RESEARCH REPORT

Danish singles have a twofold risk of acute coronary syndrome: data from a cohort of 138 290 persons

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Study objective: Atherosclerosis of the coronary and other arteries is an important health problem in virtually all countries of the world, and thus there is a persisting need for the development of preventive programmes including population risk group identification. The aim of the study was to identify sociodemographic population risk indicators of an initial episode of acute coronary syndrome (ACS), including unstable angina pectoris (UAP), myocardial infarction (MI), and sudden cardiac death (SCD).

Design: Cohort study of 138 290 residents of the municipality of Aarhus, Denmark, aged 30–69 years. Information on population members' individual age, sex, social background, and eventual death was obtained from Danish Population Registers.

Setting: University hospital.

Patients: The study prospectively identified 646 victims of ACS from 1 April 2000 to 31 March 2002.

Main results: Based on multiple logistic regression, age and single living were found to be positively associated with incident ACS in both sexes. Women >60 years living alone and men >50 years living alone were at especially high risk. They constituted only 5.4% and 7.7% of the source population, respectively, but they accounted for 34.3% and 62.4% of ACS patients dying within 30 days.

Conclusions: Single living is associated with an increased risk of ACS. Thus, risk groups identified by use of information on their age and family structure may be targets for future more focused and cost effective preventive strategies. In Western populations, such high risk groups will constitute comparatively limited parts of the population, and in Denmark they are easily identifiable in routine population registers.

Atherosclerosis of the coronary and other arteries is a important health problem in virtually all countries of the world. The incidence of myocardial infarction (MI) has decreased since the late 1960s in the USA and other industrialised countries.^{1–4} The most severe and well defined manifestations of ischaemic heart disease are combined in the acute coronary syndrome (ACS), including unstable angina pectoris (UAP), MI, and sudden cardiac death (SCD), the incidence of which has however not been researched yet in prospective studies.

Traditionally, high risk preventive strategies have targeted persons, whose risk was estimated by use of a coronary risk chart including classic risk factors, for example, age, sex, smoking, hypertension, dyslipidaemia, and diabetes mellitus.^{5–6} Such risk factors may be known for individual patients in the primary and secondary health services, but they are less suited for continuous identification of risk groups in natural populations, and there remains a need for a technique for more precise population primary prevention target group identification. One possibility is to exploit sociodemographic indicators included in the population standard registers in some countries. Although this option has been largely unexplored as concerns cardiac prevention, ischaemic heart disease occurrence is associated with a series of social indicators, especially low socioeconomic status, a low educational level, and lack of social support.^{7–15} Some of the characteristics may be represented in population registers, for example, age, sex, residence, annual income. Whether they can function as cardiac risk factor proxies depends on their discrimination ability and their availability and accessibility in population registers.

Accordingly, the aim of this study was (1) to identify register borne sociodemographic determinants of premature ACS in a Danish population segment, and (2) to estimate the precision with which they are able to identify ACS high risk groups.

METHODS

Design and study population

This was a cohort study. The cohort consisted of all persons aged 30–69 years residing in the municipality of Aarhus, Denmark, as of 1 April 2001 (that is, the midpoint population) in total 138 290 persons who were followed up as concerns ACS incidence during 1 April 2000 to 31 March 2002. The cohort was identified from the Danish public population register, Central Office of Civil Registration, based on the unique 10 digit individual identification number assigned to all Danish citizens. Incident ACS patients, residing in the municipality of Aarhus in parts of the study period, but not members of the midpoint population, were included post hoc.

