

openheart Challenge of cardiovascular prevention in primary care: achievement of lifestyle, blood pressure, lipids and diabetes targets for primary prevention in England – results from ASPIRE-3-PREVENT cross-sectional survey

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ABSTRACT

Background Implementation of the cardiovascular disease (CVD) prevention guidelines in the UK has been repeatedly evaluated under the auspices of the British Cardiovascular Society in three Action on Secondary and Primary Prevention by Intervention to Reduce Events (ASPIRE) surveys in 1994–1995, 2008–2010 and 2017–2019. The primary care arm of ASPIRE-2-PREVENT (A-3-P) was conducted to evaluate lifestyle and medical risk factor management in people at high risk of atherosclerotic CVD in everyday clinical practice.

Methods A-3-P was a cross-sectional survey in 27 general practices and health centres across 5 English National Health Service regions. Patients with no history of atherosclerotic CVD started on blood pressure and/or lipid and/or glucose lowering treatments were identified retrospectively and interviewed at least 6 months after the initiation of medication.

Results 557 patients attended the interview and examination (45.8% women; mean age 61.7±10.8 years). The risk factor control was poor: 9.3% of patients were smokers, 38.1% obese (body mass index≥30 kg/m²) and 53.5% centrally obese (waist circumference≥88 cm for women, ≥102 cm for men). Only 37.8% of patients on blood pressure-lowering therapies achieved the target of <140/90 mm Hg. Among treated dyslipidaemic patients, 59.5% reached the low-density lipoprotein cholesterol target of <2.6 mmol/L. 62% of patients with self-reported diabetes mellitus attained the glycated haemoglobin target of <7.0%.

Conclusion The results of A-3-P survey show that large proportions of people at high CVD risk have poor control of lifestyles and medical risk factors. There is considerable potential to raise the standards of preventive cardiology care by providing comprehensive, multidisciplinary prevention programmes addressing all aspects of risk factor management to reduce the total risk of future CVD.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ A wealth of scientific evidence from observational studies and randomised controlled trials now supports interventions in relation to lifestyle (smoking, diet and exercise), the treatment of hypertension, dyslipidaemia and diabetes, including the use of evidence based medications which protect the heart and circulation. The scientific evidence for primary prevention of cardiovascular disease (CVD) is summarised in the Joint British Societies' Consensus Recommendations for the Prevention of Cardiovascular Disease.

WHAT THIS STUDY ADDS

⇒ Action on Secondary and Primary Prevention by Intervention to Reduce Events-3-PREVENT provides a national audit of the implementation of the primary prevention guidelines in everyday clinical practice across England showing that the vast majority of high CVD risk patients do not achieve the guidelines recommended lifestyle, blood pressure, lipids and diabetes targets.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These results will inform services commissioners about the need of improving delivery of primary preventive cardiology care through multifactorial prevention programmes that are cost-saving for public services.

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of death and represents one of the major challenges to healthcare systems globally.¹ The main objectives of CVD prevention are to reduce morbidity and mortality, improve quality of life and increase life expectancy.¹ Primary prevention of atherosclerotic

CVD remains a major challenge. Observational studies and randomised controlled trials demonstrate that healthy lifestyles and the control of arterial hypertension, dyslipidaemia and diabetes prevent CVD events in people at high risk of developing atherosclerotic CVD.^{2–14}

The Joint British Societies' CVD prevention guidelines for clinical practice, first published in 1998 (JBS1) and updated in 2005 (JBS2) and 2014 (JBS3), defined the priorities for cardiovascular prevention: (1) people with any form of established atherosclerotic CVD; (2) individuals without established atherosclerotic CVD but who have a combination of risk factors which puts them at high total risk (estimated multifactorial CVD risk >20% over 10 years) of developing atherosclerotic CVD; (3) people with diabetes mellitus (type 1 or 2).^{15 16}

Implementation of the CVD prevention guidelines in the UK has been repeatedly evaluated under the auspices of the British Cardiovascular Society in three cross-sectional surveys called Action on Secondary and Primary Prevention by Intervention to Reduce Events using the same design and methodology in 1994–1995 (ASPIRE), 2008–2010 (ASPIRE-2-PREVENT) and 2017–2019 (ASPIRE-3-PREVENT).^{17–19} The main objective of ASPIRE-3-PREVENT (A-3-P) was to evaluate lifestyle, blood pressure, lipids and diabetes management in patients with established coronary disease (hospital arm) and in people at high risk of developing CVD (primary care arm).

The primary care arm of A-3-P was carried out to evaluate the care for people at high CVD risk in everyday clinical practice. A-3-P was conducted as part of the primary care arm of the fifth EUROASPIRE survey, which investigated preventive care in people at high CVD risk from 16 European countries.²⁰ The European Society of Cardiology (ESC) EUROASPIRE cross-sectional surveys have repeatedly evaluated implementation of the European prevention guidelines in patients with coronary disease since 1995 and in people at high CVD risk since 2008.^{20–22}

The main objectives of the primary care arm of A-3-P was to determine in people at high CVD risk, whether the JBS3 guidelines are being implemented in everyday clinical practice and to make recommendations to the British Cardiovascular Society, BACPR and Public Health England in order to improve primary prevention in people without established atherosclerotic coronary artery disease (CAD)

The principal results of the hospital arm of A-3-P survey on coronary patients have already been published elsewhere.¹⁹ This paper describes the principal results of primary care arm in relation to achievement of lifestyle, blood pressure, lipids and diabetes targets as defined in the JBS3 guidelines.

METHODS

Study design

A-3-P was a cross-sectional survey, registered with the National Institute for Health Research Clinical Research

Network (CRN) Portfolio on 23 August 2016 and made visible to all CRNs in England for those wishing to participate. 27 general practices and health centres from 7 geographical areas were recruited in this convenience sample.

Study population

The study population consisted of men and women, 18–80 years of age, without a history of CAD or other atherosclerotic manifestations, who had been on one or more of the following treatments: (1) blood pressure and/or (2) lipid-lowering and/or (3) glucose-lowering (diet and/or hypoglycaemic agents and/or insulin) treatments prescribed by a physician (between 6 months and 2 years prior to the date of interview).

Data collection

Patients were retrospectively identified from the general practice medical notes and recruited consecutively according to the start date of blood pressure-lowering, lipid-lowering or diabetes treatment. All eligible patients were invited to an interview and examination.

