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Cohort Profile

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Cohort Profile: The AMORIS cohort

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Why was the cohort set up?

During the period 1985–96, the Central Automation Laboratory (CALAB), Stockholm, Sweden was a leading centre for analyses of blood and urine samples from health screenings and primary health care in Sweden. The results from these analyses were secured as a resource for future research. The AMORIS (Apolipoprotein-related MOrtality RISk) cohort was initiated by Ingmar Jungner (I.J.), one of the founders of CALAB, and Göran Walldius (G.W.), the scientific research coordinator. This AMORIS cohort was originally set up to test if levels of apolipoprotein (apo) B (atherogenic) and apoA-I (atheroprotective) were more closely related to fatal myocardial infarction and stroke than conventional lipids, especially low-density lipoprotein (LDL)-cholesterol. In 2012 I.J. donated the CALAB database to the Karolinska Institutet, Stockholm, Sweden, for research purposes to support the research project 'Epidemiologic studies of metabolic factors and inflammation in relation to chronic disease'. The CALAB database was further updated in 2012–14 by means of record linkages to 24 different Swedish national health registers, registers of quality of care, and surveys including socioeconomic data as well as a questionnaire and biomedical data from number of research cohorts (Figure 1). This research project complies with the Declaration of Helsinki and was reviewed and approved by the Stockholm Ethical Committee (Dnr 2010/1:7). All linked data in the AMORIS cohort are anonymized.

Who is in the cohort and how often have they been followed up?

The AMORIS cohort includes a total of 812 073 subjects (49% men and 51% women) with information from laboratory analyses of blood and/or urine samples obtained between 1985 and 1996 on a varying number of biomarkers, in all representing 35 830 287 analyses. During these years, primary health care was well developed in Sweden and CALAB was often used as the preferred laboratory in Stockholm County. All individuals were either healthy individuals referred for clinical laboratory testing as a routine part of yearly health check-ups through occupational health care, or outpatients referred for laboratory testing. These two populations may be distinguished in the database by a specific code of payment. Of the laboratory analyses, 26% represented routine health screenings, 24% health care in the occupational setting and 50% other outpatient care. During the baseline period 1985–96, the number of subjects coming from routine regular health check-ups dropped, which reflects a general trend in Swedish