The cohort represented 5% of the entire Danish population in the age group 30–69 years. Our cohort was dynamic in size over the two years of the study, ranging from 136 530 as of January 2000 to 139 282 as of January 2002. The composition of our cohort was a little younger and with a slightly higher fraction of women, as compared with the average Danish population in this age group. The incidence of ACS will vary depending on the population structure as concerns age, sex, and other factors, which differentiate ACS incidence, for example, urban compared with rural domicile, family structure, work, smoking patterns, etc. The city of Aarhus is the second largest city of Denmark with 300 000 inhabitants. The municipality of Aarhus consists of 24 rural and urban communities. The distribution of ACS risk factors or the occurrence of ACS is not believed to be different from that of the average Danish population. The population is defined

Abbreviations: MI, myocardial infarction; ACS, acute coronary syndrome; UAP, unstable angina pectoris; SCD, sudden cardiac death; MMN, markers of myocardial necrosis; ECG, electrocardiogram; ROC, receiver operating characteristics curve

Figure 1 Identification of patients with acute coronary syndrome (ACS), including and excluding sudden cardiac death (SCD), among 138 290 residents aged 30–69 years. Aarhus, Denmark, April 2000 to March 2002.

with an upper age limit of age 69, and thus, predictors of premature ACS are identified.

Population sociodemographic data from Danish registers

Linked data on age, sex, marital status, citizenship, number of adults, and of children in the household, and death were obtained from the Central Office of Civil Registration for each individual member of the cohort. From Statistics Denmark we received information concerning the person's family type, education, gross income, socioeconomic status, occupation, and immigration status. If information was missing for one year, the variable value from the previous or the following year was used and consequently no variable had a proportion of missing information higher than 0.35%. Dummy variables for missing data were included in the statistical analyses but did not show any association with ACS incidence.

A high level of data security and encryption of the 10 digit individual identification number was used as required by law to protect the individual member of the cohort. Not even the authors of the manuscript would be able to recognise or identify any members of the cohort.

Case finding

We identified consecutive cases of incident ACS between 1 April 2000 and 31 March 2002. Based on daily visits by a member of the research team, patients surviving until admission with possible ACS were identified from the two coronary care units covering the municipality of Aarhus. All patients belonging to the cohort and admitted alive to the coronary care units were screened for possible ACS, irrespective of the admission diagnosis. History of ACS, present symptoms, 12 lead electrocardiogram (ECG), and measurements of markers of myocardial necrosis (MMN) were recorded by a study nurse or one of us (KMN) within 72 hours of admittance. Patients were considered to have possible ACS, if the physician who examined the patient at admission wanted to rule out MI by (1) querying the patient about presence or absence of chest pain, and (2) performing a 12 lead ECG, and (3) measuring MMN. A final study diagnosis of ACS was made if there was either UAP with significant one millimetre ST depression or T wave inversion (FRISC criteria)¹⁶ or MI according to international criteria.¹⁷

SCD cases were identified from twice a week queries to emergency rooms, departments of pathology, the Institute of

Table 1 Baseline characteristics of the study cohort of 138290 persons aged 30–69 years, residing in Aarhus, Denmark, April 2000 to March 2002

Diagnostic category	Number	% Men	Mean age	SD
Not acute coronary syndrome	137644	49.9	47.0	10.9
Incident unstable angina	109	62.2	57.9	8.7
Incident myocardial infarction	348	75.3	58.6	8.4
Incident sudden cardiac death*	189	66.1	56.5	9.4

*Not prior acute coronary syndrome.

Forensic Medicine, and the Department of Medical Officers of Health (Danish state medical officials, who receive certificates of all deaths of unknown causes). Moreover, by the end of the two year data collection period we examined all death certificates from persons of the relevant age group in which the Department of Medical Officers of Health had been involved—that is, not only cases of SCD. A person was considered a SCD case, if death was unexpected and had occurred within 24 hours of the first symptom, and other obvious causes of death had been ruled out.¹⁸ We used the time frame of 24 hours after the first symptom to include as many deaths attributable to cardiac ischaemia as possible.^{19, 20} Also patients dying within 24 hours of hospital admission were included, if the medical officers of health had been involved in the case, or if the patient died in one of the two coronary care units or in one of the two emergency rooms covering the municipality. Patients with definite diagnosis of MI dying within 24 hours of the initial symptom were categorised as MI patients and not as SCD cases.