Data collection was carried out from January 2018 to September 2018 by trained research assistants and was based on review of the general practices notes and an interview and examination, using standardised methods and instruments. Fasting (at least 12 hours) venous blood samples were drawn at the time of interview.

The following measurements were made: breath carbon monoxide (Smokerlyzer, Bedfont Scientific, Model Micro); height and weight (SECA scales 701 and measuring stick model 220, SECA Medical Measuring Systems and Scales, Birmingham, UK); waist circumference (WC) (metal tape); and blood pressure (automatic digital Omron Comfort M6 sphygmomanometers OMRON Corporation, Kyoto, Japan).

Overweight was defined as a body mass index (BMI) ≥ 25 kg/m² and < 30 kg/m² (≥ 23 kg/m² and < 25 kg/m² for Asians) and obesity as BMI ≥ 30 kg/m² (≥ 25 kg/m² for Asians).^{23 24} Central overweight was defined as a WC ≥ 94 cm for non-Asian men, WC ≥ 90 cm for Asian men, WC ≥ 80 cm for all women and central obesity as a WC ≥ 102 cm (non-Asian men); WC ≥ 90 cm (Asian men); WC ≥ 88 cm (non-Asian women); WC ≥ 80 cm (Asian women).^{23 24} The physical activity target was defined by the question 'do you take regular physical activity of at least 30 min duration on average five times a week?'.²⁵ Raised blood pressure was defined as systolic blood pressure ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mm Hg.

The Central Laboratory in the National Institute for Health and Welfare, Helsinki, Finland was accredited by the Finnish Accreditation Service and fulfilled requirements of the standard SFS-EN ISO/IEC 17025:2005. Total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C) and triglycerides (TG) were analysed in serum and glycated haemoglobin (HbA1c) in whole blood (reagents from Abbott Laboratories, Abbott Park,

Illinois, USA). The level of low-density lipoprotein cholesterol (LDL-C) was calculated by Friedewald's formula when the TG level was <4.5 mmol/L.²⁶ Elevated LDL-C concentration was defined as ≥ 2.6 mmol/L (≥ 100 mg/dL).²⁷

Plasma glucose was analysed locally with a point-of-care technique (Glucose 201RT, HemoCue, Ångelholm, Sweden).²⁸ Among patients with diabetes, elevated fasting glucose was defined as ≥ 6.0 mmol/L (≥ 110 mg/dL) and elevated HbA1c as $\geq 7.0\%$ (International Federation of Clinical Chemistry (IFCC) ≥ 53 mmol/mol). An oral glucose tolerance test (OGTT) was performed using 75 g glucose in 200 mL water in the morning after at least 10 hours of fasting in patients without self-reported diabetes and with fasting blood glucose <11.1 mmol/L. Glycaemic state was defined according to WHO as outlined in online supplemental table S1.²⁹

Data management

Data were entered and managed on the anonymised ESC EurObservational Research Programme electronic online database and stored under the provisions of the National Data Protection Regulations.

Statistical analyses

In order to estimate prevalences with precision, the necessary sample of 400 patients attending for interview was sufficient to estimate prevalences with a precision of at least 5% and a confidence of 95% and to allow power to stratify by age and gender of single risk factors with 95% CIs of width 10%. Continuous variables were summarised by the mean and SD, while categorical variables were presented by the number and percentage. The unpaired t-test was used to compare the continuous variables. The χ^2 test was used to compare categorical variables between genders, except for measures where some outcome categories were rare, in which case Fisher's exact test was preferred. The statistical analyses were performed using STATA V.11 (StataCorp).

Outcome measures

The main outcome measures were the proportions of high CVD risk people achieving the lifestyle and risk factor targets as defined in the JBS3 on CVD prevention and NICE guidelines for blood pressure and lipid management: not smoking, healthy food choices and being physically active; a BMI <25 kg/m²; blood pressure $<140/90$ mm Hg; statin prescription, HbA1c as $<7.0\%$ (IFCC <53 mmol/mol) and appropriate use of cardioprotective drug therapies for treatment of elevated blood pressure, lipids and glucose.^{1 28–30} There is no LDL-C target for primary prevention in JBS3 and NICE guidelines, and therefore the 2021 Joint European Societies guidelines LDL-C target of <2.6 mmol/L is used.²⁷ Time trends in lifestyle and risk factor management between ASPIRE-2-PREVENT and A-3-P are reported but without formal statistical tests as the two studies were undertaken

in different primary care centres which may not be comparable.

RESULTS

Characteristics of study population

A total of 557 patients attended the interview and examination. The distribution of the study population by age, gender, educational level, ethnicity and reason for inclusion in the study at interview is presented in table 1. The mean (SD) age at interview was 61.7 (10.8) years and 45.8% were women. More than half of patients (55.3%) were recruited based on the initiation of blood pressure-lowering medication, 44% were on LL therapy and 14.7% were on glucose lowering therapy. 14.3% of patients were on two or three of the therapies.

Study outcomes

Lifestyle

The prevalence of smoking, obesity and central obesity are presented in tables 2–4.

The prevalence of smoking was 9.3% (men 12.6%, women 5.5%). In the past 3 years, 36.5% of current smokers could not recall being offered professional advice to quit and 43.2% reported no intention to stop within the next 6 months. Of the current smokers, 28.8% tried to stop smoking by abstinence, 9.9% attended smoking-cessation clinics. Nicotine replacement and varenicline or bupropion were used by 16.9% and 5.6%, respectively.

Overall, 78.1% of patients (men 83.4%, women 71.8%) were overweight or obese and 38.1% (men 35.8%, women 40.8%) were obese. The prevalence of central obesity was 53.5% (men 62.0%, women 58.9%). Of obese patients, 20% could not recall being informed by a health professional they were overweight, 20% were not aware of their weight target and 39.8% had not been given any dietary advice.

Regular physical activity (≥ 30 min on average five times/week) was reported by 39.4% of the patients (men 38%, women 41.1%), while 26.3% did not undertake any planned physical activity and 72.7% could not recall being advised by a health professional to increase their physical activity.

Blood pressure, lipids and diabetes

The management of medical risk factors is presented in tables 2–6.

