Incidence, prevalence and coronary heart disease risk level in known Type 2 diabetes: a sentinel practice network study in the Basque Country, Spain

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Abstract

Aims/hypothesis. The aim of this study was to determine the incidence, prevalence and coronary heart disease risk in patients with known Type 2 (non-insulin-dependent) diabetes mellitus in a Basque Country sentinel practice network study.

Methods. During the year 2000 we did a survey among sentinel practitioners who registered information about previously and newly diagnosed Type 2 diabetic patients older than 24 years of age. We studied 65,651 people attending a primary care service in the Basque Country Health Service-Osakidetza. We collected information about diabetic complications and cardiovascular risk factors and measured the coronary heart disease risk in these patients.

Results. In the year 2000, the standardized cumulative incidence and prevalence of known Type 2 diabetes were 5.0 per 1000 (CI 95%: 4.9–5.1) and 4.6% (CI 95%: 4.5–4.7) respectively. Macroangiopathy was the

most frequent complication both in the newly diagnosed (21.6%) and previously known Type 2 diabetic patients (33%). Total cholesterol ≥ 5.17 mmol/l and LDL cholesterol ≥ 2.58 mmol/l were found in 75% and 90% of newly diagnosed and 65% and 85% of previously diagnosed Type 2 diabetic patients respectively. Of the Type 2 diabetic patients 42% were obese and 80% had high blood pressure. More than 55% of the men compared with 44% of the women with Type 2 diabetes had high or very high risk of coronary heart disease ($p < 0.05$).

Conclusion/interpretation. We report new epidemiological data on known Type 2 diabetes in the Basque Country. These patients have a high frequency of cardiovascular risk factors causing a high coronary heart disease risk. [Diabetologia (2003) 46:899–909]

Keywords Type 2 diabetes, incidence, prevalence, complications, risk factors, cardiovascular disease, coronary heart disease risk level

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Abbreviations: WHO MSVDD, World Health Organization Multinational Study of Vascular Disease in Diabetes; UKPDS, United Kingdom Prospective Diabetes Study; MRFIT, Multiple Risk Factor Intervention Trial.

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Type 2 (non-insulin-dependent) diabetes mellitus is a progressive chronic disease with long-term complications causing high associated morbidity and a considerable economic and social burden [1, 2, 3]. Diabetic patients often develop cardiovascular disease and it is the main cause of the high risk of premature death in these patients [4, 5, 6, 7]. The prevalence of diabetes is increasing due to a combination of hereditary, environmental and demographic factors [8]. To deal with this situation, it is essential for public health systems to know not only the frequency of Type 2 diabetes, but also the prevalence of long-term complications and the risk factors associated with the disease. Few surveys of the diabetic population exist in Spain and data about diabetic complications and cardiovascular risk

factors need to be characterized better, according to the new recommended targets for metabolic control. Furthermore, until now risk factor guidelines for Type 2 diabetes have been done based on unifactorial assessments of hypertension, hyperlipidaemia, and smoking [9]. This approach has underestimated the real cardiovascular risk of Type 2 diabetic patients. We have measured the overall risk of coronary heart disease of known Type 2 diabetic patients of the Basque Country based on the combination of all of these major risk factors.

The effectiveness of the different interventions carried out by primary care professionals to improve the management of diabetic patients depends on the reduction of the high cardiovascular risk in these patients [10]. We have studied the incidence, prevalence, complications, and cardiovascular risk factors of known Type 2 diabetes in the Basque Country in northern Spain. Furthermore, we have calculated the risk of coronary heart disease (CHD) in a known Type 2 diabetic population.

Subjects and methods

During the year 2000, a diabetes surveillance system was set up in The Basque Country based on a sentinel practice network. This network is an epidemiological surveillance system based on the voluntary collaboration of primary care professionals [11, 12]. Our network was founded in 1986, and has been involved in different collaborative projects with other Spanish and European networks [13, 14]. Primary care physicians play an important role in the Basque Country Health Service, where health care is free and available to the whole population in the Basque Autonomous Region (2,100,000 inhabitants). Each primary care physician is assigned a group of people to take care of within a specific area and this is revised annually.