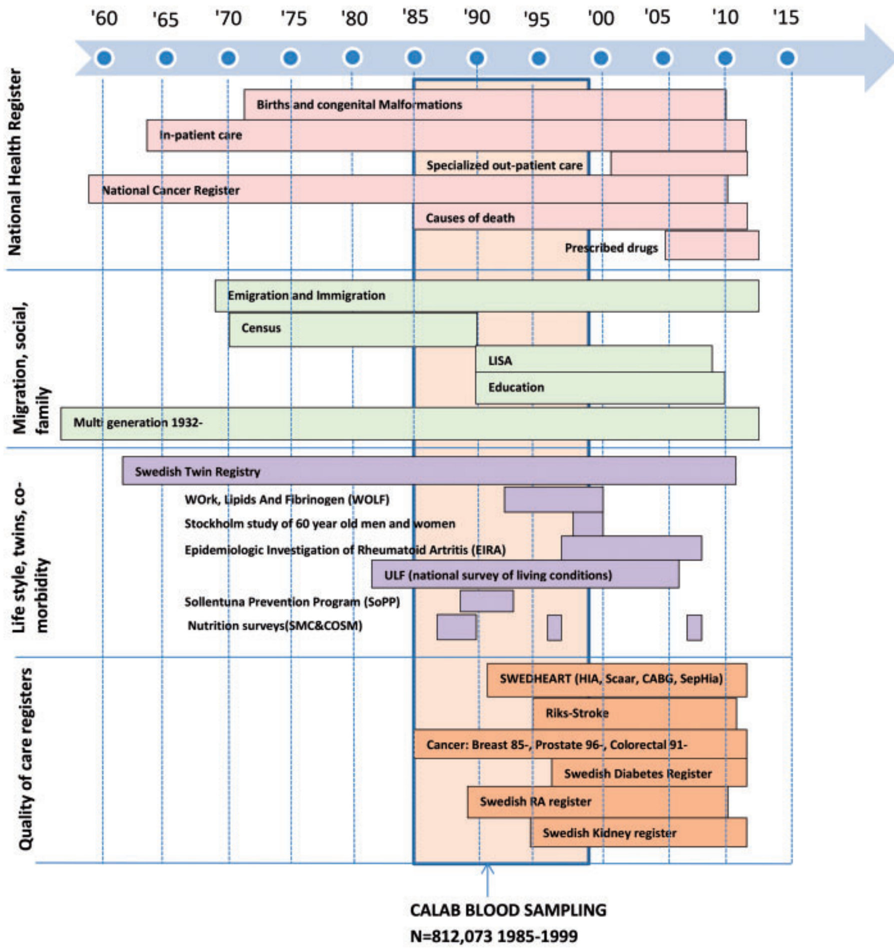

Figure 1. Description of various types of registers linked to the AMORIS laboratory database developed 1985–1999. Years at the top of the figure indicate that various registers contain data from 1960–2012. All registers overlap with the central laboratory database.

health care. In addition to the blood samples, CALAB received information on fasting status and occasionally information regarding body weight and height from the responsible physician.

The subjects of the AMORIS cohort coming from occupational routine health screenings represent a large number of companies and a broad range of branches including administrative, industrial, technology, trade, research and other activities in the greater Stockholm area. They were invited by their employers as an employment benefit option to receive regular health check-ups according to standardized programmes run by physicians at various health centres. There was a slight majority of White-collar workers. Most individuals at these companies participated in this programme. Blood samples according to screening programmes were sent to the CALAB laboratory. The physician at the health centre was responsible for medical evaluation and help with therapy if needed. More than 50% of the subjects followed a regular and individualized scheme of health check-ups at regular time intervals. No individuals were inpatients at the time their blood or urine samples were taken and none were excluded for disease symptoms or because of treatment.

All subjects of the AMORIS cohort were residents of Sweden and were predominantly living in Stockholm County (67%) at the time of the health examination and inclusion in the cohort. During the inclusion period (1985–96) the total population of Stockholm County was about 1.6 million inhabitants. Thus, the AMORIS cohort constituted a substantial part (about 35%) of the total population of Stockholm County at that time and with respect to working ages this proportion was even higher.

By linkage of the AMORIS cohort to national censuses for the period 1970–90, a detailed characterization of the cohort with regard to the socio-demographic factors covered by the censuses has been possible. These censuses were mandatory for adult Swedish citizens and with basically no loss to participation. The censuses included questions about housing, marital status, country of birth, occupation and education. Based on this information, an index of socioeconomic status (SEI) was derived distinguishing unskilled and skilled workers from lower intermediate and higher employees. For the following period and until 2012, the corresponding information has been obtained from the longitudinal integration database for health insurance and labour market studies (LISA by Swedish acronym).

The sex and age distribution of the AMORIS cohort at the time of inclusion compared with the general population of Stockholm County in 1990 is shown in Table 1. Mean age at time of first blood sampling was 42.6 years, which was about 4 years older than the general population of Stockholm County. Linkage to national censuses has shown that the proportion of subjects born outside Sweden was similar between the AMORIS cohort and the general population of Stockholm County in 1990 (Table 1).The subjects of the AMORIS cohort had a somewhat higher education and a larger proportion was married. About 90% of subjects between 20 and 64 years old were employed, which was a somewhat higher proportion than the general population of Stockholm County in 1990. The gainfully employed subjects of the AMORIS cohort represent a wide range of occupations. The specific occupations represented in the AMORIS cohort, identified by the three-digit Nordic Occupational Classification (NYK) code, include several different blue-collar as well as white-collar occupations predominantly found in a more urban environment. For example, the proportion of farmers was less than 1% of all gainfully employed subjects (Table 1). Importantly, among those employed, the socioeconomic distribution of the AMORIS cohort was very similar to that of the population of Stockholm County in 1990 according to national census. The proportion of workers or lower-grade employees was 45% in the total employed population of Stockholm County and 43% in the AMORIS cohort. The comparatively high proportion of employed subjects in the AMORIS cohort reflects the recruitment to laboratory testing by occupational health screening, and is reflected in a lower all-cause mortality [Standardized Mortality Ratio (SMR): 0.86] in the AMORIS cohort compared with the general population during the period 1985–2012.

