How did the study come about?

The Danish Metropolit project was established in 1965. The main initiator of the project was Kaare Svalastoga, the first professor of sociology at the Institute of Sociology, University of Copenhagen. In the late 1950s, Svalastoga attempted to promote a collaborative project between researchers from Denmark, Finland, Norway, and Sweden, the aim of which was to establish a prospective study covering early school age to early mid-life, which dealt with intergenerational mobility and differential life-chances in each of the four countries. Only boys were to be included since social mobility at that time was regarded to be most closely connected with the male breadwinner’s occupation. In addition, deviant behaviour (one area of research interest) was assumed to be more prevalent in boys. The result of his effort was the establishment of a Danish and a Swedish cohort, the former called the Metropolit study. Details of the Swedish cohort are published in an accompanying cohort profile in this issue of the Journal.

Professor Svalastoga acted as chairman of the Danish Metropolit project at the Institute of Sociology until 1976. After 1976 the project was run by a team of researchers consisting of Birthe Holten, Erik Høgh, Erik Manniche, Tom Rishøj, Gert Strande-Sørensen, Kaare Svalastoga, and Preben Wolf. The latter succeeded Svalastoga as chairman in 1976. Up to 1976 Project Metropolit was partly financed by the Danish National Scientific Foundation. Later parts have had financial support from the National Council for Prevention of Crime and Delinquency.1 During the early 1980s the Institute of Sociology was hampered by different conflicts and the Institute was closed down temporarily. The project was then moved to the Institute for Longitudinal Studies, a private initiative under the leadership of Erik Høgh. During this period funding became difficult. After the mid 1980s there was very little produced from the project and it was assumed that the data had been lost. However, in connection with a data archiving initiative, we managed to get in contact with Erik Høgh in 2000 and found out that the data existed and was person identifiable. After a number of meetings the data were handed over and in November 2001 the Danish Data Inspection gave permission to retain the identity of study subjects and trace them using the Danish health registers. The subsequent revitalization has been funded by grants from the Danish Heart Association, the Lundbeck foundation, the Danish Health Insurance Foundation, the Danish Pharmaceutical Fund, and Else and Mogens Wedell-Wedelborgs Fund. The core team consists of Merete Osler (project leader), Bjørn Holstein, Anne-Marie Nybo Andersen, Rikke Lund, Mogens Trab Damsgaard, Ulla Christensen, and Pernille Due (on leave from 2002–).

What does the study cover?

The original study had four main areas of enquiry: (i) social mobility, especially intergenerational mobility, and the role played by education; (ii) memberships of groups and formal associations; (iii) conformity and deviance; and (iv) choice of partner, marital adjustment, and divorces in families of procreation. The aim of the revitalization was to investigate the influence of transgenerational, fetal, and childhood circumstances on later health.2

Who is in the sample?

The cohort was defined as all boys born in 1953 in the Copenhagen Metropolitan area, which covers the municipalities of Copenhagen, Frederiksberg, and Gentofte, together with the three adjacent counties of Copenhagen, Frederiksberg, and Roskilde (see map; Figure 1). At that time the population of this area was just >35% of the total Danish population, and this 1953 male birth cohort totalled 12 270 subjects. With the establishment of the Danish Civil Registration System (CRS) in April 1968 all persons living in Denmark were assigned a unique personal identification number (CPR-number). In the early 1970s, Svalastoga and his co-workers identified the CPR-number using data on name and date of birth for a total of 11 532 of the original cohort. This is the population for which information was available for revitalization, initiated in 2002 (Table 1).

How often have they been measured and what has been measured?

Prospective data collection on the cohort began in 1965 with the first collection of school data (Table 1). Parallel with that data sweep data from birth certificates were collected. Later data sweeps were concentrated around the years 1966, 1968, and 1975 and after the revitalization in year 2004. Details of the information obtained have been reported in previous papers.1,2 Our revitalization has included both register linkages...
to the Cause of Death Registry, the National Patient Registry, the Psychiatric Central Registry, and the Cancer Registry, manual collection of data from conscript board examinations, and a questionnaire based follow-up (Tables 1 and 2). Social data on education, occupations, and income from 1981 to 2005 and drug prescriptions to the cohort in the time period 1994–2005 will be linked to the cohort by the end of 2005.

The original data also included information on crime and ecological data with statistical information from 1960 about each of the parishes within the metropolitan area. However, it has not been possible to locate these data in the files that were available at the time of revitalization.

What is attrition like?