Sixty-one physicians (5.5% of the primary care physicians in the Basque Country Health Service-Osakidetza) participated in attending 65,651 people (4% of the population older than 24 years of age in the Basque Country). All Health Service areas of the Basque Country were represented in the study. The physicians participating in the study had the same age and sex distribution as the Basque Country primary care physicians. Furthermore, the study sample followed a similar age and sex dis-

tribution to the Basque Country population (Table 1). Prevalence and annual cumulative incidence were adjusted by age and sex distribution of the Basque population.

Sentinel physicians recorded information during the year 2000 about previously and newly diagnosed Type 2 diabetic patients older than 24 years of age. Newly Type 2 diabetic patients or incident cases were defined as people who were not diabetic before January 1st 2000 and were diagnosed with Type 2 diabetes during the year 2000. Prevalent cases were considered to be those patients with Type 2 diabetes diagnosed before and during the mid-year 2000. We estimated the point prevalence with reference to mid-year 2000 (July 1st 2000). Type 2 diabetes was diagnosed according to the diagnostic criteria set out by the in 1985 until 1998 [15]. From then on the new diagnostic criteria of the World Health Organisation (WHO) were used [16].

All diabetic patients were registered using a standardised form. The standardised questionnaire included data on chronic diabetic complications, and clinical risk factors. A blood sample for biochemistry was obtained from all diabetic patients participating in the study. Different sources of information were used to assess the presence of cardiovascular disease: firstly, a detailed survey on patient medical history, physical examination and complementary investigations were carried out in the patients participating in the study; secondly, medical records from hospitals or other specialists in cases of hospitalisation or out-patient consultation were recorded respectively; thirdly, clinical signs and symptoms referred by the patients to the physicians were registered. The confidentiality and security of the data collected in this study was carried out in accordance with the Spanish law normative in use.

Coronary heart disease was diagnosed when a history of myocardial infarction or angina was reported. Any episode of stroke and intermittent claudication was registered. Angina and intermittent claudication were defined by the WHO criteria of symptoms including precipitating and relieving factors [17]. Family history of diabetes and gestational diabetes was registered. The usual physical activity of most patients was assessed as sedentary (rarely exercises), and active (if the patient did three or more hours of exercise per week). Overweight and obesity were defined as a BMI of 25 to 29 and 30 or over, respectively. Smoking was classified as non-smoker, habitual smoker and former smoker.

Blood pressure was measured after the patient had rested for at least 2 min. It was measured in the arm with a mercury sphygmomanometer and auscultation without masking the readings, usually with a regular size inflatable cuff, unless the arm circumference was greater than 33 cm for which a large cuff was used. The diastolic pressure was taken at the Korotkoff phase 5. Hypertension was defined if either the pa-

Table 1. Comparison between the study sample and the population of the Basque Country. Distribution by age and sex

Age groups	Primary Care Sentinel Network sample			Basque Country population		
	Men <i>n</i> (%)	Women <i>n</i> (%)	Total <i>n</i> (%)	Men <i>n</i> (%)	Women <i>n</i> (%)	Total <i>n</i> (%)
25–44 years	15,315 (48.0)*	15,155 (44.3)*	30,470 (46.4)*	349,695 (45.2)*	345,511 (41.8)*	695,206 (43.4)*
45–64 years	9746 (30.6)*	9562 (28.8)*	19,308 (29.4)*	257,401 (33.2)*	256,876 (31.1)*	514,277 (32.1)*
65–74 years	4236 (13.3)	4648 (13.4)	8884 (13.5)	106,488 (13.8)	118,261 (14.3)	224,749 (14.0)
≥75 years	2590 (8.1)	4399 (13.5)	6989 (10.6)	60,821 (7.9)	106,412 (12.9)	167,233 (10.4)
Total	31,887 (100)	33,764 (100)	65,651 (100)	774,405 (100)	827,060 (100)	1,601,465 (100)

* $p < 0.01$

tient was on antihypertensive drugs or the blood pressure was equal or over 135 mmHg systolic and/or equal to or over 80 mmHg diastolic [18]. Assessment of macrovascular disease included a routine 12-lead ECG. Peripheral vascular disease was assessed by dorsal pedis and posterior tibial pulses palpation, two or more absent pulses on either side being taken as abnormal. The ankle/wrist index was measured considering less than 1 as abnormal, and the presence of amputations was registered.