Persons with known serious life threatening diseases, who died suddenly, were not considered SCD cases. Obvious suicides, accidents, and drug related sudden deaths were also excluded, as were those found dead, if we were unable to obtain relevant information of the circumstances of the episode or of the time interval since death had occurred.

Definitions of ACS, as used in clinical trials, do not often include SCD, and therefore we show determinants of ACS with and without SCD for comparison.

Clinical data

Information concerning history of ACS and the presence or absence of chest pain was obtained from the patients' charts,

as were the 12 lead ECG. Serial measurements of MMN, either troponin T or creatine kinase MB, were obtained from the laboratory database.

To ascertain the cause of death among possible SCD cases we researched information from general practitioners, hospital charts, necropsy reports, death certificates relatives, and the police.

Patients

We identified a total of 1839 patients surviving until admission to one of the coronary care units. Of the 1576 patients with possible ACS, 288 had a previous history of ACS, and 457 were diagnosed with first time (incident) ACS. Sudden and unexpected death occurred in 313 persons. Five of the deceased were excluded because of missing information concerning the time interval, and 203 were believed to actually have died from SCD. In this latter group there were 189 without history of ACS, and they were therefore considered to be incident SCD cases (fig 1).

Evaluation of the ACS diagnosis

A specialist in cardiovascular medicine (MLL) performed diagnostic evaluation of the ACS diagnosis in the first 120 patients with a study diagnosis of ACS (surviving until admission). As there was full agreement in the diagnostic evaluation, we did not use an end point committee in the evaluation of the diagnosis of ACS.

Statistical analysis

The individual resident was the unit of analysis, and all information was assigned to individual population members. ACS including and excluding SCD functioned as dependent

Table 2 Incident acute coronary syndrome (ACS), including or excluding sudden cardiac death (SCD), by sex and significant social indicators, among 69247 women and 69043 men aged 30–69 years, residing in Aarhus, Denmark, April 2000 to March 2002

Sex; social indicator		Population		ACS: excluding SCD		ACS: including SCD	
		Number	%†	%‡	OR§	%‡	OR§
Women							
Marital status	Couple living together unmarried	8403	12.1	0.07	0.5*	0.11	0.3*
Family type	No children in house	40724	58.8	0.26	2.1	0.41	3.6***
	Single (no other adults)	17659	25.5	0.21	1.1	0.51	2.3***
Education	Basic school (8–10 grade)	18001	26.0	0.34	8.1***	0.50	9.6***
	Short higher education	3052	4.4	0.03	0.2*	0.07	0.4
	Medium higher education	14616	21.1	0.09	0.3*	0.14	0.6§
	Long higher education	5529	8.0	0.05	0.4*	0.07	0.6**
Economy	Gross income <100000 DKK	5195	7.5	0.52	1.9**	0.85	2.3***
	Gross income <200000 DKK	20727	29.9	0.24	1.3*	0.38	1.1
Socioeconomy	Employees—upper level	8090	11.7	0.05	0.4*	0.06	0.3*
	Employees—medium level	13058	18.9	0.06	0.5*	0.08	0.4**
	Employees—basic level	16035	23.2	0.08	0.7	0.09	0.4**
	Old age pension (age 67+)	2259	3.3	0.62	3.8***	0.97	1.1
Trade	Early retirement pension	5835	8.4	0.62	1.5*	1.22	4.5***
	Retail trade, hotels, restaurants	4841	7.0	0.04	0.3	0.04	0.2*
	Public service sector	29569	42.7	0.08	0.3*	0.10	0.4***
Men							
Marital status	Divorced	7707	11.2	0.74	1.5**	1.28	1.8**
Family type	Married	40454	58.6	0.54	1.0	0.65	0.7***
	Never married	19740	28.6	0.21	0.6**	0.39	0.8*
	Couple living together unmarried	9936	14.4	0.23	0.5*	0.28	0.4*
Education	No children in house	43297	62.7	0.67	2.6***	0.95	3.5***
	Single (no other adults)	14282	20.7	0.64	1.5**	1.34	2.9***
Economy	Basic school (8–10 grade)	14427	20.9	0.64	1.1	0.95	1.3*
	Gross income <100000 DKK	4995	7.2	0.96	1.6*	1.52	1.9***
Socioeconomy	Employees—upper level	11305	16.4	0.26	0.7*	0.31	0.6**
	Employees—medium level	8105	11.7	0.30	0.9	0.33	0.7*
	Unemployed	2694	3.9	1.52	1.4	1.66	1.6*
	Early retirement pension	4507	6.5	1.11	1.9***	2.06	2.8***
Trade	Manufacturing	8974	13.0	0.31	0.6*	0.36	0.5***
	Retail trade, hotels, restaurants	8339	12.1	0.31	0.8*	0.36	0.6§

