

English version of "Verbreitung von Fettstoffwechselstörungen bei Erwachsenen in Deutschland. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1)"

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Prevalence of dyslipidemia among adults in Germany

Results of the German Health Interview and Examination Survey for Adults (DEGS1)

Background and purpose

Dyslipidemia is one of the most important known and modifiable risk factors for the development of coronary heart disease (CHD) [1]. Of prognostic relevance are changes in blood lipid concentrations (dyslipidemia), in particular elevated concentrations of total cholesterol and of cholesterol attached to low-density lipoprotein (LDL) as well as low concentrations of cholesterol attached to high-density lipoprotein (HDL) [2].

Total and HDL cholesterol concentrations are frequently used to assess the prevalence of dyslipidemia in the population [3]. However, responsiveness to therapy and the benefit of lipid-lowering medication for cardiovascular risk have until now only been demonstrated for LDL cholesterol. Evidence-based treatment guidelines therefore refer primarily to this parameter [4, 5, 6, 7]. Compared to LDL cholesterol, total and HDL cholesterol concentrations are influenced to a far lesser degree by the time at which food was last ingested [3, 8, 9]. In large epidemiological studies it is frequently not feasible or feasible for part of the survey population only to determine fasting blood lipid concentrations following a sufficiently long fasting period. Thus, in many countries it has become established practice to measure total cholesterol and HDL cholesterol concentrations in order to assess dyslipidemia for health monitoring of the population [3, 10, 11]. The percentage of

persons with dyslipidemia in the population in which the person affected is aware of it (level of awareness) and the percentage of people being treated for diagnosed dyslipidemia (level of treatment) are additional indicators for the implementation of prevention programmes.

This report is intended to provide current estimates of the distribution of total and HDL cholesterol concentrations among adults 18–79 years of age in Germany. In addition, it provides analysis of the overall prevalence of dyslipidemia and the levels of awareness and treatment of dyslipidemia using measured total cholesterol concentrations, using self-reports of participants as to whether they have ever been diagnosed with dyslipidemia and using documented consumption of lipid-lowering medication.

Methods

The German Health Interview and Examination Survey for Adults ("Studie zur Gesundheit Erwachsener in Deutschland", DEGS) is part of the health monitoring system at the Robert Koch Institute (RKI). The concept and design of DEGS are described in detail elsewhere [12, 13, 14, 15, 16]. The first wave (DEGS1) was conducted from 2008–2011 and comprised interviews, examinations and tests [17, 18]. The target population comprises the resident population of Germany aged 18–79 years. DEGS1 has a mixed design, which permits both cross-sectional

and longitudinal analyses. For this purpose, a random sample from local population registries was drawn in addition to persons who participated in the German National Health Interview and Examination Survey 1998 (GNHIES98) and also took part in DEGS1. A total of 8,152 persons participated, including 4,193 first-time participants (response rate 42%) and 3,959 persons who previously participated in GNHIES98 (response rate 62%). There were 7,238 persons who attended one of the 180 examination centres, and 914 were interviewed only. Across the age range 18–79 years, the net sample (n=7,988, including 7,116 in study centres) permits representative cross-sectional analyses as well as time trend analyses based on comparison with GNHIES98 [16]. The data of revisiting GNHIES98 participants can be used for longitudinal analyses. The cross-sectional and longitudinal analyses are conducted using a weighting factor, which corrects deviations in the sample from the population structure (as of 31 Dec 2010) with respect to age, sex, region and nationality as well as type of municipality and education [16]. A separate weighting factor was generated for the examination part of the study. The calculation of the weighting factor also considered the probability of repeat participation among GNHIES98 participants, based on a logistic regression model. A non-response analysis and comparison of selected indicators using data from census statistics show that the

Tab. 1 Mean (95% confidence interval) total cholesterol (n=7,038) and HDL cholesterol (n=7,045) concentrations among adults in Germany according to age group and sex, DEGS1 2008–2011