Overall, 55.7% of patients (men 57.6%, women 53.3%) had elevated blood pressure ($\geq 140/90$ mm Hg). In the group of patients on blood pressure-lowering medication, only 37.8% had blood pressure of $<140/90$ mm Hg. A total of 46.9% of patients in this group were aware of their blood pressure level, 39.4% knew their recommended target and 21.5% could not recall being told by a health professional that they had elevated blood pressure. Renin angiotensin systems inhibitors (ACE inhibitors/angiotensin receptor blockers (ARBs)) were the most common (64%), followed by calcium channel blockers (47.8%), diuretics (11.2%) and β -blockers (10.9%),

Table 1 Demographic characteristics of patients attending interview

Variable	Category	All (N=557) N (%)	Men (N=302) N (%)	Women (N=255) N (%)	P value*
Age†	–	61.7±10.8	60.7±10.7	62.7±10.8	0.03
Sex	Male	302 (54.2%)	–	–	–
	Female	255 (45.8%)	–	–	–
Ethnicity	Caucasian	500 (91.1%)	266 (89.9%)	234 (92.5%)	0.10
	Arabic	2 (0.4%)	2 (0.7%)	0 (0.0%)	
	Black African	7 (1.3%)	6 (2.0%)	1 (0.4%)	
	Chinese/Japanese	3 (0.6%)	2 (0.7%)	1 (0.4%)	
	South Asian	14 (2.6%)	10 (3.4%)	4 (1.6%)	
	East Asian	2 (0.4%)	2 (0.7%)	0 (0.0%)	
	Other	21 (3.8%)	8 (2.7%)	13 (5.1%)	
Reason for inclusion‡	BP-lowering therapy	318 (55.3%)	167 (55.3%)	151 (59.2%)	0.35
	Lipid-lowering therapy	245 (44.0%)	140 (46.4%)	105 (41.2%)	0.22
	Glucose-lowering therapy	82 (14.7%)	41 (13.6%)	41 (16.1%)	0.41
	BPL therapy only	257 (46.1%)	136 (45.0%)	121 (47.5%)	0.22
	LL therapy only	178 (32.0%)	100 (33.1%)	78 (30.6%)	
	GL therapy only	42 (7.5%)	23 (7.6%)	19 (7.5%)	
	BPL+LL therapy	40 (7.2%)	25 (8.3%)	15 (5.9%)	
	BPL+GL therapy	13 (2.3%)	3 (1.0%)	10 (3.9%)	
	LL+GL therapy	19 (3.4%)	12 (4.0%)	7 (2.8%)	
	BPL+LL+GL therapy	8 (1.4%)	3 (1.0%)	5 (2.0%)	
Education level	Primary school or less	4 (0.7%)	2 (0.7%)	2 (0.8%)	0.28
	Secondary school	223 (40.0%)	118 (39.1%)	105 (41.2%)	
	High school	59 (10.6%)	30 (9.9%)	29 (11.4%)	
	Intermediate	61 (11.0%)	41 (13.6%)	20 (7.8%)	
	College/University	155 (27.8%)	78 (25.8%)	77 (30.2%)	
	Postgraduate	55 (8.6%)	33 (10.9%)	22 (8.6%)	

*P-values or comparisons of males and females.

†Mean ± standard deviation reported.

‡Patients could have more than one individual reason.

BP, blood pressure; LL, lipid-lowering.

with 66.7% on 1, 24.5% on 2, 5.3% on 3 and 1.5% on ≥4 blood pressure-lowering medications. Four-fifths of patients (81.7%) reported 100% adherence with their blood pressure-lowering drugs intake. In people *not* using antihypertensive medication, blood pressure was elevated (≥140/90 mm Hg) in 45.6% of patients (men 49.1%, women 41.6%). In the group of patients being treated for hypertension, lipid-lowering medication was prescribed in 36.0% and 67.0% had elevated LDL-C≥2.6mmol/L. Of those treated for hypertension and not on lipid-lowering drugs, 87.7% had an LDL-C≥2.6mmol/L.

Elevated LDL-cholesterol (≥2.6mmol/L) was found in 64.7% of patients (men 61.6%, women 68.3%). A total of 59.5% of patients on lipid-lowering therapy had LDL-cholesterol<2.6mmol/L, 41.8% were aware of their cholesterol level, 30.7% knew their recommended

target and 54.5% could not recall being told by a health professional that they had elevated cholesterol. Overall, 78.8% reported 100% adherence with lipid-lowering drugs, mainly statins (99.6%), 0.7% were on fibrates and 1.5% on other lipid-lowering drugs. Importantly, 88.2% of patients on *no* lipid-lowering medication had LDL-C≥2.6mmol/L (men 87.8%, women 88.6%). In the group of patients being treated for dyslipidaemia, 44.9% were also on blood pressure-lowering drugs and 47.3% had a blood pressure above the target of<140/90 mm Hg. Of those with dyslipidaemia not on antihypertensive therapies, 39.3% had a blood pressure≥140/90 mm Hg.

Previously known diabetes was reported by 17.9% (men 18.2%, women 17.5%) and 38% of them had a HbA1c≥7.0%. Nearly two-thirds (63.9%) were on oral glucose-lowering medication, 6.2% on insulin and 63.8% on diet; 80% reported complete adherence with

