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Prevalence and treatment of isolated and concurrent hypertension and hypercholesterolaemia in the United Kingdom

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WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT

- The 1998 and 2003 Health Survey for England revealed a high prevalence of hypertension and hypercholesterolaemia in the population of England.
- Major changes in the reimbursement of primary care for the management of both hypertension and hypercholesterolaemia have occurred in the UK.

WHAT THIS STUDY ADDS

- Using a GP database we have examined the proportion of subjects diagnosed and treated for hypertension and hypercholesterolaemia over time. To examine the true population rates and primary care data we compared the results of the Health survey for England in both 1998 and 2003 with the recorded data on GP computers.
- Despite current guidelines, many patients with hypertension and/or hypercholesterolaemia are under-treated and, even amongst those who are treated, many do not achieve their blood pressure and/or lipid targets.
- Although treatment rates in the UK have improved recently, particularly for lipid-lowering therapies, they remain suboptimal.

AIMS

To determine the prevalence and treatment of hypertension, dyslipidaemia and both together in the UK between 1998 and 2006.

METHODS

We used The Health Improvement Network (THIN) a general practice-based database from 1998 to 2006 and we compared the 1998 and 2003 data to that taken from the Health Survey for England (HSE) in 1998 and 2003.

RESULTS

The prevalence (treatment) of hypertension was 25.3% (11.4%) in 1998, 27.8% (15.1%) in 2003 and 26.9% (16.2%) in 2006 in THIN. In HSE it was 37.3% (9.6%) in 1998 and 32.9% (13.8%) in 2003. For dyslipidaemia the figures were 8.6% (1.9%), 18.5% (6.5%) and 24.4% (9.8%) for THIN and 67.8% (2.3%) and 74.9% (7.0%) for HSE. Concurrent hypertension and dyslipidaemia in THIN increased from 5.5% (1.1%) in 1998 to 13.5% (4.5%) in 2003 and 17.4% (7.1%) in 2006. The prevalence of both conditions was 30.6% (0.7%) in HSE in 1998 and 28.7% (3.1%) in 2003.

CONCLUSIONS

There has been a progressive improvement in the detection and treatment of hypertension, dyslipidaemia and both conditions together between 1998 and 2006. However, much still needs to be done to improve the diagnosis and treatment of hypertension, hypercholesterolaemia and concurrent hypertension and hypercholesterolaemia in the United Kingdom.

Introduction

Cardiovascular disease (CVD) is the leading cause of death worldwide. In Europe, it contributes to nearly 2 million deaths per year in people under the age of 75 years [1], and accounts for 49% of all deaths in Europe [2]. The high prevalence of CVD is attributed to the presence of high levels of modifiable cardiovascular risk factors including hypertension, hypercholesterolaemia, smoking, sedentary lifestyle, diabetes or glucose intolerance and obesity [3]. Hypertension is second only to smoking in its contribution to the burden of disease in developed countries [4]. Globally, hypertension and hypercholesterolaemia are estimated to contribute to 7.1 and 4.4 million deaths per year, respectively [4]. These two risk factors frequently coexist [5–8], and their impact on CVD events is thought to be more than additive [9, 10].

Lifestyle changes are recommended for patients at risk of CVD [11, 12]. However, lifestyle measures alone are often not sufficient and patients should be treated with appropriate antihypertensive and lipid-lowering therapy [11, 12]. Meta-analyses of clinical trials have demonstrated beyond doubt that antihypertensive [13–16] and lipid-lowering [17–19] therapies significantly reduce patients' CVD morbidity and mortality. Current guidelines also advocate the use of statins as lipid-lowering agents [11, 12, 20, 21].

Despite these guidelines, many patients with hypertension and/or hypercholesterolaemia are under-treated and, even amongst those who are treated, many do not achieve their blood pressure [22] and/or lipid targets [22–26]. However, treatment rates have improved somewhat recently, particularly for lipid-lowering therapies, but remain suboptimal [27].

The 1998 Health Survey for England (HSE) demonstrated the high prevalence of hypertension and hypercholesterolaemia in the population of the United Kingdom [28, 29]. In order to estimate the extent to which these conditions are clinically diagnosed and treated in primary practice in the United Kingdom, we conducted a study utilizing electronic records from The Health Improvement Network (THIN) [30] and compared these results against the population-based data from the 1998 HSE [31, 32] and the 2003 HSE [33, 34].

Methods

Primary analyses

The primary aim of this study was to compare the prevalence of hypertension and hypercholesterolaemia, occurring either alone or together, and drug treatment for these conditions, in the 1998 and 2003 population-based HSE and in a cross-sectional analysis of THIN primary care database for the same years. We also examined trends in the prevalence and drug treatment of these conditions from 1998 to 2006 in THIN.

THIN database contains clinical, prescribing and other records, including blood pressures and test results, of over 5.5 million patients. Data are derived directly from the practitioner's electronic patient records, dating from 1985 for some practices. THIN data are likely to reflect what actually happens in primary care in the United Kingdom [http://www.epic-uk.org/thin.htm].