Age group (years)					
Sex	18–29	30–44	45–64	65–79	Overall
Total cholesterol (mg/dL)					
Women	179.2(175.4–183.1)	188.8(185.2–192.4)	217.8(214.6–221.0)	224.7(220.6–228.8)	205.1(202.6–207.5)
Men	170.1(166.3–173.9)	204.1(200.0–208.2)	210.5(206.8–214.3)	204.9(200.9–209.0)	200.1(197.8–202.4)
Overall	174.6(171.8–177.3)	196.6(193.7–199.4)	214.2(211.4–216.9)	215.6(212.7–218.4)	202.6(200.6–204.6)
HDL cholesterol (mg/dL)					
Women	60.6(59.3–61.9)	59.7(58.6–60.9)	62.2(61.1–63.4)	60.2(59.0–61.4)	60.9(60.1–61.6)
Men	47.7(46.7–48.7)	47.8(46.6–48.9)	50.1(49.0–51.1)	50.3(49.4–51.2)	49.1(48.4–49.7)
Overall	54.0(53.0–55.1)	53.6(52.7–54.5)	56.1(55.2–57.1)	55.6(54.8–56.5)	55.0(54.4–55.6)

Weighted results for mean values in mg/dL, 38.67 mg/dL = 1 mmol/L; cholesterol level in mg/dL \times 0.0258598 = cholesterol level in mmol/L.

net sample is highly representative of the resident population aged 18–79 years in Germany [16].

Study population

The following analyses are based on data from men and women who participated in the examinations in DEGS1 and for whom measurements of serum total cholesterol concentration (n=7,038) and serum HDL cholesterol concentration (n=7,045) were available. Where additional variables are included, the overall number of observations is slightly lower due to missing data and the total number is shown accordingly.

Data and definitions

Laboratory values were determined using serum samples obtained from blood taken in the study centres [18]. Serum concentrations of total cholesterol and HDL cholesterol were determined within 6 weeks after blood collection using an enzymatic procedure (Architect ci8200, Abbott, Germany) in serum samples that had been frozen (–40°C) over the intervening period and had not previously been thawed. The processes of taking blood, obtaining samples and transporting samples as well as the analyses were carried out in accordance with standardised operational procedures [15, 17, 18].

Classification of total cholesterol concentrations into cardiovascular risk categories was carried out using the European Society of Cardiology's (ESC) [7] current guideline recommendations and concentrations ≥ 190 mg/dL (approx.

5.0 mmol/L) were defined as elevated. In accordance with the recommendations of the US Adult Treatment Panel III (ATP III) in the National Cholesterol Education Program [19] and with European Cardiovascular Disease Statistics [10], values ≥ 240 mg/dL (approx. 6.2 mmol/L) were additionally defined as highly elevated. For reasons of comparability with the current results from the US National Health and Nutrition Examination Surveys (NHANES), the classification of HDL cholesterol concentrations was also based on ATP III recommendations and values < 40 mg/dL (approx. 1.0 mmol/L) were defined as low [3, 7]. In contrast to total cholesterol, for HDL cholesterol the ESC guidelines recommend gender-specific thresholds (< 40 mg/dL for men, < 45 mg/dL for women) [7].

As part of the standardised computer-assisted personal interview (CAPI) by a study physician, information on diagnosed dyslipidemia was obtained by asking the question: "have you ever been diagnosed with dyslipidemia by a doctor?" [15, 17]. Dyslipidemia was defined as total cholesterol level ≥ 190 mg/dL or the response "yes" to the question regarding diagnosed dyslipidemia. Here a distinction was made between known dyslipidemia ("yes" response to the question of diagnosed dyslipidemia, regardless of total cholesterol level) and previously unknown dyslipidemia (total cholesterol level ≥ 190 mg/dL and a "no" or "don't know" response to the question of diagnosed dyslipidemia). The percentage of people with known dyslipidemia (level of awareness) was calculated as the ratio of the prevalence of

known dyslipidemia to the overall prevalence of dyslipidemia.

As part of the standardised medication interview, which features automatic registration and identification of medications being taken, data were collected on the current usage of lipid-lowering medication [15, 17, 20]. All medications included in ATC subgroup C10 were defined as lipid-lowering. The level of treatment is defined as the proportion of all persons with known dyslipidemia who are being treated for it.

