The contribution of cardiovascular risk factors to peripheral arterial disease in South Asians and Blacks: a sub-study to the Ethnic-Echocardiographic Heart of England Screening (E-ECHOES) study

P.C. BENNETT¹,², G.Y.H. LIP¹,*, S. SILVERMAN², A.D. BLANN¹ and P.S. GILL³,*

From the ¹Centre for Cardiovascular Sciences, University of Birmingham, ²Department of Vascular Surgery, City Hospital, Birmingham, B18 7QH and ³School of Health and Population Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK

Address correspondence to Dr P.S. Gill, School of Health and Population Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK. Email: p.s.gill@bham.ac.uk

*These authors contributed equally to this work.

Received 11 April 2010 and in revised form 2 June 2010

Summary

Objective: To determine whether differences exist in prevalence of peripheral arterial disease (PAD) between South Asians (people originating from India, Pakistan and Bangladesh) and Blacks (Black Caribbean and Black African), the two largest minority ethnic groups in the UK. To determine if associations with cardiovascular risk factors and this disease differ between these two ethnic groups.

Patients and Methods: We recruited 572 patients (356 South Asian and 216 Blacks) ≥45 years as a sub-study to a community screening project, the Ethnic-Echocardiographic Heart of England Screening (E-ECHOES) study. All subjects completed an interviewer-led questionnaire, anthropometric measurements and blood sampling. Ankle brachial pressure index (ABPI) was calculated and intermittent claudication was assessed using the Edinburgh Claudication Questionnaire. The presence of PAD was defined as ABPI <0.9.

Results: The mean age was 62 years overall with no difference between the two ethnic groups. The prevalence of PAD was 13.2% [95% confidence interval (CI) 9.7–16.7] in South Asians and 10.2% (95% CI 6.2–14.2) in Blacks with no significant difference between the two ethnic groups. The prevalence of PAD was higher in South Asian women than Black women (16.3 vs. 6.1%; P = 0.011). No difference in prevalence was found in men (11 vs. 14% P = 0.47, in South Asians and Blacks, respectively). The prevalence of intermittent claudication was 0.9% (95% CI 0.11–1.63). On multivariate logistic regression, mean systolic blood pressure, diabetes, smoking and male sex were independently associated with PAD in South Asians (P = 0.016, 0.022, 0.037 and 0.008, respectively). In Blacks, only age remained independently associated with PAD on multivariate logistic regression (P = 0.003).

Conclusion: The prevalence of PAD is similar in South Asians and Blacks, and similar to levels reported in pre-dominantly White populations. South Asian women had a higher prevalence of PAD than Black women, which is not explained by traditional cardiovascular risk factors.
Introduction

Peripheral artery disease (PAD) is an important healthcare problem in developed nations and is associated with considerable morbidity and mortality. PAD is the disease process resulting from obstruction of large peripheral arteries, exclusive of the coronary and intracranial cerebrovascular system, most commonly due to atherosclerosis. Most typically, it is referred to in relation to the lower limbs. PAD is an indicator of widespread atherosclerosis in other vascular territories, including the cerebral and coronary circulations and considerable overlap exists between them.

Several population-based studies based on predominantly White populations have found the prevalence of PAD to be between 6 and 18% over the age of 55 years. The prevalence rises with age and has been found to be ~20% in people over 70 years of age and up to 60% in the over 85 years age group. However, little is known about the prevalence of PAD in non-White populations. The aim of this pilot study was to estimate the prevalence of PAD in the two largest UK minority ethnic groups (South Asians and Blacks), which will give us preliminary data to base a larger, powered epidemiological study in due course. South Asians (people originating from India, Pakistan and Bangladesh) and Blacks (Black Caribbean and Black African) comprise 75% of minority ethnic groups within the UK. In order to meet the healthcare needs of the diverse population which exists in the UK, it is important to know if any differences in disease epidemiology exist between different minority ethnic groups.

Methods

Study design and recruitment

This was a pilot cross-sectional population survey of a selected sample from the cohort of over 5400 Black and South Asian male and female residents of Birmingham aged 45 years and over participating in the E-ECHOES community screening study. Details of the study methods, including inclusion and exclusion criteria, have been published.

Using 2001 Census data, wards serving the Birmingham Special Health Authority area, having >50% Black and minority Ethnic Groups as residents were selected and 20 practices recruited from these wards. Using the practice age–sex register, all subjects of South Asian or Black ethnicity age ≥45 years were invited to participate. Subjects attended for an assessment at their local general practice. The study was approved by the local research and ethics committee and written informed consent was obtained from all patients.