At the time of this analysis THIN study population included patients from 326 THIN practices. We identified patients (aged $\geq$ 16 years) with a history of hypertension or drug treatment for hypertension among those registered with each practice at the beginning of 1998, 2003 or 2006. The presence of hypertension was determined by one or more of the following: a recorded clinical diagnosis, blood pressure recordings (systolic blood pressure $\geq$ 140 mmHg or diastolic blood pressure $\geq$ 90 mmHg, averaged over three successive occasions), or a record of antihypertensive drug prescribing. Treatment for hypertension was defined as: thiazide diuretics, unless prescribed for oedema or congestive heart failure; β-adrenoceptor blockers, unless prescribed for angina or anxiety or with nitrates; calcium channel blockers, unless prescribed for angina or with nitrates; angiotensin-converting enzyme inhibitors, unless prescribed for congestive heart failure or with loop diuretics; angiotensin II receptor blockers; α-adrenoceptor blockers or centrally acting drugs. We also identified patients with hypercholesterolaemia in 2003 and 2006. The presence of hypercholesterolaemia was determined by one or more of the following: a recorded clinical diagnosis, a recorded cholesterol measurement (total cholesterol $\geq$ 5 mmol l^{-1} (193 mg dl^{-1}) or low-density lipoprotein cholesterol $\geq$ 3 mmol l^{-1} (116 mg dl^{-1})) or a record of prescription of lipid-lowering drug treatment (drugs in BNF chapter 2.12: statins, ezetimbe, fibrates, anion exchange resins, nicotinic acid, fish oils).

The HSE comprised data on individuals from randomly selected addresses. We used the subset of people aged $\geq$ 16 years with valid blood pressure and total cholesterol data. These individuals were defined as hypertensive if, on the day they were surveyed, they had systolic blood pressure $\geq$ 140 mmHg or diastolic blood pressure $\geq$ 90 mmHg (based on the average of the last two of three blood pressure measurements taken on the same day), or they were being treated for hypertension. They were defined as dyslipidaemic if they had a total cholesterol concentration $\geq$ 5 mmol l^{-1} or they were being treated with lipid-regulating drugs.

The prevalence of hypercholesterolaemia in patients with or without hypertension and the prevalence of hypertension in patients with or without hypercholesterolaemia were also determined in the HSE and THIN.

Secondary analysis

In a secondary analysis, we determined the time to diagnosis of hypercholesterolaemia in patients with or without hypertension and, conversely, the time to diagnosis of

hypertension in patients with or without hypercholesterolaemia. We identified patients in THIN aged ≥ 16 years and with no prior history of hypertension or hypercholesterolaemia on 1 January 2003. An inception cohort of hypertensive patients was identified, comprising patients in whom hypertension was first identified between 1 January 2003 and 31 December 2005. Each patient in this cohort was matched with four patients of the same age and gender in the same practice who did not have hypertension. The date of diagnosis of hypertension was defined as the index date for each hypertension case and their controls. The time from the index date to the diagnosis of hypercholesterolaemia in patients with recognized hypertension was compared with that in patients not diagnosed as hypertensive.

Similarly, we defined an inception cohort of dyslipidaemic patients and compared the time to diagnosis of hypertension in these patients with that in a control group of patients not diagnosed with hypercholesterolaemia.

Statistical methods

In the primary analysis, the prevalence of diagnosis and treatment for hypertension, hypercholesterolaemia and both conditions were calculated for patients in seven age categories, by gender and for all patients. Survival models with Weibull distributions were used to model time to diagnosis of disease, adjusting for year, age and gender.

Results

Primary analyses

We used data from 326 practices contributing to THIN. We identified a population of 2.04, 2.46 and 2.58 million patients aged ≥ 16 years and permanently registered in THIN in 1998, 2003 and 2006, respectively. The HSE included 15 908 individuals aged ≥ 16 years in 1998, and 14 836 in 2003. Of these, measurements for blood pressure and total cholesterol were available for 9410 and 6855 individuals. Table 1 shows the gender and age distribution in the five study groups. About 32% of THIN population was under the age of 35 years, compared with only 20% of the HSE sample in 2003 with both blood pressure and cholesterol data.

Prevalence and drug treatment of hypertension

The prevalence of hypertension increased with advancing age in both men and women across all three study groups (Table 2, Figure 1A). Similar rates were found in THIN and in the HSE, except in 1998 when the rates in the HSE were higher across all age groups.

The overall prevalence of hypertension was lower in the 2003 HSE (32.9%) than in 1998 HSE (37.3%). The treatment rates among those with hypertension increased from 25.6% to 41.8%. In THIN population the prevalence of recorded hypertension was 25.3% in 1998, 27.8% in 2003 and 26.9% in 2006. Treatment rates with antihypertensive medication among these patients were 45.2% in 1998, 54.4% in 2003 and 60.3% in 2006 (Table 2).

Prevalence and drug treatment of hypercholesterolaemia

The point prevalence of hypercholesterolaemia in the HSE increased with advancing age, peaking at 93.2% amongst women aged 65–74 years and at 89.2% amongst men aged 55–64 years in 2003 (Table 2). The rates were slightly higher in all age groups than those observed in 1998. The prevalence of hypercholesterolaemia was much higher in the population-based HSE than in THIN for all age groups (Figure 2A). In the 2003 HSE, 74.9% were diagnosed with hypercholesterolaemia whilst this condition was only diagnosed and recorded in 18.5% of the 2003 THIN population (Table 2). In THIN, the prevalence of diagnosed and recorded hypercholesterolaemia did not exceed 50% in any age group (Table 2). Between 1998 and 2006 the prevalence of diagnosed and recorded hypercholesterolaemia in THIN increased three-fold, but remained far below the rates observed in the HSE.

In the 2003 HSE only 9.4% of those with hypercholesterolaemia were treated with lipid-lowering medication (Table 2), an increase from 3.4% in 1998. However, in THIN treatment rates among patient with recorded hypercholesterolaemia were 22.6% in 1998, 34.9% in 2003 and 40.3% in 2006 (Table 2, Figure 2B).