Retinopathy was studied with direct ophthalmoscopy carried out by an ophthalmologist and classified as normal, non-proliferative retinopathy, proliferative retinopathy and maculopathy. Nephropathy was defined as albumin urine excretion above 20 mg/l or above 30 mg/24 h. Peripheral neuropathy was assessed by clinical examination with 5.07 monofilament (10 g), and by clinical symptoms, and the presence of ulcers or feet deformations [19]. A fasting blood sample was taken or, when fasting glucose values were between 6.1–7.0 mmol/l (110 to 126 mg/dl), an OGTT with 75 g of glucose load was carried out. Analysis of HbA_{1c} was done using chromatography (HPLC) (range for normal values between 4.8–6.2%). Plasma total cholesterol, HDL, LDL and triglycerides concentrations were measured. We used the Third Report of the National Cholesterol Education Program (NCEP) recommended target values of total cholesterol of less than 5.17 mmol/l (200 mg/dl), HDL over 1.03 mmol/l (40 mg/dl), triglycerides less than 1.68 mmol/l (150 mg/dl), and LDL less than 2.58 mmol/l (100 mg/dl) [20].

Additionally, the risk of CHD was calculated using the criteria of the Second Joint Task Force of European and other Societies on Coronary Prevention [9]. This level of risk was calculated in diabetic patients without cardiovascular disease, with a multifactorial risk assessment using a combination of risk factors: age, sex, systolic blood pressure in mmHg, total cholesterol concentration, and smoking status. The level of a

person's absolute 10-year risk of CHD event was defined as: low under 5%, mild 5 to 10%, moderate 10 to 20%, high 20 to 40%, and very high over 40%.

Statistical analyses: data were analysed using the Statistical Package for the Social Sciences 10.0 for Windows (SPSS, Chicago, Ill., USA). Data was presented as cases per 1000 subjects, percentage and means $\pm$ standard error (SE). Prevalence and incidence were adjusted by age and sex distribution of the Basque population. The following age stratification was selected: 25 to 64 years, 65 to 74 years and older than 74 years. The chi-square (χ^2) test and Student's *t* test were applied to compare proportions and means respectively. A *p* value of less than 0.05 was considered to be statistically significant. When appropriate, data were stratified by age and sex and Mantel Haenszel odds ratio was provided.

Results

Prevalence During the study period a total of 2920 known Type 2 diabetic patients were recorded. The adjusted prevalence of known Type 2 diabetes was 4.6% (CI 95%: 4.5–4.7). The highest prevalence was 12.6% in the Basque Country population of 65- to 74-year-old subjects. Mean age of patients was 68 years, women being older than men ($p < 0.001$). The mean and SE time of diabetes development was 8.1 ± 0.1 years (Table 2).

The most frequent complication in known Type 2 diabetic patients was macroangiopathy (33%), with 30% having abnormal ECG, 12.4% CHD, 9.8% stroke, 14.1% signs of peripheral vascular disease,

Table 2. Prevalence and annual cumulative incidence of known Type 2 diabetes in Basque Country population

Prevalent cases	Men <i>n</i> =1404		Women <i>n</i> =1516		Total <i>n</i> =2920		P value
Age (mean $\pm$ SE)	65 $\pm$ 0.3		69 $\pm$ 0.3		68 $\pm$ 0.2		<0.05
Duration of diabetes (years) (mean $\pm$ SE)	7.8 $\pm$ 0.2		8.5 $\pm$ 0.2		8.1 $\pm$ 0.1		<0.05
Age group	Cases	Prevalence %	Cases	Prevalence %	Cases	Prevalence %	
25–44	44	0.3	35	0.2	79	0.3	
45–64	528	5.4	396	4.1	924	4.8	
65–74	526	12.6	581	12.6	1 107	12.6	
≥ 75	306	12.3	504	11.8	810	12.0	
Total*	1 404	4.6	1 516	4.7	2 920	4.6	
Newly diagnosed cases	Men <i>n</i> =140		Women <i>n</i> =145		Total <i>n</i> =285		P value
Age (mean $\pm$ SE)	63 $\pm$ 0.9		65 $\pm$ 0.9		64 $\pm$ 0.7		<0.05
Age group	Cases	Incidence per 1000	Cases	Incidence per 1000	Cases	Incidence per 1000	
25–44	9	0.6	7	0.5	16	0.5	
45–64	67	7.3	54	5.9	121	6.6	
65–74	45	12.2	54	13.3	99	12.8	
≥ 75	19	8.4	30	7.7	49	8.0	
Total*	140	5.0	145	4.9	285	5.0	