Table 2 Summary of lifestyle and risk factors

	All		Men		Women		P value
	N	n (%)	N	n (%)	N	n (%)	
Current smoker	557	52 (9.3%)	302	38 (12.6%)	255	14 (5.5%)	0.004
Overweight and obese†	557	435 (78.1%)	302	252 (83.4%)	255	183 (71.8%)	0.001
Obese‡	557	212 (38.1%)	302	108 (35.8%)	255	104 (40.8%)	0.22
Central overweight and obesity§	548	423 (77.2%)	297	220 (74.1%)	251	203 (80.9%)	0.06
Central obesity*	548	293 (53.5%)	287	143 (48.2%)	251	150 (59.8%)	0.007
Not at physical activity target¶	538	326 (60.6%)	292	181 (62.0%)	246	145 (58.9%)	0.47
BP							
Elevated BP 1**	557	310 (55.7%)	302	174 (57.6%)	255	136 (53.3%)	0.31
Elevated BP 2††	557	481 (86.4%)	302	268 (88.7%)	255	213 (83.5%)	0.07
Lipids							
TC≥5.0 mmol/L	533	588 (47.8%)	289	125 (43.3%)	244	130 (53.3%)	0.02
TC≥4.5 mmol/L	533	348 (65.3%)	289	173 (59.9%)	244	175 (71.7%)	0.004
TC≥4.0 mmol/L	533	426 (79.9%)	289	216 (74.7%)	244	210 (86.1%)	0.001
LDL≥1.8 mmol/L	524	468 (89.3%)	281	246 (87.5%)	243	222 (91.4%)	0.16
LDL≥2.0 mmol/L	524	437 (83.4%)	281	227 (80.8%)	243	210 (86.4%)	0.08
LDL≥2.6 mmol/L	524	339 (64.7%)	281	173 (61.6%)	243	166 (68.3%)	0.11
LDL≥3.0 mmol/L	524	235 (44.9%)	281	112 (39.9%)	243	123 (50.6%)	0.01
Non-HDL≥2.5 mmol/L	533	450 (84.4%)	289	236 (81.7%)	244	214 (87.7%)	0.06
Low HDL‡‡	533	113 (21.2%)	289	54 (18.7%)	244	59 (24.2%)	0.12
Triglyceride≥1.7 mmol/L	533	160 (30.0%)	289	103 (35.6%)	244	57 (23.4%)	0.002
Diabetes (self-reported)	548	98 (17.9%)	297	54 (18.2%)	251	44 (17.5%)	0.84
Newly diagnosed diabetes§§	429	21 (4.9%)	231	14 (6.0%)	198	7 (3.5%)	0.23

*Defined as WC≥102 cm for non-Asian men, WC≥90 cm for Asian men, WC≥88 cm for Non-Asian women, WC≥80 cm for Asian women.

†Defined as BMI≥25 kg/m², except for Asians where BMI≥23 kg/m².

‡Defined as BMI≥30 kg/m², except for Asians where BMI≥25 kg/m².

§Defined as WC≥94 cm for non-Asian men, WC≥90 cm for Asian men, WC≥80 cm for non-Asian women, WC≥80 cm for Asian women.

¶Defined as undertaking physical activity less than five times per week.

**Defined as BP≥140/90 mm Hg.

††Defined as BP≥130/80 mm Hg.

‡‡Defined as <1.2 mmol/L for women, <1.0 mmol/L for men.

§§Defined as glucose≥7.0 mmol/L with no self-reported diabetes.

BMI, body mass index; BP, blood pressure; HDL, high-density lipoprotein; TC, total cholesterol; WC, waist circumference.

their glucose-lowering medication. Only 15% of those with self-reported diabetes were aware of their glucose level and 10.1% knew their glucose target, with only 20.4% self-monitoring. Screening for dysglycaemia in people without self-reported diabetes showed that based on fasting plasma glucose results only, newly diagnosed diabetes (fasting plasma glucose≥7.0 mmol/L) was found in 4.9%. The results of HbA1c showed that 92.6% of patients without self-reported diabetes had HbA1c<42 mmol/mol; increased diabetes risk (HbA1c 42–47 mmol/mol) was found in 6.3%, and 1.2% had newly diagnosed diabetes (HbA1c≥48 mmol/mol) (online supplemental table S2). Based on the OGTT in patients without self-reported diabetes, 59.8% were normoglycaemic, 10.4% had impaired fasting glucose (IFG), 19.4% had impaired glucose tolerance (IGT) and new diabetes was found in 10.4% (online supplemental

table S3). In the study population whose glycaemic status was known based on self-report or the results of an OGTT, 21.1% had a history of diabetes, 47.2% were normoglycaemic, 8.2% had IFG, 15.3% had IGT and new diabetes was diagnosed in 8.2% (online supplemental table S3 and figure 1). Of those with self-reported diabetes, 60.7% were on antihypertensive medication and 53.8% had elevated blood pressure (≥140/90 mm Hg). In the group of patients with diabetes not on antihypertensive medication, 58.7% had a blood pressure≥140/90 mm Hg. Just under half (49.2%) of patients with diabetes were on lipid-lowering medication, of whom 34.0% had an LDL-C≥2.6 mmol/L. Of those with diabetes not on lipid-lowering medication, 71.4% had elevated LDL-C (≥2.6 mmol/L). Just over a third (37.1%) of patients with diabetes were prescribed ACE inhibitors/ARBs and 58.8% were on statins.

Table 3 Lifestyle changes reported by patients to reduce their cardiovascular disease risk within the last 3 years

	All n/N (%)	Men n/N (%)	Women n/N (%)	P value
Smoking*				
Abstinence	21/73 (28.8%)	17/49 (34.7%)	4/24 (16.7%)	0.11
Reduction	14/73 (19.2%)	10/49 (20.4%)	4/24 (16.7%)	0.70
Smoking cessation clinic	7/73 (9.9%)	4/49 (8.5%)	3/24 (12.5%)	0.59
Nicotine replacement therapy	12/71 (16.9%)	8/47 (17.0%)	4/24 (16.7%)	0.97
Bupropion	2/71 (2.8%)	2/47 (4.3%)	0/24 (0.0%)	0.31
Varenicline	2/71 (2.8%)	2/47 (4.3%)	0/24 (0.0%)	0.31
Patients with BMI≥30 kg/m ²				
Reduction of fat	132/211 (62.6%)	62/107 (57.9%)	70/104 (67.3%)	0.16
Reduction of calories	130/207 (62.8%)	62/106 (58.5%)	68/101 (67.3%)	0.19
Regular physical activity	98/211 (46.5%)	53/107 (49.5%)	45/104 (43.3%)	0.36
Patients on BP-lowering medications				
Special diet†	19/339 (5.6%)	14/186 (7.5%)	5/153 (3.3%)	0.09
Reduction of salt	188/337 (55.8%)	96/184 (52.2%)	92/153 (60.1%)	0.14
Increased physical activity	192/339 (56.6%)	100/186 (53.8%)	92/153 (60.1%)	0.24
Patients on lipid-lowering medications				
Special diet†	12/273 (4.4%)	9/160 (5.6%)	3/113 (2.7%)	0.24
Reduction of fat	148/271 (54.6%)	87/158 (55.1%)	61/113 (54.0%)	0.86
More fruit and vegetables	173/271 (63.8%)	99/159 (62.3%)	74/112 (66.1%)	0.52
More fish	143/271 (52.8%)	86/159 (54.1%)	57/112 (50.9%)	0.60
Increased physical activity	152/271 (56.1%)	89/160 (56.0%)	63/112 (56.3%)	0.96
In patients with diabetes				
Reduction of fat	61/97 (62.9%)	31/53 (58.5%)	30/44 (68.2%)	0.33
More fruit and vegetables	71/97 (73.2%)	40/54 (74.1%)	31/43 (72.1%)	0.83
Less sugar	73/98 (74.5%)	41/54 (75.9%)	32/44 (72.7%)	0.72
Less alcohol	33/95 (34.7%)	19/53 (35.9%)	14/42 (33.3%)	0.80
Increased physical activity	60/97 (61.9%)	34/54 (63.0%)	26/43 (60.5%)	0.80