Prevalence and drug treatment of concurrent hypertension and hypercholesterolaemia

In 2003 28.7% of the HSE population had concurrent hypertension and hypercholesterolaemia, a small increase since 1998. The prevalence of concurrent hypertension and hypercholesterolaemia was higher in the HSE than THIN for all age groups (Table 2, Figure 3A). The prevalence of diagnosed and recorded concurrent disease in THIN increased from 5.5% in 1998 to 13.5% in 2003 and 17.4% in 2006 (Table 2, Figure 3A).

Treatment rates of concurrent disease were low in the HSE, 2.4% of those diagnosed with both conditions in 1998 and 10.9% in 2003. Treatment rates in THIN were higher: 21.0% in 1998, 33.4% in 2003 and 40.5% in 2006.

Table 2 shows the prevalence of hypertension in patients with and without hypercholesterolaemia and the prevalence of hypercholesterolaemia in patients with and without hypertension in the three study groups. In the 2003 HSE hypertension was more prevalent in individuals with hypercholesterolaemia (38.4%) than in those without hypercholesterolaemia (16.8%). Similarly, in THIN, hypertension was more prevalent in individuals with hypercholesterolaemia (1998 THIN: 72.9%) than in those without this condition (1998 THIN: 21.7%). The converse was also true, with hypercholesterolaemia being more prevalent in individuals with hypertension compared with patients

Table 1

Prevalence of diagnosis and treatment rates by age for hypertension, hypercholesterolaemia and both conditions in the HSE and in THIN in 1998 and 2003 and in THIN alone in 2006

	Total patients	Hypertension Diagnosed		Treated		Hypercholesterolaemia Diagnosed		Treated		Concurrent hypertension and hypercholesterolaemia Diagnosed		Treated	
		n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
HSE 1998													
Men													
Age (years)													
16–24	364	69	19.0			81	22.2			20	5.5		
25–34	791	153	19.3	3	0.4	390	49.3	2	0.2	88	11.1		
35–44	849	221	26.0	22	2.6	604	71.1	7	0.8	179	21.1	4	0.5
45–54	830	343	41.3	52	6.3	653	78.7	24	2.9	283	34.1	8	1.0
55–64	647	389	60.1	112	17.3	543	83.9	49	7.6	330	51.0	11	1.7
65–74	570	400	70.2	119	20.9	454	79.6	36	6.3	329	57.7	10	1.8
75+	349	257	73.6	80	22.9	249	71.4	3	0.9	193	55.3		
All ages	4 400	1 832	41.6	388	8.8	2 974	67.6	121	2.8	1 422	32.3	33	0.8
Women													
Age (years)													
16–24	397	17	4.3	1	0.2	103	25.9			8	2.0		
25–34	850	56	6.6	3	0.4	380	44.7			29	3.4		
35–44	959	126	13.1	23	2.4	564	58.8	3	0.3	96	10.0		
45–54	989	306	30.9	61	6.2	729	73.7	11	1.1	251	25.4	2	0.2
55–64	728	359	49.3	101	13.9	646	88.7	35	4.8	330	45.3	12	1.6
65–74	591	427	72.2	167	28.3	544	92.0	37	6.3	396	67.0	18	3.1
75+	496	386	77.8	155	31.2	444	89.5	12	2.4	350	70.6	5	1.0
All ages	5 010	1 677	33.5	511	10.2	3 410	68.1	98	2.0	1 460	29.1	37	0.7
Both sexes	9 410	3 509	37.3	899	9.6	6 384	67.8	219	2.3	2 882	30.6	70	0.7
THIN1998													
Men													
Age (years)													
16–24	126 073	2 024	1.6	304	0.2	411	0.3	36	0.0	62	0.0	6	0.0
25–34	202 080	9 292	4.6	1 173	0.6	3 930	1.9	223	0.1	896	0.4	45	0.0
35–44	184 959	20 267	11.0	3 804	2.1	12 374	6.7	1 261	0.7	4 147	2.2	404	0.2
45–54	165 152	40 637	24.6	12 158	7.4	22 582	13.7	4 474	2.7	11 505	7.0	2 151	1.3
55–64	124 905	51 283	41.1	21 841	17.5	25 277	20.2	7 521	6.0	16 770	13.4	4 433	3.5
65–74	98 450	53 725	54.6	27 599	28.0	20 669	21.0	6 797	6.9	16 348	16.6	4 408	4.5
75+	75 406	43 413	57.6	23 446	31.1	7 151	9.5	1 605	2.1	6 186	8.2	1 076	1.4
All ages	977 025	220 641	22.6	90 325	9.2	92 394	9.5	21 917	2.2	55 914	5.7	12 523	1.3

