

Awareness and Treatment of Hypercholesterolemia: Results of the First Survey of the MONICA Project Augsburg

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Introduction

During the last years the cardiovascular risk factor hypercholesterolemia has gained public interest particularly after the final reports of the findings of the Lipid Research Clinics Coronary Primary Prevention Trial (LRC-CPPT). This study showed that a reduction in the serum cholesterol level reduced the incidence of fatal and non-fatal coronary events [1,2]. Consensus conferences were held to establish criteria on how to diagnose and treat moderate- and high-risk levels of serum cholesterol. Two conferences were of particular interest, the conference held by the European Atherosclerosis Society (EAS) in 1987 [3], and the conference of the expert panel of the National Cholesterol Education Program (NCEP) conducted in the USA in 1987 [4]. The treatment recommendations are similar: Start with dietary counseling and, if dietary treatment does not succeed sufficiently, add drug treatment. When establishing a program like the National Cholesterol Education Program, it is important to know something about the extent of the problem in the target population, the attitudes of the affected people and the attitudes of their physicians as well.

In the paper presented here estimates of the prevalence, awareness, and treatment of hypercholesterolemia will be given for a Southern German population. We will determine, if awareness varies by sex or by age. Furthermore, it will be examined, whether people with higher cholesterol levels are more aware of their hypercholesterolemic values than those with lower values.

Study Design and Methods

Study Population

The study population consists of the participants of the first survey of the Monica Augsburg project, which was conducted in 1984/85. A sex-age stratified two-stage cluster sample was drawn from the population registers of the city of Augsburg and of the communities of two surrounding counties (Landkreise) [5]. From the 5312 sampled people, 243 could not be reached and contacted due to errors in the population registers, deaths, or migration. From the remaining 5069 persons, 4022

participated; 3776 were included in the analysis presented here, reflecting a response of 74.5%.

Serum Cholesterol Determination

The blood drawing and handling was performed under standardized conditions. From the sitting participant, 25 ml blood was drawn with minimal tourniquet use. The participants were generally non-fasting. The blood was centrifuged within two hours after venipuncture at 1500 G. This serum was cooled and analyzed within three days. The analyses were done on the autoanalyzer SMAC (Fa. Technicon) using the CHOD-PAP method (Boehringer Mannheim); HDL-cholesterol was precipitated with Phosphatungstate/Mg²⁺ and then analyzed in the same way. Internal and external quality controls were carried out. The external quality control was done by the Lipid Standardization Centre of the World Health Organization in Prague.

Determination of Awareness and Treatment of Hypercholesterolemia

Information on awareness and treatment was gathered in a standardized interview. Awareness was determined by the question: «Have elevated lipid levels been found during the last 12 months?» Drug treatment was determined by current drug use. All drugs taken during the preceding seven days were recorded and coded later according to the West German drug coding list called Rote Liste [6]. All chemically defined drugs of the Rote Liste Group 57 were categorized as lipid-lowering drugs. Dietary treatment also was determined in the interview («Do you maintain a special diet?»). One of the following answers was sufficient for definition of dietary treatment: Low fat intake, low saturated fat intake, low cholesterol intake, high polyunsaturated fat intake, caloric restriction, diet prescribed by a cardiologist.

Definition of Hypercholesterolemia

The definitions of the EAS and of the NCEP were applied and consequently the descriptive analyses were done twice, once with each definition:

EAS, 1987: I: 250–299 mg/dl
II: ≥ 300 mg/dl

NCEP, 1988: I: 200–239 mg/dl + risk status
II: ≥ 240 mg/dl

In the EAS the risk categories are also based on triglyceride levels. Since in our study no triglyceride measurements were carried out, the definitions combine categories defined there and the «low» risk categories with serum cholesterol levels under 250 mg/dl are not used here. The corresponding «low» risk category of the NCEP is used: Cholesterol levels between 200 and 240 mg/dl are defined as risky if a person, having values in this range, has additional risk factors. The risk status is defined by either already having ischemic heart disease (myocardial infarction or myocardial ischemia in the medical history) or having at least two of the following risk factors: male sex, hypertension, current smoking of at least 10 cigarettes per day, severe overweight (defined by Body Mass Index ≥ 27.8 kg/m² for men and ≥ 27.3 kg/m² for women adopted from the NIH consensus conference on «Health Implications of Obesity» [7]; the determination is described elsewhere [8]), diabetes mellitus or cerebrovascular disease in the medical history, premature coronary death in either one of the parents before age 55 (all obtained by the interview), or HDL-cholesterol < 35 mg/dl.