*p<0.05; **p<0.01; ***p<0.001. †Percentage of total. ‡Percentage of group with characteristics. §Odds ratio controlled for age. Reference group among persons without characteristic.

Table 3 Predictors† of incident acute coronary syndrome (ACS), including and excluding sudden cardiac death (SCD), by sex, among 69247 women and 69043 men aged 30–69 years, residing in Aarhus, Denmark, April 2000 to March 2002

Sex; predictor	ACS: excluding SCD		ACS: including SCD	
	OR	95% CI	OR	95% CI
Women				
Age (years)	1.10‡	1.08 to 1.12	1.08‡	1.06 to 1.10
Single living (no other adults)	–	–	2.0***	1.5 to 2.7
Divorced	–	–	0.6*	0.4 to 0.9
Early retirement pension	2.8***	1.9 to 4.3	2.7***	1.9 to 3.8
Men				
Age (years)	1.33‡	1.16 to 1.53	1.30‡	1.16 to 1.46
Age (years, squared)	0.99*	0.99 to 1.00	0.99**	0.99 to 1.00
Single living (no other adults)	1.4*	1.1 to 1.7	2.6***	2.1 to 3.1
Long higher education	0.6*	0.4 to 0.9	0.5**	0.3 to 0.8
Early retirement pension	1.4***	1.0 to 1.9	1.7**	1.3 to 2.1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. ‡Per year of age. †Based on multiple logistic regression. Total candidate predictor set: age, marital status, family type, citizenship, education, economy, socioeconomic status, and occupation. Model fits, women: $p = 0.3$ and $p = 0.2$ for ACS excluding and including SCD, respectively; men: $p = 0.6$ and $p = 0.6$ for ACS excluding and including SCD, respectively.

variables. The statistical analysis included Pearson's χ^2 test or Fisher's exact test for the 2×2 table and multiple logistic regression. All analyses were performed separately for women and men. Regression models were reduced by forwards selection of variables using the χ^2 distributed $-2 \ln$ (likelihood ratio) and the Wald χ^2 as significance tests. Regression model goodness of fit was estimated by use of the Hosmer-Lemeshow test. We applied $p < 0.05$ as the general level of significance. Individual probabilities of death were estimated based on the

final regression models and combined to continuous predictive risk scales, the predictive validities of which were shown by the areas under receiver operating characteristics (ROC) curves.²¹

RESULTS

Overview

The study population comprised all 138 290 persons aged 30–69 years residing in the municipality of Aarhus by the

Figure 2 Receiver operating characteristics curve (ROC)* based on estimated probabilities of acute coronary syndrome (ACS), including and excluding sudden cardiac death (SCD) by sex, among 69 247 women and 69 043 men in age group 30–69 years residing in Aarhus, Denmark, April 2000 to March 2002.

