

COHORT PROFILE

Cohort Profile: The Northern Swedish Cohort

Anne Hammarström* and Urban Janlert

Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden

*Corresponding author. Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden.
E-mail: anne.hammarstrom@fammed.umu.se

Accepted 4 July 2011

How did the study come about?

The Northern Swedish Cohort was started by Anne Hammarström [principal investigator (PI)] in collaboration with Urban Janlert and other researchers within the field of social medicine (Ragnar Berfenstam, Finn Diderichsen, Töres Theorell, Lars H Gustafsson, Claes Sundelin, Gustav Jonsson). At that time, the PI was a newly qualified registered medical doctor and was searching for a PhD project. An older colleague advised us to start a longitudinal study, which could be the database for our future research.

The background to the study was the relatively high unemployment rate among young people in Sweden at the beginning of the 1980s. Whereas some studies were available about the health consequences of unemployment in the adult population,^{1–3} there was a lack of research about possible health consequences of youth unemployment. Thus, we decided to perform a longitudinal study of a cohort of school-leavers. The chosen setting was Northern Sweden, as the highest levels of both youth and adult unemployment were found in that part of Sweden. In fact, unemployment had been endemic in this part of Sweden for a long time. The county capital of Norrbotten, Luleå, was chosen as this is a typical middle-sized, industrial town, which is comparable to Sweden as a whole with regard to important socio-demographic background data such as labour market structure, percentage of foreign born, housing, divorce rate and socio-economic status.⁴

Initially, we planned to follow up the cohort after 2 and 5 years. However, after the first 5 years, the study had attracted the interest of the scientific community and of policymakers, and thus there was a request for new follow-ups.

What does it cover?

The original research topic was to examine the health consequences of youth unemployment.

The possible consequences of youth unemployment for health in adult age was also the focus of the application for the follow-up in 1995, but this time the research questions were broadened to include analyses of the life course and trade cycle. The research questions focused on the possible health consequences of unemployment and whether these relations were influenced by occupation, length of unemployment, age, gender and socio-economic status.

The investigation in 2008 has so far included four different projects. One has a broad focus on the health consequences of the structural transformations of the labour market that were initiated during the 1990s. The transformation led to increased flexibility in the labour market, with more temporary employment and higher rates of unemployment. The aim of the study was to analyse the association between insecure labour market attachment and health. The hypothesis was that the more time insecurely attached to the labour market, the poorer is the health status, and that movements from the periphery to the centre of the labour market will lead to improved health. Our theoretical premise was that insecurity, inadequate opportunity for development and lack of decision latitude in work can lead to stress reactions, which in turn manifest themselves in poorer health behaviour and health status (self-reported symptoms, depression, blood pressure, cortisol, etc.).

The aim of the second project of the follow-up in 2008 is to analyse the importance of gender equality in domestic work for the health status of men and women. One of the main research aims was to analyse whether a higher degree of gender equality in domestic work is related to better health among men and women. The research questions also included the following: does greater gender equality in domestic work promote improved health behaviour among men? Could decreased workload explain the relation between improved gender equality in domestic work and better health among women? Do labour market attachment and socio-economic status

influence the relationship between gender equality in domestic work and health? What is the importance of health-related selection? The second main research area was based on qualitative analyses of the research question: what does gender equality in domestic work mean for the construction of masculinities and femininities within couple relationships and for the experiences of health?

The third project is related to the Barker hypothesis on the fetal origins of adult disease, i.e. that adaptation *in utero* to unfavourable conditions will affect health in adult life. Our point of departure was that a methodological problem in most studies of this hypothesis is the lack of possibilities to analyse intermediate variables between birth and the development of diseases in adult age. The aim of this project is to study whether signs of fetal growth retardation could predict biological risk factors for cardiovascular diseases in adult age, even after controlling for a life-course exposure, i.e. the accumulation of adverse life experiences from childhood to adulthood.

The fourth project focuses on modifiable risk factors (social, psychological, biological) during the life course for metabolic syndrome in adult age. One research question is to explain the excess risk of the metabolic syndrome among women who grow up in unfavourable circumstances. Another research question focuses on explaining the excess risk of the metabolic syndrome in adult age among men as compared with women.