* Standardized by age and sex

Table 3. Chronic complications of Type 2 diabetes by sex stratified by age (%)

Prevalent cases	Sex	Retinopathy <i>n</i> =1985	Nephropathy <i>n</i> =2294	Neuropathy <i>n</i> =2540	Macroangiopathy <i>n</i> =2769
Age					
25–64	Male	13	25	14	24
	Female	15	13	9	16
65–74	Male	19	29	17	42
	Female	22	17	20	27
75+	Male	22	37	30	52
	Female	29	22	26	39
	Total	20	23	19	33
		OR(MH)=0.8 CI 95%=0.6–1.0	OR(MH)=2.1 CI 95%=1.5–3.4	OR(MH)=1.1 CI 95%=0.9–1.4	OR(MH)=1.7 CI 95%=1.5–2.1
Newly diagnosed cases					
Age					
25–64	Male	5	6	11	17
	Female	6	7	2	9
65–74	Male	9	36	5	35
	Female	16	16	16	17
75 +	Male	0	13	39	47
	Female	0	6	25	30
	Total	6	12	12	22
		OR(MH)=0.6 CI 95%=0.1–2.6	OR(MH)=1.6 CI 95%=0.6–4.3	OR(MH)=1.4 CI 95%=0.6–3.2	OR(MH)=2.3 CI 95%=1.2–4.6

OR (MH): Odds Ratio of Mantel-Haenszel standardized by age

Fig. 1. Cardiovascular risk factors (%) standardised by age in prevalent and newly diagnosed cases in known Type 2 diabetes: Total cholesterol ≥ 5.17 mmol/l (200 mg/dl), HDL<1.03 mmol/l (40 mg/dl), Triglycerides ≥ 1.68 mmol/l (150 mg/dl), LDL ≥ 2.58 mmol/l (100 mg/dl) and HbA_{1c} $\geq 6.5\%$

Table 4. Cardiovascular risk factors in known Type 2 diabetes standardised by age

Prevalent cases	Men <i>n</i> =1332	Women <i>n</i> =1442	Total <i>n</i> =2774	<i>p</i> value
Familiar history of diabetes (%)	42	46	44	NS
Gestational diabetes (%)		5		
Physical activity (%):				
active	69	51	58	
sedentary	31	49	42	<0.001
Smoking (%):				
never	38	93	67	
former	39	3	20	<0.001
current	23	4	13	
	Means $\pm$ SE	Means $\pm$ SE	Means $\pm$ SE	
BMI	28 $\pm$ 0.1	31 $\pm$ 0.1	30 $\pm$ 0.1	<0.001
Blood pressure:				
systolic	138 $\pm$ 0.5	142 $\pm$ 0.5	141 $\pm$ 0.3	<0.001
diastolic	79 $\pm$ 0.3	81 $\pm$ 0.5	80 $\pm$ 0.3	<0.001
Total cholesterol				
(mmol/l)	5.43 $\pm$ 0.02	5.69 $\pm$ 0.02	5.56 $\pm$ 0.02	<0.001
(mg/dl)	210 $\pm$ 1.1	220 $\pm$ 1.0	215 $\pm$ 0.8	
LDL				
(mmol/l)	3.46 $\pm$ 0.02	3.56 $\pm$ 0.02	3.51 $\pm$ 0.02	<0.05
(mg/dl)	134 $\pm$ 1.1	138 $\pm$ 1.1	136 $\pm$ 0.8	
HDL				
(mmol/l)	1.31 $\pm$ 0.01	1.45 $\pm$ 0.01	1.37 $\pm$ 0.01	<0.001
(mg/dl)	51 $\pm$ 0.5	56 $\pm$ 0.4	53 $\pm$ 0.4	
Triglycerides				
(mmol/l)	1.54 $\pm$ 0.03	1.55 $\pm$ 0.02	1.55 $\pm$ 0.01	NS
(mg/dl)	138 $\pm$ 2.6	139 $\pm$ 2.0	139 $\pm$ 1.6	
HbA _{1c} (%)	6.9 $\pm$ 0.04	7.2 $\pm$ 0.04	7.1 $\pm$ 0.03	<0.05

8.4% intermittent claudication, and 1.4% amputations. Diabetic nephropathy (microalbuminuria) was present in 23%, retinopathy in 20% (46% non-proliferative, 17% proliferative, 15% maculopathy and 22% non-specified retinopathy), and neuropathy in 19% of the patients. Total large vessel disease (OR=1.7, CI 95% 1.5–2.1) and nephropathy (OR=2.1, CI 95% 1.5–3.4) in men exceeded that in women (Table 3).