Owing to the existence of the Danish population covering registers we have, in principle, very little loss to follow-up. We have, however, a substantial amount of missing data as described in the following: In 1965, cohort members filled in a questionnaire in the classroom during school hours. A total of 7987 (69.3%) of the 11,532 men had participated in this first school survey (Table 1). The main reasons for not being included in the school survey were: dead or moved out of area between ages 0 and 12 years (9%), lack of willingness of a school or class to participate in survey (8%) or absence of the boy from school on the test day. In 1968, a random sample of 25% of cohort members was drawn. In addition, the 10% highest scoring and the lowest scoring boys on the cognitive school test were included. The families of the boys were visited by trained research staff for personal interviews with the mother or carer. In total 82.3% of mothers from the sampled families were interviewed. Thus, 2929 (25.4%) of the 11,532 men were included in the family survey (Table 1). The latest follow-up in the CRS in September 2004 indicated that there had been 384 (3.3%) emigrations (outside Denmark, Greenland, and the Faroe Islands), 28 (0.1%) with unknown address, and 1015 (8.8%) deaths. Further a total of 576 subjects had requested the CRS not to pass their address on for research purposes. Thus, we know that these subjects are alive but they cannot be contacted. This status is valid for 1 year if not renewed. After a pilot survey in May 2004 among 313 out of a random 3% sample (n = 347) the remaining 9216 men with available address in Denmark were sent a questionnaire in September–November 2004. In May 2005 we checked whether any of the 576 men with address protection had changed this status. Of them 3 had died and 20 had changed. The latter were also sent a questionnaire. To date 6219 (65.9%) of those eligible have returned a questionnaire.

To assess if the subjects, who participated in the school, family, and follow-up survey, respectively, were representative of the total cohort, we compared early life, conscript board, and vital status characteristics that were available for nearly all cohort members with those who did not participate (Table 3). Those who did not attend the school survey had slightly lower mean birth weight compared with the study participants, were more likely to be born to single mothers, had lower proportion of fathers with higher occupational social class, and had lower educational attainment at the time of their conscription.
Table 1 Metropolit project: sources and information from survey and manual register available on boys born in the metropolitan area of Copenhagen 1953

<table>
<thead>
<tr>
<th>Source and year of data collection</th>
<th>Population for which data have been collected</th>
<th>Variables</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965 Birth data: Retrospective collection of birth data from birth records and registers</td>
<td>Boys born in 1953 in the Metropolitan area of Copenhagen (12 270 boys born according to official statistics)</td>
<td>Data on birth weight, birth length, place of birth, duration of birth, mother's age at birth, mother's marital status at birth, father's occupational social class at birth (~18 variables)</td>
<td>11 532</td>
</tr>
<tr>
<td>1965 School data I: Questionnaire administered to the boys in school</td>
<td>Children in fifth grade in schools in the Metropolitan area of Copenhagen</td>
<td>Data on kind of school, cognitive tests, sociometric questions, social aspirations, leisure activities and club membership (~38 variables)</td>
<td>7987</td>
</tr>
<tr>
<td>1966 School data II: Questionnaire administered to boys and teachers in school</td>
<td>Same as in 1965</td>
<td>Data on classroom social structure, educational performance tests and father's occupational social class (~8 variables)</td>
<td>8018</td>
</tr>
<tr>
<td>1968 Family data: Personal interview of mothers</td>
<td>A random one in four sample of the original cohort. In addition, the 10% highest and 10% lowest scoring on cognitive test in 1965</td>
<td>Data on family structure, parent's and grandparent's education and occupation, height of father, mother and son, parent's membership of organizations, and parent's leisure activities, economic situation, and ambitions regarding sons future (~88 variables)</td>
<td>2929</td>
</tr>
<tr>
<td>1971-Conscript data: Retrospective collection of conscript board examination data from conscript board registers</td>
<td>Boys born in 1953 in the Metropolitan area of Copenhagen alive and not emigrated from Denmark in 1971 (n = 11 494)</td>
<td>Data on education, occupation, height, weight, cognitive test, driving licence, diseases. (app 15 variables)</td>
<td>11 108</td>
</tr>
<tr>
<td>2004 Follow data I: Mailed questionnaire</td>
<td>Boys born in 1953 in the Metropolitan area of Copenhagen with postal address in Denmark in 2004 (n = 9546)</td>
<td>Data on health, social position, work environment, health behaviour, attitudes, and reproductive history (~150 variables)</td>
<td>6219</td>
</tr>
</tbody>
</table>

Table 2 Register-based follow-ups available for the 11 532 men born in the Metropolitan area of Copenhagen in 1953

<table>
<thead>
<tr>
<th>Follow-up period</th>
<th>Register</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1.1975</td>
<td>Demographic data from Statistics Denmark</td>
<td>Occupation, marital status</td>
</tr>
<tr>
<td>4.1.1968–1.22.2002</td>
<td>Danish Civil Registration System</td>
<td>Vital status, marital status history, identification of family relations (age and of vital status for parents and biological children)</td>
</tr>
<tr>
<td>1.1.1981–12.31.2004</td>
<td>Integrated databases in Statistics Denmark</td>
<td>Occupation, income, family relations, drug prescriptions, contact to general practitioner</td>
</tr>
</tbody>
</table>

They also had a higher mortality. Similar differences in socio-economic position were found between participants and non-participants in the family survey.

Among cohort members alive in 2004, those who did not participate in the questionnaire-based follow-up less often had fathers from higher social classes and had a lower education at conscript than those who participated (Table 3).

What has been found?

