Explanations for the High Risk of Diabetes-Related Amputation in a Caribbean Population of Black African Descent and Potential for Prevention

ANSELM J.M. HENNIS, MRCP, PHD[1,2]
HENRY S. FRASER, FRCP, PHD[1,2]
RAMESH JONNALAGADDA, MS[2]
JOHN FULLER, FRCP[3]
NISH CHATURVEDI, MRCP, MD[4]

OBJECTIVE — Diabetes-related lower-extremity amputation (LEA) rates are elevated in blacks compared with whites in the U.S., but are lower in African Caribbeans in the U.K., whereas anecdotal reports suggest high rates in the Caribbean. We aimed to establish the incidence and risk factors for diabetes-related LEA in a Caribbean population.

RESEARCH DESIGN AND METHODS — We conducted an incident and prospective case-control study of case patients (individuals with diabetes having a LEA) and community-based control subjects (individuals with diabetes without a LEA) in Barbados, West Indies. Participants completed an interview and examination of risk factors for amputation, including footwear use.

RESULTS — The overall 1-year incidence of LEA ($n = 223$) was 173 per 10^5 population and 936 per 10^5 population with diabetes (557 per 10^5 for minor amputation and 379 per 10^5 for major amputation). Women had higher amputation rates than those reported in the Global Lower Extremity Amputation Study, apart from the U.S. Navajo population. Independent risk factors for all diabetes-related LEAs were poor footwear (odds ratio [OR] 2.71 [95% CI 1.23–5.97]), elevated GHb (1.40 per percent increase [1.26–1.57]), peripheral neuropathy (1.05 per volt increase [1.03–1.08]), and peripheral vascular disease.

CONCLUSIONS — Diabetes LEA rates in Barbados are among the highest in the world. Inadequate footwear independently tripled amputation risk. Education of professionals and patients, particularly about footwear and foot care, coupled with improved diabetes clinical care, is key to reducing amputation risk in this population.

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Type 2 diabetes is a global public health concern, with middle-income developing countries such as those in the Caribbean having a disproportionate disease burden (1). Populations of black African descent in the U.S., U.K., and Caribbean share a common genetic ancestry and experience high prevalences of type 2 diabetes (2).

Data on the risk of diabetes-related lower-extremity amputation (LEA) in populations of African descent are conflicting. A twofold excess risk observed in blacks in the U.S. can largely be accounted for by poor access to health care (3–6). Paradoxically, in the U.K., where access to health care is thought to be more equitable, the risk of diabetes-related LEA is one-third lower in African Caribbeans compared with Europeans living in London (relative risk 0.67) (7). Although anecdotal evidence from the Caribbean based on hospital bed occupancy suggests high rates of diabetes-related amputations (8), definitive data are still lacking. This study was therefore conducted to determine the incidence of amputation and relevant risk factors to plan efforts to reduce the burden of amputation in this and similar populations.

RESEARCH DESIGN AND METHODS

There were two parts to this study: an incidence study to document diabetes-related amputation rates and to compare findings with those of other population-based studies and a case-control study to determine reasons for the anticipated especially high rates of amputation in the Caribbean. Each individual undergoing an amputation during the study period contributed data once at the time of the first observed procedure.

Amputation incidence study

All persons having a LEA during the 12-month period commencing in November 1999 were identified prospectively. An amputation was defined as the complete loss in a transverse plane of any part of a lower limb (9), including wedge and ray amputations. Minor amputations involved the toes and foot, and major amputations were those through the tibia and femur (10). Because such procedures take place only in the hospital setting, research nurses identified case patients by maintaining a daily record of amputations performed at the island's two hospitals from surgical case lists. These lists were cross-checked against ward admission

From the [1]Chronic Disease Research Centre, Tropical Medicine Research Institute, University of the West Indies, Barbados, West Indies; the [2]School of Clinical Medicine & Research, University of the West Indies, Barbados, West Indies; [3]University College, London, U.K.; and the [4]National Heart & Lung Institute, Imperial College, London, U.K.

