Divorce and suicide risk

There is accumulating evidence that divorced and separated people have much higher suicide rates than their married counterparts. In a previous paper published in this journal, it was observed that divorced and separated men were nearly 2.4 times more likely to kill themselves than their married counterparts. That study, however, failed to directly compare divorced men and women. While it informed us that divorced people are at higher risk of suicide than the married, it said nothing about the suicide risk of divorced men relative to divorced women. The purpose of this communication is to assess the magnitude of the differentials in suicide risk between the two groups, and explore possible reasons that might explain the disparities.

Data were obtained from the US National Longitudinal Mortality Study (NLMS), 1979–1989, and covariates used were taken from Kposowa. The response variable was the risk of suicide, and analysis was restricted to divorced and separated non-Hispanic white men and women. Proportional hazards regression models were fitted to the data, and relevant results are in table 1.

Model 1 presents the age adjusted effects of sex on the risk of suicide. Divorced men were over eight times more likely to commit suicide than divorced women (RR = 8.36, 95% CI = 4.24 to 16.38). After taking into account other factors that have been reported to contribute to suicide, divorced men still experienced much increased risks of suicide than divorced women. They were nearly 9.7 times more likely to kill themselves than comparable divorced women (RR = 9.68, 95% CI = 4.87 to 19.22). Put another way, for every divorced woman that committed suicide, over nine divorced men killed themselves.

These results dramatise the terrible consequences of being a divorced man in America, and lead to the question: why are divorced men killing themselves? Some analysts argue that the research community has ignored a plausible explanation for the excess suicide risks experienced by divorced men. As Perrault and Farrell observe, while social, psychological, and even personal problems facing women are readily denounced, societal institutions tend to ignore or minimise male problems as evident in suicide statistics. For instance, in many jurisdictions in the US there seems to be an implicit assumption that the bond between a woman and her children is stronger than that between a man and his children. As a consequence, in a divorce settlement, custody of children is more likely to be given to the wife. In the end, the father loses not only his marriage, but his children. The result may be anger at the court system especially in situations wherein the husband feels betrayed because it was the wife that initiated the divorce, or because the courts virtually gave away everything that was previously owned by the ex-husband or the now defunct household to the former wife. Events could spiral into resentment (toward the spouse and “the system”), bitterness, anxiety, and depression, reduced self esteem, and a sense of “life not worth living”. As depression and poor mental health are known markers of suicide risk, it may well be that one of the fundamental reasons for the observed association between divorce and suicide in men is the impact of post divorce (court sanctioned) “arrangements”. Clearly this is an issue that needs further investigation.

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References

3 Perrault C. And if we speak about men? Sante Ment Que 1990;15:134–44.

Table 1 Hazards regression estimates of the impact of divorce on the risk of white suicide

<table>
<thead>
<tr>
<th>Covariate</th>
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<th>Population at risk</th>
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<td>64.27**</td>
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<td></td>
</tr>
<tr>
<td>Number of cases</td>
<td></td>
<td>27604</td>
<td>27604</td>
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*Significant at p<0.05. **Significant at p<0.01. URS, likelihood ratio statistic; df, degrees of freedom; RR, relative risk; CI, confidence intervals.
BOOK REVIEWS

Ethical dimensions of health policy


The main aim of the book is to examine the connections between ethics and health pol-
icy. Experts from different disciplines and spheres have contributed. The book is struc-
tured in four parts. From an ethical delibera-
tion on healthcare goals readers proceed through an intermediate chapter to political
decision making. The final chapter deals with
ethical controversies on the resource alloca-
tion, accountability, vulnerability, and ethics
of the health services research.

The book focuses to a large extent on the US reality and provides an insight into the
history of their healthcare reforms as well as the recent debate on a universal healthcare
system based on social solidarity. European
or other readers may learn from a very
profound and sophisticated consideration of
how ethical and political approaches may
interfere. The pragmatic claim that the
bioethical debate descends from academic
heights and influences directly political deci-
sions is illustrative. Readers face the debate
on justice from a reverse side. Concepts that
are taken for granted in Europe are being
vindicated and legitimised (Rawls is repeat-
edly reflected). An outline of a future
collective and organisational rather than
personal accountability for health care is
innovative (Cassell, McFarland). The post-
modern practice as delineated by Malon and
Luh may be viewed as visionary although
stimulating. New health services research
agenda such as research of trust, privacy,
internet practices has been suggested.