Some early publications have resulted from the project Metropolit; in addition to a summary of the methods, some of these described the prevalence and correlates of childhood cognitive function.

The first actual use of project Metropolit for longitudinal research was for a number of publications describing the prevalence and correlates of registered delinquency. As already stated the early data provide a platform for studying the influence of a number of early life factors on adult health and disease. Analyses exploring the influence of social conditions in early life, birth dimensions, and marital status history on adult mortality and health and analyses on the association between childhood cognitive function and health later in life have been completed in recent years.

These analyses have provided new insight into some intriguing research questions: low birth weight has in a number of studies been found to be a risk factor for schizophrenia, and there has been recent interest in the association between birth weight
and common affective disorders. Some, though not all, studies have found an inverse association between birth weight and depression. In the Metropolit study we used data to examine the association between birth weight and risk of psychiatric hospital discharge with a depression diagnosis during the years 1969–2003. A total of 190 men, corresponding to 1.8% of the cohort, had a discharge diagnosis of depression. The Cox’s regression failed to show any association between birth weight and risk of hospital admission for depression before or after adjustment for social indicators at birth. The point estimates were close to 1. Thus, our study does not support the hypothesis of a relation between birth weight and depression. Another analysis has explored the association between all previous marital status events from age 15 to 40 years and subsequent mortality. We found that cumulated periods of divorce/widowhood, in particular, were strong independent predictors of mortality in young adulthood. Further, studies will include an intergenerational perspective and include the effect of parents’ and grandparents’ divorce experience. In a recent analysis we add to the sparse literature on intelligence and disease-specific outcomes by examining the relationship of childhood intelligence with later life risk of coronary heart disease (CHD) and stroke. By introducing recently acquired data on hospital admissions for CHD and stroke, these analyses extend earlier findings from the same study, which found an inverse relation between IQ and cardiovascular mortality. There were 150 CHD and 93 stroke events during follow-up into mid-life. Childhood intelligence was inversely related to CHD with the highest rate apparent in adults who, as children, had low test scores (βlowest vs highest quartile 2.70; 95% confidence interval 1.60–4.57; \( P_{\text{trend}} = 0.0001 \)). After adjustment for paternal social class and birth weight, this association was attenuated only marginally. There was little evidence of an IQ–stroke relationship.

In addition to these research themes, a number of new projects are under way: studies on childhood social relations and a number of adult health outcomes, studies on childhood social conditions and adult psychosocial characteristics as well as studies on early life determinants of substance abuse and adult obesity.

A complete list of publications is on the web at www.metropolit.dk.

**What are the main strengths and weaknesses?**

The cohort consists of all males born in a well-defined area (covering one-third of the Danish population), who survived to the age of 15 years. A complete register-based follow-up for mortality and morbidity is one of the major strengths of our study. The many medical and socioeconomic registers in combination with the CPR-number provide unique opportunities for follow-up, thus losses are not a serious source of bias in this cohort. The mortality and hospital admission data were available for >95% of this non-selected population. Another strength is that 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. Also the conscript board information includes valid and nearly complete information on height, weight, and cognitive function in early adulthood.

One limitation of this cohort, which pertains to all life course cohorts, is that the effects of early life factors on adult disease that we find in this cohort may not be generalizable to contemporary children. Thus, one might question the meaning of measures of socioeconomic position in 1953, and of cognition and preferred leisure time activities in 1968 in relation to similar exposures for contemporary children. In addition, we had access to only a few of the many other factors that might be related to exposures in early life and later morbidity and mortality, such as adolescent behaviour. Thus, in the present study this information is scant for some life stages. Further, the information on school performance and family environment was only available for 69.2 and 25% of the cohort members, respectively. Our cohort consists of males only, and there is some evidence of sex and gender differences in the relation of some early life factors to adult disease that we could not assess in this cohort.

A lot of effort was required to trace the actual number of subjects in the different sub-cohorts and to understand the
recoding made in the data file. For example, in the original data reasons for non-participation and recoding of errors were not clearly documented. Consequently, this does not seem to have biased our findings to date (on the basis of sensitivity analyses), and since the participants in the school and family surveys showed nearly the same distribution on basic variables they do not seem to constitute highly selected parts of the population.

Although the follow-up covered a period of >30 years, the participants are still young and, therefore, the number of cases is small for some outcomes, in particular for cause-specific deaths (though it is always possible to supplement this with non-fatal outcomes from the hospital registers). Future follow-up will capture more cases.

Can I get hold of the data? where can I find out more?

The data are held by the Metropolit project team and the original data are also archived at the Danish Data Archive. Potential collaborators should discuss ideas informally with the project leader and steering group by email (mosler@health.sdu.dk) before completing a formal expression of interest. Proposals are assessed for feasibility and potential overlap with ongoing or completed work. Following approval, collaborators complete a written agreement with aim, variables, and time schedule.

We intend to give more information on surveys, data documentation, and administrative procedures at the website. At present there are ongoing collaborative analyses with the Aberdeen and Stockholm cohorts, profiled in this issue of the journal.

Acknowledgements

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