Data of cardiovascular risk factors in prevalent cases are described in Table 4. Of the prevalent cases 61% had HbA_{1c} 6.5% or over, being higher in women (64.8%) than in men (57.6%) ($p<0.05$). Of the Type 2 diabetic patients, 85% had LDL ≥ 2.58 mmol/l, 65.4% total cholesterol ≥ 5.17 mmol/l, 18.3% HDL less than 1.03 mmol/l and 33.4% triglycerides over 1.68 mmol/l. Abnormal concentrations of HDL were higher and total cholesterol lower in men (24.1% and 59.7% respectively) than in women (13.1% and 70.6% respectively) ($p<0.05$). High BP was found in 79.6% of the patients, and was higher in women (84.1%) than men (74.6%) ($p<0.05$). Obesity was found in 42.4% of the patients

being higher in women (50.7%) than in men (33.6%) ($p<0.05$). Only 16% of Type 2 diabetic patients had normal weight and 84% were overweight or obese. A sedentary lifestyle was more frequent in women (48.6%) than in men (31.3%) ($p<0.05$). However, smoking was significantly more frequent among men than women ($p<0.05$) (Fig. 1).

The value of HbA_{1c} and the duration of diabetes were associated with higher frequency of complications.

The risk of CHD in known Type 2 diabetic patients was higher in men than in women. Of the diabetic men 60% showed high (20–40%) or very high (>40%) risk of CHD, while 56% of the women had values compatible with moderate (10–20%), mild (5–10%) or low (<5%) risk of CHD ($p<0.05$) (Table 5).

Incidence. The annual standardised cumulative incidence of known Type 2 diabetes in the Basque Country population older than 24 years of age attending the primary care centers was 5 per 1000 inhabitants (CI 95%: 4.9–5.1) with similar incidence in both sexes.

Table 4. (continued)

Newly diagnosed cases	Men <i>n</i> =138	Women <i>n</i> =140	Total <i>n</i> =278	<i>p</i> value
Familiar history of diabetes (%)	31	44	37	NS
Gestational diabetes (%)		6		
Physical activity (%):				
active	73	49	60	
sedentary	27	51	40	<0.001
Smoking (%):				
never	41	91	67	
former	35	4	19	<0.001
current	24	5	14	
	Means $\pm$ SE	Means $\pm$ SE	Means $\pm$ SE	
BMI:	29 $\pm$ 0.4	32 $\pm$ 0.6	31 $\pm$ 0.4	<0.001
Blood pressure:				
systolic	137 $\pm$ 1.4	141 $\pm$ 1.4	139 $\pm$ 1.0	<0.05
diastolic	81 $\pm$ 0.9	83 $\pm$ 0.8	82 $\pm$ 0.6	NS
Total cholesterol				
(mmol/l)	5.74 $\pm$ 0.1	5.89 $\pm$ 0.1	5.81 $\pm$ 0.07	NS
(mg/dl)	222 $\pm$ 3.8	228 $\pm$ 3.6	225 $\pm$ 2.6	
LDL				
(mmol/l)	3.69 $\pm$ 0.09	3.74 $\pm$ 0.09	3.72 $\pm$ 0.06	NS
(mg/dl)	143 $\pm$ 3.6	145 $\pm$ 3.4	144 $\pm$ 2.5	
HDL				
(mmol/l)	1.31 $\pm$ 0.03	1.37 $\pm$ 0.03	1.34 $\pm$ 0.02	NS
(mg/dl)	51 $\pm$ 1.4	53 $\pm$ 1.2	52 $\pm$ 1.0	
Triglycerides				
(mmol/l)	1.73 $\pm$ 0.09	1.73 $\pm$ 0.09	1.73 $\pm$ 0.07	NS
(mg/dl)	155 $\pm$ 8.0	155 $\pm$ 8.2	155 $\pm$ 6.6	
HbA _{1c} (%)	6.7 $\pm$ 0.1	6.8 $\pm$ 0.1	6.8 $\pm$ 0.1	NS

Table 5. CHD risk level in known Type 2 diabetes* (%)