Table 1. Sociodemographic characteristics of subjects in the AMORIS cohort at time of inclusion (1985–99) compared with the general population of Stockholm County in 1990

	AMORIS at baseline	Stockholm county (1990)
Number of subjects	812073	1654766
Female	51%	52%
Mean age (years)	42.6	38.4
Age distribution		
$\leq$ 20 years	8%	24%
20–39 years	39%	31%
40–59 years	38%	26%
60–79 years	13%	16%
$\geq$ 80 years	2%	3%
Country of birth		
Sweden	85%	84%
Finland	5%	5%
RoW	10%	11%
$=<$ 9 years education	28.3%	24.3%
Married	43.3%	36.5%
Gainfully employed (20–64 years)	89.8%	85.1%
Socioeconomic group		
Unskilled worker	90680 (20%)	177362 (22%)
Skilled worker	58598 (13%)	117969 (15%)
Lower employee	108315 (22%)	165185 (20%)
Intermediate employee	110329 (23%)	174235 (22%)
Higher employee	89918 (18%)	135042 (17%)
Self employed	15446 (3%)	35691 (4%)
Farmer	3377 (1%)	1437 (0%)

RoW, rest of the world.

What has been measured?

Laboratory data in the CALAB laboratory database

All laboratory blood and urine analyses included in the AMORIS cohort were performed on fresh blood/urine samples by CALAB. For 51% of the subjects in the cohort, information is available on repeated blood samples sometimes exceeding 50 analyses over the time period until 1996. The CALAB database includes 35 815 102 laboratory values recorded for 595 biomarkers (Table 2). The majority of analyses (90%) concerns chemistry and haematology viral serology biomarkers (1993–96), but there are also measurements representing immunology, allergy and bacteriology as well as viral serology. Several chemistry biomarkers were part of a standard analysis package including novel analyses not requested by the referring physician, such as apoB, apoA-I and the apoB/apoA-I ratio

Table 2. Laboratory data sections analysed in the AMORIS cohort. Number of unique tests within each section and number of repeated assessments performed

Laboratory section	*N* (tests)	*N*, repeated measurements
Chemistry	247	34792624
Immunology	56	163508
Allergy	125	261494
Bacterial serology	42	137272
Bacterial culture	72	272847
Total	595	35815102

for specification of dyslipidaemias, and fructosamine for diagnosis of diabetes. Since CALAB was an international leader and front-runner for the development of health screening and automation in laboratory practice (Autochemist®), investigations on potentially valuable risk markers for future use were also performed. More details on CALAB automation methodology with some of the early results from AMORIS studies can be found elsewhere.[1–5] For example, the following serum biomarkers have been used to assess lipid profiles: triglycerides, total cholesterol, LDL- and high-density lipoprotein (HDL)-cholesterol, apoB, apoA-I and a variety of lipid ratios. Lipid and apolipoprotein assessment methods have been described and validated in detail by Walldius[4,5] and Talmud.[6]

Table 3 shows an example of this standard package of biomarkers, which was often measured repeatedly with yearly intervals, representing regular health screenings. Data are shown separately for subjects visiting health check-ups and primary care. About 53% of chemistry biomarkers were known to be measured under overnight fasting conditions, 9% had been fasting for 4 h and 2% for 2 h. It is possible to restrict the analyses to only those subjects who were taking part in a repeated and standardized yearly health screening programme (26% of the AMORIS cohort). The age distribution and a history of previous major morbidity by type of visit are shown in Table 4.

For all biomarkers in the CALAB database the method used for analysis, including changes in the analytical procedures, have been well documented. All analytical procedures for measuring lipids and apolipoproteins were compliant with the WHO International Federation of Clinical Chemistry protocols standard programmes[7,8] and were computerized with systems for automatic calibration[1,3–5] with an extensive quality control scheme used. For example, the accuracy of total cholesterol and triglyceride values was checked against standards from the National Institute of Standards and Technology, Gaithersburg, MD, USA, or against analyses done at lipid reference laboratories certified by the US Centers for Disease Control.