Statistical Analysis

First, descriptive analyses were performed. Tests of differences in the awareness of different age-sex groups were performed (Chi²-test, Fisher's exact test). Logistic regression analyses were carried out for men and women separately to determine predictors of the awareness while controlling for other variables which could confound or affect the proposed relationship between awareness and either age or cholesterol level. Logistic models were calculated including all participants with cholesterol ≥ 240 mg/dl, with awareness as dependent variable (dichotomized), and serum cholesterol (4 categories), age (3 categories), education (dichotomized), hypertension, BMI, smoking (dichotomized as described in definition «risk status») as independent variables. All second-order interactions of cholesterol with the possibly effect modifying variables and with age were tested and eliminated from the model using a backward stepping procedure (exclusion criterion $p > 0.05$).

Results

Prevalence of Hypercholesterolemia

In Figure 1 the prevalences of hypercholesterolemia according to the EAS and to the NCEP definitions are shown. For all definitions the prevalence increases with age. Young men have higher prevalences than young women in the comparable age groups while older women have higher prevalences than older men. Combining the two risk groups according to the definitions of the NCEP, 76% of women in the age group 55–64 years will be labeled as hypercholesterolemic;

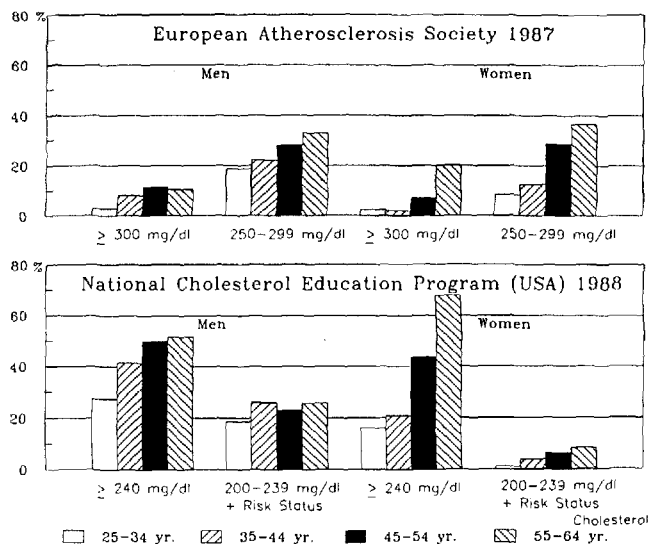


Fig. 1. Prevalence of hypercholesterolemia in the study area Augsburg according to the different definitions of the European Atherosclerosis Society and of the National Cholesterol Education Program. MONICA Project Augsburg; Survey 1984/85.

in young men (age group 25–34) about 45% belong to this risk group. As should be expected, the prevalences vary markedly according to the different definitions.

Awareness of Hypercholesterolemia

In the following tables the youngest age groups were combined to form the age group 25–44. The awareness in this age group is rather low, whereas it is higher in older ages in both sexes (see Table 1). There are no

Tab. 1. Awareness of hypercholesterolemia according to the different definitions of the European Atherosclerosis Society and of the National Cholesterol Education Program.

MONICA Project Augsburg; Survey 1984/85.