Seen to be self evident, sometimes an effort to square the circle may be
suspected. However, the focus on inher-
ance of values in policy making, on negoti-
cation culture and procedural aspects as crucial in setting and implementing healthcare goals
makes the text instructive. A lesson of
democracy in health care is the essence that
readers breathe as the fresh air at each page.
Even when not all authors share the same opinion, the book is illuminated by an
optimistic faith that connecting ethics and
health policy is viable—a sustainable health
policy necessitates a moral legitimacy and
bioethics shall promote the social action.

E Kežìová (Krizova)

World report on violence and health


Violence was declared in Resolution
WH/A49.23 (1996) as a major and growing public health problem across the world. This is the first world report on violence and health aimed mainly to raise awareness about the issue of violence globally and to make the case that violence is preventable and that the book is illustrated by an
optimistic faith that connecting ethics and
health policy is viable—a sustainable health
policy necessitates a moral legitimacy and
bioethics shall promote the social action.

E Kežìová (Krizova)

Law in public health practice

19-514871-1

The aim of this book, written jointly by a
variety of law and public health practice
specialist authors—who represent the ranks of the legal and public health practitioners in
the United States of America—is to clarify the
principles of law as they bear on the practice
of public health.

The reader is invited to improve their
understanding of the legal principles under-
living public health practice; that is to say how law may be applied to improve the health
of people. And after reading the book, this
aspiration is reached, especially the discovery
of the wide range of daily activities of public
health where the legal dimension is present.

The first part is related with the conceptual
foundations of the legal basis for public health practice and covers topics as constitu-
tional and statutory basis, the applications of
regulatory and criminal law, bioethics, some
infectious disease pathogens used as weap-
ons of mass destruction,— and overarching
areas like common ethical issues in public
health such us the concerns about balancing
benefits between communities and indivi-
duals or human rights. Also the book
provides a framework that can guide practi-
tioners' reflections in their decisions.

The last two parts examine the public health law infrastructure and make recom-
mandations for needed improvements. With
many selected examples the interrelation of
law with the core functions of public health
are thoroughly reviewed and documented:
the interaction between private and public
health law, and the coordination between
lawyers and legal counsel, surveillance and
outbreak investigations, research, confiden-
tiality and privacy, managed care in public
health, interventions in emergency response,
and particular populations (children, home-
less persons, disabilities, or undocumented
immigrants). And also high priority and
emerging areas in public health such as
epidemiology, communicable diseases, public
health emergencies, reproductive health,
tobacco prevention, and environmental,
injury, occupational issues.

It must be taken into account that the
context of the book is the United States, but
despite the fact of the peculiarities of its
regulation, the basis and principles are
applicable to any country beyond its own
legislation and serves as a primary resource
for promoting the development and imple-
mentation of an effective public health law
infrastructure and increase the visibility and
effectiveness of law as a tool for the promo-
tion of the public's health. It is recommend-
able reading for public health practitioners
wishing to improve their understanding
about how the law affects the prevention of
disease and injury.

E Ronda

Case studies in forensic epidemiology

S Loue. (Pp 203; price not stated). Kluwer
Academic/Plenum Publishers, New York,

Sané Loue's book Case studies in forensic
epidemiology represents a significant turning
point in our habitual conception of epidemiol-
ogy as a statistical indicator of the extent to
which the population is affected by some
infectious—that is, toxicological—agent.

The reader is attracted by the title of the
book itself because forensic epidemiology is

www.jech.com
much less elaborated in professional literature than some epidemiological research within different specialist fields of medical science. The author is very successful in presenting the application of forensic epidemiology, as well as its role in court trials, as a bridge between many criminal deviations of the society, and its responsibility for crimes committed. Her final goal is getting court and police officials to apply efficient changes to negative social actions.

In eight case studies within 12 chapters of the book the author describes the connection between court trials and important epidemiological analysis that can be found in the cases of many trials started by women smokers who had silicon breast implantations done, which consequently caused them serious health problems. In this connection the author describes the obstacles attorneys and judges are faced with while prosecuting powerful tobacco lobbies, pointing out the core of the problem, that is an evident hazardous effect of smoking to human health.

As a forensic expert I would point out case study five in chapter eight that deals with road accidents caused by drivers under the influence of alcohol. The fact that road accidents caused by drunk drivers represent the main cause of most such accidents, is corroborated by some alarming epidemiological data. In this connection, the author describes the activities of non-profit organisation Mothers Against Drunk Drivers, which achieves significant results in making the public aware of the problem. Moreover, they organise legal help to the families of the victims of such accidents, which makes the organisation recognisable and increasingly influential in trials against irresponsible drivers.