Women												
Age (years)												
16–24	132 707	3 427	2.6	691	0.5	500	0.4	44	0.0	65	0.0	10	0.0
25–34	209 048	13 069	6.3	3 553	1.7	3 226	1.5	156	0.1	658	0.3	28	0.0
35–44	178 875	22 538	12.6	8 518	4.8	7 932	4.4	461	0.3	2 535	1.4	170	0.1
45–54	160 895	46 776	29.1	20 040	12.5	16 834	10.5	1 988	1.2	8 897	5.5	1 041	0.6
55–64	125 631	60 351	48.0	27 818	22.1	22 358	17.8	5 415	4.3	16 105	12.8	3 178	2.5
65–74	113 030	66 502	58.8	33 920	30.0	21 096	18.7	7 094	6.3	17 585	15.6	4 622	4.1
75+	135 305	81 109	59.9	47 495	35.1	10 206	7.5	2 454	1.8	9 145	6.8	1 760	1.3
All ages	1 055 491	293 772	27.8	142 035	13.5	82 152	7.8	17 612	1.7	54 990	5.2	10 809	1.0
Both sexes	2 032 516	514 413	25.3	232 360	11.4	174 546	8.6	39 529	1.9	110 904	5.5	23 332	1.1
HSE 2003													
Men													
Age (years)													
16–24	239	16	6.7	0	0.0	64	26.8	0	0.0	9	3.8	0	0.0
25–34	415	48	11.6	2	0.5	249	60.0	1	0.2	36	8.7	0	0.0
35–44	639	114	17.8	17	2.7	496	77.6	11	1.7	96	15.0	1	0.2
45–54	576	204	35.4	56	9.7	488	84.7	28	4.9	179	31.1	13	2.3
55–64	575	274	47.7	114	19.8	513	89.2	81	14.1	246	42.8	36	6.3
65–74	432	270	62.5	138	31.9	374	86.6	98	22.7	237	54.9	50	11.6
75+	263	179	68.1	83	31.6	205	77.9	46	17.5	143	54.4	17	6.5
All ages	3 139	1 105	35.2	410	13.1	2 389	76.1	265	8.4	946	30.1	117	3.7
Women													
Age (years)													
16–24	276	4	1.4	0	0.0	99	35.9	0	0.0	1	0.4	0	0.0
25–34	487	26	5.3	4	0.8	246	50.5	0	0.0	20	4.1	0	0.0
35–44	726	74	10.2	13	1.8	443	61.0	1	0.1	52	7.2	0	0.0
45–54	659	150	22.8	50	7.6	523	79.4	22	3.3	129	19.6	9	1.4
55–64	701	303	43.2	139	19.8	635	90.6	51	7.3	273	38.9	22	3.1
65–74	471	299	63.5	164	34.8	439	93.2	82	17.4	279	59.2	41	8.7
75+	396	297	75.0	164	41.4	357	90.2	62	15.7	269	67.9	25	6.3
All ages	3 716	1 153	31.0	534	14.4	2 742	73.8	218	5.9	1 023	27.5	97	2.6
Both sexes	6 855	2 258	32.9	944	13.8	5 131	74.9	483	7.0	1 969	28.7	214	3.1
THIN 2003													
Men													
Age (years)													
16–24	161 238	2 807	1.7	528	0.3	926	0.6	92	0.1	182	0.1	24	0.0
25–34	216 423	11 164	5.2	1 898	0.9	7 093	3.3	602	0.3	2 205	1.0	215	0.1
35–44	236 869	28 315	12.0	7 351	3.1	26 357	11.1	3 743	1.6	10 748	4.5	1 642	0.7
45–54	184 817	49 163	26.6	19 723	10.7	45 557	24.6	11 872	6.4	26 068	14.1	6 562	3.6
55–64	163 941	73 183	44.6	38 266	23.3	62 043	37.8	24 850	15.2	44 910	27.4	16 192	9.9
65–74	116 819	70 962	60.7	44 825	38.4	54 385	46.6	29 277	25.1	46 099	39.5	21 301	18.2
75+	99 335	62 376	62.8	41 570	41.8	32 684	32.9	16 728	16.8	29 955	30.2	12 840	12.9
All ages	1 179 442	297 970	25.3	154 161	13.1	229 045	19.4	87 164	7.4	160 167	13.6	58 776	5.0

Table 1

Continued

	Total patients	Hypertension Diagnosed *n*	%	Treated *n*	%	Hypercholesterolaemia Diagnosed *n*	%	Treated *n*	%	Concurrent hypertension and hypercholesterolaemia Diagnosed *n*	%	Treated *n*	%
Women													
Age (years)													
16–24	173 435	5 776	3.3	904	0.5	1 278	0.7	81	0.0	238	0.1	30	0.0
25–34	232 093	17 404	7.5	3 832	1.7	5 895	2.5	397	0.2	1 726	0.7	122	0.1
35–44	230 243	32 994	14.3	11 912	5.2	18 572	8.1	1 715	0.7	7 511	3.3	761	0.3
45–54	180 037	55 911	31.1	27 322	15.2	36 778	20.4	6 088	3.4	22 162	12.3	3 716	2.1
55–64	166 202	83 929	50.5	46 753	28.1	57 925	34.9	16 884	10.2	44 344	26.7	11 650	7.0
65–74	131 126	82 515	62.9	51 944	39.6	57 430	43.8	25 631	19.5	50 500	38.5	19 269	14.7
75+	167 585	106 825	63.7	75 026	44.8	49 102	29.3	21 350	12.7	46 006	27.5	17 109	10.2
All ages	1 280 721	385 354	30.1	217 693	17.0	226 980	17.7	72 146	5.6	172 487	13.5	52 657	4.1
Both sexes	2 460 163	683 324	27.8	371 854	15.1	456 025	18.5	159 310	6.5	332 654	13.5	111 433	4.5
THIN 2006													
Men													
Age (years)													
16–24	172 886	2 440	1.4	637	0.4	1 309	0.8	144	0.1	271	0.2	47	0.0
25–34	210 967	9 684	4.6	1 916	0.9	8 416	4.0	917	0.4	2 460	1.2	321	0.2
35–44	245 272	26 806	10.9	8 545	3.5	34 006	13.9	5 498	2.2	13 298	5.4	2 483	1.0
45–54	197 554	48 832	24.7	22 999	11.6	60 560	30.7	17 014	8.6	33 003	16.7	9 686	4.9
55–64	175 750	76 280	43.4	45 542	25.9	82 390	46.9	36 342	20.7	58 154	33.1	24 524	14.0
65–74	121 542	72 659	59.8	50 426	41.5	69 549	57.2	42 708	35.1	58 008	47.7	31 603	26.0
75+	109 641	67 649	61.7	49 362	45.0	51 149	46.7	32 175	29.3	46 823	42.7	25 212	23.0
All ages	1 233 612	304 350	24.7	179 427	14.5	307 379	24.9	134 798	10.9	212 017	17.2	93 876	7.6
Women													
Age (years)													
16–24	183 289	4 994	2.7	841	0.5	1 893	1.0	141	0.1	343	0.2	42	0.0
25–34	231 248	16 343	7.1	3 500	1.5	7 835	3.4	626	0.3	2 258	1.0	238	0.1
35–44	242 420	33 322	13.7	12 223	5.0	25 767	10.6	2 955	1.2	10 074	4.2	1 348	0.6
45–54	191 499	53 652	28.0	28 248	14.8	50 643	26.4	9 413	4.9	28 080	14.7	5 646	2.9
55–64	179 344	86 253	48.1	52 904	29.5	80 078	44.7	25 557	14.3	58 542	32.6	17 826	9.9
65–74	135 424	82 262	60.7	56 279	41.6	74 061	54.7	36 685	27.1	63 406	46.8	28 106	20.8
75+	179 179	111 377	62.2	84 351	47.1	79 926	44.6	42 607	23.8	74 684	41.7	34 855	19.5
All ages	1 342 403	388 203	28.9	238 346	17.8	320 203	23.9	117 984	8.8	237 387	17.7	88 061	6.6
Both sexes	2 576 015	692 553	26.9	417 773	16.2	627 582	24.4	252 782	9.8	449 404	17.4	181 937	7.1