Address correspondence and reprint requests to Dr. Anselm Hennis, Chronic Disease Research Centre, Tropical Medicine Research Institute, University of the West Indies, Jemmott's Lane, Bridgetown, Barbados, West Indies. E-mail: ahennis@caribsurf.com.

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Abbreviations: LEA, lower-extremity amputation; PVD, peripheral vascular disease.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

registers to ensure identification of all patients admitted with lower extremity problems. All cases of amputation were ascertained, and clinical assessments were performed within 72 h of admission whenever possible. When amputees were too unwell to complete the interview, information was sought from relatives.

Amputation case-control study

Data collection was continued to accrue the required 200 diabetes-related cases for the case-control analysis. Based on established methods (11), 2,115 individuals (1 per household) were selected by a simple random sample from the 2000 electoral register obtained from the Statistical Department. This number was based on a worst-case scenario of a combined nonresponse and ineligibility rate of 50% (inability to locate and losses from migration, illness, or death). Control subjects were identified from persons with diabetes who had never had an amputation and were stratum-matched to case patients by 5-year age-group only, which allowed evaluation of sex-specific amputation risk. Research staff visited nonresponders to ascertain eligibility and reduce nonresponse bias.

Participants completed an interview that included items on demographics, socioeconomic status, self-assigned racial group, lifestyle behaviors, diabetes, and medical history. A detailed inventory about footwear was administered, comprising rubber thong sandals, flat-sole broad leather shoes, high-heel shoes, narrow-toe hard leather shoes, closed broad sandals, and canvas sneakers, aided by pictures (12). Fashion footwear was defined as narrow-toe hard leather shoes worn by both sexes and high-heel pointed toe shoes worn by women. Additional information was obtained about locations and activities when the various types of footwear were worn, as well as the frequency and duration of use. Symptoms of peripheral arterial disease elicited at interview were used to establish a diagnosis of claudication (13).

Blood pressure was measured twice after 5 min of rest in a seated position using a standard mercury sphygmomanometer (Accoson, London, U.K.). Weight, height, and body circumferences were measured in a standard manner, and for those who could not stand, height reported in the national identity card (previously measured) was recorded (comparisons indicated that the latter measure was valid). Peripheral vascular disease (PVD) was evaluated by palpation of foot pulses (present if *any* pedal pulse was absent, absent if all pulses present, and indeterminate for above ankle amputation) and Doppler studies (Dopplex; Huntleigh Diagnostics, Cardiff, U.K.) for the measurement of ankle blood pressure. The ankle brachial index was calculated as the only or higher value of ankle systolic blood pressure divided by ipsilateral arm systolic blood pressure (abnormal values <0.9 and normal values ≥ 0.9 for ankle brachial difference <75 mmHg) (14). A composite PVD index comprising claudication, ankle brachial index <0.9, or absence of any foot pulse unrelated to amputation was derived. Peripheral neuropathy was assessed by eliciting knee and ankle reflexes (present if *any* reflex was depressed/absent, absent when all reflexes were present, and normal), measuring vibration perception threshold of the right medial malleolus using a biosthesiometer (Biomedical Instrument, Newbury, OH), and sensitivity to a monofilament applied 10 times to the dorsum of the great toes (abnormal if five or less applications felt at either toe, normal if more than five applications felt at both toes, and otherwise indeterminate). Blood was taken for measurement of GHb (Glyc-Affin GHb kits; Isolab, Akron, OH). Ethical approval was granted by the Medical Research Ethics Committee of the Ministry of Health, and participants were enrolled only after signed informed consent was obtained.