It is the author’s goal, which she entirely managed to achieve, to explain the extremely important role of forensic epidemiology in court trials. To sum up, this extraordinary work represents a significant contribution to a successful solving, within the framework of legal system, of difficult and painful court epidemiological problems of the society.

A Bosnar

ActivEpi CD ROM


ActivEpi is a multimedia presentation of the material commonly found in an introductory epidemiology course on CD ROM. In 15 lessons, basic concepts and measures of epidemiology are presented. ActivEpi is intended to be used in a variety of teaching formats, including distance learning, self-paced learning on-campus courses, and short courses. The course uses a variety of tools—among others, videos, narrated expositions, exercises, and datasets and quizzes for self evaluations.

With respect to the logical structure of the contents, this introduction is as stringent and clear as previous, more traditional teaching material by David Kleinbaum, including the classic 1982 textbook, which has, certainly, helped numerous epidemiologists and epi students around the world, including myself (who had the additional true privilege to experience David Kleinbaum as an outstanding “physical teacher”), to structure epidemiological reasoning. Whether or not the multimedia approach now offered by David Kleinbaum makes learning more attractive, easy, or effective than more traditional forms of learning in a classroom context or from an introductory textbook alone to some degree be a matter of taste, generation, and personal preferences. Being aware that this carries the danger of being blamed old fashioned, I have to admit that I felt the multimedia features to be a little bit too abundant in this course, and sometimes even to be a source of distraction actually hindering concentrated learning rather than a real advantage. Perhaps younger generations of epidemiologists who have grown up with multimedia features from their cradle may appreciate this type of learning much more—I am afraid that I will continue to recommend my students a good personal teacher along with a good introductory textbook along with such a software. However, these resources may not be universally available. In such circumstances, this course may fill a real gap.

H Brenner

Reference


For our young colleagues, the relevance of this book is justified by its reference lists along, as these include most of the papers that provided the most important achievements of epidemiology and public health from 1919 onwards. The book is easy to consult and read, because for each calendar period the main topics are separately considered—that is, infectious diseases, occupational factors, nutrition, environment, etc. Thus, for instance, under the headings tobacco or air pollution, summary overviews are given on the earlier developments of research and control of these risk factors, which remain of central interest for their public health relevance today.

A second reason for appreciating this book is related to its attention to the major social and public health implications of our discipline. Over the past few years, we have seen (and participated to) endless debates on the potential impact of risk factors such as electromagnetic fields or hair dyes, whose public health relevance, if any, remains marginal. Furthermore, the interest of many of us has been often focused more to the publication of modest excess relative risks, than to the critical understanding and evaluation of their potential public health implications. It is thus a pleasure to read a book that provides an overview of the main achievements and contributions of our discipline to public health and society in its broader terms. The book also includes some interesting chapter on methodological developments (from questionnaires to statistical methods) and philosophy of medicine.

Most of us will also find of interest the chapter on trends in UK and US society and politics, which is unusually objective and far from strong partisan opinions, as well as those on the history of the development of public health departments in UK and US universities and other research institutions. In a period of conflicts of interest, the summary of main funding sources is also of important relevance.

A message drawn from the book is that, over the past few decades, US research in public health has improved more than its UK counterpart. Any comparison between public health institutions and achievements in the UK and the US, however, leaves most of—who live and work outside these two countries—with a sense of admiration and envy.

C La Vecchia

Migrant health in Europe

An international conference on differences in health and health care provision is to be held in Rotterdam, Netherlands, on 23–25 June 2004. Further details: Lilian Hoonhout, Department of Health Policy and Management, Erasmus MC, PO Box 1738, 3000 DR Rotterdam, Netherlands (email: c.zoer@planet.nl; web site: http://www.migranthealth.net).

CORRECTIONS

An authors’ error occurred in this paper by Dr Leung and others (2003;57:857–63). Professor Charles D Spielberger and Dr Paul Yung should have been acknowledged for granting permission to use the original and Chinese version of the State-Trait Anxiety Inventory.

An editorial error occurred in this article by Mr Geoff Der (2003;57:384). The picture credit was omitted and should have read “The illustration was reproduced with permission from the Whitworth Art Gallery, The University of Manchester. (c) Succession Picasso/DACS 2003.”

An authors’ error occurred in the paper by Dr Osler and others (2003;57:681–6). The 12th line in the first paragraph on page 683 should have read “100-152, 160-199; ICD10 (not ICD10-code K70).”