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# Inadequate medical treatment of patients with coronary artery disease by primary care physicians in Germany

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DETECT  
Diabetes Cardiovascular Risk-Evaluation:  
Targets and Essential Data  
for Commitment of Treatment  
(See appendix)

■ **Summary** *Aims* The DETECT study was performed to obtain representative data about the frequency, distribution, and treatment of patients with coronary artery disease (CAD) in the primary care setting in Germany. *Methods and results* The DETECT study was a cross-sectional clinical-epidemiological survey of a nationally representative sample of 3795 primary care offices and 55 518 patients. Overall, 12.4% of patients were diagnosed with CAD. Stable angina pectoris and myocardial infarction were the most frequent (4.2%) subgroups, followed by status post (s/p) percutaneous coronary interventions (PCI, 3.0%) and s/p coronary bypass surgery (2.2%). Patients with CAD were prescribed AT1 receptor antagonists (in 19.4% of cases), beta blockers (57.2%), ACE inhibitors (49.9%), antiplatelet agents (52.7%), statins (43.0%), and long-term nitrates

(24.5%). When comparing all CAD patients with social health care insurance to those who had private insurance, private patients had significantly higher rates of revascularisation procedures and use of preventive medications. *Conclusion* Great potential remains for improving secondary prevention in primary care in Germany to reduce the risk of further coronary or vascular events, especially in patients with social health care insurance.

■ **Key words**

Coronary heart disease – prevalence – secondary prevention – primary care

## Introduction

Cardiovascular disease is a major cause of death in most European populations [1, 2]. In Germany, the most common causes of death in 2003 were chronic ischaemic heart disease (19.1%) and acute myocardial infarction (7.5%, Table 1) [3]. More women than men die from coronary artery disease (CAD). Therefore, in women too, CAD is the leading cause of

death. The chance a German woman will die from CAD is seven times higher than the chance she'll die from breast cancer (Table 1).

In addition to coronary bypass surgery and percutaneous coronary interventions (PCI) [4, 5], treatment with appropriate medications can reduce mortality and/or morbidity in patients with CAD. Examples include platelet inhibitors, beta blockers, ACE inhibitors, and statins [1]. The recent survey of the

**Table 1** Causes of death in Germany

	All	Male	Female
German population on 31 Dec 2002	82 536 680	40 344 879 (49%)	42 191 801 (51%)
Total death	853 946 (1%)	396 270 (0.9%)	457 676 (1.1%)
Death from cardiovascular disease	396 622 (46%)	162 210 (41%)	234 412 (51%)
Death from acute myocardial infarction	64 229 (7.5%)	34 679 (8.8%)	29 550 (6.5%)
Death from chronic ischaemic heart disease	163 445 (19.1%)	77 123 (19.5%)	86 322 (18.9%)
Death from CAD (acute and chronic)	227 674 (26.7%)	111 802 (28.2%)	115 872 (25.3%)
Death from breast cancer	17 437 (2%)	264	17 173 (3.8%)
Death from malignant tumours	209 255 (24.5%)	110 703 (27.9%)	98 552 (21.5%)

The latest data from the German Statistical Federal Bureau in Wiesbaden are from 2003 (Statistisches Bundesamt Deutschland: <http://www.destatis.de> 2005)

European Society of Cardiology (ESC) on coronary revascularisation in 5619 patients revealed that 95% received antithrombotic drugs, 74% received beta blockers, 57% received ACE inhibitors, and 67% received statins at discharge [5]. Another recent ESC survey covering 3779 patients with stable angina showed that 78% of these patients received aspirin, 67% received beta blockers, 37% received ACE inhibitors, and 48% received statins [6]. In this European survey, however, only 144 patients from Germany were enrolled.

The existing data regarding the prevalence of coronary heart disease in Germany are severely limited. Therefore, the purpose of the DETECT study was to obtain representative data about the frequency, distribution, and treatment of patients with CAD in the German primary care setting.