Socioeconomic status was determined using an index, which includes details of formal education and vocational training, occupational status and net household income (weighted by household needs) permitting classification into low, medium and high status groups [21].

Statistical analysis

After stratification by age group (18–29, 30–44, 45–64, 65–79 years) and sex, the mean total and HDL cholesterol concentrations were calculated with 95% confidence intervals (CI). Age- and gender-specific prevalence figures (95% CI) for elevated (≥ 190 mg/dL) and highly elevated (≥ 240 mg/dL) total cholesterol concentrations and for low (< 40 mg/dL) HDL cholesterol concentrations were calculated as percentages of the total number of people with valid laboratory values for the relevant lipid parameters. Age- and gender-specific prevalence figures (95% CI) for known dyslipidemia, previously undiagnosed dyslipidemia and overall dyslipidemia were calculated as percentages of the total number of

people with an available total cholesterol value and a valid response (“yes”, “no” or “don’t know”) to the question regarding diagnosed dyslipidemia. Persons who did not respond to the question regarding diagnosed dyslipidemia or for whom there were no laboratory readings for total cholesterol level were excluded from these analyses.

Logistic regression was used to analyse the correlation between socioeconomic status and the following dichotomous target variables:

- high total cholesterol concentrations (≥ 190 mg/dL; ≥ 240 mg/dL),
- level of awareness among all people with dyslipidemia, and
- level of treatment among people with known dyslipidemia.

Age group, sex and place of residence (federal states of former West Germany or of former East Germany and Berlin) were included as covariables.

All the results shown are weighted. In order to take into account both the weighting and the correlation of participants within one municipality, confidence intervals and p values were determined using SPSS 20 procedures for complex samples. Differences are considered statistically significant if the respective 95% confidence intervals do not overlap.

Results

Distribution of total cholesterol and HDL cholesterol concentrations

The mean total cholesterol concentration is 200.1 mg/dL (5.17 mmol/L) among men and 205.1 mg/dL (5.30 mmol/L) among women (■ **Tab. 1**). Apart from in the age group 30–44 years, the age group-specific means and the overall mean for women are significantly higher than for men. The mean values for women increase continuously and significantly from the youngest to the oldest age group. Among men the mean total cholesterol concentration increases significantly from the youngest age group to the 30–44 years age group. Among men in the upper age groups there is no further significant increase.

The mean HDL cholesterol concentration is 49.1 mg/dL (1.27 mmol/L) among

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Prevalence of dyslipidemia among adults in Germany. Results of the German Health Interview and Examination Survey for Adults (DEGS1)

Abstract

Interview and laboratory data from the first wave of the German Health Interview and Examination Survey for Adults (DEGS1) from 2008–2011 were used to provide current estimates of the prevalence of dyslipidemia which are representative of the population in Germany 18–79 years of age. A total of 56.6% of men and 60.5% of women 18–79 years have elevated serum total cholesterol concentrations in excess of the currently recommended threshold of 190 mg/dL; 17.9% of men and 20.3% of women have highly elevated total cholesterol concentrations ≥ 240 mg/dL. A total of 19.3% of men and 3.6% of women have high density lipoprotein cholesterol concentrations below 40 mg/dL.

The overall prevalence of dyslipidemia (total cholesterol ≥ 190 mg/dL or medical diagnosis of dyslipidemia) is 64.5% for men and 65.7% for women. Of these, more than half of both men and women have previously undiagnosed dyslipidemia. Among persons with known dyslipidemia, 30.8% take lipid-lowering medication. Dyslipidemia is widely prevalent among adults in Germany. More in-depth analyses will examine time trends in the prevalence of dyslipidemia in Germany and in an international comparison.