*Change during the last 3 years reported by current smokers and those who quit within 3 years only.
†Prescribed by a doctor or other health professional.
BMI, body mass index; BP, blood pressure

DISCUSSION

Principal findings

The A-3-P survey shows that a large majority of high CVD risk patients in England, identified by long-term use of therapies for hypertension, lipid-lowering or diabetes, fail to achieve the lifestyle, risk factor and therapeutic targets set by the Joint British Societies' (JBS3) on CVD prevention¹ and NICE guidelines on hypertension management and cardiovascular risk assessment and reduction, including lipid modification^{30–32}. Lifestyles are unhealthy with correspondingly high prevalences of obesity and central obesity, and inadequate blood pressure, cholesterol and glucose control. A wide treatment gap exists between the evidence-based guidelines and clinical practice.

Overall, 1 in 10 of high CVD risk patients were current smokers, with a significantly higher prevalence in men compared with women. Moreover, over a third of current

smokers had no recall of professional advice to stop smoking in the last 3 years and more than two-fifths did not intend to quit smoking within the next 6 months. Stopping smoking is the most cost-effective strategy for CVD prevention.³³

Healthy diet and weight loss (≥5% initial weight) is associated with moderate improvement in BP, LDL-C, triglyceride and glucose levels among individuals with overweight/obesity.⁴ Weight loss reduces or delays the development of T2DM in persons with obesity.^{4 13} About one-fifth of obese patients have never been told they were overweight by a health professional and two-fifths were not advised to follow dietary guidelines. More than two-thirds of patients reported not receiving any professional advice on physical activity, three-fifths were not achieving the physical activity goal and a quarter were not involved in any planned physical activity.

Table 4 Lifestyle and risk factor management

	All n/N (%)	Men n/N (%)	Women n/N (%)	P value
Smoking*				
No professional advice in the last 3 years	19/52 (36.5%)	16/38 (42.1%)	3/14 (21.4%)	0.17
No quit attempt in the last 3 years	21/52 (40.4%)	14/38 (36.8%)	7/14 (50.0%)	0.39
No intention to quit in the next 6 months	19/44 (43.2%)	11/30 (36.7%)	8/14 (57.1%)	0.20
Obesity†				
Never told being overweight	42/210 (20.0%)	19/107 (17.8%)	23/103 (22.3%)	0.41
No attempt to lose weight last month	75/211 (35.6%)	44/108 (40.8%)	31/103 (30.1%)	0.11
Not considering losing weight in 6 months	37/208 (17.8%)	27/108 (25.0%)	10/100 (10.0%)	0.005
Not aware of weight target	38/190 (20.0%)	20/101 (19.8%)	18/89 (20.2%)	0.94
Not advised to follow dietary guidelines	84/211 (39.8%)	38/107 (35.5%)	46/104 (44.2%)	0.20
Physical activity				
Planned physical activity to increase fitness	260/532 (48.9%)	147/292 (50.3%)	113/240 (47.1%)	0.45
No planned physical activity‡	140/532 (26.3%)	79/292 (27.1%)	61/240 (25.4%)	0.67
No professional advice on physical activity	404/556 (72.7%)	216/301 (71.8%)	188/255 (73.7%)	0.61
Blood pressure				
Awareness of BP level§	137/292 (46.9%)	75/161 (46.6%)	62/131 (47.3%)	0.90
Awareness of BP target§	113/287 (39.4%)	64/159 (40.3%)	49/128 (38.3%)	0.73
100% adherence with BP lowering drugs§	264/323 (81.7%)	149/176 (84.7%)	115/147 (78.2%)	0.39
Never been told having high BP¶	66/307 (21.5%)	38/171 (22.2%)	28/136 (20.6%)	0.73
LDL cholesterol				
Awareness of TC level**	99/237 (41.8%)	62/142 (43.7%)	37/95 (39.0%)	0.47
Awareness of TC target**	73/238 (30.7%)	47/138 (34.1%)	26/100 (26.0%)	0.18
100% adherence with LL drugs**	208/264 (78.8%)	119/153 (77.8%)	89/111 (80.2%)	0.47
Never been told having high cholesterol††	170/312 (54.5%)	85/158 (53.8%)	85/154 (55.2%)	0.80
Diabetes				
Awareness of glucose level‡‡	12/80 (15.0%)	6/42 (14.3%)	6/38 (15.8%)	0.85
Awareness of glucose target‡‡	4/79 (10.1%)	4/40 (10.0%)	4/10.3 (38.3%)	0.97
Self-monitoring‡‡	20/98 (20.4%)	10/54 (18.5%)	10/44 (22.7%)	0.61
100% adherence with glucose lowering drugs§§	52/65 (80.0%)	31/37 (83.8%)	21/28 (75.0%)	0.39

*Figures for current smokers only.

†Figures for obese patients only.

‡Also no intention to do so in the next 6 months.

§Figures for patients using antihypertensive drugs.

¶Figures for patients with raised blood pressure (>140/90 mm Hg).

**Figures for patients using lipid-lowering drugs.

††Figures for patients with LDL cholesterol ≥2.5 mmol/L.

‡‡Figures for self-report diabetics.

§§Figures for patients using glucose-lowering drugs.

.BP, blood pressure; LDL, low-density lipoprotein; LL, lipid-lowering; TC, total cholesterol.