Table 4 Predictors† of incident acute coronary syndrome (ACS), including and excluding sudden cardiac death (SCD), by sex, among 69247 women and 69043 men aged 30–69 years, residing in Aarhus, Denmark, April 2000 to March 2002

Sex; predictor	ACS: excluding SCD		ACS: including SCD	
	OR	95% CI	OR	95% CI
Women				
Age group 60–69	6.6***	4.6 to 9.4	5.0***	3.4 to 6.7
Single living (no other adults)	1.0	0.7 to 1.5	2.3***	1.7 to 3.0
Men				
Age group 50–69	9.2***	6.8 to 12.5	7.9***	6.2 to 10.1
Single living (no other adults)	1.5**	1.2 to 1.9	2.9***	2.4 to 3.5

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. †Based on multiple logistic regression. Total candidate predictor set: age and single living. Model fits, women: $p = 0.9$ and $p = 0.2$ for ACS excluding and including SCD, respectively; men: $p = 0.5$ and $p = 0.8$ for ACS excluding and including SCD, respectively.

midpoint of the study period. Table 1 shows baseline characteristics of the cohort.

During the 24 months, we identified 457 patients surviving until admission (UAP and MI) and a further 189 cases of SCD. Consequently, crude incidence rate of ACS were 165 and 234 per 100 000 person years excluding and including SCD, respectively. UAP constituted for 16.9%, MI for 53.8%, and SCD 29.3% of ACS cases. There were 22 (4.8%) and 211 (32.7%) who died within 30 days of diagnosis among ACS cases excluding and including SCD, respectively.

Determinants of ACS

In both sexes, the strongest positive bivariate associations with ACS incidence were living as a single, living without

children, low educational level, low gross income, and being a pensioner (table 2). Conversely, the strongest negative associations with ACS incidence were with living unmarried as a couple, high educational level, and being an employee.

In the multivariate analyses, ACS predictors were found to be fairly similar in the two sexes. Predictors positively associated with ACS were age, single living, and early retirement pension. Moreover, among women, low risk of ACS was associated with being divorced, and among men with a high educational level (table 3).

Risk group identification

The predictive validity of estimated ACS probability, based on the four regression models of table 3, (separate for women

Figure 3 Receiver operating characteristics curve (ROC)* based on estimated probabilities of acute coronary syndrome (ACS), including and excluding sudden cardiac death (SCD) by sex, among 69 247 women and 69 043 men in age group 30–69 years residing in Aarhus, Denmark, April 2000 to March 2002.

Table 5 Proportion of area under receiver operating characteristics curves (ROC) with 95% confidence intervals, based on estimated probabilities* of incident acute coronary syndrome (ACS), including and excluding sudden cardiac death (SCD) among 69247 women and 69043 men aged 30–69 years, residing in Aarhus, Denmark, April 2000 to March 2002

Sex; type of logistic regression model	ACS: excluding SCD		ACS: including SCD	
	ROC area (%)	95% CI	ROC area (%)	95% CI
Women				
Complete model based on table 3	79.5	75.6 to 83.3	80.8	77.9 to 83.8
Reduced model based on table 4	69.6	64.4 to 74.9	73.1	69.2 to 77.0
Men				
Complete model based on table 3	80.2	78.2 to 82.3	79.5	77.4 to 81.5
Reduced model based on table 4	74.7	72.3 to 77.1	76.8	74.7 to 78.9

*Based on multiple logistic regression model of table 3 and 4.

and men, including and excluding SCD), as shown by area under the ROC curve (fig 2), ranged from 79.5% to 80.8%. However, we wanted to identify high risk groups in the population based on predictors that were (1) easily accessible from the registers and (2) strongly associated with ACS incidence in both sexes and (3) had a high predictive validity, when used in a reduced regression model. Single living and high age (women 60+ years and men 50+ years) fulfilled these criteria and thus were tested in the reduced regression models (table 4).

The predictive validity of the four reduced models, as indicated by the area under the ROC curve, ranged from 69.6% to 76.8% (fig 3). Based on the reduced model the area was just significantly lower. Among men with ACS including SCD the two areas' confidence limits overlapped (table 5).