Clinical assessment

Demographic data and medical history were collected using a standard questionnaire and recording form. Data were derived from both the subject and their medical records. All clinical assessments were performed at the same visit. Subjects were defined as having hypertension if they were previously known to have hypertension from medical records, using anti-hypertensive medication, or whose mean of three blood pressure recordings after 5 min rest was >140/90 mmHg. Similarly, subjects were defined as having diabetes mellitus if, their medical records stated it or if they were using anti-diabetic medication. Subjects were defined as being illiterate if they never attended school in any country. Former smokers are those who have previously smoked tobacco but stopped >1 year prior to assessment. Smokers who stopped <1 year prior to assessment will be defined as current smokers.

PAD assessment

The presence of PAD was assessed by measurement of ankle brachial pressure index (ABPI). This was measured after 5 min rest in the supine position with a continuous Doppler device (Super Dopplex II, Huntleigh Healthcare), 8 MHz probe and a manual sphygmomanometer. Systolic blood pressure (SBP) in the brachial artery was measured in both arms using a blood pressure cuff and Doppler detection in the antecubital fossa. SBP was recorded three times in each arm. SBP in the left and right dorsalis pedis and posterior tibial arteries was then measured in a blood pressure cuff applied just proximal to the malleoli. For each pressure measurement, the pulse was located using the Doppler probe and the cuff then inflated until the pulse was obliterated. The cuff was then deflated slowly and the pressure noted when the pulse detected by the Doppler probe re-appeared. ABPI was calculated for each leg as the ratio of the higher of the two systolic pressures at the ankle and the average of the left and right brachial systolic pressures, unless there was a discrepancy ≥10 mmHg in blood pressure values between the two arms, in which case the higher side systolic pressure was used. To standardize the blood pressure measurements all recordings were performed by one operator (P.B.), trained in the measurement of ABPI.

ABPI values ≤0.9 in one or both legs were considered diagnostic of PAD. The absence of PAD was defined as levels from 0.91 to 1.39 in the absence of re-vascularization of the lower...
limbs. ABPI values $\geq 1.4$ were excluded from the analysis as they do not define the diagnosis of PAD.

**Intermittent claudication assessment**

The presence of intermittent claudication was defined by the criteria of the Edinburgh Claudication Questionnaire. Translated versions of this questionnaire were used in the chosen language of the patient if this was not English: Urdu, Punjabi, Hindi, Gujarati and Bengali. The translated versions were validated as part of the study, the results of which are to be published in due course. PAD was considered asymptomatic when ABPI $<0.9$ and the Edinburgh Claudication Questionnaire showed no IC. It was considered to be symptomatic if the Edinburgh Claudication Questionnaire suggested definite or atypical claudication.

**Laboratory assessment**

If consent was granted, blood was drawn from the antecubital fossa using the vacutainer system. Random blood was analysed for full blood count, urea and electrolytes, liver function tests, glucose, HbA1c, and total cholesterol and triglycerides. Consent was obtained for blood sampling in 47% of this sub-study to E-ECHOES (40.2% South Asians and 58.3% Blacks).

**Statistical analysis**

Statistical analysis was undertaken using Minitab version 15. Data were summarized using mean, median, standard deviation and inter-quartile range for continuous parameters. Student’s $t$-test was used for differences in continuous variables and Chi-squared test for categorical data. In cases where less than five participants were used in analysis Fisher’s exact test was used. Spearman rank correlation coefficient was calculated to test the association between the ABI and a number of risk factors. A $P$-value $<0.05$ was deemed significant. Only variables with statistical significance on univariate analysis were entered into logistic regression analysis. The odds ratios (ORs) of PAD were calculated for risk factors which retained independence on logistic regression.

**Results**

Between March 2008 and February 2009, 574 patients (358 South Asians and 216 Blacks) were recruited, aged between 45 and 100 years; two patients with ABI $>1.39$, were excluded, bringing the total analysed to 356 South Asians and 216 Blacks. The ethnic breakdown of the South Asian group was: 40.4% Pakistani, 38.9% Indian, 16.9% Bangladeshi and 2.8% East African Asian, which is broadly representative of the distribution of these ethnic groups within Birmingham. Table 1 shows clinical, demographic and ABPI characteristics of the two groups. The South Asian group included more men, had more first generation migrants, greater illiteracy, more CAD, higher serum triglycerides and HbA1c, and lower HDL cholesterol than Blacks. In the whole sample, 69 participants had PAD; 47 were South Asians whilst 22 were Black. Of these, five had intermittent claudication.