In Supplement 2 (available at *IJE* online) we have tabulated 41 common methods used in 17 published papers based on the AMORIS cohort. Virtually all of the methods used by the CALAB laboratory were performed by automated techniques and instrumentation, as more closely described in papers 1–5 in Supplement 2.

Linkages to national health registers, quality of care registers and research registers

The CALAB database consists of information from laboratory analyses and a personal identification number (PIN)

Table 3. Numbers and summary statistics of biomarkers included in the standard laboratory package offered by CALAB. Data from health check-ups and primary care are shown separartely. Analysis from first examination included and crude and age-adjusted estimates presented by type of visit

	Health check-up			Primary care		
Age at baseline (years)	$N = 506701$	44.5 (14.5)		$N = 123957$	47.9 (18.6)	
		Biomarkers				
Marker	*N*	Mean (SD)	Meanw† (SD)	*N*	Mean (SD)	Meanw† (SD)
S-ALAT	453076	0.45 (0.62)	0.44 (0.05)	117337	0.44 (0.61)	0.45 (0.04)
S-ASAT	433619	0.38 (0.42)	0.38 (0.04)	115577	0.38 (0.39)	0.38 (0.04)
S-albumin	408882	43.3 (2.88)	43.3 (0.38)	116910	42.9 (3.04)	43.1 (0.30)
S-ApoA-I	162185	1.42 (0.24)	1.42 (0.03)	47070	1.48 (9.82)	1.47 (0.03)
S-ApoB	148927	1.24 (0.35)	1.22 (0.04)	47071	1.27 (0.39)	1.22 (0.04)
S-fructosamine	331731	2.09 (0.24)	2.09 (0.03)	123175	2.09 (0.28)	2.08 (0.03)
S-GT	445277	0.45 (0.76)	0.46 (0.15)	115462	0.48 (0.89)	0.49 (0.10)
S-potassium	362548	4.24 (0.34)	4.23 (0.05)	107441	4.22 (0.35)	4.21 (0.04)
S-cholesterol	467882	5.55 (1.17)	5.56 (0.14)	115043	5.57 (1.23)	5.51 (0.13)
S-creatinine	458178	81.9 (15.7)	81.9 (3.25)	116336	79.4 (17.7)	78.6 (3.26)
S-sodium	247468	141 (3.25)	141 (0.34)	78755	140 (2.89)	140 (0.34)
S-urate	420729	291 (73.3)	292 (12.7)	112248	282 (79.0)	278 (10.0)
Fs-glucose	446926	4.94 (1.20)	4.97 (0.21)	113677	5.12 (1.57)	5.05 (0.20)
Fs-triglycerides	466433	1.31 (0.99)	1.32 (0.10)	114415	1.35 (1.07)	1.34 (0.09)

S-, serum; Fs, fasting.

†Age-adjusted values by using the complete AMORIS standard package population age distribution (20 years interval) as reference.

Table 4. Age distribution and major disease history in the health check-up and the primary care populations

	Health check-up (N = 506748)		Primary care (N = 123983)	
Age distribution	*N*	%	*N*	%
< 20 years	10685	2.1	6259	5.1
20–40 years	185470	36.6	39449	31.8
40–60 years	237509	46.9	42374	34.2
60–80 years	65039	12.8	31137	25.1
> 80 years	8045	1.6	4764	3.8
Previous diseases				
Condition	*N*	**% (age adj)**	*N*	**% (age adj)**
Myocardial infarction	4490	0.9 (1.0†)	1802	1.5 (1.0†)
Stroke	3420	0.7 (0.8†)	1164	0.9 (0.7†)
Cancer	18875	3.7 (3.9†)	6457	5.2 (4.5†)

†Age-adjusted values by using the complete populations age distribution (20 years interval) as reference.

used for linkage to a number of other information sources. These linkages are grouped in national health registers, migration, social and family registers, lifestyle, the Swedish Twin Registry and quality of care registers (see overview in Figure 1).