Prevalent cases	Men <i>n</i> =878	Women <i>n</i> =1064	Total <i>n</i> =1942	<i>p</i> value
Low	1	2	1	
Mild	18	4	11	<i>p</i> <0.05
Moderate	22	50	37	
High	54	44	49	
Very high	5	0	2	
Newly diagnosed cases	Men <i>n</i> =103	Women <i>n</i> =114	Total <i>n</i> =217	<i>p</i> value
Low	1	2	2	
Mild	22	6	14	<i>p</i> <0.05
Moderate	21	48	34	
High	51	44	48	
Very high	5	0	2	

* in diabetic patients without cardiovascular disease

Incidence peak was found in the 65- to 74-year-old group (12.8 per 1 000). The average age of the newly diagnosed Type 2 diabetes cases was 64 ± 0.7 years, higher in women than in men ($p < 0.05$) (Table 2). Of the patients 86% were diagnosed by fasting glucose, 4.6% by random glucose and 8.5% by OGTT. Thirty-six per cent of the 285 newly diagnosed Type 2 diabetic patients already had one or more complications at diagnosis. Macroangiopathy was the most frequent complication affecting 22% of the patients; abnormal ECG was present in 7%, CHD (7%), stroke (4%), intermittent claudication (3%), signs of peripheral arteriopathy (14%), and amputations (1%). Neuropathy was present in 12.5% of the patients, nephropathy in 12.6%, and retinopathy in 6.5% (Table 3). The prevalence of macrovascular disease is higher in newly diagnosed Type 2 diabetic men than in women (OR=2.3, CI 95%: 1.2–4.6).

Data on cardiovascular risk factors is described in Table 4. Forty-six per cent of the newly diagnosed patients had HbA_{1c} values of 6.5% or over. More than 70% of these patients had total cholesterol ≥ 5.17 mmol/l, 91% LDL ≥ 2.58 mmol/l, 20.8% HDL less than 1.03 mmol/l, and 38.8% triglycerides ≥ 1.68 mmol/l. High BP was found in 83.2% of newly diagnosed Type 2 diabetic patients, 85% in women and 81.4% in men (NS). Obesity was present in 45.6% of the patients and 87.2% were overweight or obese. Obesity was more frequent in women (53.0%) than in men (38.4%) ($p < 0.05$) as was sedentary lifestyle (52% vs 27%) ($p < 0.05$). However smoking was significantly more frequent among men than women ($p < 0.05$) (Fig. 1).

The risk of CHD for newly diagnosed cases was higher in men than in women. More than half of the men (56%) showed high (20–40%) or very high CHD risk ($>40\%$), while 56% of the women had values compatible with moderate (10–20%), mild (5–10%) or low risk of CHD ($<5\%$) ($p < 0.05$) (Table 5).

Discussion

Prevalence and incidence of known Type 2 diabetes. Sentinel networks are an epidemiological information system and have been greatly developed in the last few years [21]. Many sentinel networks in Europe [22, 23, 24, 25] and in the United States [12] have been used to study diseases diagnosed at the primary care level. The usefulness of these networks has been confirmed both for the study of acute and chronic pathologies, including diabetes [26, 27, 28, 29, 30, 31]. One of the limitations attributed to the sentinel system is its ability to represent accurately because of the voluntary participation of the physicians in the network. However, several studies have validated the information gathered through sentinel networks and it has been concluded that such networks are feasible and

have a low-biased approach for population studies [28]. Other studies have concluded that sentinel samples are representative in age and sex distribution of the total practice population when they are based on an adequate size [32]. Likewise, those studies that have compared the Ambulatory Sentinel Practice Network (ASPN) sample with the random National Ambulatory Medical Care Survey (NAMCS) in the United States, have concluded, that the ASPN sample is sufficiently representative of the general population and that Sentinel Network serves as a useful laboratory for investigation in primary care [33, 34]. Although study samples based on sentinel networks have some limitations, given the characteristics of our sample, we consider that the results of this study could be biased a little and therefore, the extrapolation of results to the general population of the Basque Country is possible.