## Methods

DETECT (Diabetes cardiovascular-risk Evaluation: Targets and Essential data for Commitment of Treatment) is a three-stage, cross-sectional clinical-epidemiological study with a prospective-longitudinal component in a nationally representative sample of 3795 primary care settings and 55 518 patients. The overall physician response rate to the survey was 95.5%. A standardised assessment was completed for each patient, including diagnostic screening measures (i.e., blood pressure, heart rate, body mass index, and waist circumference) and questionnaires were completed for patients and their physicians. A subsample of 7519 patients also completed a standardised laboratory screening program with follow-up after 12 months. Data were weighted to adjust for non-response, regional distribution, and attrition. Further details about the study have been published previously [7, 8].

All prevalence estimates reported in this paper were based exclusively on clinical diagnoses or specifications rated as 'definite' by the treating physician ( $n=55\,518$ ). Patients with a definite diagnosis of CAD were placed into the following six subclassifications: stable angina, unstable angina, myocardial infarction, PCI, coronary bypass surgery, and other. All physicians in DETECT practiced in the primary care setting in Germany.

Within the standardised clinical assessment, physicians supplied data about the actual drug therapy the patient received. All prescription rates were based on patients with the definite diagnosis of CAD receiving a known actual medication ( $n=6569$ ). Regarding the prescription rates for CAD patients with a different number of comorbid diseases, just the following comorbid diseases were considered: Diabetes mellitus, hypertension, and hyperlipidaemia. Whereas the diagnoses of hypertension and hyperlipidaemia were based solely on a physician's clinical diagnosis, a patient was considered to have diabetes mellitus either if the patient was diagnosed clinically or if the patient received a prescription for an anti-diabetic drug. The prevalence estimates derived from the study were based on the physician diagnoses. Using descriptive statistics, we compared the distributions of variables among all categories. Associations were estimated using logistic regression models. All statistical analyses were conducted with the software package STATA 8 [9].

## Results

### ■ Prevalence of CAD

Table 2 shows the prevalence of CAD and its subgroups broken out by age and gender. Overall, 12.4% of patients (6895/55 518) were diagnosed with CAD. Stable angina pectoris and myocardial infarction

**Table 2** Prevalence of CAD and its subgroups in primary care in Germany by age and gender

Age groups	CAD		Stable angina		Unstable angina		s/p MI	s/p PCI		s/p CABG		
	N	%	N	%	N	%	%	N	%	N	%	
Total (N=55 518)	6895	12.4	2353	4.2	627	1.1	2326	4.2	1638	3.0	1201	2.2
18–34 (N=8727)	49	0.6	5	0.1	3	0.0	9	0.1	5	0.1	5	0.1
35–44 (N=8829)	133	1.5	23	0.3	7	0.1	49	0.6	39	0.4	13	0.2
45–54 (N=9325)	486	5.2	117	1.3	51	0.6	209	2.2	165	1.8	71	0.8
55–64 (N=10 608)	1397	13.2	397	3.7	146	1.4	517	4.9	402	3.8	253	2.4
65–74 (N=11 556)	2736	23.7	949	8.2	232	2.0	932	8.1	657	5.7	534	4.6
75+ (N=6473)	2094	32.4	862	13.3	188	2.9	610	9.4	370	5.7	325	5.0
Male (N=22 679)	3969	17.5	1218	5.4	316	1.4	1649	7.3	1169	5.2	915	4.0
18–34 (N=3243)	15	0.5	0	0.0	1	0.0	5	0.2	2	0.1	1	0.0
35–44 (N=3334)	78	2.3	14	0.4	3	0.1	40	1.2	30	0.9	9	0.3
45–54 (N=3781)	323	8.5	75	2.0	34	0.9	153	4.1	129	3.4	60	1.6
55–64 (N=4716)	931	19.7	245	5.2	82	1.7	403	8.6	319	6.8	214	4.5
65–74 (N=5189)	1624	31.3	498	9.6	123	2.4	679	13.1	453	8.7	414	8.0
75+ (N=2416)	998	41.3	386	16.0	73	3.0	369	15.3	236	9.8	217	9.0
Female (N=32 839)	2926	8.9	1135	3.5	311	1.0	677	2.1	469	1.4	286	0.9
18–34 (N=5484)	34	0.6	5	0.1	2	0.0	4	0.1	3	0.1	4	0.1
35–44 (N=5495)	55	1.0	9	0.2	4	0.1	9	0.2	9	0.2	4	0.1
45–54 (N=5544)	163	2.9	42	0.8	17	0.3	56	1.0	36	0.7	11	0.2
55–64 (N=5892)	466	7.9	152	2.6	64	1.1	114	1.9	83	1.4	39	0.7
65–74 (N=6367)	1112	17.5	451	7.1	109	1.7	253	4.0	204	3.2	120	1.9
75+ (N=4057)	1096	27.0	476	11.7	115	2.8	241	5.9	134	3.3	108	2.7