HSE, Health Survey for England; THIN, The Health Improvement Network.

Table 2

Prevalence of hypertension with and without hypercholesterolaemia and hypercholesterolaemia with and without hypertension in the HSE and in THIN in 2003 (row and column totals are not shown for clarity) and in THIN alone for 2006

		Hypercholesterolaemia		
		No	Yes	% Yes
HSE 2003 (n = 6 855)				
Hypertension	No	1 435	3 162	68.8%
	Yes	289	1 969	87.2%
	% Yes	16.8%	38.4%	
THIN 2003 (n = 2 460 163)				
Hypertension	No	1 653 468	123 371	8.9%
	Yes	350 670	332 654	48.7%
	% Yes	21.7%	72.9%	
THIN 2006 (n = 2 576 015)				
Hypertension	No	1 705 284	178 178	12.4%
	Yes	243 149	449 404	64.9%
	% Yes	16.2%	71.6%	

HSE, Health Survey for England; THIN, The Health Improvement Network.

without hypertension in both the 2003 HSE (87.2% *vs.* 68.8%) and THIN (2003 THIN: 48.7% *vs.* 8.9%) study populations.

Secondary analysis

In the secondary analysis using THIN patient population, we found that the likelihood of hypertension being diagnosed and recorded in patients with hypercholesterolaemia (n = 36 012) was 2.0 (95% CI 1.9, 2.1) times greater than in patients from the same practice and matched for age and gender, but without hypercholesterolaemia. The likelihood of hypercholesterolaemia being diagnosed in patients with hypertension (n = 19 107) was 5.4 (95% CI 5.2, 5.6) times greater than in patients without hypertension.

Discussion

The HSE is a population-based sample and provides an assessment of the point prevalence of patients with blood pressures and/or total cholesterol concentrations above the thresholds used to define hypertension and hypercholesterolaemia. Guidelines stress the need for more than one blood pressure measurement to diagnose hypertension. In the HSE, blood pressure measurements were made during one visit and therefore the prevalence of hypertension may have been overestimated [29]. In contrast, THIN indicates the extent of clinically diagnosed and recorded hypertension and hypercholesterolaemia among patients who visit their general practitioner, and is likely to underestimate the prevalence in the general population. The prevalence of hypercholesterolaemia was indeed higher in the HSE (74.9% overall) than in THIN (18.5% overall) in 2003. The age specific prevalence rates of hypertension