As the predictive validity of the reduced model was almost as good as the full model, we chose the simple model to be used for identification of high risk groups in the population.

In women we defined high risk groups as those who were at least 60 years old and singles. In this group we could identify 34.3% of persons with ACS (including SCD), who died within 30 days after the diagnosis, in 5.4% of the female population. The ACS incidence rate was 602 per 100 000 person years in this high risk group as contrasted with the average incidence rate among women of 137 per 100 000 person years (table 6).

In men we defined high risk groups as those who were at least 50 years old and singles. In this group we were able to identify 62.4% of persons with ACS (including SCD), who

What is already known on the topic

Social indicators of acute coronary syndrome, especially low socioeconomic status, a low educational level, and lack of social support have been exploited in different studies. Such determinants are not readily available from the background population.

What this paper adds

We were able to identify high risk groups of acute coronary syndrome based on simple sociodemographic findings from an entire population. Women >60 years living alone and men >50 years living alone were at especially high risk.

died within 30 days after the diagnosis, in 7.7% of the male population. The ACS incidence rate was 1503 per 100 000 person years in this high risk group as contrasted with the average incidence rate among men of 331 per 100 000 person years (table 6).

DISCUSSION

In this cohort study enrolling an entire population of 138 290 residents aged 30–69 years, we were able to combine prospective case finding based on clinical data and definite

Table 6 Risk groups of incident acute coronary syndrome (ACS) including and excluding sudden cardiac death (SCD) by sex, among 69247 women and 69043 men in age group 30–69 years residing in Aarhus, Denmark, April 2000 to March 2002

Parameter		ACS: excluding SCD		ACS: including SCD	
		Age 30–59	Age 60–69	Age 30–59	Age 60–69
Women					
Not single living	IR*	48.5	310.9	54.1	352.4
	%†	64.0	10.4	64.0	10.4
	%‡	0.0	16.7	7.1	10.0
Single living	IR*	46.7	321.0	161.6	601.9
	%†	20.1	5.4	20.1	5.4
	%‡	33.3	50.0	48.6	34.3
		Age 30–49	Age 50–69	Age 30–49	Age 50–69
Men					
Not single living	IR*	57.3	469.8	69.4	509.2
	%†	48.0	31.3	48.0	31.3
	%‡	0.0	37.5	5.7	16.3
Single living	IR*	61.2	756.3	177.9	1503.1
	%†	13.0	7.7	13.0	7.7
	%‡	6.3	56.3	15.6	62.4

*Incidence rate of acute coronary syndrome per 100000 person years. †Percentage of the female and male population group with characteristics. ‡Percentage of the total number of deaths within 30 days after ACS diagnosis.

diagnostic criteria, with the benefits of Danish registers, in which sociodemographic information of each individual resident in the population is available. Danish register data have a high validity as they are generated from compulsory reporting from government authorities for each citizen. As Danish legislation does not require an informed consent for such register studies, there was no non-responsivity. All consecutive cases of possible ACS were included, and each individual case was ascertained according to protocol.

We identified a series of significant sociodemographic predictors of incidence of ACS in the population. Age and single living were both strongly associated to incidence of ACS in women as well as in men and risk group identification could be restricted to application of age and single living without considerable loss of precision. Between 1999 and 2002, the proportion of singles in the municipality of Aarhus increased by 3.3% in the age group 30–69 (Statistics Denmark), providing an additional possible explanation for the increase in MI incidence. ACS incidence is likely to be causally related to single living, as many well established risk factors are clearly associated with single living, for example, smoking, obesity, high cholesterol level, less frequent contacts to the general practitioner, and a decreased tendency or ability to call for help in emergency situations.^{10 14 22 23} The importance of the latter factor is emphasised by our finding that single living is more strongly associated with incidence of ACS including SCD than with incidence of ACS excluding SCD. Moreover, a series of behavioural and psychological factors, associated with single living could be of importance for the ACS risk.^{13 24} Lack of social support, for example, has been well reported to contribute to cardiovascular disease in laboratory animals as well as humans.^{15 25} On the other hand, social isolation may be caused by illness, because some ill persons tend to withdraw from society. In contrast, women being divorced had a low risk of ACS. Being divorced is not equal to living alone, but also other explanatory psychosocial factors may be of importance.