Data derived from 55 518 patients. *s/p* status post; *MI* myocardial infarction; *PCI* percutaneous coronary intervention; *CABG* coronary artery bypass surgery

**Table 3** Medications used by patients with CAD (and its subgroups) in primary care offices in Germany

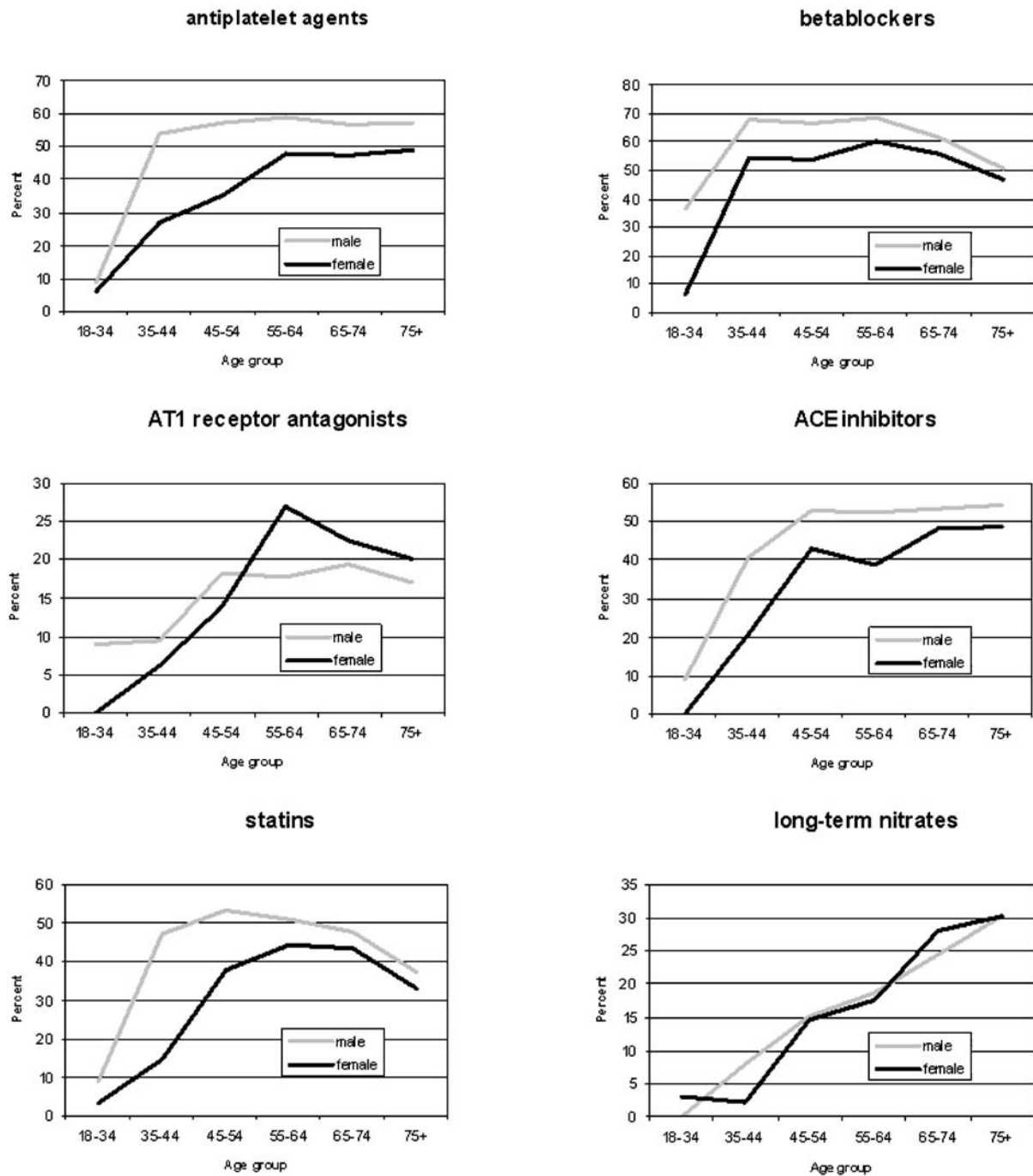
	CAD (N=6569)		Stable angina (N=2295)		Unstable angina (N=613)		s/p MI (N=2270)	s/p PCI (N=1598)		s/p CABG (N=1175)		
	N	%	N	%	N	%	%	N	%	N	%	
Antiplatelet agents	3463	52.7	1180	51.4	277	45.2	1497	66.0	1149	71.9	791	67.3
Beta blockers	3758	57.2	1187	51.7	334	54.5	1563	68.9	1196	74.8	870	74.0
ACE inhibitors	3279	49.9	1102	48.0	331	54.0	1305	57.5	929	58.1	676	57.5
AT1 receptor antagonists	1275	19.4	520	22.7	125	20.4	432	19.0	346	21.7	243	20.7
Statins	2824	43.0	894	39.0	257	41.9	1331	58.6	1055	66.0	764	65.0
Long-term nitrates	1609	24.5	694	30.2	188	30.7	625	27.5	447	28.0	286	24.3