**South Asians**

In South Asians, the prevalence of PAD was 13.2% [95% confidence interval (CI) 9.7–16.7] overall, with no significant gender difference [16.3% in women (95% CI 10.1–21.9) and 11% in men (95% CI 6.8–15.2)]. Women were older on migration to UK (23 vs. 22 years; $P=0.04$) and had a higher body mass index (BMI) than men (29.1 vs. 27.2; $P<0.0001$). The prevalence of illiteracy in the language of origin was high in both groups, higher in women (40.1 vs. 23%; $P=0.001$). Men were more likely to be hypertensive (76.1 vs. 63.3%; $P=0.009$), ever-smokers (45.5 vs. 3.4%; $P<0.0001$) and current smokers (18.7 vs. 1.4%; $P<0.0001$). Men were also more likely to have diabetes (34.9 vs. 25.2%; $P=0.05$), have a higher HbA1c (6.93 vs. 6.36%; $P=0.007$) and were more likely to be on cholesterol lowering medications (52.6 vs. 41.5%; $P=0.038$) and antiplatelet drugs (43.1 vs. 23.1%; $P<0.0001$).

Participants with PAD were significantly older and had a higher mean SBP and pulse pressure (PP) than those with normal ABPI (Table 2). On logistic regression, male sex, mean SBP, smoking and diabetes all remained independent predictors of PAD (Table 3).

**Blacks**

In Blacks, the prevalence of PAD was 10.2% overall (95% CI 6.2–14.2) and was higher in men (14.9% [95% CI 8.04–21.7] vs. 6.1% [95% CI 1.7–10.3]; $P=0.034$). Women had higher BMI than men (31 vs. 27.7; $P<0.0001$) and a larger waist circumference (99.2 vs. 95.8 cm; $P=0.049$). Men were more likely to be ever smokers (68.3 vs. 30.4%; $P<0.0001$) and current smokers (31.7 vs. 11.3%; $P<0.0001$). Whilst no difference was found in total cholesterol, women had a higher BMI, mean LDL- and HDL cholesterol (all $P<0.05$) and there was no difference in triglyceride levels. Participants with PAD were significantly older, had
a higher mean SBP and PP and had a much higher prevalence of hypertension than those without PAD (Table 2). On logistic regression only age remained independently associated with PAD (Table 3), though an association between smoking and PAD achieved borderline significance (P = 0.056).

### Ethnic comparisons in PAD groups

No differences in prevalence of PAD were found between South Asians and Blacks with both sexes combined (Table 1). Black participants with PAD had more prevalent hypertension (95.5 vs. 74.9%; P = 0.038) and were older (71 vs. 64 years; P = 0.028). South Asians had higher illiteracy (21.3 vs. 0%; P ≤ 0.0001). There were no significant differences in prevalence of PAD between South Asians and Blacks by age group. When comparing South Asian and Black women, the former group had a significantly greater prevalence of PAD (16.3 vs. 6.1%; P = 0.011), whilst South Asian women had a lower prevalence of ever (P = 0.001) and current smoking (P < 0.0001) and a lower BMI (P = 0.011) than Black women. South Asian women did have higher mean triglyceride (P = 0.018) and lower HDL levels (P = 0.003).

No difference in prevalence of PAD was found between South Asian and Black men with PAD (11 vs. 14% respectively; P = 0.47). Their risk factor profiles differed, however, as Black men had more prevalent ever (P = 0.011) and current (< 0.0001) smoking and South Asian men had lower mean HDL level (P = 0.001).

### Discussion

Ethnic minority groups make up 7.9% of the general population of the UK. The largest of these being Asian/Asian British (50.2%) and Black/Black British (24.8%). To date there is a paucity of data on PAD amongst minority ethnic groups, in particular the South Asian group. This pilot study shows that the prevalence of PAD is similar amongst the South Asian and Black groups and indeed similar
to previously published prevalence data in other populations,\(^8\) which supports the validity of this study.