	Awareness (in %) in hypercholesterolemic persons (n) defined by									
	European Atherosclerosis Society					National Cholesterol Education Program				
	≥ 300 mg/dl		250–299 mg/dl		Test ¹	≥ 240 mg/dl		200–239 mg/dl + Risk Status		Test ²
	n	%	n	%		n	%	n	%	
Men										
25–44 years	51	13.7	182	6.0	n.s.	311	8.4	199	6.5	n.s.
45–54 years	60	21.7	144	12.5	n.s.	258	15.9	116	7.8	*
55–64 years	52	21.2	163	23.9	n.s.	255	22.4	125	11.2	**
Women										
25–44 years	19	10.5	97	3.1	n.s.	171	3.5	22	9.1	n.s.
45–54 years	34	17.6	139	7.9	n.s.	214	9.4	31	12.9	n.s.
55–64 years	92	38.0	176	15.3	***	320	21.6	40	10.0	n.s.

* P < 0.05; ** p < 0.01; *** p < 0.001

¹ Test on difference between the cholesterol level groups ≥ 300 mg/dl vs. 250–299 mg/dl

² Test on difference between the cholesterol level groups ≥ 240 mg/dl vs. 200–239 mg/dl + risk status

appreciable differences between men and women. Even in the group with the highest risk, that is people with cholesterol levels ≥ 300 mg/dl, no higher awareness is seen, with one exception. Women, aged 55–64 years, with cholesterol levels in this range are significantly more aware than women with lower cholesterol values and than men in the corresponding group, as well. The group with lower risk, 200–239 mg/dl in association with risk status, have a significantly lower awareness than those with values ≥ 240 mg/dl only in men older than 45 years.

Logistic regression models were calculated including all participants with cholesterol values ≥ 240 mg/dl. When controlling for other factors which could possibly explain the better awareness in older ages, for instance presence of other risk factors, the analysis confirmed the descriptive results (see table 2). Only in women do those with higher risk have a significantly higher degree of awareness than those at lower risk. In both men and women, in the model and in stratified

Tab. 2. Effects of age and cholesterol level on awareness of hypercholesterolemia in people with cholesterol ≥ 240 mg/dl controlled for BMI, hypertension, smoking, and education. Results from a multivariate logistic regression analysis.

MONICA Project Augsburg: Survey 1984/85.

	Men (n = 817)			Women (n = 688)		
	coeff.	std.err.	p	coeff.	std.err.	p
Age 45–54 years	0.72	0.275	< 0.01	0.76	0.492	n.s.
Age 55–64 years	1.23	0.267	< 0.001	1.52	0.462	< 0.001
Chol. 260–279 mg/dl	0.02	0.273	n.s.	-0.08	0.361	n.s.
Chol. 280–299 mg/dl	0.16	0.284	n.s.	0.23	0.362	n.s.
Chol. ≥ 300 mg/dl	0.30	0.275	n.s.	1.20	0.298	< 0.001
Intercept*	-2.64	0.286	-	-3.42	0.461	-
R		0.131			0.279	

* The intercept contains the age group 25–44, cholesterol 240–259 mg/dl, non-hypertensives, non-smokers and smokers < 10 cigs./day, persons with normal weight and low education (primary school only, 7–8 years of education).

analyses there is a consistent but non-significant trend for awareness to increase with increasing cholesterol values. In women the prevalence odds ratio for awareness in high risk (≥ 300 mg/dl) compared to the low risk group (240–259 mg/dl) is about 4.

Lipid-lowering Drug Use in the Population

The prevalence of lipid-lowering drug use is very low (2% in men, 1% in women). None of the participants in the age group 25–34 years consumed lipid-lowering drugs. In men the drug use is higher in the older age groups, while in women only those of the oldest age group used lipid-lowering drugs. In Table 3 the percent distributions of the different drugs or drug combinations are listed according to their generic names. Seventy two percent of the drugs used are fibric acid

Tab. 3. Treatment of hypercholesterolemia. Lipid-lowering drug use (percentage use of different preparations) MONICA Project Augsburg: Survey 1984/85.

	% of drug users (n = 53)
Derivatives and analogs of fibric acid:	
Bezafibrate	38
Bezafibrate/ β -Sitosterol	2
Clofibrate	6
Clofibrate/Inositolnicotinate	2
Etofibrate	17
Fenofibrate	6
Gemfibrocil	2
β -Sitosterol	9
Colestipol	2
Probucol	4
Mg-Pyridoxal-5-Phosphate-Glutaminat	13

and derivatives or analogs of fibric acid. Cholestipol or nicotinic acid, the first choice drugs, contribute with only 4%.