For abbreviations see Table 2

were the most frequent subgroups (4.2%), followed by *s/p* PCI (3.0%), and *s/p* coronary bypass surgery (2.2%). The ratio between stable angina and unstable angina was 3.8. Table 2 also reveals an age-related increase in all diagnoses and specifications. Furthermore, the prevalence rates for all diagnoses and specifications were higher in men compared to women in most age groups.

### ■ Medications in patients with CAD

Table 3 lists the intake frequency of antiplatelet drugs, beta blockers, ACE inhibitors, AT1 receptor antagonists, statins, and long-term nitrates in patients with CAD, both as a group and within each subgroup. The prescription rates of these drugs, with the exception of AT1 receptor antagonists and long-term nitrates, showed a trend toward higher use in patients after myocardial infarction, PCI, and coronary bypass surgery than in patients with stable or unstable angina.

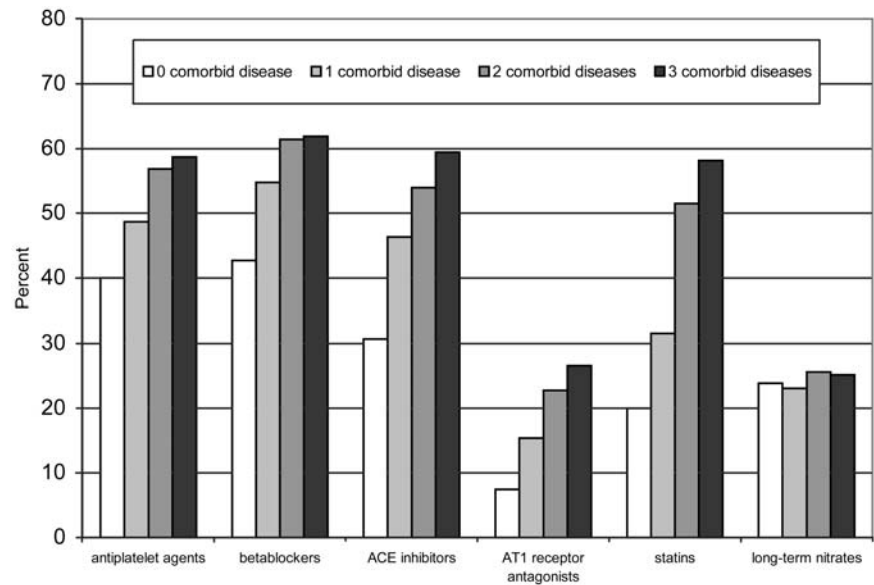


**Fig. 1** Differences in medication rates of CAD patients according to age and gender

We observed significant differences in prescribed medications between CAD patients with social health care insurance and those with private health care insurance. Whereas CAD patients with social health care insurance were prescribed ACE inhibitors (social: 50.3%; private: 41.0%; OR=0.48;  $P<0.001$ ) and

long-term nitrates (social: 25.0%; private: 16.2%; OR=0.41;  $P<0.0001$ ) more frequently than CAD patients with private health insurance, the opposite was true for AT1 receptor antagonists (social: 19.1%; private: 29.5%; OR=1.35;  $P<0.001$ ), beta blockers (social: 57.1%; private: 63.8%; OR=0.76;  $P<0.001$ ),

**Fig. 2** Prescription rates for medication groups by the number of comorbid diseases (diabetes mellitus, hypertension, and hyperlipidaemia) in patients with CAD



antiplatelet agents (social: 52.5%; private: 56.1%; OR=0.75;  $P<0.001$ ), and statins (social: 42.6%; private: 50.6%; OR=0.93;  $P<0.173$ ).

Male (m) patients received drugs from the following classes significantly more often than female (f) patients: beta blockers (m: 60.8%; f: 52.3%; OR=1.26;  $P<0.001$ ), ACE inhibitors (m: 53.0%; f: 45.7%; OR=1.50;  $P<0.001$ ), antiplatelet agents (m: 57.2%; f: 46.5%; OR=1.85;  $P<0.001$ ), and statins (m: 46.3%; f: 38.5%; OR=1.62;  $P<0.001$ ). Female patients received AT1 receptor antagonists (m: 18.1%; f: 21.2%; OR=1.19;  $P<0.001$ ) and long-term nitrates (m: 23.5%; f: 25.8%; OR=1.55;  $P=0.000$ ) significantly more frequently than male patients.

Figure 1 shows differences in medication groups according to age and gender. For all medication groups, a relationship between prescription rates and age is clearly visible – most impressive in a linear manner for nitrates.

Figure 2 lists the prescription rates for CAD patients with the comorbid diseases diabetes mellitus, hypertension, and hyperlipidaemia. It is statistically significant that physicians prescribe more secondary preventive medications in CAD patients with a higher comorbidity ( $P<0.0005$  for all medications except nitrates).

### ■ Revascularisation rates in patients with CAD

CAD patients underwent PCI and coronary bypass surgery in 23.8% and 17.4% of cases, respectively. After PCI, 15.9% of patients still had stable angina compared to 9.6% after coronary bypass surgery.