There is no current national epidemiological diabetes data in Spain. Type 2 diabetes epidemiological information in our country has been carried out in small population areas and with different methodologies [35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47]; therefore, the comparisons among these data should be considered carefully. These studies have shown the prevalence of Type 2 diabetes between 4.0% [37] and 18% [46]. Only four cross-sectional studies provide prevalence data at the regional level. The total prevalence of Type 2 diabetes (known and unknown), in Aragón (1994) was 6.1% [38], in Galicia (1995) 7.8% [43], Cataluña (1999) 10.3% [44] and Asturias 9.9% [47]. The prevalence of known Type 2 diabetes in our study was 4.6% (CI 4.5–4.7) compared to 3% in Aragón, 6.7% in Cataluña and 4% in Asturias. These data are in agreement with the prevalence of diabetes described in several European countries, 3.2% Ireland, 4.1% Belgium, 4.2% Germany, 3.5% United Kingdom, 4.0% France or 7.1% in Italy [8]. However, our prevalence data is lower than the United States data with a 7.3% of known diabetes in the year 2000 [48].

There is very little data on the incidence of Type 2 diabetes in Spain and Europe. In a 10-year prospective study with a sample of 584 patients older than 30 years of age in Leioa (Basque Country), an annual incidence of known Type 2 diabetes of 4.1 per 1000 was estimated [45]. The Cremona Study in Italy found a diabetes incidence of 2.1 per 1000 person-years [49]. In our study we found an annual incidence of 5 per 1000 (CI 95%: 4.9–5.1), with a peak incidence between 65 to 74 year age group (12.8 per 1000). Our annual incidence for the 45 to 64 age group was similar to that estimated for the United States (6.03 per 1000) [50]. In Italy the incidence was 6.0 per 1000 person-year in people older than 50 years of age [49].

Chronic complications. We found a prevalence of retinopathy, nephropathy and polineuropathy around 20% in known Type 2 diabetes. Macroangiopathy was the most common complication present in 33% of known

Type 2 diabetic patients. The prevalence of Type 2 diabetic complications in our study is similar to that described previously in Spain in the last decade [51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62], and in the WHO Multinational Study of Vascular Disease in Diabetes (WHO MSVDD) [63]. However, in a recent study in China, the prevalence of microvascular complications was higher and the prevalence of macrovascular disease was lower than in the previous studies [64]. The high rates of retinopathy (47%) and proteinuria (57%) found in China could be related to later diagnosis, degree of hyperglycaemia, and/or increased susceptibility to microangiopathy. The low prevalence of cardiovascular risk factors is a likely contributor to the low rates of arterial disease (<20%) in the Chinese diabetic cohort, and resembles the Tokyo and Hong Kong centres of the WHO MSVDD [63, 64]. In our study, total large vessel disease and nephropathy in men exceeded that in women. However in the WHO MSVDD [63] and in the Chinese sample [64] the prevalence of macroangiopathy was higher in women than in men. The higher CHD risk that we have found in Type 2 diabetic men is in agreement with the higher prevalence of macroangiopathy found in our Type 2 diabetic men.

There are very few studies on long-term complications in incidence cases of Type 2 diabetes. Thirty-six (36%) of the newly diagnosed Type 2 diabetic patients already have one or more complications at diagnosis in our study. In the UKPDS half of the newly diagnosed Type 2 diabetic patients have complications at diagnosis [65]. This difference is mainly due to the lower prevalence in retinopathy in our patients, 6.5%, compared to 25% in the UKPDS. This high rate could be explained by the later diagnosis of diabetes in the UKPDS that could be suspected by the value of HbA_{1c} of 11.6% found in their patients at diagnosis compared with HbA_{1c} of 6.8% in our study. However, in our study, the validity of retinopathy diagnosed by different ophthalmologists in practice is a possible limitation. Macrovascular disease was again the most frequent complication in our study, with 22% of the newly diagnosed Type 2 diabetic patients having CHD, stroke or peripheral vascular disease. In Finland, which has a high prevalence of CHD in the general population, newly diagnosed diabetic patients had an 18% prevalence of myocardial infarction in both sexes, and if angina and abnormal ECG were included, 32% of the men and 42% of the women had CHD, which was higher than in the control population [66]. In our study, the prevalence of macrovascular disease is higher in newly diagnosed Type 2 diabetic men than in women, contrary to the higher prevalence of abnormal ECG and the absence of foot pulses in women than in men in UKPDS [65]. This higher frequency of macroangiopathy that we have found is in agreement with the high CHD risk level present in our newly diagnosed Type 2 diabetic men. In our sample, as in

UKPDS, newly diagnosed Type 2 diabetic women have a similar prevalence of microvascular complications to men.