National health registers, migration, social and family registers

The major national health registers of Sweden include the National Cause of Death Register (1985–2011), the National Cancer Register (1958–2011), the National Patient Register (regional information 1964–86; national information 1987–2011, including specialized outpatient care from 2001), the National Medical Birth Register (1973–2011) including the National Register of Congenital Malformations (from 1964) and the National Prescribed Drug Register (2005–11). By means of record linkage to these registers it has been possible to identify all deaths after the first blood sampling, all cancers diagnosed before and following blood sampling going back to 1958, and all hospitalizations from 1964 regionally from 1970 for Stockholm County and from 1987 nationally.

Information from the Medical Birth Register provides information on pregnancies and deliveries for women in the AMORIS cohort. This includes information on tobacco smoking before and during pregnancy. In addition, for all members of the cohort born 1973 or later (n = 64 619) there is information on birth weight and height, as well as complications at delivery including congenital malformations and other birth-related factors. Together with information from the Multi Generation Register, it is possible to retrieve information on parity and age at first childbirth.

As mentioned above and to further characterize the AMORIS cohort with regard to socio-demographic factors, the CALAB database has been linked to National Censuses 1970, 1980, 1985 and 1990 (Figure 1). National censuses were performed in Sweden every 5 or 10 years during the period 1960–90 and covered information about country of birth, marital status, employment status, education, occupation and socioeconomic group. For information post 1990, the database was linked to the longitudinal integration data base for health insurance and labour market studies (LISA register by its Swedish acronym)[9] and a Swedish national education register, thereby covering essentially corresponding information for the period 1990–2010. Furthermore, information on all emigration out of Sweden and immigration into the country was captured from 1968 onwards through linkages with the National Register of the Total Population.

Lifestyle, twins, comorbidity and quality of care registers

To obtain information on lifestyle factors, the CALAB database was also linked to a number of research cohorts from Karolinska Institutet (Figure 1): the WOLF study,[10] the study of 60-year-old men and women in Stockholm,[11] a primary prevention programme in Sollentuna municipality of Stockholm county,[12] the Swedish mammography cohort,[13] the EIRA cohort[14] and a cohort for studies of nutritional factors.[15] As a result, information on key risk factors for chronic diseases including tobacco smoking, low physical activity, poor diet, alcohol intake, obesity and hypertension could be obtained for many but not all of subjects in the AMORIS cohort. Information on tobacco smoking is available for more than 270 000 subjects, of which about 60% was from general health screening (surveys or health check-ups of healthy individuals). Since many of the smoking data stem from the Medical Birth Register, smoking status is known for 35% of women but only for 5% of men. Information on body mass index (BMI) is available for almost 300 000 subjects (37%). Physical activity and blood pressure/hypertension are known for about 10% of the cohort, with slightly higher proportions for men as compared with women. The AMORIS cohort also has information from the Swedish twin registry where 9729 twins were identified in the cohort. Of these, 4689 were men and 5040 women. There were 1624 complete twin pairs, of whom 536 were monozygotic, 1043 dizygotic and 45 of unknown zygosity. The Swedish twin registry[16] contains information on health and lifestyle factors and was collected from a number of questionnaires during 1961–96.

To obtain more detailed clinical information for major diseases, the CALAB database was also linked to various quality of care registers containing more complete information on diagnosis, treatment and disease characteristics (Figure 1). For cardiovascular (CV) diseases, the AMORIS cohort was linked to SWEDEHEART[17] which, during the latter part of the observation period, had a nationally more or less complete coverage of all patients treated at a coronary care unit, undergoing coronary artery bypass surgery angiography or percutaneous coronary intervention (PCI.)[17] For patients with stroke, data from RIKSSTROKE were added.[18] For patients with diabetes, information was obtained from the National Diabetes Register (NDR).[19] Additional clinical information has been retrieved from clinical quality registers for prostate, breast and colorectal cancer as well as for patients with rheumatoid arthritis (Swedish RA register[20]), and end-stage renal diseases (Swedish kidney register[21]).

Clinical outcomes

The AMORIS cohort contains a large number of clinical events, representing a broad spectrum of diseases. Between 1985 and 2012, there were 153 820 deaths (18.9 %) (Table 5). Between 1985 and 2011, a total of 144 533 (17.8 %) incident cases of cancer were identified in the cohort. During the same period more than 4.5 million hospitalizations or specialized outpatient visits were recorded. There was virtually no loss to follow-up but 42 909 subjects were censored due to emigration out of Sweden.