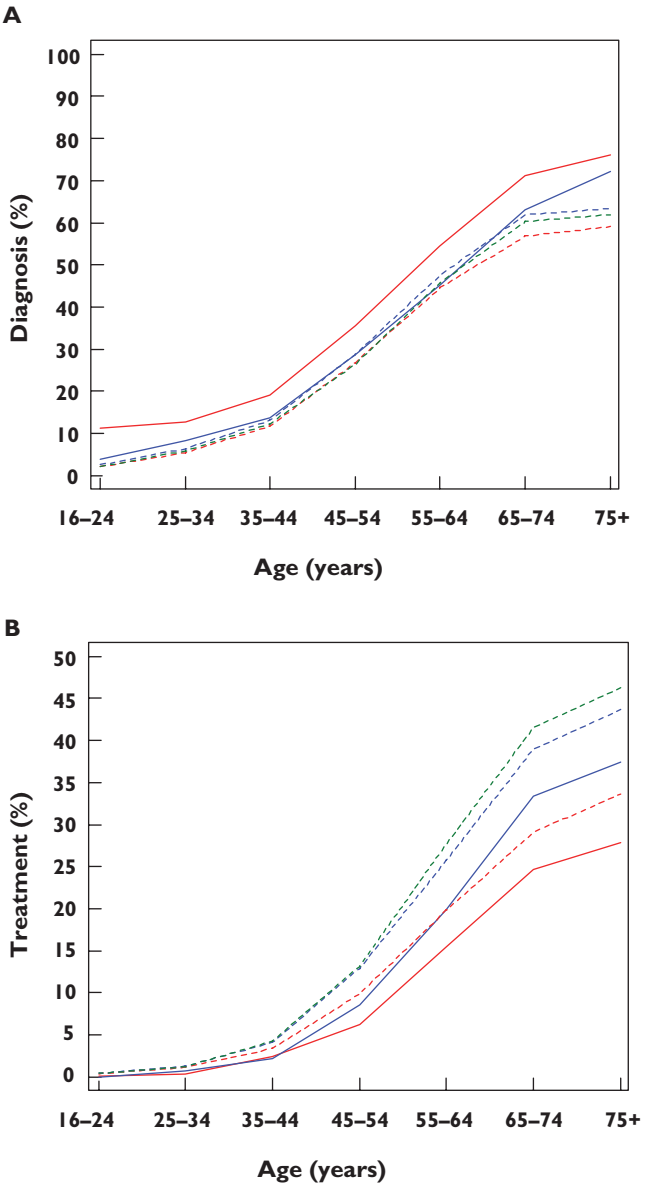

Figure 1

Prevalence of diagnosis (A) and treatment (B) for hypertension in the HSE (solid lines) and THIN (dashed lines) in 1998 (red), 2003 (blue) and 2006 (green)

averaged over both sexes were similar in THIN and the HSE sample; there was a higher prevalence of hypertension in women aged 16–54 years in THIN than in the HSE and a lower prevalence in men. Many women in this age group are of child-bearing potential. Those prescribed the contraceptive pill or who are pregnant are likely to have their blood pressure more regularly monitored. Those aged 45–54 years may have begun their menopause, which may also increase their likelihood of visiting their general practitioner and having their blood pressure measured. Both oestrogen therapy and resulting repeated blood pressure

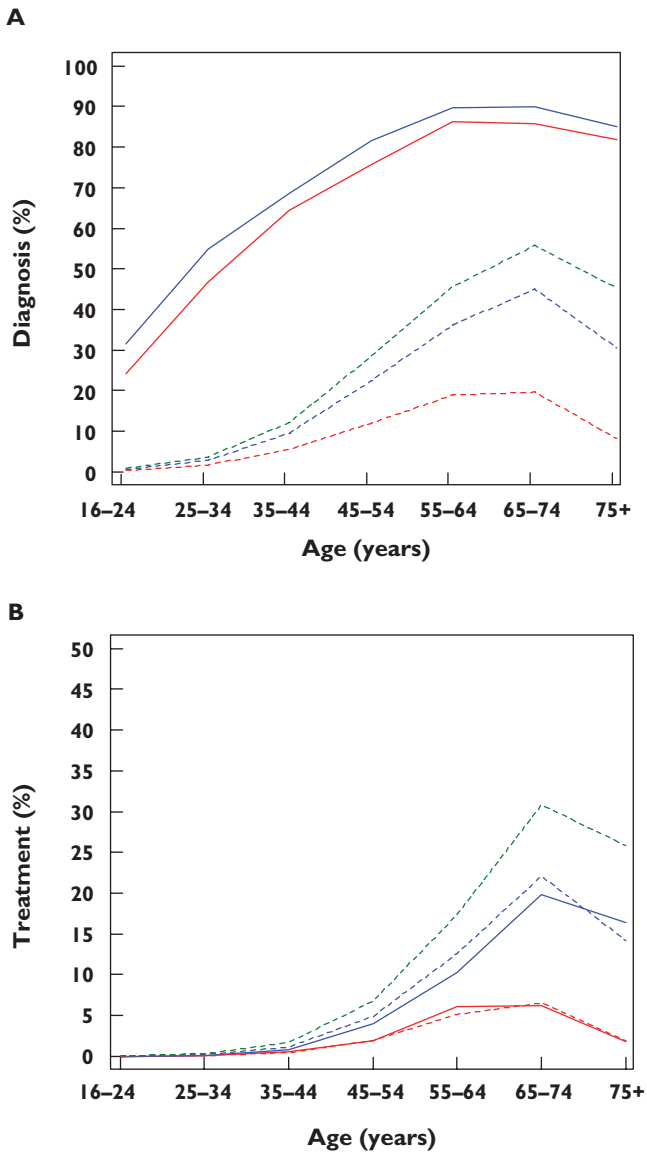

Figure 2

Prevalence of diagnosis (A) and treatment (B) for hypercholesterolaemia in the HSE (solid lines) and THIN (dashed lines) in 1998 (red), 2003 (blue) and 2006 (green)