This study reports findings similar to existing literature in that the rates of ever smokers and current smoking is lower in South Asians than in Blacks, overall and in each sex and that men are more likely to be smokers than women in both ethnic groups.\(^{14}\) We observed that smoking was an independent predictor for PAD in South Asians, which differs from findings of a previous Indian population-based study.\(^{15}\) Our data suggests a trend between smoking and PAD in Blacks, but possibly due to the low numbers of participants with PAD, the association did not reach significance (\(P = 0.056\)).

### Table 2 Characteristics between PAD and non-PAD groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>PAD n = 47 (±SD) (IQR)</th>
<th>Non-PAD n = 309 (±SD) (IQR)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) South Asians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>64 ± 11</td>
<td>60 ± 11</td>
<td>0.039</td>
</tr>
<tr>
<td>Male (%)</td>
<td>70.2</td>
<td>34.6</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>lowest side ABPI</td>
<td>0.8 ± 0.1</td>
<td>1.06 ± 0.11</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>BMI</td>
<td>28.2 ± 3.7</td>
<td>27.9 ± 5</td>
<td>0.142</td>
</tr>
<tr>
<td>mean SBP (mmHg)</td>
<td>150 ± 21</td>
<td>141 ± 19.9</td>
<td>0.005</td>
</tr>
<tr>
<td>Pulse Pressure (mmHg)</td>
<td>69 ± 18</td>
<td>58 ± 16</td>
<td>0.001</td>
</tr>
<tr>
<td>Hypertensive (%)</td>
<td>74.5</td>
<td>70.2</td>
<td>0.55</td>
</tr>
<tr>
<td>Diabetic (%)</td>
<td>21.3</td>
<td>32.4</td>
<td>0.125</td>
</tr>
<tr>
<td>CAD (%)</td>
<td>8.5</td>
<td>13.2</td>
<td>0.36</td>
</tr>
<tr>
<td>CBVD (%)</td>
<td>4.3</td>
<td>4.9</td>
<td>0.858</td>
</tr>
<tr>
<td>Total cholesterol (mmol/l)</td>
<td>4.26 (3.2–5.2)(^a)</td>
<td>4.37 (3.8–5.2)(^b)</td>
<td>0.363</td>
</tr>
<tr>
<td>LDL (mmol/l)</td>
<td>2.13 (1.4–2.8)(^a)</td>
<td>2.31 (1.8–2.9)(^b)</td>
<td>0.303</td>
</tr>
<tr>
<td>HDL (mmol/l)</td>
<td>0.9 (0.7–1.4)(^a)</td>
<td>1.06 (0.9–1.2)(^b)</td>
<td>0.410</td>
</tr>
<tr>
<td>Triglycerides (mmol/l)</td>
<td>2.1 (0.9–3.2)(^a)</td>
<td>1.99 (1.3–2.7)(^b)</td>
<td>0.838</td>
</tr>
<tr>
<td>HbA1c (%)</td>
<td>6.9 (6.2–9.2)(^a)</td>
<td>6.3 (6.0–7.0)(^b)</td>
<td>0.107</td>
</tr>
<tr>
<td>Ever smoker (%)</td>
<td>21.3</td>
<td>29.1</td>
<td>0.265</td>
</tr>
<tr>
<td>Illiteracy (%)</td>
<td>21.3</td>
<td>31.4</td>
<td>0.157</td>
</tr>
<tr>
<td>(b) Blacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>71 ± 12.4</td>
<td>62 ± 11</td>
<td>0.001</td>
</tr>
<tr>
<td>Male (%)</td>
<td>54.5</td>
<td>45.4</td>
<td>0.44</td>
</tr>
<tr>
<td>lowest side ABI</td>
<td>0.75 ± 0.1</td>
<td>1.07 ± 0.1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>BMI</td>
<td>28.7 ± 5.</td>
<td>29.6 ± 5.9</td>
<td>0.029</td>
</tr>
<tr>
<td>mean SBP (mmHg)</td>
<td>155 ± 18</td>
<td>144 ± 18</td>
<td>0.012</td>
</tr>
<tr>
<td>Pulse pressure (mmHg)</td>
<td>75 ± 20</td>
<td>60 ± 16</td>
<td>0.003</td>
</tr>
<tr>
<td>Hypertensive (%)</td>
<td>95.5</td>
<td>73.2</td>
<td>0.021</td>
</tr>
<tr>
<td>Diabetic (%)</td>
<td>31.8</td>
<td>26.8</td>
<td>0.617</td>
</tr>
<tr>
<td>CAD (%)</td>
<td>4.5</td>
<td>7.2</td>
<td>c</td>
</tr>
<tr>
<td>CBVD (%)</td>
<td>4.5</td>
<td>4.1</td>
<td>c</td>
</tr>
<tr>
<td>Total cholesterol (mmol/l)</td>
<td>4.68 (3.9–5.4)(^d)</td>
<td>4.6 (3.7–5.3)(^e)</td>
<td>0.769</td>
</tr>
<tr>
<td>LDL (mmol/l)</td>
<td>2.73 (2.1–3.4)(^d)</td>
<td>2.5 (1.8–3.1)(^f)</td>
<td>0.836</td>
</tr>
<tr>
<td>HDL (mmol/l)</td>
<td>1.35 (0.9–1.7)(^d)</td>
<td>1.32 (1.1–1.6)(^e)</td>
<td>0.808</td>
</tr>
<tr>
<td>Triglycerides (mmol/l)</td>
<td>1.4 (0.2–2)(^d)</td>
<td>1.36 (0.9–2.2)(^e)</td>
<td>0.463</td>
</tr>
<tr>
<td>HbA1C (%)</td>
<td>6.24 (5.9–12.8)(^d)</td>
<td>6.1 (5.7–6.6)(^e)</td>
<td>0.594</td>
</tr>
<tr>
<td>Ever smoker (%)</td>
<td>40.9</td>
<td>49</td>
<td>0.391</td>
</tr>
<tr>
<td>Illiteracy (%)</td>
<td>0</td>
<td>0</td>
<td>c</td>
</tr>
</tbody>
</table>