What has been found? Key findings and publications

To date, a total of 104 publications have been based on the AMORIS cohort, predominantly in the areas of cardiovascular disease and cancer.

Cardiovascular disease

In a subsample of 35 000 individuals with measurements of apoB, apoA-I and their ratio, we found a 3–6-fold increase in the risk of acute myocardial infarction when cholesterol levels were $\geq$ 6.50 mmol/l and triglycerides were $\geq$ 2.30 mmol/l, as compared with those with lower values.[1,2] A key study was published in 2001 in the *Lancet*, based on 175 553 men and women with a mean follow-up of 66.8 months.[4] The results indicated that apoB, apoA-I and especially the apoB/apoA-I ratio were highly predictive of fatal myocardial infarction and also more closely related to myocardial infarction than the measurements of LDL cholesterol.[4] These observations were further confirmed[22–24] and also extended to other CV outcomes such as stroke[25,26] and congestive heart failure.[27–29] In addition, we also observed an association with risk of CV outcomes between the apoB/apoA-I ratio and inflammation markers such as uric acid,[29] haptoglobin,[30] leukocytes and C-reactive protein (CRP).[27] Furthermore, in studies on diabetic subjects we found that high levels of fructosamine, indicating degree of glycation, were closely related to HbA1c over time in predicting risk of myocardial infarction and fatal events.[31,32] Finally, in patients with moderately reduced renal function their renal function was closely related to the apoB/apoA-I ratio and increased risk of myocardial infarction and stroke.[33,34] The majority of these findings have been summarized and discussed in a review which takes into account also other international results.[35]

Cancer

We investigated glucose levels and risk of breast, endometrial and ovarian cancer and showed that glucose levels below the diagnostic threshold for diabetes are associated with an increased risk not only of endometrial cancer, but also postmenopausal breast cancer.[36] We also studied the interplay between glucose, triglycerides, total cholesterol and risk of prostate, kidney,and gastrointestinal cancers.[37–39] Finally we assessed lipids and risk of breast, endometrial, and ovarian cancer,[40,41] but only found a consistent positive association between triglycerides and endometrial cancer risk.

We have evaluated associations between levels of immunoglobulin E (IgE) and cancer risk in 24 820 persons.[42] We also reviewed different markers of inflammation, including C-reactive protein (CRP), albumin and

Table 5. History and follow-up of the full AMORIS cohort

	Men	Women	Total
Number of subjects (%)	397443 (48.9)	414630 (51.1)	812073 (100)
Mean age at first examination (years)	42.6	42.7	42.6
Deaths 1985–2012 (%)	81926 (20.6)	71894 (17.3)	153820 (18.9)
Hospitalization from 1964 to baseline	628361	1081225	1709586
Hospitalization from baseline to 2011	1338661	1531086	2869747
Cancer cases from 1958 to baseline	11086	29723	40809
Cancer cases from baseline to 2010	72800	71733	144533

Table 6. Selected risk factors of chronic diseases, available through linkages with a variety of data sources

Risk factor	Men		Women		Total
	$N = 397443$		$N = 414630$		812073 (100.0)
	Screening	Event-related	Screening	Event-related	
Smoking, *n*	19911	67229	144490	39725	271355 (33.4)
Physical activity, *n*	18469	24494	16524	15963	75450 (9.3)
Body mass index, *n*	75580	38356	163454	22429	299819 (36.9)
Self- reported hypertension, *n*	15132	30526	13412	17665	76735 (9.4)
Blood pressure, *n*	11164	35112	8679	22809	77764 (9.5)
Alcohol, *n*	12072	0	8491	0	20563 (2.5)
Diet, *n*	10828	0	7672	0	18500 (2.3)

leukocytes.[43] One study was of particular interest as it used three repeated measurements of these markers.[44] More recently, we examined serum C-reactive protein (CRP), albumin, haptoglobin and white blood cells (WBC) in relation to breast cancer risk and survival. Findings showed systemic inflammation to be weakly associated with breast cancer risk and to impact on survival.[45] Serum lactate dehydrogenase (LDH), another marker of inflammation and metabolic alterations in cancer, was studied in relation to survival following cancer diagnosis.[46] Worse overall survival in breast cancer patients was seen in those women with higher serum LDH measured within 3 years preceding diagnosis. We have also found an association between gamma-glutamyl transferase (GGT) and various forms of cancer beyond liver dysfunction tests (alanine aminotransferase).[47]

What are the main strengths and weaknesses?