Who is in the sample?

The cohort consists of all pupils who in 1981 attended, or should have attended, the last year of compulsory school (age 16 years) in all schools in the municipality of Luleå. The PI visited all 46 classes in the last year of compulsory school in the municipality of Luleå and asked the pupils if they wanted to be part of the longitudinal study. Written information was given to them, as well as to their parents. The local municipality provided lists of all pupils in the last year of compulsory school, and all form teachers were asked whether any pupil had left compulsory school in advance. Those 11 pupils who had left school in advance (for various reasons such as childbirth or school fatigue) were contacted and personally visited by the PI.

The study was preceded by a major effort to anchor the project in the local municipality as well. The PI visited the local education authority, all principals of the nine compulsory schools within the town, all school nurses, all study and careers advisers, the parent–teacher association as well as the pupils' association. They were all invited to send a representative to a reference group concerning the study, and all of them did except for the trade union. The aim of the reference group was to plan and design the study as well as to get early feedback about the results.

The reference group continued its work until the 1986 follow-up had been performed.

The attrition rate was extremely low. Of the total 1083 pupils (506 girls, 577 boys) who were invited, 1080 participated in the baseline investigation. The missing three boys who were invited but did not enter the study were all sons of highly educated parents.

A subsample was made from the cohort, consisting of all participants who were unemployed directly after compulsory school ($n=13$ girls, 15 boys). They all agreed to be part of the study.

All school nurses and form teachers in 1981 as well as all form teachers in 1983 were also part of the sample. None refused to participate.

How often have they been followed up?

As shown in Figure 1, the cohort has been followed up five times—in 1981 (age 16 years), 1983 (age 18 years), 1986 (age 21 years), 1995 (age 30 years) and 2008 (age 43 years). Clinical measurements were performed in 1981, 1986 and 2008. Interviews were performed with key persons—with the school nurses in 1981 and with the form teachers in 1981 and 1983.

The subsample with early unemployed participants has been followed with personal interviews since autumn 1981. Until now, they have been interviewed on average four times per person. The main topic has been the health consequences of unemployment.

The study has been approved by the Regional Ethics Vetting Board in Umeå.

What has been measured?

A summary of the content of the questionnaires is given in Table 1.

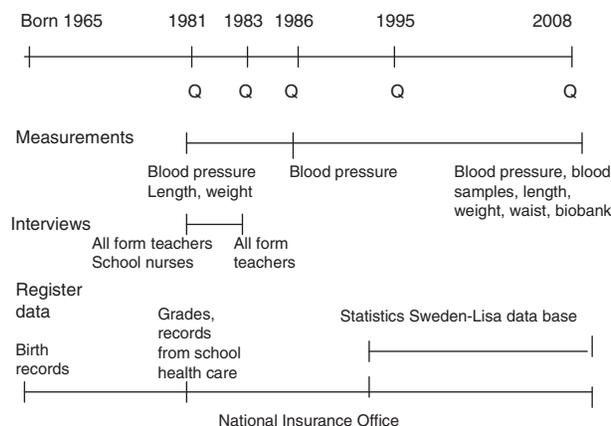


Figure 1 Design of the Northern Swedish Cohort. Q, questionnaire

Measurements

Blood pressure was measured at age 16, 21 and 43 years and information on body mass index (BMI) is available from age 16 (from the school health records), 43 (measured), 21 and 30 years (self-reported). The most recent survey at age 43 years also comprised a health examination including measurement of waist circumference, and blood sampling after one night's fast was assessed for total cholesterol, high density lipoprotein and low density lipoprotein cholesterol, triglycerides, apolipoprotein A1 and B, fasting glucose and C-reactive protein. The participants also completed a 1-day saliva collection (four samples) assessed for salivary cortisol. One blood sample was also stored at the biobank at Umeå University Hospital.