There is a wealth of scientific evidence that control of blood pressure, lipids and glucose can reduce the risk of CV events in high-risk patients.^{6–14} High blood pressure is one of the most important treatable causes of premature morbidity and mortality.²⁸ The most recent 2019 NICE NG136 guidelines on the diagnosis and treatment of hypertension in adults recommends that the clinic blood pressure treatment target should be <140/90 mm Hg for everyone aged under 80 years, including people with type

2 diabetes.³¹ The major change in this new guideline is that it adds people with a moderate risk of developing CVD (QRISK of between 10% and 19% of developing CVD in the next 10 years), rather than just those at high risk of CVD, to the list of indications in which drug treatment can be offered. This brings the risk threshold for treatment in hypertension in line with that for statins.³¹ It also goes further in recommending treatment be considered in younger patients (under 60 years) with QRISK

Table 5 Therapeutic control of blood pressure, cholesterol and glucose

	All		Men		Women		P value
	N	n (%)	N	n (%)	N	n (%)	
People on BP meds							
BP at target 1*	339	128 (37.8%)	186	68 (36.6)	153	60 (39.2%)	0.62
BP at target 2†	339	36 (10.6%)	186	17 (9.1%)	153	19 (12.4)	0.33
People on no BP meds							
BP at target 1*	215	117 (54.4%)	114	58 (50.9%)	101	59 (58.4%)	0.27
BP at target 2†	215	38 (17.7%)	114	15 (13.2%)	101	23 (22.8%)	0.07
People on LLD							
TC<5.0 mmol/L	265	203 (76.6%)	154	122 (79.2%)	111	81 (73.0%)	0.24
TC<4.5 mmol/L	265	151 (57.0%)	154	98 (63.6%)	111	53 (47.8%)	0.01
TC<4.0 mmol/L	265	95 (35.9%)	154	66 (42.9%)	111	29 (26.1%)	0.005
LDL<1.8 mmol/L	259	51 (19.7%)	149	34 (22.8%)	110	17 (15.5%)	0.14
LDL<2.0 mmol/L	259	82 (31.7%)	149	53 (35.6%)	110	29 (26.4%)	0.12
LDL<2.5 mmol/L	259	154 (59.5%)	149	92 (61.7%)	110	62 (56.4%)	0.38
LDL<3.0 mmol/L	259	211 (81.5%)	149	124 (83.2%)	110	87 (79.1%)	0.40
Non-HDL<2.5 mmol/L	265	77 (29.1%)	154	31 (33.1%)	111	26 (23.4%)	0.09
People on NO LLD							
TC<5.0 mmol/L	266	75 (28.2%)	134	42 (31.3%)	132	33 (25.0%)	0.25
TC<4.5 mmol/L	266	34 (12.8%)	134	18 (13.4%)	132	16 (12.1%)	0.75
TC<4.0 mmol/L	266	12 (3.8%)	134	7 (5.2%)	132	5 (3.8%)	0.57
LDL<1.8 mmol/L	263	5 (1.9%)	131	1 (0.8%)	132	4 (3.0%)	0.18
LDL<2.0 mmol/L	263	5 (1.9%)	131	1 (0.8%)	132	4 (3.0%)	0.18
LDL<2.6 mmol/L	263	31 (11.8%)	131	16 (12.2%)	132	15 (11.4%)	0.83
LDL<3.0 mmol/L	263	78 (29.7%)	131	45 (34.4%)	132	33 (25.0%)	0.10
Non-HDL<2.5 mmol/L	266	6 (2.3%)	134	2 (1.5%)	132	4 (3.0%)	0.40
Diabetics (self-report)							
Glucose<7 mmol/L	92	43 (46.7%)	50	20 (40.0%)	42	23 (54.8%)	0.16
HbA1c<7%	92	31 (62.0%)	80	31 (62.0%)	42	26 (61.9%)	0.99
BP at target†	98	9 (9.2%)	54	4 (7.4%)	44	5 (11.4%)	0.50

*Defined as BP<140/90 mm Hg.

†Defined as BP<130/80 mm Hg.

BP, blood pressure; HbA1c, glycated haemoglobin; HDL, high-density lipoprotein; LDL, low-density lipoprotein; TC, total cholesterol.

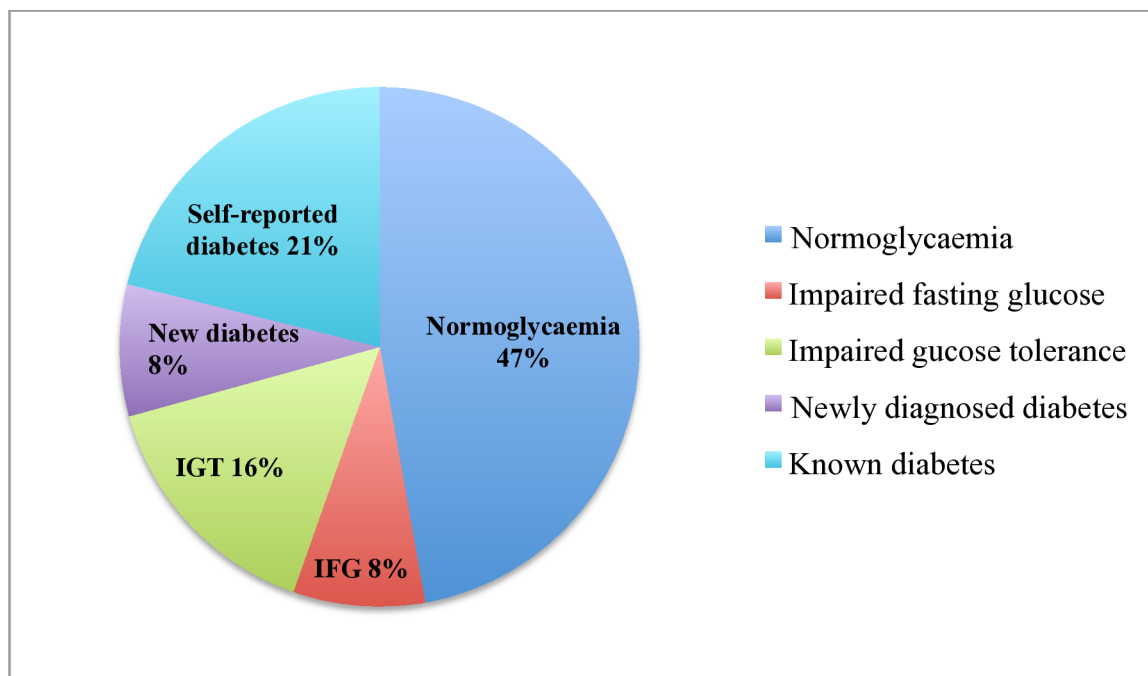
less than 10% risk, where there might be concerns about their 'lifetime risk'.³⁰ In this survey, just over a third achieved the recommended target of <140/90 mm Hg. Less than half of patients on blood pressure-lowering medication were aware of their blood pressure level and only two-fifths knew their blood pressure target. Importantly, nearly half of patients at high CVD risk because of treated dyslipidaemia and/or diabetes had blood pressure>140/90 mm Hg but without any antihypertensive medication prescribed.