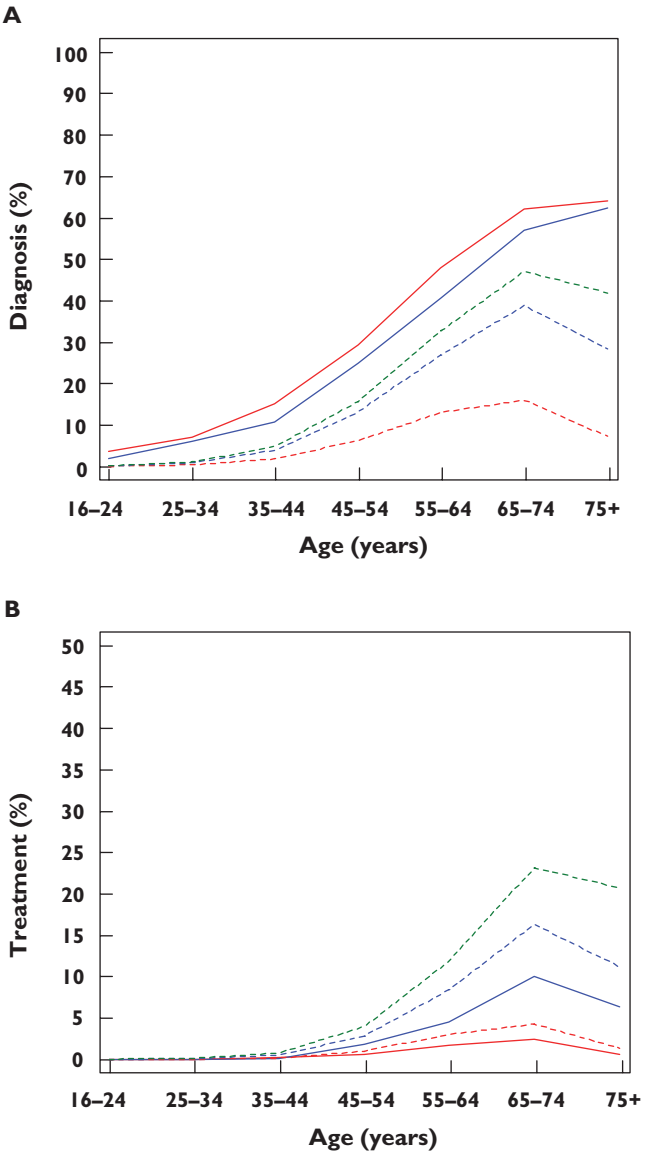

Figure 3

Prevalence of diagnosis (A) and treatment (B) for concurrent hypertension and hypercholesterolaemia in the HSE (solid lines) and THIN (dashed lines) in 1998 (red), 2003 (blue) and 2006 (green)

measurements could contribute to the higher prevalence of diagnosed hypertension observed in young and middle-aged women.

Our study demonstrated a very low prevalence of recognized hypercholesterolaemia in THIN (18.5% in 2003 *vs.* 74.9% in the HSE). One explanation for this could be the lack of screening for this condition. Cholesterol screening in the United Kingdom was recommended only in those patients who were at high risk (10-year risk >20%) of CVD [20, 35, 36] at the time of this study. This may have contributed to the under-recognition of hypercholesterolaemia, particularly among younger patients. Whilst it would have been better to have had high density lipoprotein (HDL) concentrations measured in all subjects, these data were not available widely and so we used only total and LDL cholesterol measurements in this study.

Previously published analyses of the 1998 HSE confirm the prevalence of hypertension and hypercholesterolaemia reported in the present study ($n = 11\,529$, hypertension 37%, defined as systolic blood pressure (SBP) $\geq$ 140 mmHg or diastolic blood pressure (DBP) $\geq$ 90 mmHg [29]; $n = 10\,569$, hypercholesterolaemia 68%, defined as total cholesterol ≥ 5 mmol l^{-1} [28]). The prevalence of hypertension and hypercholesterolaemia observed in the HSE is comparable with figures reported in other national surveys [37–39].

The differences we have observed in the present study between clinic- and population-based data are consistent with reports of clinic-based studies conducted in Europe [25] and in the United States [40, 41].

Few surveys have looked into the prevalence of concurrent hypertension and hypercholesterolaemia. A study in the United States estimated that the prevalence of concurrent hypertension and hypercholesterolaemia is approximately 20% (LDL cholesterol $\geq$ 130 mg dl^{-1} [or $\geq$100 mg dl^{-1} in patients with cardiovascular risk factors] and blood pressure $\geq$ 140/90 (or 130/80 mmHg depending on risk factors), or taking medications for these conditions) (42). We found that the overall prevalence of concurrent hypertension and hypercholesterolaemia was 30.6% in the HSE. A survey in France found that 36.2% of hypertensive men (SBP $\geq$ 140 mmHg or DBP $\geq$ 90 mmHg or antihypertensive treatment) aged $\geq$ 55 years had concurrent hypercholesterolaemia (defined as total cholesterol $\geq$ 6.5 mmol l^{-1} (250 mg dl^{-1})) [43]. A study in the United States comparing the prevalence of hypercholesterolaemia in two ethnically different, community-dwelling samples of hypertensive adults found levels of hypercholesterolaemia among hypertensive individuals similar to those we report, ranging from 49.5% in black women to 78.4% in white men [44]. In the HSE 82.1% of individuals with hypertension had concurrent hypercholesterolaemia.

The prevalence of concurrent hypertension and hypercholesterolaemia observed in the clinic mirrors the trend earlier discussed for isolated hypertension and hypercholesterolaemia. Concomitant hypertension and hypercholesterolaemia were reported in <10% of patients in both the Dutch [25] and United States managed care populations [40]. In the VA population [41], the recorded prevalence of concurrent hypertension and hypercholesterolaemia was considerably higher (30.7%), presumably due to the demographics of this study population. A key strength of the present study is that the GP clinic data and the HSE data were derived in the same National Health Service system.

The prevalence of diagnosed hypertension in THIN changed little between 1998 (25.3%) and 2006 (26.9%), while the prevalence of diagnosed hypercholesterolaemia increased from 8.6% to 24.4% over this 8 year period. Comparison of the prevalence rates in THIN and the HSE in 2003 suggests that about 84% of expected hypertension but only 25% of expected hypercholesterolaemia was detected and recorded in the United Kingdom in that year.