Data from interviews with key persons

The interviews (about each participant) with the school nurses dealt with the presence and severity of eczema and/or allergy, other illness or handicap, number of visits to the school nurse (in the last year of compulsory school), main diagnosis of school nurse visit, taking part in pupils' well-being meeting.

The teacher interviews about each participant in 1981 covered the following items (the items also covered in the teacher interviews in 1983 are indicated in brackets): the behaviour of the class, knowledge about the class (1983), composition (1983), number of years in teaching (1983), gender of the teacher (1983), attitude towards the pupil (1983), the pupil's intellectual capacity, performance, gross motor ability, fine motor ability, difficulties in reading and writing (1983), speech problems, language problems, Swedish as mother tongue, smoking, alcohol consumption, truancy, absence due to other reasons, Monday absence, knowledge about problems in the family, parental interest in the pupil's studies, parental attitude to the pupil, prospects for future work (1983) and studies, opinion about the pupil, assessment on a six-grade scale of the pupil's tiredness/alertness, depressiveness/exhilaration, passivity/activity, silence/outspokenness, dependence/independence (1983), aggression/lack of aggression (1983), insecurity/confidence, isolation/extroversion, unpopularity/popularity among students, unpopularity/popularity among teachers (unpopularity/popularity in 1983). In addition, the following items were included in the 1983 interview: ability to concentrate or not, unhelpful/helpful, knowledge about illness, psychological symptoms, abuse (alcohol, narcotics, etc.), criminality, knowledge about parental illness, psychological symptoms, criminality and assault/battery.

Register data

The following register data have been added to the cohort:

- (1) Manual record of birth data from participants own birth: height, weight, physical status,

malformation, gestational age; data regarding the mother: age, parity, diseases, complications during delivery.

- (2) Manual record of school, class and (in upper secondary school) also study programme, based on information from each school.
- (3) Manual record of grades (for each subject from the last year of compulsory school) based on information from the local municipality.
- (4) Manual record of school health data: measurement of vision, sense of colour, hearing, weight, height, number and diagnosis of visits to the school physician (during the last 3 years of compulsory school), referrals (instance and diagnosis).
- (5) The following data have been added from the longitudinal integration database for health insurance and labour market studies (Swedish acronym LISA) at Statistics Sweden for each year between 1992 and 2007: employment, number of employees at one's workplace, number of sources of income, number of days (gross, net) per year in allowances due to parental leave, temporary parental leave (due to care of sick children), sick leave, rehabilitation, work injury, preventive sick leave, unemployment and labour market measures (and which type of measures).
- (6) The following data have been added from the National Social Insurance Office for 1982, 1983, 1985—annual information about civil status, number of days in parental leave (all data missing for 1984, 1986, 1987). For the 1988–1992 period, the following data have been added: annual information about civil status, number of days in parental leave, extent (whole, 25%, 50%) for the participant as well as the other parent. For 1988–1992 period, annual information about the number of days' sick leave and extent (whole, 25%, 50%) has also been added.
- (7) The following data have been added from the LISA database for all employees at the workplaces of each cohort participant (from 2003 until 2007): sex, age, income, education, type of workplace, number of days (gross, net) per year in allowances due to parental leave, temporary parental leave (due to care of sick children), sick leave, rehabilitation, work injury and preventive sick leave.

What is attrition like?

During the 27-year period, 12 participants died. At the 27-year follow-up, 94.3% ($n = 1010$) of those still alive of the original cohort ($n = 1071$) continued to participate. Thus, over the 27 years, 5.7% of the participants have been lost and ~1% points of these has been due to premature deaths.