Drug Treatment of Hypercholesterolemia

None of the 25–34 year old male participants and none of the 25–54 year old female participants with hypercholesterolemic values took lipid lowering drugs. The highest prevalence of drug treatment was about 7% in the age group 55–64. No significant difference in drug treatment could be found among different risk groups, particularly between people with levels ≥ 300 mg/dl compared to people at lower risk.

Dietary Treatment of Hypercholesterolemia

Only 1% of all men and 4% of all women with cholesterol levels ≥ 300 mg/dl reported following a diet regimen with lowered saturated fat and/or cholesterol and/

Tab. 4. Dietary treatment of hypercholesterolemia according to the different definitions of the European Atherosclerosis Society and of the National Cholesterol Education Program.

MONICA Project Augsburg: Survey 1984/85.

	Dietary treatment in (%) in hypercholesterolemic persons (n) defined by							
	European Atherosclerosis Society				National Cholesterol Education Program			
	≥ 300 mg/dl	250–299 mg/dl			≥ 240 mg/dl	200–239 mg/dl + Risk Status		
	n	%	n	%	n	%	n	%
Men								
25–44 years	51	9.8	182	5.5	311	6.8	199	6.5
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55–64 years	52	17.3	163	15.3	255	15.7	125	11.2
Women								
25–44 years	19	0.0	98	13.3	172	12.2	22	18.2
45–54 years	34	14.1	139	10.1	214	12.5	31	16.1
55–64 years	92	17.4	176	15.3	320	16.9	40	20.0

or increased polyunsaturated fat content (none in the 25–44 age group in both sexes). The corresponding percentage for the 250–299 mg/dl group was 1% in both sexes. When including all diets included in the definition of dietary treatment, a higher dietary treatment status was achieved in almost all age-sex groups and risk groups (see table 4). There were no significant differences in prevalence of dietary treatment among the different definitions of hypercholesterolemia. Women seem to be more often under dietary treatment than men (statistically significant with $p < 0.05$ only in the younger age group).

Discussion

The prevalence of hypercholesterolemia, defined according to the recently held consensus conferences, is high in the examined population in Southern Germany. The awareness of hypercholesterolemia is low in younger people, as well as in the high risk group with cholesterol values ≥ 300 mg/dl. Persons, aged 45–64 years, show a higher degree of awareness than younger people. The logistic regression analysis showed that in participants with cholesterol values ≥ 240 mg/dl the awareness is not increasing with increasing cholesterol levels in men, and in women only those with cholesterol levels ≥ 300 mg/dl have a higher proportion of awareness than those with lower levels. Women tend to be less aware than men in all age groups with the exception of age group 55–64 years. This finding is in contrast to that found in people with hypertension, where in different German populations women have been consistently found to be more aware of their high blood pressure than men [8,9,10]. The logistic model shows, that the presence of other risk factors does not improve the awareness considerably. The prevalence of lipid-lowering drug use is very low. Dietary therapy seems to be low and most likely insufficient. Taking into account, that dietary treatment in our study is not defined stringently enough, the dietary treatment should be lower than it is reported here. In conclusion we can say, that there is a large need for the identification and effective management of hypercholesterolemia in the examined population in Southern Germany.

Summary

In the first survey of the MONICA project Augsburg (1984/1985), awareness and treatment of hypercholesterolemia was determined among a two-stage cluster sample of 5069 25–64 year old citizens (participation 79.6%). Hypercholesterolemia was defined according to the Conference of the European Atherosclerosis Society (EAS) and the National Cholesterol Education Program (NCEP). Awareness (elevated lipid levels found during the last 12 months), and drug and dietary treatment were determined by an interview. The awareness was low and varied between 4 and 24% in the different age-sex groups with no significant differences between sexes, with one exception: The awareness in women aged 55–64 years with cholesterol levels ≥ 300 mg/dl was 38% and differed significantly from that found in men in the same age group (21%). Older participants showed a higher degree of awareness than younger; in men the

awareness was independent from the cholesterol level, in women those with higher levels showed a better awareness than those with lower levels (results from a logistic regression analysis for cholesterol levels ≥ 240 mg/dl). The use of lipid-lowering drugs was low in the study population (2% in men, 1% in women). The drug treatment of hypercholesterolemia was low and in no age-sex group higher than 7%, despite the definition of hypercholesterolemia; the dietary treatment was not higher than 20%. In conclusion it is shown, that there is a great need for the identification and management of hypercholesterolemia in the examined population in Southern Germany.