\(^a\) n = 14.  
\(^b\) n = 129.  
\(^c\) Too small sample size for analysis.  
\(^d\) n = 10.  
\(^e\) n = 116.
We found the prevalence of diabetes was much higher in South Asians and in Blacks than in previous studies. In diabetic patients, the risk of PAD is increased by age, duration of diabetes mellitus and blood glucose control. We found that the prevalence of diabetes in South Asians with PAD was 2-fold higher than those with normal ABPI, which reflects results found in India. Whilst the prevalence of diabetes in this study in predominantly first-generation South Asian migrants was much higher than in those living in India, the mean age of participants in this study was much older. In Black participants, the prevalence of diabetes in patients with PAD was higher than those without, but this difference failed to reach statistical significance.

The most frequent dyslipidaemia associated with PAD are raised triglyceride levels and low HDL cholesterol. In the literature, South Asians appear to have a less favourable lipid profile than other ethnic groups, with lower HDL cholesterol and higher triglycerides which become more pronounced on migration from the Indian subcontinent. On the other hand, Blacks have a more favourable lipid profile. This study reflects previous reports of the differences in lipid profile between ethnic groups.

Several components of blood pressure, including PP, SBP and diastolic blood pressure (DBP) have been shown to be independent cardiovascular risk factors. Hypertension is known to be a risk factor for both symptomatic and asymptomatic PAD. Hypertension is well known to be more prevalent in Blacks, compared to South Asian and White ethnic groups in the UK. The prevalence of hypertension in this study was very high in both ethnic groups. Previous (pre-dominantly white-population-based) studies have shown that 35–55% of patients with PAD also had hypertension at presentation. However, US studies have shown that among patients with PAD, the prevalence of hypertension was higher in African Americans than in Whites, and lower in Asians. We found no significant differences in the prevalence of hypertension between the PAD and normal ABPI groups in South Asians. In Blacks the difference in hypertension between these two groups was significant. Our study found that in the PAD groups Blacks had significantly more hypertension than South Asians supporting previous literature. In this study, we found hypertension to be an independent predictor of PAD in South Asians but not in Blacks. However, the small number of Black participants with PAD may have contributed to this finding.

Another important finding of this study is that the prevalence of coronary artery disease (CAD) and cerebrovascular disease (CBVD) was low in participants. As expected South Asians had significantly more CAD than Blacks and there was no difference in CBVD. The prevalence and presence of co-existent CAD and CBVD with PAD was very low and not different to the non-PAD group in both ethnic groups. While PAD has been reported as conferring a greater risk of developing CAD and CBVD in predominantly white populations, the findings of this study support data previously reported from India.