Table 1 Summary of questionnaire data collected on the Northern Swedish Cohort at 5 occasions of data collection (1981, 1983, 1986, 1995, 2008)

Year for data collection	1981	1983	1986	1995	2008
Parental information: age, occupation, country of birth, divorce, illness, labour market status, contact	+				
Social background factors: place of birth, language, moving, siblings, housing, crowded, property, financial situation, subjective social group	+				
Health status: somatic/psychosomatic symptoms	+	+	+	+	+
Psychological symptoms	+	+	+	+	+
Self-rated health				+	+
Reasons for fears/sorrows	+	+			
Body image	+				
Age of menstruation			+		
GHQ (General Health Questionnaire)		+	+	+	+
Medication	+			+	+
Height, weight	R	+	+	+	+
Health-care consumption (visits to dentist, physician, hospitals, etc.)	+	+	+	+	+
Truancy	+	+			
Sick leave	+	+			+
Sleeping hours	+		+	+	+
Sleep problems	+		+	+	+
Work disability			+	+	+
Frequency, amount of alcohol consumption	+	+	+	+	+
Tobacco consumption (smoking/snuff use)	+	+	+	+	+
Narcotics	+	+	+		
Food habits; breakfast, coffee, sweets, fruits/vegetables, etc.	+	+			+
Being reported to the police	+		+		
Violence				+	+
Physical activity	+		+	+	+
Personal hygiene	+	+	+		
Use of contraceptives	+		+		
Health knowledge/abuse attitudes	+				
School situation (enjoy school, lessons and classmates, learn for future, decision making, time for and help with home work, work load)	+				
Work: present labour market situation	+	+	+	+	+
Number of actual/preferred hours in waged work/week	+	+	+	+	+
Do what they want to do? Obstacles?	+	+	+	+	+
School dropout, resignation from job		+	+	+	
Education	R	+	+	+	+
Length and no. of times (since last follow-up) in unemployment, labour market measures, temporary and permanent job (job history matrix)	+	+	+	+	+
Ways of getting a job?			+	+	
Want to take any job available?		+	+	+	
Work Involvement Scale			+	+	+
Risk of unemployment				+	+

(continued)

Table 1 Continued

Year for data collection	1981	1983	1986	1995	2008
Demand/control/support model				+	+
Work: stressful, monotonous, new learning, control, make use of abilities	+	+	+		
Unemployed friends/relatives		+	+	+	+
Meaningful spare time	+		+	+	+
Membership (and time spent) in associations	+	+	+	+	+
Alone or together with friends?	+		+	+	
Social support (quantitative/qualitative)				+	+
Living in rural or urban area				+	+
Material/non-material preferences			+	+	
Future pessimism	+	+	+	+	+
Four questions about lack of control in general	+	+	+	+	+
Ideology				+	
Social capital					+
Gender equality in couple relationship					+
Responsibility for children/domestic work				+	+
Partner: labour market situation				+	+
Life events	+	+	+	+	+
How often cinema, viewing TV, disco, going out	+				
Use of spare time (in hours/week)				+	+
Financial situation	+	+	+	+	+
Locus of control	+	+	+	+	
Moving	+	+	+	+	
Future prospects	+	+	+		
Personal inventory ^a	+		+		

R, available in register data.

^aGunnela Westlander (satisfaction, self-worth), Lidwall (anxiety, psychosomatic, depression), Sroles scale of anomaly, Type A behaviour.

Among the non-responders, there is an overrepresentation of boys (77% among the non-responders compared with 52% among the responders), of individuals with low grade from compulsory school (48% compared with 41%) and of low parental socio-economic position (57% compared with 53%). A similar pattern is also found among the participants who died during the follow-up. As the attrition rate has been so low, it has been possible to study marginal groups, e.g. unemployed, addicts and persons with psychiatric problems.

What has it found? Key findings and publications

To date over 100 papers and reports have been published from the cohort. A complete list of the publications is available on the homepage of the cohort (http://www.medfak.umu.se/english/research/research-projects/lulea_cohort_project/).

Below, selected findings are summarized in relation to our major research areas.