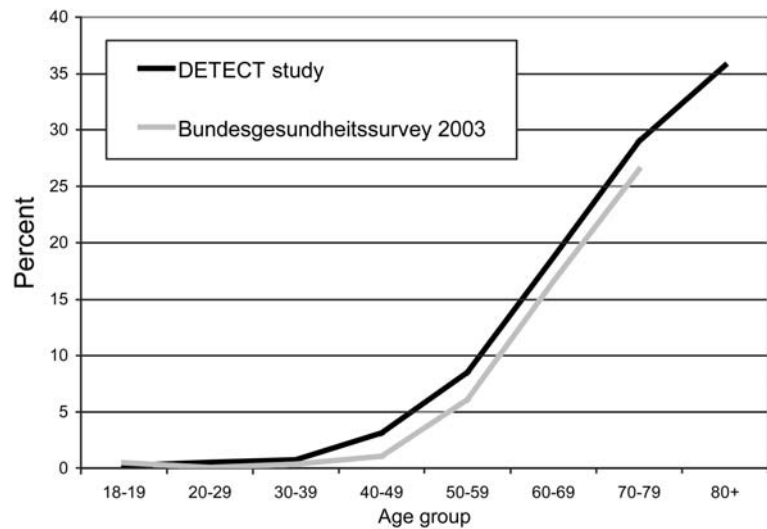
The highest revascularisation rates were observed in patients with s/p myocardial infarction (42.3% in PCI and 29.7% in coronary bypass surgery). Male CAD patients received PCI and coronary bypass surgery more often than female CAD patients (PCI: 29.5% vs 16.0%, OR=2.19,  $P<0.001$ ; coronary bypass surgery: 23.1% vs 9.8%, OR=2.77,  $P<0.001$ ). CAD patients with private health care insurance received PCI and coronary bypass surgery more often than CAD patients with social health insurance (PCI: 33.7% vs 23.3%, OR=0.60,  $P<0.001$ ; coronary bypass surgery: 22.7% vs 17.2%, OR=0.71,  $P=0.016$ ).

## Discussion

### ■ Prevalence of CAD

According to the results of the DETECT study, nearly every eighth patient in German primary care offices is a patient with established CAD. As such, effective secondary prevention is of utmost importance. Comparing the prevalence of CAD in primary care offices in the DETECT study with the prevalence of CAD in the general population in the German Federal Survey [10], the DETECT study found slightly higher prevalence rates (Fig. 3). In DETECT, stable angina was 3.8 times as frequent as unstable angina. This result is comparable to the ratio of 4.55 that was calculated by the Equinox Group [11]. It should be noted as a limitation that the prevalence rates – with the exception of diabetes mellitus – were based exclusively on physician diagnoses. Given this limitation, the actual

**Fig. 3** Comparison of prevalence of CAD in primary care offices (DETECT) and in the general population in Germany (German Federal Survey, "Bundesgesundheitsurvey"). The DETECT study shows a slightly higher prevalence



prevalence would be expected to be slightly higher than the reported rates.

### ■ Medication prescription rates

A recently published study showed that the use of multiple evidence-based classes of cardiovascular medications (i.e., antiplatelet, lipid-lowering, beta blockers, and ACE inhibitors) is associated with improved outcome (free of death or myocardial infarction) [12]. In our own experience in a single-centre survey in patients undergoing PCI in the year 2000, 89% of the referred patients were on antithrombotic medications, 65% were on beta blockers, 43% were on ACE inhibitors, and 46% were on statins [13]. The corresponding ranges from eleven studies of in-patients published in the period between 1997 and 2000 were 77–100% for antithrombotic medications, 30–80% for beta blockers, 10–72% for ACE inhibitors, and 13–77% for statins [13].

The pivotal data for Europe regarding prescription rates in CAD patients before hospital discharge were derived from the EUROASPIRE I and II studies [14]. Table 4 summarises the key data from EUROASPIRE I and II as compared to the DETECT results. Although considerable improvement in the prescription rates of beta blockers, ACE inhibitors, and statins occurred between 1995/1996 (EUROASPIRE I) and 1999/2000 (EUROASPIRE II), the corresponding prescription rates in Germany in 2003 (DETECT) remained below the European average, especially in terms of prescriptions of antiplatelet medications, beta blockers, and statins (Table 4). In the UK, Brady et al. [15] observed similar prescription rates of

**Table 4** Comparison of prescription rates for the four secondary prevention medication groups for CAD patients in EUROASPIRE I and II vs. DETECT