Lipid management was very poor with two-fifths of patients on lipid-lowering medication having LDL-C≥2.5 mmol/L. More than half of patients in this group had never been told they had high cholesterol. Only two-fifths were aware of their TC level and less than a third reported knowing their cholesterol target. A large

majority (nearly 90%) of high risk patients, because of treated hypertension and/or diabetes, had LDL-C≥2.5 mmol/L but without any lipid-lowering therapy being prescribed. The most recent NICE guidelines on CVD risk assessment and reduction, including lipid modification (CG181) together with the updated NICE pathway on lipid modification therapy for preventing CVD, recommend offering atorvastatin 20 mg for the primary prevention of CVD to people who have a 10% or greater 10-year risk of developing CVD, estimated using the QRISK V.2 assessment tool.^{31 32} NICE pathway on lipid modification therapy for preventing CVD, last updated in 2021, recommends measuring TC, HDL cholesterol and non-HDL cholesterol in all people who have been started on atorvastatin 20 mg for primary prevention at 3 months of treatment and aiming for a greater than

Table 6 Summary of cardioprotective drug therapies

	All		Men		Women		P value
	N	n (%)	N	n (%)	N	n (%)	
All people							
Antiplatelets	553	31 (5.6%)	299	18 (6.0%)	254	13 (5.1%)	0.65
Aspirin	553	11 (2.0%)	299	8 (2.7%)	254	3 (1.2%)	0.24
Clopidogrel	553	10 (1.8%)	299	5 (1.7%)	254	5 (2.0%)	1.00
Other antiplatelets	553	11 (2.0%)	299	6 (2.0%)	254	5 (2.0%)	1.00
Statins	555	272 (49.0%)	301	160 (53.2%)	254	112 (44.1%)	0.03
People on LLDs							
Statins	273	272 (99.6%)	160	160 (100%)	113	112 (99.9%)	0.41
Atorvastatin	273	223 (81.7%)	160	129 (80.6%)	113	94 (83.2%)	0.59
Fluvastatin	273	0 (0.0%)	160	0 (0.0%)	113	0 (0.0%)	–
Rosuvastatin	273	10 (3.7%)	160	6 (3.8%)	113	4 (3.5%)	1.00
Pravastatin	273	9 (3.3%)	160	5 (3.1%)	113	4 (3.5%)	1.00
Simvastatin	273	28 (10.3%)	160	18 (11.3%)	113	10 (8.9%)	0.52
Other statin	273	2 (0.7%)	160	2 (1.3%)	113	0 (0.0%)	0.51
Fibrates	272	2 (0.7%)	159	1 (0.6%)	113	1 (0.9%)	1.00
Other LLD	272	4 (1.5%)	159	2 (1.3%)	113	2 (1.8%)	1.00
Fixed-dose combinations LLD	272	0 (0.0%)	159	0 (0.0%)	113	0 (0.0%)	–
BP-lowering medications	272	122 (44.9%)	159	76 (47.8%)	113	46 (40.7)	0.25
People on BP meds							
β-blockers	339	37 (10.9%)	186	15 (8.1%)	153	22 (14.4%)	0.06
ACE inhibitors	339	153 (45.1%)	186	97 (52.2%)	153	56 (36.6%)	0.004
ARBs	339	64 (18.9%)	186	35 (18.8%)	153	29 (19.0%)	0.97
Calcium channel blockers	339	162 (47.8%)	186	89 (47.9%)	153	73 (47.7%)	0.98
Diuretics	339	38 (11.2%)	186	19 (10.2%)	153	19 (12.4%)	0.52
Other antihypertensive medication	339	19 (5.6%)	186	12 (6.5%)	153	7 (4.6%)	0.46
Fixed dose combinations	339	1 (0.3%)	186	0 (0.0%)	153	1 (0.7%)	0.45
BP-lowering drugs	339		186		153		0.56
1 BP drug		123 (66.7%)		123 (66.1%)		110 (71.9%)	
2 BP drugs		83 (24.5%)		49 (26.3%)		34 (22.2%)	
3 BP drugs		18 (5.3%)		10 (5.4%)		8 (5.2%)	
≥4 BP drugs		5 (1.5%)		4 (2.2%)		1 (0.7%)	
Statins	339	121 (35.7%)	186	76 (40.9%)	153	45 (29.4)	0.03
Diabetics*							
Controlled by diet	88	56 (63.6%)	48	30 (62.5%)	40	26 (65.0%)	0.81
Oral glucose drugs	97	62 (63.9%)	54	37 (68.5%)	43	25 (58.1%)	0.29
Metformin	97	55 (56.7%)	54	34 (63.0%)	43	21 (48.8%)	0.16
Sulphonylurea	97	10 (10.3%)	54	5 (9.3%)	43	5 (1.6%)	0.75
Incretins	97	10 (10.3%)	54	7 (13.0%)	43	3 (7.0%)	0.51
Glitazones	97	0 (0.0%)	54	0 (0.0%)	43	0 (0.0%)	–
Other oral drugs	97	0 (0.0%)	54	0 (0.0%)	43	0 (0.0%)	–
Insulin	97	6 (6.2%)	54	5 (9.3%)	43	1 (2.3%)	0.22
Statins	97	57 (58.8%)	54	33 (61.1%)	43	24 (55.8%)	0.60
ACE inhibitors/ARBs	97	36 (37.1%)	54	21 (38.9%)	43	15 (34.9%)	0.69
*Self-reported diabetics only. ARBs, angiotensin receptor blockers; BP, blood pressure.							



IFG = Impaired fasting glucose; IGT = Impaired glucose tolerance

Figure 1 The actual distribution on different glucose categories (expressed as percentages).

40% reduction in non-HDL cholesterol.³⁰ However, in contrast to the European guidelines, there is no LDL-C target for primary prevention in the JBS3 and NICE lipid modification guidelines.