The health consequences of unemployment and temporary employment

Our research has shown that exposure to unemployment (>12 weeks from age 16 years until age 18 years and >6 months from age 16 years until age 21 years) leads to poorer self-reported health (both somatic and psychological symptoms) as well as to poorer health behaviour (such as smoking, alcohol consumption, sexual risk taking), even after control for possible confounders.⁴⁻¹¹ Whereas it is well known that poor health and unfavourable health behaviour increase the risk of becoming unemployed (the so-called health-related selection), our research shows that the effects of exposure to unemployment are stronger than the health-related selection.^{6,12} With regard to exposure, there seems to be a dose-response correlation, so that the longer the time in youth

unemployment the worse the deterioration of psychological symptoms.¹⁰

Unemployment between age 16 and 21 years had a significant explanatory effect on smoking and psychological symptoms at age 30 years.¹² Thus, the health consequences of youth unemployment seem to remain in young adult age, even after control for later unemployment and for other confounders.¹² Also, when comparing the relations between long-term unemployment and psychological symptoms at age 21 and 30 years, we found stronger relations among young persons as compared with adults.¹³

At age 43 years, we have also found significant relations (after control for confounders) between unemployment and mental health, smoking, alcohol consumption (among women) and few visits to dentist (among men).¹⁴ We conclude that in a Swedish context, men and women are quite equally hit by the health consequences of unemployment.

An analysis of the health consequences of youth unemployment in different economic cycles showed that the economic cycle had little or no impact on the health of the unemployed.^{15–17} However, during the economic recession of the 1990s, young non-unemployed women had significantly more somatic symptoms as compared with during boom. Thus, the business cycle seems to have a negative influence on the health situation of young women who worked and studied.¹⁸

Our research also shows a negative relationship between being in temporary employment and health status, especially on mental health.^{19–21} Important mediators of these effects seem to be poor financial situation and job insecurity.¹⁹ Moreover, the health effects of non-permanent employment depend on the socio-economic status of the employees, being more adverse in the less educated.²²

The life-course origins of metabolic health

Another research theme of the cohort has focused on the life-course origins of metabolic health in mid-adulthood. We have showed that social inequities in overweight reflect the cumulative influence of multiple adverse circumstances experienced from adolescence to young adulthood. Among the different socio-economic life-course models for metabolic outcomes in mid-life, we have found support for the cumulative risk and sensitive period (in adolescence) models for serum lipids²³ and for allostatic load.²⁴ The circadian cortisol regulation, particularly the cortisol awakening response, appears to be mainly related to early socio-economic circumstances, corresponding to a sensitive period model.²⁵ We have also demonstrated an association between adolescent socio-economic status and the metabolic syndrome in mid-adulthood in women, independently of BMI and blood pressure in adolescence and young adulthood and of socio-economic status and health behaviours in adulthood.²⁶ These findings thus

suggest other pathways than an early impact of socio-economic disadvantage on metabolic systems that tracks into adulthood, which will be explored in our future research.

We have also examined the importance of birth weight for circadian cortisol regulation and for serum lipids. For cortisol levels, we found that across the normal birth weight spectrum there is a positive association between birth weight and cortisol levels, particularly in the evening, and also high levels in those born preterm or of low birth weight.²⁷ Of a range of serum lipids examined, we found support only for the fetal origins hypothesis for triglycerides in women,²³ albeit independently of the life-course accumulation of unfavourable social exposures (socio-economic status and adversities). Overall, social exposures displayed stronger relationships to lipids than did birth weight.²³

What are the main strengths and weaknesses?

The main strengths of this study are the extraordinarily high response rate in combination with the long follow-up time. A cohort of school-leavers from a middle-sized town has been followed for 27 years. The question of the generalization of the results from the Northern Swedish Cohort needs to be discussed. The participants have been followed regardless of where they have moved (in Sweden or abroad). The cohort has proven to be comparable to the country as a whole with regard to socio-demographic and socio-economic factors as well as health status and health behaviour.^{4,28} The cohort is closed, which means that the cohort today is more a homogeneous ethnic group than the Swedish population as a whole.

At the time the cohort was chosen, the sample size was regarded as large. Today the sample size is regarded as relatively small, which is the main limitation of the study. However, it would have been extremely difficult to keep up the high response rate with a larger sample. One important prerequisite for the high response rate has been the close relation between the project leader and the participants—the PI met the participants several times during the follow-up, blood pressure measurements, interviews, etc. As one of the participants said at the 27-year follow-up: ‘I never participate in studies but I do in this case because I know you.’