Strengths

Comprising about 800 000 individuals, the AMORIS cohort is unique with more than 35 million laboratory values from nearly 600 different methods and linkages to several national registers and research cohorts using the Swedish personal identification number. It constitutes a large and representative part of the population of Stockholm County between1985 and 1996. Record linkage to Swedish national registers, clinical quality of care registers and research cohorts provides opportunities for detailed prospective observational studies of associations between biomarkers and the risk of chronic disease morbidity and mortality. All biomarkers were measured on fresh blood/urine samples at the same clinical laboratory based on well-documented analytical methods and, for a large proportion, in a routine health screening setting. More than 50% of the cohort had repeated examinations. Furthermore, there is a complete follow-up of mortality, cancer incidence and other major diseases requiring hospitalization for more than 20 years up to 2012. Linkages of the AMORIS cohort to national censuses have shown that it represents the general population of Stockholm County during the inclusion period.

Limitations

A limitation of the AMORIS cohort is the partial availability of information on lifestyle factors, certain cardiovascular risk factors and specific treatments. However, such information is available in sub-cohorts to confirm results obtained in the entire cohort. Information is available from either screening (CALAB, research cohorts and medical birth register) or event related registers (quality of care registers) regarding major cardiovascular risk factors as shown in Table 6. In addition, from 2005 to 2012 antihypertensive treatment was available from the NPDR. If single risk factors are studied, sub-cohorts could amount to several hundred thousand subjects.

A slightly greater proportion of employed subjects in the AMORIS cohort compared with the general population give a ‘healthy worker effect’ reflected by lower all-cause mortality. Although this does not affect the internal validity of studies based on the AMORIS cohort, it could lead to underestimates of prevalence and incidence rates in the general population.

Conclusion

The AMORIS cohort represents a unique and extensive resource for research on biomedical factors and chronic diseases. Data from the AMORIS cohort have improved the understanding of associations between metabolic abnormalities and the risk of cardiovascular disease and cancer.

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

Information on how to access data from the AMORIS cohort is provided by the steering group members of the AMORIS study upon request in e-mail under the heading 'AMORIS Cohort Collaboration'. This is further outlined at the AMORIS homepage [http://amoriscohort.imm.ki.se] and in the policy document included in this article as Supplement 1 (available at *IJE* online). Both the policy document and the home page include mail addresses to steering group members. A password under the heading 'For researchers' allows access to more detailed information regarding all laboratory data and is also available upon request.

Profile in a nutshell

- The AMORIS (Apolipoprotein-related MOrtality RISk) cohort is a unique biochemistry and clinical resource for epidemiologic studies of metabolic factors and inflammation in relation to chronic disease. These data enables studies on pathophysiological mechanisms and related risks based on more than 20 years of follow-up of morbidity and mortality in major chronic diseases.
- The AMORIS database is located at the Institute of Environmental Medicine (IMM), Karolinska institutet, Stockholm, Sweden. Baseline blood and/or urine samples were collected during 1985-1999 in 812,073 mainly healthy subjects visiting health check-ups (49% men and 51% women, age range about 0-100 years).
- More than 35 million laboratory values based on fresh blood and urine samples, including repeated measurements, have been recorded covering more than 500 biomarkers. During the follow-up, there were 153,820 deaths (18.9%), 144,533 incident cases of cancer (17, 8%) and 4.5 million hospitalizations.
- The CALAB laboratory database is linked to 24 national health registers including quality of care registers, national registers of socioeconomic data and research cohorts.
- Access to data for collaboration is provided by the Steering group members of the AMORIS study by request in email under the heading AMORIS Cohort Collaboration. This can be found at the AMORIS homepage http://amoriscohort.imm.ki.se and in the Policy document included as Supplement 1.

Supplementary Data

Supplementary data are available at *IJE* online

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