Defining high risk groups in the suggested manner (single women >60 years old and single men >50 years old) leaves a high proportion of false negative results especially in women. Such choices of how to define a high risk group will however always include the question of balancing the false positive results with the false negatives and with the capacity and costs of the number of persons to “screen”. In the present context, the marginal cost of “screening” was however negligible, as it was based on an existing register. Pre-screening of the Danish population with identification of high risk groups, like the ones identified in this study can easily be obtained in countries with well established public registers of high validity. The ethical consequences of screening a certain part of the population is similar to other screening strategies of for example screening women above age 35 for breast cancer or men above age 60 for colon cancer. Problems with false positive and false negative results are unavoidable.

One of the weak points of the study is the limitation in selecting patients of a certain age group. We chose the lower limit of age 30 because the expected number of MI patients

below age 30 would be 5 or less in a background population of our size. The reason for the choice of the upper age limit was (1) limitation in the capacity to identify patients from all admissions and ECG findings on a daily basis, (2) social factors like occupation and socioeconomic status were of strongest interest in the working population, and (3) comorbidity is a pronounced problem in older patients, and (4) other studies in the same category used the same or even more restricted age limits.³ Selection of ACS high risk groups in the suggested manner (single women >60 years old and single men >50 years old) leaves the question of including or excluding persons above age 70 for future population based screening strategies. It seems natural to also include persons above age 70, as the incidence of ACS is known to increase with age, but for the sake of documentation this would be criticisable. As a population aged 30–69 is included, the study determines predictors of premature ACS. Sex based differences are mainly associated to age as women are hit by the disease some 10 years later than men. This is also consistent with the suggested screening strategy.

Although behavioural change may be difficult,²⁶ patients at identified and communicated high risk of disease may be more motivated for smoking cessation, exercise, dietary change, and weight loss. Reducing the level of cholesterol in the population by use of drugs or diet may reduce the occurrence of IHD.^{27 28} Although mass strategies may be effective in preventing IHD occurrence, they cannot be expected to be as cost effective as high risk strategies, for example, the use of statin treatment seems cost effective when applied in high risk groups with increased levels of cholesterol but not in general populations.²⁹ Based on the restricted size of high risk groups, screening for classic risk factors, like family history, diabetes, dyslipidaemia, hypertension, and smoking, as used in well known risk charts,^{6 30} may be performed by general practitioners to form the basis for lifestyle and treatment interventions. Other screening strategies, to further identify persons at high risk of coronary artery disease could include biochemical measurements such as LDL-cholesterol or apolipoprotein B/apolipoprotein AI ratio³¹ and measurements of coronary artery calcium by computed tomography,³² as such examinations are comparatively cheap and with minimal risk of side effects.

CONCLUSIONS

About one of three ACS patients will die within 30 days of the diagnosis. High age and single living are the strongest predictors of ACS. By use of comparatively simple information from a population register, groups with excessive high risk of ACS and high risk of dying from ACS are identifiable. Such groups may be targets for complementary high risk preventive strategies, which may be comparatively cost effective as they entail only small parts of the resident population.

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Policy implications

As sociodemographic risk indicators are easily identifiable, they should be used in future identification of high risk group of acute coronary syndrome. Such high risk groups may be targets for future more focused and cost effective preventive strategies, which may complement population mass interventions.

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Conflicts of interest: none declared.

Ethics: the regional committee of ethics in medical science and the Danish Data Protection Agency approved the study and its database.

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