So, would we have done the study differently today? Probably not, as it would have been impossible to have personal contact with a larger sample. Certainly, we would have devoted all the time we did in order to get a high response rate during a long-term follow-up. It was good to concentrate on one town—the study has become famous in that town and it was relatively simple to establish support for the study among key persons/groups before it

started. We also believe that it was important to initially put heavy emphasis on defining a theoretical point of departure that guided our research questions. The theories we chose are still valid today, and even after 27 years we are satisfied with most questions in the questionnaire. What we lack is more early questions about abuse (physical, psychological, sexual) and social support as well as measures of the positive dimensions of health.

Our growing interest in life-course epidemiology would of course have benefited from starting the study earlier, at birth or at least in Grade 1. Also, as our theoretical perspectives have widened, if we had done the study again we would have included questions later added (GHQ, social support, gender relations, etc.) from the beginning as well as questions about childhood and adult abuse, salutogenesis (or other positive aspects of health) as well as social capital. Also, for analyses of biological risk markers we would have stored blood samples from the beginning of the study (preferably at birth).

We would like to give the following teaching points to researchers who want to set up a similar study:

- Be sure to anchor the research among key persons before you start a cohort study.
- Spend time formulating your theoretical premises, which will then guide the questionnaires for a long time.
- Feedback on the results from each follow-up is important in motivating the participants for subsequent participation.

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

The Northern Swedish Cohort is conducted at Umeå University. Our longitudinal dataset has great potential for secondary analysis. These data are not freely available but collaborative ideas are welcome. Anne Hammarström is the main contact person. The website with documentation for the cohort and detailed information about variables and publications is available at http://www.medfak.umu.se/english/research/research-projects/lulea_cohort_project/.

Funding

Until the investigation in 1995, the cohort study was funded by the former Delegation for Social Research, the Institute of Social Research and the National Institute of Public Health. The investigation in 2008 was financed by the Swedish Council for Working Life and Social Research, the Swedish Research Council and the County Council of Västerbotten.

Acknowledgements

We would like to thank all participants of the study for their long-lasting interest and for the time they have spent and the efforts they have made for the study. We would also like to thank all our collaborators and co-authors as well as the funding organizations.

Conflict of interest: None declared.

References

- ¹ Jahoda M, Lazarsfeld PF, Zeisel H. *Die Arbeitslosen von Marienthal. Ein soziographischer Versuch*. Leipzig: Hirzel, 1933.
- ² Cobb S, Kasl SV. *Termination: The Consequences of Job Loss*. Cincinnati: US Department of Health, Education and Welfare, 1977. DHEW/NIOSH Publ. No. 77-224.
- ³ Brenner MH. *Mental Illness and the Economy*. Cambridge, MA: Harvard UP, 1973.
- ⁴ Hammarström A. *Youth Unemployment and Ill-Health. Results from a Two Year Follow-Up Study*. Solna and Sundbyberg: Karolinska Institute, The National Institute of Psychosocial Factors and Health and the Department of Social Medicine 'Kronan', 1986 (in Swedish, summary in English).
- ⁵ Hammarström A, Janlert U, Theorell T. Youth unemployment and ill-health: results from a 2-year follow-up study. *Soc Sci Med* 1988;**26**:1025–33.
- ⁶ Janlert U, Hammarström A. Alcohol consumption among unemployed youths. *Br J Addict* 1992;**87**:703–14.
- ⁷ Hammarström A, Janlert U. Unemployment and change of tobacco habits. A study from 16 to 21 years of age. *Addict* 1994;**89**:1691–96.
- ⁸ Hammarström A, Janlert U. Unemployment – an important predictor for future smoking. A 14 year follow-up of school leavers. *Scand J Public Health* 2003;**31**:229–32.
- ⁹ Hammarström A. Health consequences of youth unemployment. *Public Health* 1994;**108**:403–12.
- ¹⁰ Hammarström A, Janlert U. Nervous and depressive symptoms in a longitudinal study of youth unemployment—selection or exposure? *J Adolesc Health* 1997;**20**:293–305.
- ¹¹ Hammarström A, Janlert U. Unemployment and sexual risk taking among adolescents. *Scand J Soc Med* 1998;**25**: 266–70.
- ¹² Hammarström A, Janlert U. Early unemployment can contribute to adult health problems – results from a longitudinal study of school-leavers. *Int J Epidemiol Community Health* 2002;**56**:624–30.
- ¹³ Reine I, Novo M, Hammarström A. Does the association between ill health and unemployment differ between young adults and adults? Results from a 14-year follow-up. *Public Health* 2004;**118**:337–45.
- ¹⁴ Hammarström A, Gustafsson P, Strandh M, Virtanen P, Janlert U. It's no surprise! Men are not more hit than women and men by the health consequences of unemployment in the Northern Swedish Cohort. *Scand J Public Health* 2011;**39**:187–93.
- ¹⁵ Novo M, Hammarström A, Janlert U. Health hazards of unemployment – only a boom phenomenon? A study of young men and women during times of prosperity and times of recession. *Public Health* 2000;**114**:25–29.