Cardiovascular risk factors. Data from UKPDS [65] suggest that each particular macrovascular complication could be dependent on several specific and different cardiovascular risk factors in Type 2 diabetic patients. The correlation found is similar to those in non-diabetic patients, including stroke with hypertension [67], peripheral vascular disease with smoking [68], and a low HDL cholesterol, hypertriglyceridemia and hypercholesterolemia with heart disease [69, 70]. The association of cardiovascular risk factors to known Type 2 diabetic patients in our study is similar to other studies in Spain [37, 38, 51, 52, 54, 55, 56, 62, 71, 72, 73, 74], and to the WHO SVDD [63]. The lipid profile found in Type 2 diabetic patients are frequently above the recommendations of the third report of the National Education Program (NCEP) and the American Diabetes Association [20, 75] for Type 2 diabetic patients.

In newly diagnosed Type 2 diabetes we have found a high prevalence of cardiovascular risk factors. The distribution of cardiovascular risk factors between the sexes is similar to our prevalent cases and to the UKPDS newly diagnosed Type 2 diabetic patients [65].

From the Multiple Risk Factor Intervention Trial (MRFIT) data, it is also evident that diabetes is a strong, independent risk factor for cardiovascular disease (CVD) mortality over and above the effect of BP, serum cholesterol, and cigarette smoking [5]. In our study high HbA_{1c} and duration of diabetes are associated with diabetic complications.

CHD risk level. Type 2 diabetes mellitus is characterized by an increased risk of CVD in men and women [76]. In particular there is an excess incidence of CHD and stroke in people with diabetes [5, 77]. In the last decade or so, several prospective studies have examined the strength of the associations between various putative risk factors and CVD mortality in diabetic patients. The three largest studies MRFIT, UKPDS and WHO MSVDD [5, 7, 78] have shown that classic CVD risk factors like high BP, serum cholesterol and cigarette smoking are predictive of CVD mortality in patients with Type 2 diabetes. Furthermore, the studies mentioned above confirm that the presence of a combination of these classic CVD risk factors markedly increase CVD mortality in men and woman with Type 2 diabetes. Traditionally, risk-factor guidelines have been concerned with unifactorial assessment in the management of hypertension, hyperlipidaemia or diabetes. This has resulted in undue emphasis being placed on individually high risk factors rather than on the overall level of risk based on a combination of risk factors. Therefore, we have used the joint recommendations of the Task Force Report for prevention of CHD in clinical practice emphasizing the importance

of multifactorial risk assessment to measuring global risk of CHD in a Type 2 diabetic population [9]. Sixty percent of our Type 2 diabetic men and around 50 percent of our Type 2 diabetic women, without previously cardiovascular diseases, have high or very high risk of CHD. Diabetic patients without previous myocardial infarction have as high a risk of myocardial infarction as non-diabetic patients with previous myocardial infarction, suggesting that Type 2 diabetes could confer the same degree of risk as pre-existing coronary heart disease [6]. However, in a recent cross-sectional and cohort study the authors had found that patients with Type 2 diabetes were at a lower risk of cardiovascular outcomes than patients with established coronary heart disease [79]. This seems more likely because patients with previous cardiovascular diseases are already at a very high absolute risk of a further vascular event [9]. In our study about half of the patients had a high or very high CHD risk. Therefore, Type 2 diabetic patients without a previous history of cardiovascular diseases have a different CHD risk according to the simultaneous combination of cardiovascular risk factors. Our results have important implications for clinical management and control practices because those at the highest multi-factorial risk can be identified and targeted for lifestyle interventions, and selective use of proven drug therapies.

National Health Systems must be aware of the increase in the incidence and prevalence of Type 2 diabetes, and its implications for the health of the general population. Type 2 diabetes is associated with potentially avoidable chronic complications and cardiovascular risk factors generating a high risk of CHD. Treatment of Type 2 diabetes must aim not only improving blood glucose control, but also eliminating cardiovascular risk factors. Moreover, it adds to the growing consensus that the best possible management of diabetes, based on a multifactorial approach, represents good preventive medicine. Primary care practitioners, in the front line of the Health Care System, should provide an integrated and multi-intensive treatment that will be essential for preventing chronic complications and reducing the high CHD risk of Type 2 diabetic patients.

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