In the 2006 THIN, only 60.3%, 40.3% and 40.5% of patients with diagnosed and recorded hypertension, hypercholesterolaemia and both conditions together, respectively, were treated with antihypertensive and/or lipid-lowering medications. Such low treatment rates are particularly worrying considering that THIN is biased towards well-performing practices in the United Kingdom. Because of this, our results are likely to be optimistic estimates of the national primary care treatment rates in the United Kingdom. The VA clinic-based study by Johnson *et al.* reported treatment rates of 46.6%, 31.5% and 27.6% with antihypertensives, lipid-lowering agents and both types of medications for asymptomatic patients without diabetes but with hypertension, hypercholesterolaemia or both conditions, respectively. This increased to 66.8%, 42.5 and 50.5%, respectively, in patients with diabetes [26]. In patients with symptomatic CVD treatment rates were higher across all patient groups. In contrast, the treatment rates reported for the Dutch clinic-based study by van Wyk *et al.* were considerably higher. Among treatment-eligible patients with newly diagnosed hypertension, hypercholesterolaemia and both conditions, treatment rates of 71%, 57% and 72%, respectively, were observed within 1 year of diagnosis [25]. These higher treatment rates may be due to differences in the way in which treatment rates were calculated rather than just differences in the management of these patients. In studies in the United States based on the National Health and Nutrition Examination Survey (NHANES), 37.3% of participants with hypertension and hypercholesterolaemia in 2001–02 received treatment for both conditions [42]. A recent review has shown that hypertension treatment rates are much better in the USA compared with England [45].

The present findings have important clinical implications. The low rates of diagnosis of hypertension and hypercholesterolaemia in THIN compared with the prevalences in the HSE suggest the need to improve screening for hypertension and, particularly, hypercholesterolaemia in clinical practice. The increase in the prevalence of hypertension with advancing age is well documented. Clinicians are therefore more likely to screen older patients for this condition. Our observations from both the HSE and THIN clearly demonstrate an age-related increase in the prevalence of hypercholesterolaemia, suggesting the need to screen routinely for hypercholesterolaemia in the elderly, particularly because the elderly are susceptible to CVD. Others have argued that, in order to maximize the number of event-free life years gained, lipid-lowering treatment may often need to be started in younger individuals [46].

The high prevalence of concurrent hypertension and hypercholesterolaemia in the HSE suggests that when one of these conditions is diagnosed the patient should be screened for the other. Indeed, our results demonstrate considerable clustering of these two cardiovascular risk factors in the United Kingdom population. The observation that less than 25% of those diagnosed with both risk factors in THIN were treated for both conditions indicates a lost opportunity for further risk reduction, particularly in view of the substantial benefits offered by lipid-lowering treatment in hypertensive patients [47]. Future efforts must be directed towards educating clinicians and patients on the importance and benefits of treating all modifiable risk factors. However, educational approaches may only have short-term effects in changing practitioner

behaviour, and therefore need to be augmented with wider-reaching approaches [48, 49].

Guidelines for the treatment of hypertension and hypercholesterolaemia call for the assessment and treatment of multiple rather than isolated cardiovascular risk factors [12, 20, 21]. Pharmacological treatment of hypertension [16, 50, 51] and hypercholesterolaemia [18, 19, 47, 50] has been demonstrated to result in significant reductions in the risk of major cardiovascular events.

Limitations

THIN data are limited in that they are observational and taken from electronic records created by general practitioners in primary care. The presence of a disease condition can therefore only be determined for patients who have sought medical care, and where the condition has been investigated, measured and/or diagnosed, and the measurements and/or diagnosis have been recorded electronically by the practitioner. Records may therefore be incomplete and subject to practitioner variation. For example, normal blood pressure recordings or cholesterol assessments may not have been recorded. They may also have been subjected to diagnostic bias for patients who sought medical care for other conditions. Treatment rates do not included nondrug therapy and are based on prescription records, rather than dispensing records. However, the latter would tend to overestimate actual drug treatment rates as patients may not have collected these prescriptions or taken their medications [52]. Finally, THIN practices are likely to represent the most motivated and better practices in the United Kingdom. Despite this, the treatment rates observed in this study are still low.

In contrast to THIN, which is based on longitudinal data accumulated over the course of a year, the HSE measured blood pressure and serum cholesterol during a single patient visit.

We acknowledge that the methodology we employed to ensure that drugs were prescribed for hypertension will have removed from the cohort those treated for both hypertension and ischaemic heart disease or heart failure. This is a limitation that will tend to underestimate the prevalence of these conditions.

In conclusion, our study demonstrates that much still needs to be done to improve the diagnosis and treatment of hypertension, hypercholesterolaemia and concurrent hypertension and hypercholesterolaemia in the United Kingdom. Clinicians need to be aware of the high prevalence of these conditions and should increase their efforts to screen for these conditions, particularly in patients who already have one of these cardiovascular risk factors identified or who are at a high risk of CVD. Furthermore, physicians should insure that all patients with hypertension and/or hypercholesterolaemia should be treated adequately in order to reduce the likelihood of CVD.

The Health Survey for England is commissioned by the Department of Health. The 1998 Health Survey for England was carried out by the National Centre for Social Research and the Department of Epidemiology and Public Health at University College London. Access to the dataset was provided by the UK Data Archive. None of the above organizations bear any responsibility for the analysis and interpretation of the data in the present study. Access to the THIN and Health Service for England databases were paid for by Pfizer Inc.

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