According to the JBS3 guidelines, people with diabetes mellitus type 2 should be considered and managed as high CVD risk and prescribed cardioprotective medications including ACE inhibitors/ARBs and statins.¹ However, in this survey, two-fifths of patients with known diabetes had HbA1c above the guidelines target of <7%, two-fifths were on ACE inhibitors/ARBs and less than three-fifths on statins. The OGTT in those without self-reported diabetes demonstrate that nearly two-fifths of patients had some form of dysglycaemia (IFG, IGT or newly diagnosed diabetes).³² As the OGTT is the only test which most reliably identifies all patients with diabetes and also those with IGT^{34, 35, 36}, screening with an OGTT should be recommended for all patients at high CVD risk without self-reported diabetes.

There may be several explanations for the poor control of blood pressure, lipid and glucose, such as unhealthy lifestyles, monotherapy, low-dose prescriptions, not up-titrating of medications to achieve risk factors targets, the absence of such targets, physician inertia to treat patients according to the recent guidelines and poor patient adherence with medications. The most recent guidelines recommend in most patients initiating antihypertensive treatment with a two-drug, preferably as a single-pill combination. One of the explanations for the poor lipid management in patients may be the absence of LDL-C target for primary prevention in the JBS3 and NICE lipid modification guidelines both recommending initiation

of Atorvastatin 20 mg in all people at high risk of developing of CVD. In addition to the poor glycaemic control in patients with self-reported diabetes, there were many patients without known diabetes who had some form of dysglycaemia including undetected diabetes.

Importantly, a large majority of patients in this survey identified as being at high CVD risk on the basis of being prescribed blood pressure and/or lipid-lowering medications and/or having diabetes, had more than one of these risk factors. Overall, 41.8% had one, 39.4% had two, 5.6% had three and 0.2% had four uncontrolled cardiovascular risk factors (current smoking, elevated blood pressure, elevated LDL-C or uncontrolled diabetes). Only 13.0% had all four risk factors controlled. As total cardiovascular risk is a function of the interaction of many risk factors, the multifactorial risk factor management is important because modest increases of several risk factors can result in a higher absolute risk than a high level of a single risk factor. Screening and managing all CVD risk factors is more effective than treating single risk factors in isolation. This is acknowledged in the JBS3 and NICE lipid modification and hypertension guidelines recommending the assessment and managing of blood pressure, lipids and diabetes according to total cardiovascular risk using the QRISK V.2 risk assessment tool.

Comparison with other surveys

A comparison between A-3-P (2017–2019) and ASPIRE-2-PREVENT (2008–2010) is provided to illustrate possible trends in lifestyle and attainment of risk factor targets but without formal statistical tests as these two surveys were conducted in different general practices which may

not be comparable, the patients are older in the third survey and there was a difference in the identification of the study populations with a lower proportion of patients identified at high cardiovascular risk because of treatment for diabetes mellitus in the third survey. However, despite the potential for bias the overall trends are interesting with some improvement in lifestyle management in A-3-P with fewer people smoking, being overweight, obese or centrally obese and an increase in the proportion of people achieving the physical activity target. When it comes to the medical risk factor control, there appears to be no improvement in the blood pressure, LDL-cholesterol and glucose control (online supplemental table 4).

The results of A-3-P are in accordance with other earlier surveys of primary prevention in Europe.^{20 37–39} By comparison with the EUROASPIRE V survey on 2759 patients from 16 European countries, using the same design and methodology as A-3-P, our survey found 47.0% of patients in EUROASPIRE V reached the target of <140/90 mm Hg (<140/85 mm Hg in people with diabetes), compared with 37.8% in A-3-P. Among patients with treated dyslipidaemia, 46.9% of EUROASPIRE V patients achieved LDL-cholesterol target of <2.6 mmol/L, compared with 59.5% in A-3-P. Among patients on diabetes treatments, the HbA1c <7.0% was achieved by 65.2% and 62%, respectively. Compared with EURIKA study on 7641 patients from 12 European countries without clinical CVD, and with at least one major CVD risk factor, blood pressure was controlled in 37.1 in A-3-P and 39% of patients in EURIKA. The lipid control in A-3-P was better than in EURIKA. Among treated patients with dyslipidaemia, 81.5% of A-3-P patients attained an LDL-C of <3 mmol/L, compared with 41% of patients in EURIKA.³⁷ In another study of 8928 patients in 10 European countries, 32% of high CVD risk patients were smokers, 36% obese, 49% had blood pressure >140/90 mm Hg, 64% TC ≥5 mmol/L and 14% fasting glucose levels >6.1 mmol/L.³⁸ The International Cholesterol management Practice Study investigated achievement of LDL-C targets in patients at high or very high CVD risk receiving lipid-modifying therapy in countries outside Western Europe and the proportion of patients achieving guideline-specified treatment targets was 44% for LDL-C, 55% for blood pressure and 39% for diabetes.³⁹

Strengths and limitations

A major strength of A-3-P is that data were collected with in person interviews using standardised methods, equipment and central laboratory analyses, as data from general practice medical notes may be incomplete. One of the limitations of this survey is that without the patient attending for interview and giving written informed consent to review their medical record, it was not possible to calculate a response rate. However, the potential for selection bias is likely to be conservative. Sicker patients would have been less likely to attend interviews so the reality of primary prevention practice would be even

worse than in our survey. Another limitation is that the identification of high CVD risk patients is based on a convenience sample of general practices across England, with no centres located in Scotland, Wales and Northern Ireland, meaning the results are not representative for the UK. Importantly, as the majority of A-3-P patients had more than one risk factor putting them at high multifactorial risk, they require comprehensive lifestyle and medical risk factor management in order to reduce the risk of future CVD.

CONCLUSIONS

The results of A-3-P survey show that many patients at high CVD risk have unhealthy lifestyles with high prevalences of sedentary behaviour, obesity and central obesity. The management of blood pressure, lipids and diabetes is poor with the majority of patients not achieving guideline recommended targets for primary CVD prevention. The NHS should provide professional services for patients at high risk of developing CVD to promote a healthier lifestyle as well as optimising drug therapies to achieve guideline targets for blood pressure, lipids and glucose. There is a considerable potential to raise the standards of preventive cardiology care through modern, comprehensive multifactorial prevention programmes⁴⁰ addressing all aspects of lifestyle and risk factor management in order to reduce the risk of future CVD.

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Patient consent for publication Not applicable.

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