Keywords

Dyslipidemia · Germany · Adults · Health survey · Prevalence

Verbreitung von Fettstoffwechselstörungen bei Erwachsenen in Deutschland. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1)

Zusammenfassung

Interview- und Labordaten der ersten Erhebungswelle der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1) 2008–2011 wurden genutzt, um aktuelle und für die Bevölkerung im Alter von 18 bis 79 Jahren in Deutschland repräsentative Einschätzungen zur Verbreitung von Fettstoffwechselstörungen vorzunehmen. Insgesamt haben 56,6% der Männer und 60,5% der Frauen im Alter von 18 bis 79 Jahren ein erhöhtes Serum-Gesamtcholesterin oberhalb des aktuell empfohlenen Grenzwertes von 190 mg/dl; 17,9% der Männer und 20,3% der Frauen haben ein stark erhöhtes Gesamtcholesterin von ≥ 240 mg/dl. Einen HDL-Cholesterinwert von 40 mg/dl unterschreiten insgesamt 19,3% der Männer und 3,6% der Frauen. Die Gesamtprävalenz von Fettstoffwechselstörungen

(Gesamtcholesterin ≥ 190 mg/dl oder ärztliche Diagnose einer Fettstoffwechselstörung) beträgt 64,5% für Männer und 65,7% für Frauen; davon haben jeweils mehr als die Hälfte der betroffenen Personen eine bislang unerkannte Dyslipidämie. Lipidsenkende Medikamente werden von 30,8% der Personen mit bekannter Dyslipidämie eingenommen. Fettstoffwechselstörungen sind bei Erwachsenen in Deutschland weit verbreitet. Vertiefende Auswertungen werden die zeitliche Entwicklung in der Prävalenz von Fettstoffwechselstörungen in Deutschland und im internationalen Vergleich untersuchen.

Schlüsselwörter

Fettstoffwechselstörung · Deutschland · Erwachsene · Gesundheitssurvey · Prävalenz

men and 60.9 mg/dL (1.57 mmol/L) among women. With respect to the mean there are virtually no differences between the different age groups among women, with the exception of a significantly higher mean for the age group 45–64 years as compared to age group 30–44 years. Significantly higher mean values are evident among men 45 years and older compared to men in the age groups up to 45 years.

Elevated total cholesterol concentrations ≥ 190 mg/dL were found in 60.5% of women and 56.6% of men (■ **Tab. 2**). Highly elevated total cholesterol concentrations ≥ 240 mg/dL are found in 20.3% of women and 17.9% of men. Among men the prevalence estimates for elevated and highly elevated total cholesterol concentrations show a sharp increase from age group 18–29 years to age group 30–

Tab. 2 Prevalence of risk categories for total cholesterol (n=7,038) and HDL cholesterol (n=7,045) as percentages (95% confidence interval) according to age group and sex, DEGS1 2008–2011

Age group (years)					
Sex	18–29	30–44	45–64	65–79	Overall
Total cholesterol ≥190 mg/dL (approx. 5.0 mmol/L)					
Women	32.8(28.3–37.6)	42.9(38.0–47.8)	76.1(73.0–79.0)	78.2(74.1–81.9)	60.5(57.9–63.0)
Men	25.9(21.8–30.6)	61.4(56.4–66.1)	65.7(61.4–69.8)	63.5(58.8–68.0)	56.6(54.0–59.1)
Overall	29.3(26.3–32.4)	52.3(48.8–55.8)	70.9(68.1–73.6)	71.4(68.4–74.3)	58.5(56.5–60.6)
Total cholesterol ≥240 mg/dL (approx. 6.2 mmol/L)					
Women	6.6(4.5–9.4)	8.9(6.7–11.8)	27.2(24.1–30.4)	33.9(29.8–38.2)	20.3(18.6–22.2)
Men	4.2(2.4–7.0)	19.3(15.9–23.2)	23.2(20.1–26.7)	19.3(15.7–23.6)	17.9(16.1–19.8)
Overall	5.3(4.0–7.1)	14.2(12.2–16.5)	25.2(22.9–27.7)	27.2(24.4–30.1)	19.1(17.8–20.5)
HDL cholesterol <40 mg/dL (approx. 1.0 mmol/L)					
Women	2.4(1.3–4.2)	4.0(2.6–6.1)	3.4(2.3–4.9)	4.8(3.2–7.1)	3.6(2.9–4.5)
Men	21.6(17.5–26.3)	23.2(18.9–28.1)	17.4(14.5–20.8)	15.4(12.5–18.8)	19.3(17.2–21.6)
Overall	12.1(9.9–14.9)	13.8(11.3–16.7)	10.4(8.7–12.4)	9.7(8.1–11.6)	11.4(10.2–12.8)

Weighted results as percentages (95% confidence intervals).