The prevalence of both asymptomatic and symptomatic PAD in this study is similar to previous reports in various populations. Importantly, we found no difference in its prevalence between South Asians and Blacks overall. However, South Asian women had significantly greater prevalence of PAD than Black women, which could not be accounted for by traditional risk factors. Dyslipidaemia was the only less favourable characteristic in the former ethnic group. Our findings differ from the low rate of PAD reported in the only Indian epidemiological study. However, the average age of participants in this study was considerably older and reflects the fact that PAD is predominantly a disease of the elderly. Indeed, we found age to be negatively correlated with ABPI (P = 0.001 and 0.021, respectively) in both South Asians and Blacks, and subjects with PAD were significantly older than in the normal ABPI groups, which is in keeping that age is an important factor in PAD. Indeed amongst Blacks, age was the only risk factor to independently predict PAD.

Factors which may play a role in explaining apparent differences in PAD prevalence are patient education, access to healthcare and communication issues. It has been thought that the higher prevalence of PAD in African Americans over Whites is
due to level of education, income and access to healthcare, and once these are accounted for, African Americans are no more likely to have PAD than Whites.\textsuperscript{39} In the UK, where healthcare is free at the point of access, Black ethnicity has not been found to be associated with higher prevalent PAD than Whites.

Disparities in health and healthcare clearly exist among minority ethnic groups in the UK.\textsuperscript{17} It is estimated that there are over 300,000 people from four established communities within the UK (Indian, Pakistani, Bangladeshi and Chinese) unable to converse adequately with their healthcare professional.\textsuperscript{40} South Asian women in particular may be more disadvantaged in communicating their problems to health professionals. This may partly explain the lower prevalence of PAD.\textsuperscript{41,42}

Another explanation for the apparent difference in PAD prevalence in South Asian and Black women could be the possibility of a genetic pre-disposition to cardiovascular disease and indeed to the development of vascular disease in different territories. South Asians living in the UK have a higher incidence of and mortality from CAD than Europeans\textsuperscript{43–45} and Blacks have a higher incidence of and mortality from CBVD and less CAD.\textsuperscript{43–45} While previous studies have suggested the prevalence of PAD is lower in South Asians,\textsuperscript{15,41,42,46} there are very little epidemiological data on this subject.

**Limitations**

ABPI measurement was used as a surrogate indicator of PAD in this study. A value of <0.9 is considered a reliable method for detecting PAD and it has been shown to be 95% sensitive and specific for detecting angiogram positive disease.\textsuperscript{47–49} This study was fully intended to be a small pilot study so that preliminary data could be obtained in order to plan a much larger epidemiological study in the UK. As a consequence, participant numbers were small which may have affected associations between ABPI and risk factors. Consent for blood was low, especially in South Asians, but comparable to those found in national surveys.\textsuperscript{19}

Due to the cross-sectional design of this study we could not report causal associations between socio-demographic variables and PAD. One must therefore be cautious when interpreting the data. Another limitation of this study is that of responder bias. Whilst all eligible South Asian and Black subjects were invited to take part in the E-ECHOES study, patients could respond via a free-phone telephone number or return a stamped addressed envelope. To minimize response bias especially from non-English speakers, subjects were telephoned and a verbal explanation was provided. Another possible bias may come from the fact that ethnic minority participants with co-morbidities, such as hypertension and diabetes, may be more likely to attend for screening than their healthier counterparts, which may have reflected the high prevalence of these co-morbidities in this study. This may have affected the PAD prevalence we found.

**Conclusion**

This study in South Asians and Blacks found equivalent rates of PAD to those previously reported in White populations. However, the prevalence of PAD in South Asian women was higher than Black women. Further studies are needed to see whether sociodemographic factors or genetic markers play the greater role in the development and progression of PAD.

**Acknowledgements**

We are grateful to all the subjects; practice staff including receptionists, nurses, managers and general practitioners for taking part in this study. The opinions expressed in this paper are not necessarily those of the funding bodies. We thank all members of the E-ECHOES Team and Ronnie Hayes, City Hospital, Birmingham. In addition, we thank Prof. Fowkes for granting permission to use and translate the Edinburgh Claudication Questionnaire.

**Funding**

This study is funded by the British Heart Foundation (PG/05/036), Heart of Birmingham Teaching Primary Care Trust, Sanofi-Aventis UK, and through the National Health Service R&D support funding (Primary Care Research Network-Central England).

**Conflict of interest:** None declared.

**References**

1. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA. Fowkes FRG on behalf of the TASC II working group. Inter-society consensus for the management of peripheral arterial disease (TASC II). Eur J Vasc Endovasc Surg 2007; 33:51–75.