Résumé

Connaissance et traitement de l'hypercholestérolémie: résultats de la première enquête de population MONICA à Augsburg

La première enquête de population du projet MONICA à Augsburg, réalisée en 1984–85 sur un échantillon aléatoire de 5069 sujets âgés de 25 à 64 ans, a permis de déterminer dans quelle mesure les gens ont conscience de leur hypercholestérolémie et la traitent en conséquence. Les critères de délimitation retenus sont ceux de la conférence de l'«European Atherosclerosis Society» et des «National Cholesterol Education Program». En règle générale, le niveau de connaissance de l'hypercholestérolémie est faible, mais augmente avec l'âge: de 4% chez les plus jeunes, il s'élève au-delà de 55 ans à 21% chez les hommes et 38% chez les femmes, pour un cholestérol dépassant 300 mg/dl. C'est uniquement chez ces dernières que la prise de conscience augmente avec la gravité de l'hypercholestérolémie. Moins de 20% des personnes atteintes suivent un traitement diététique et moins de 7% reçoivent des médicaments anti-lipidiques. En conclusion: il faut que des moyens plus importants soient mis en oeuvre pour détecter les cas d'hypercholestérolémie et intensifier son traitement.

Zusammenfassung

Bekanntheits- und Behandlungsgrad der Hypercholesterinämie: Ergebnisse der ersten Querschnittsstudie des MONICA-Projektes Augsburg

Im Rahmen der ersten Querschnittsstudie des MONICA-Projektes Augsburg wurden an einer zweistufigen Clusterstichprobe der 25- bis 64jährigen Bevölkerung ($n=5069$, Beteiligung 79.6%) der Bekanntheits- und Behandlungsgrad der Hypercholesterinämie untersucht. Die Definition der Hypercholesterinämie erfolgte in Anlehnung an Konferenzen der European Atherosclerosis Society (EAS) und des National Cholesterol Education Program (NCEP). Der Bekanntheitsgrad (erhöhte Blutfette im Laufe der letzten 12 Monate festgestellt), der diätetische und medikamentöse Behandlungsgrad wurden im Interview erhoben. Der Bekanntheitsgrad war niedrig und variierte zwischen 4 und 24% in den einzelnen Alters- und Geschlechtsgruppen, wobei keine signifikanten Geschlechtsunterschiede bestanden, mit einer Ausnahme: Bei den 55- bis 64jährigen Frauen mit Cholesterinwerten ≥ 300 mg/dl betrug er 38% und unterschied sich signifikant von dem gleichaltriger Männer (21%). Ältere Teilnehmer wiesen einen signifikant höheren Bekanntheitsgrad auf als jüngere; der Bekanntheitsgrad war bei Männern unabhängig von der Höhe des Cholesterinspiegels, bei Frauen war er bei Cholesterinwerten ≥ 300 mg/dl höher als bei niedrigeren Werten (Ergebnisse einer logistischen Regressionsanalyse an Probanden mit Werten ≥ 240 mg/dl). Die Einnahme lipidsenkender Präparate war in der Studienpopulation sehr niedrig (Männer: 2%; Frauen: 1%). Der medikamentöse Behandlungsgrad war in keiner Alters- und Geschlechtsgruppe und für keine Definition der Hypercholesterinämie höher als 7%, der diätetische Behandlungsgrad nicht höher als 20%. Zusammenfassend läßt sich feststellen, daß ein großer Bedarf besteht, Strategien zur Auffindung und Behandlung von Personen mit erhöhten Cholesterinspiegeln zu entwickeln.

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