44 years. Among men 30 years and older there are no further significant differences between age groups. Among women the prevalence of elevated total cholesterol concentrations increases continuously and significantly from approximately a third in the youngest age group to 76.1% in the age group 45–64 years with respect to the 190 mg/dL threshold, and from 6.6 to 27.2% with respect to the 240 mg/dL threshold. There is no further significant increase in the oldest age group. The highest relative increase in the prevalence of elevated cholesterol concentrations among women is consistently found between age group 30–44 years and age group 45–64 years.

A total of 19.3% of men and 3.6% of women have low HDL cholesterol concentrations (■ Tab. 2). While no significant differences according to age group are evident among women, the prevalence of low HDL cholesterol concentrations decreases significantly in men above 45 years of age; the prevalence drops from over 20% in the younger age groups to 17.4% in the age group 45–64 years and to 15.4% in the age group 65–79 years.

Prevalence, level of awareness and level of treatment

Taking into account both reported medical diagnoses of dyslipidemia and total cholesterol concentrations ≥190 mg/dL, for both sexes together almost two thirds of all adults aged 18–79 years have dyslipidemia (■ Tab. 3). The prevalence increases significantly from the youngest to the oldest age group, rising from 27.3 to 81.4% among men and from 34.2 to 90.0% among women.

Over a third both of men and of women 18–79 years of age have previously undiagnosed dyslipidemia. Dyslipidemia is known to be present, on the other hand, in a total of 28.1% of men and 27.1% of women, with a significant increase in prevalence with increasing age and with no significant differences between sexes (■ Tab. 3). The level of awareness of dyslipidemia increases in both sexes from around 15% in the youngest age group to over 60% in the oldest. The respective overall levels of awareness are considerably lower than 50% for both sexes, with a proportion of 43.6% for men and 41.2% for women (data not shown in ■ Tab. 3). Nearly identical results on known dyslipidemia were obtained when data were included from study participants who were surveyed by means of interview on-

ly and were not examined in study centres (complete data for n=7,947 among n=7,988). For example, the prevalence of known dyslipidemia was 27.8% (95% CI 26.2–29.6) among men and 27.5% (95% CI 25.9–29.2) among women.

Of people with known dyslipidemia 30.8% currently take lipid-lowering medication (level of treatment 29.1% among women, and 32.3% among men). The level of treatment increases continuously with increasing age among both men and women: 0.0% for persons aged 18–29 years, 10.1% for those aged 30–44 years, 25.8% for those aged 45–64 years, and 47.3% for those aged 65–79 years (data not shown in ■ Tab. 3).

The results from the logistic regression analyses adjusted for age, sex and place of residence show no significant correlation between socioeconomic status and either presence of elevated total cholesterol concentrations or level of treatment. However, level of awareness of having dyslipidemia is significantly higher among people with medium socioeconomic status than those with low socioeconomic status (data not shown).

Discussion

According to the available results from DEGS1 more than half of men and women aged 18–79 years in Germany have elevated serum total cholesterol concentrations above the currently recommended threshold of 190 mg/dL. Of these, approximately one third of both men and of women have highly elevated total cholesterol concentrations ≥240 mg/dL. 19.3% of men, but only 3.6% of women have HDL cholesterol concentrations below the 40 mg/dL threshold minimum. The mean values for total and HDL cholesterol concentrations are significantly higher for women than for men. Viewed in combination as having a reported medical diagnosis of dyslipidemia or elevated total cholesterol concentrations, approximately two thirds of men and women have dyslipidemia and in just over 50% of cases of both men and women dyslipidemia was previously undiagnosed. The level of treatment for known dyslipidemia overall is 30.8%, with no significant difference between sexes. There is evidence

Tab. 3 Prevalence of dyslipidemia when taking into account reported medical diagnosis and total cholesterol concentrations ≥ 190 mg/dL (approx. 5.0 mmol/L) ($n=7,013$) as percentages (95% confidence intervals) according to age group and sex