Study	EUROASPIRE-I	EUROASPIRE-II	DETECT
Data collected during year(s)	1995–1996	1999–2000	2003
Number of patients with CAD	n = 3569	n = 3379	n = 6569
Antiplatelet medication	81.2%	83.9%	52.7%
Beta blockers	53.7%	66.4%	57.2%
ACE inhibitors	29.5%	42.7%	49.9%
Statins	18.5%	57.7%	43.0%

Although the EUROASPIRE I and II data reflect the medications at discharge from hospitals and DETECT reflects the medication after discharge in an out-patient setting, the prescription rates for antiplatelet medication, beta blockers, and statins are still lower than the average for discharge medications Europe

antiplatelet agents, but clearly lower prescription rates of beta blockers (21.4%), ACE inhibitors (13.4%), and statins (16.2%) in 24431 patients with a diagnosis of CAD in primary care.

Several publications have reported that men receive adequate treatment for CAD more often than women [16–18]. This study also shows lower prescription rates of beta blockers, ACE inhibitors, antiplatelet agents, and statins in women than in men, even though the prevalence rates of diabetes mellitus, hypertension, and hyperlipidaemia are similar in both genders. This result indicates a bias in prescription behaviour between male and female patients treated in primary care [19]. One reason may be that physicians in general considered the male patient to be at higher risk than the female patient

[16]. On the other hand, female CAD patients received nitrates more often than male CAD patients, possibly reflecting their lower rates of PCI (16.0% vs 29.5%) and lower rates of bypass surgery (9.8% vs 23.1%). The higher rates of AT1 receptor inhibitors may possibly be related to a higher incidence of ACE-inhibitor side effects in women [20]. The debate regarding the difference in drug prescriptions between CAD patients with social health care insurance and private insurance is ongoing. Although the cost-containment restrictions ("medication budget") for primary care physicians in Germany might explain the documented failure of guideline-oriented medications, the undertreatment even with acetylsalicylic acid shows that economic restrictions are not the sole explanation.

The prescription rates of all drugs essential to improving prognosis of patients with CAD is correlated with the number of comorbidities (diabetes, hypertension, hyperlipidaemia). This situation reflects the fact that doctors are aware of the increasing risk these patients have for further cardiovascular events. On the other hand, even coronary patients with no comorbidity do need the full combination of antiplatelet agents, statins, beta blockers, and ACE inhibitors/AT1 receptor antagonists. Taking this need into account, the prescription rates for these patients were remarkably low, ranging between 7.5% and

42.7%. Furthermore, in patients with one or more comorbidities, room for improvement still exists in secondary preventive drug treatment.

### ■ Revascularisation rates

Many studies report lower revascularisation rates in women with CAD or acute coronary syndrome than in men with similar conditions [21–24]. These findings were confirmed by DETECT. Bertoni et al. [25] reported lower rates of coronary bypass surgery for women in the United States between 1995 and 2001, whereas the rates of catheterisation-based procedures were similar for both genders. Patients with private health care insurance in our study received PCI and coronary bypass surgery more often than CAD patients with social health insurance. This result is consistent with other studies that have found that insurance status appears to affect treatment in patients with acute myocardial infarction [26, 27].

Of course, one should keep in mind that lifestyle changes also play an important role in secondary prevention of coronary heart disease. Patients with established coronary heart disease are encouraged to stop smoking tobacco, make healthy food choices, increase physical activity, avoid excess weight, and reduce any existing excess weight [1].

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## Appendix

DETECT (Diabetes Cardiovascular Risk-Evaluation: Targets and Essential Data for Commitment of Treatment) is a cross-sectional and prospective-longitudinal, nationwide clinical epidemiological study. DETECT is supported by an unrestricted educational grant of Pfizer GmbH, Karlsruhe, Germany. Principal investigator: Prof. Dr. H.-U. Wittchen; Staff members:

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