- ¹⁶ Novo M, Hammarström A, Janlert U. Smoking habits – a question of trend or unemployment? A comparison of young men and women between boom and recession. *Public Health* 2000;**114**:460–63.
- ¹⁷ Novo M. Young and unemployed – does the trade cycle matter for health? A study of young men and women during times of prosperity and times of recession. Umeå: Department of Public Health and Clinical Medicine, Umeå University, 2000.
- ¹⁸ Novo M, Hammarström A, Janlert U. Do high levels of unemployment influence the health of those non-employed? A gendered comparison of young men and women during boom and recession. *Soc Sci Med* 2001;**53**:293–303.
- ¹⁹ Waenerlund AK, Virtanen P, Hammarström A. Is temporary employment related to health status? Analysis of the Northern Swedish cohort. *Scand J Public Health* 2011;**39**: 533–39.
- ²⁰ Virtanen P, Janlert U, Hammarström A. Exposure to temporary employment and job insecurity: a longitudinal study of the health effects. *Occup Environ Med* 2011;**68**: 570–74.
- ²¹ Virtanen P, Janlert U, Hammarström A. Exposure to non-permanent employment and health: analysis of the associations with 12 health indicators. *J Occup Environ Med* 2011;**53**:653–57.
- ²² Hammarström A, Virtanen P, Janlert U. Are the health consequences of temporary employment worse among low educated than among high educated? *Eur J Public Health* 2010; doi:10.1093/eurpub/ckq135 [Epub 30 September 2010].
- ²³ Gustafsson PE, Janlert U, Theorell T, Westerlund H, Hammarstrom A. Fetal and life course origins of serum lipids in mid-adulthood: results from a prospective cohort study. *BMC Public Health* 2010;**10**:484.
- ²⁴ Gustafsson PE, Janlert U, Theorell T, Westerlund H, Hammarstrom A. Socioeconomic status over the life course and allostatic load in adulthood: results from the Northern Swedish Cohort. *J Epidemiol Community Health* 2010; doi:10.1136/jech.2010.108332 [Epub 25 October 2010].
- ²⁵ Gustafsson PE, Janlert U, Theorell T, Hammarstrom A. Life-course socioeconomic trajectories and diurnal cortisol regulation in adulthood. *Psychoneuroendocrinology* 2010;**35**: 613–23.
- ²⁶ Gustafsson PE, Persson M, Hammarstrom A. Life course origins of the metabolic syndrome in middle-aged women and men: the role of socioeconomic status and metabolic risk factors in adolescence and early adulthood. *Ann Epidemiol* 2011;**21**:103–10.
- ²⁷ Gustafsson PE, Janlert U, Theorell T, Hammarstrom A. Is body size at birth related to circadian salivary cortisol levels in adulthood? Results from a longitudinal cohort study. *BMC Public Health* 2010;**10**:346.
- ²⁸ Novak M. *Social Inequity in Health: Explanation from a Life Course and Gender Perspective*. Umeå: Department of Public Health and Clinical Medicine, Umeå University, 2010.