	Age group (years)				
Dyslipidemia	18–29	30–44	45–64	65–79	Overall
Women					
<i>Dyslipidemia overall</i>	34.2(29.8–38.9)	46.6(41.7–51.5)	80.5(77.6–83.2)	90.0(87.0–92.3)	65.7(63.3–68.0)
– Known	5.2(3.4–7.7)	12.7(10.2–15.7)	32.1(29.1–35.2)	54.7(50.8–58.5)	27.1(25.4–28.9)
– Previously undiagnosed	29.1(24.8–33.7)	33.8(29.1–38.9)	48.4(44.6–52.3)	35.3(31.8–39.0)	38.6(36.2–41.0)
Men					
<i>Dyslipidemia overall</i>	27.3(23.1–31.9)	64.6(59.8–69.1)	75.6(72.1–78.8)	81.4(77.5–84.7)	64.5(62.0–66.9)
– Known	4.2(2.5–7.1)	18.3(14.9–22.2)	36.6(33.5–39.8)	49.9(45.5–54.4)	28.1(26.2–30.0)
– Previously undiagnosed	23.1(19.1–27.5)	46.3(41.4–51.2)	39.0(35.2–43.0)	31.4(27.4–35.8)	36.4(34.0–38.9)
Overall					
<i>Dyslipidemia overall</i>	30.7(27.7–33.8)	55.7(52.2–59.2)	78.1(75.7–80.2)	86.0(83.5–88.2)	65.1(63.1–67.0)
– Known	4.7(3.4–6.4)	15.6(13.4–18.0)	34.3(32.2–36.6)	52.5(49.5–55.4)	27.6(26.4–28.8)
– Previously undiagnosed	26.0(23.1–29.1)	40.2(36.7–43.7)	43.7(40.7–46.8)	33.5(31.0–36.1)	37.5(35.6–39.5)

Weighted results as percentages (95% confidence intervals).

of socioeconomic inequality with respect to level of awareness, but not with respect to level of treatment or to the presence of elevated total cholesterol concentrations.

Prevalence

Nationally representative data on the prevalence of hypercholesterolemia among adults in Germany was last provided by GNHIES98. At that time, 72.6% of men and 74.9% of women aged 18–79 years had total cholesterol concentrations of 200 mg/dL or more; 32.2% of men and 34.9% of women had concentrations of 250 mg/dL or higher [22]. Direct comparison of the values obtained in GNHIES98 and DEGS1 is not possible within the scope of this study, since a change in the measurement devices used first necessitates cross-calibration of the cholesterol level readings from both examination surveys. However, in view of the fact that the thresholds for elevated total cholesterol and highly elevated total cholesterol were lowered in the interim from 200 to 190 mg/dL and from 250 to 240 mg/dL respectively [7, 10, 19, 23], the prevalence of elevated total cholesterol observed in DEGS1 suggests that there has been a decline.

A previous analysis investigated time trends in hypercholesterolemia among adults in Germany based on data from GNHIES98 and from earlier national health surveys carried out as part of the German Cardiovascular Prevention Sur-

vey (“Deutsche Herz-Kreislauf-Präventionsstudie”, DHP) [24]. However, the data presented here from DEGS1 cannot simply be dovetailed with these data due to important methodological differences. For reasons of comparability among the older surveys, for instance, only persons aged 30–69 years from former West Germany were included. Furthermore, with regard to diagnosed dyslipidemia and lipid-lowering medication, all the data analysed came from questionnaires that participants could fill in themselves, and not from medical interviews and a standardised medication interview, as is the case in DEGS1.

Analyses of data from the National Health and Nutrition Examination Surveys (NHANES) from six cross-sectional surveys between 1999/2000 and 2009/2010 show a marked drop in the prevalence of highly elevated total cholesterol concentrations of 240 mg/dL or higher for the population 20 years of age and older in the USA. The relative drop is slightly greater for men, at approximately 29% as compared to about 27% for women. Prevalence estimates for the Caucasian population of the USA resulting from the 1999/2000 NHANES survey are 11.4% for men and 15.4% for women [3] and are thus considerably lower than comparable estimates for Germany based on data from DEGS1. By contrast, with figures of 31.9% for men and 11.0% for women in the Caucasian population of the USA, low HDL cholesterol concen-

trations of less than 40 mg/dL are clearly far more common there than in Germany. Exact comparisons, however, again require cross-calibration of survey data, since although the laboratory methods are comparable in principle, there are differences between NHANES and DEGS1 with respect to preanalytical conditions, measurement devices and reagents.

Levels of awareness and treatment

Just over a quarter of men and women 18–79 years of age have known dyslipidemia. This means that there is a level of awareness in both sexes of considerably less than 50%. To date there is no data available from Germany for cross-sectional comparison or for assessment of trends. Results from the Behavioral Risk Factor Surveillance System (BRFSS) 2009 for the population of the USA aged 18 years of age and older shows that total cholesterol concentrations had been determined for 77.6% of women and 74.5% of men within the preceding 5 years. The proportion of people in this group with known hypercholesterolemia was 37.5% for men and 32.6% for women [25]. Thus the prevalence of known hypercholesterolemia can be estimated at just over a quarter, so that the results from the BRFSS generally show a good level of consistency with the estimates from DEGS1. Periodically collected representative data are available from the BRFSS for the years 2005, 2007 and

2009, which confirm a slight, yet continuous and significant increase both in the percentage of persons who underwent cholesterol measurement and in the prevalence of known hypercholesterolemia between 2005 and 2009. Totalling at about 31%, the level of treatment among people with known hypercholesterolemia in DEGS1 was just under a third. The levels of treatment observed in NHANES 1999–2006 and in the Swiss national health interview survey of 2007 were somewhat higher, at 38% and about 39% respectively. Compared with previous data collection waves in the 1990s, the level of treatment therefore more than doubled both in the USA and in Switzerland [26, 27]. Initial analyses on trends in the prevalence of dyslipidemia and in the levels of awareness and treatment in Germany will become possible when data from GNHIES98 and DEGS1 are compared. The proportion of people who have had their cholesterol concentration measured within a given time frame has not been assessed up to now and in future this needs to be considered in periodically repeated health surveys.

Methodological strengths and limitations

The results presented here on the prevalence of dyslipidemia are representative of the population in Germany aged 18–79 years [16]. In conjunction with other health-related information, conclusions about influencing factors and a range of health consequences can be drawn in more in-depth analyses.

One important limitation is that it was not possible to include measurement results for LDL cholesterol or triglycerides. Concentrations of these are highly dependent upon the time since food was last ingested. As examination appointments were allocated at various times of day in DEGS1, fasting level data are available for only 46% of those examined (no random selection).

Information on diagnosed dyslipidemia is based on self-reports by participants. In addition, the question regarding medical diagnosis of dyslipidemia did not distinguish between elevated cholesterol concentrations and el-

evated triglyceride concentrations. Isolated triglyceride increases, however, are rare, while combinations with hypercholesterolemia occur frequently. The prevalence of elevated triglyceride concentrations will be examined in more in-depth analyses, in which adjustments will be made for the time since last food intake as an influencing factor.

Up to now it has not been clarified whether the ratio of total to HDL cholesterol, which is also a cardiovascular risk marker, reflects the significance of non-HDL cholesterol. Non-HDL cholesterol is calculated as the difference between total and HDL cholesterol concentrations. Besides LDL cholesterol, it also includes the cholesterol fractions attached to very-low-density lipoprotein (VLDL) [28, 29]. Results from recent prospective observational studies support the prognostic relevance of non-HDL cholesterol to predicting fatal and non-fatal myocardial infarction [30]. More in-depth analyses using data from DEGS1 will also take these parameters into account.

Conclusion and outlook

Dyslipidemia is widely prevalent among adults in Germany and only about two in every five affected persons know they have dyslipidemia. More in-depth analyses that quantify the time trend in the prevalence of dyslipidemia in Germany and that will permit comparison of trends in Germany and the USA are planned for the future. Besides cross-calibration of laboratory values, these analyses will also require further standardisation of the applied threshold values and should also include serum measurements of the difference between total and HDL cholesterol concentrations (non-HDL cholesterol concentration) as well as triglycerides.

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