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Statistical analysis

Sample size estimates were based on footwear as a major modifiable risk factor for amputation. Available data indicated that 40% of persons with diabetes used appropriate footwear (15), requiring a total of 200 case patients and 200 control subjects to detect an appropriate footwear rate of 57% in control subjects, with 90% power and 5% significance. Incidence rates of amputation were calculated and directly standardized against the world and European populations (applying age-specific amputation rates in the Barbados population to identical age strata in these standard populations to obtain an overall weighted average rate), enabling comparison with other data (16,17). Incidence of diabetes-related amputation for the diabetic population was calculated based on estimates of diabetes prevalence from previous studies (2,18). For the case-control analyses, characteristics associated with amputation were compared by *t* test for continuous variables and by χ^2 test for categorical variables. Logistic regression was used to estimate univariate and multivariate adjusted odds ratios (ORs) for the risk of amputation.

RESULTS

Amputation incidence study

During the first year of the study, 223 LEAs (diabetes related and non–diabetes related) took place for an overall incident rate of 173 per 10^5 population (95% CI 150–195 per 10^5; 49.2 and 77.0 per 10^5 standardized to world and European populations, respectively). A total of 167 persons with diabetes (age 70.9 ± 12.6 years [mean ± SD]) underwent an amputation during this period: 96.4% with type 2 diabetes, 97% self-reporting black race, and 28.1% who had been hospitalized during the previous year. The unadjusted diabetes LEA incidence rate was 129.6 per 10^5 population (95% CI 109–149 per 10^5) and 41.3 and 62.2 per 10^5, respectively, standardized to world and European populations. This rate was 936 per 10^5 (557 and 379 per 10^5 for minor and major amputation, respectively) based on the population just with diabetes. Racial differences were evident; standardized incident amputation rates (European population) in black and white/other Barbadians were 60.2 and 44.6 per 10^5, respectively. The standardized rate (European population) of first-time diabetes-related LEA ($n = 120$) was 43.6 per 10^5.

Amputation case-control study

Overall, 210 case patients with diabetes-related LEA were identified, whereas 199 individuals (81.9% of those eligible and invited to participate) formed the control group. Identical proportions of case patients and control subjects (97.5%) reported their race as black, and further analyses are restricted to this group (205 case and 194 control subjects).

Table 1 presents data on possible risk factors for diabetes-related amputation. Case and control subjects were similarly aged because of age-stratum matching. A

Table 1—*Factors associated with diabetes-related LEA*

	Case patients	Control subjects	Univariate OR (95% CI)	*P*
n	205	104		
Sex (male/female)	44.9 (92/205)	34.5 (67/194)	1.54 (1.03–2.31)	0.035
Age (years)	70.3 ± 0.90 (205/205)	69.6 (0.87) (194/194)	1.01 (0.99–1.02)	0.57
Marital status (single/spouse)	71.2 (146/205)	50.0 (97/194)	2.47 (1.64–3.74)	<0.0001
Occupation (professional/nonprofessional)	7.4 (15/204)	11.3 (22/194)	0.62 (0.31–1.23)	0.17
Monthly household income (<$500 U.S.)	45.7 (58/127)	31.4 (48/153)	1.84 (1.13–3.00)	0.0145
Vehicle ownership (yes/no)	45.6 (93/204)	55.2 (107/194)	0.68 (0.46–1.01)	0.057
Hypertension history (yes/no)	64.9 (133/205)	63.4 (123/194)	1.07 (0.70–1.64)	0.75
Stroke history (yes/no)	17.1 (35/205)	7.2 (14/194)	2.65 (1.38–5.09)	0.0036
Diabetes duration (years)	17.8 ± 0.84 (173/205)	11.9 ± 0.74 (177/194)	1.06 (1.03–1.08)	<0.0001
Usual treatment with insulin use (yes/no)	26.5 (54/204)	10.3 (20/194)	3.13 (1.79–5.47)	0.0001
Smoker (yes/no)	18.0 (37/205)	17.5 (34/194)	1.04 (0.62–1.73)	0.89
Foot inspection advice (yes/no)	78.3 (159/203)	82.0 (159/194)	0.80 (0.48–1.31)	0.37
Foot exam by a medic (yes/no)	96.1 (197/205)	98.4 (190/193)	0.39 (0.10–1.49)	0.17
Daily foot self-exam (yes/no)	71.9 (146/203)	86.5 (167/193)	0.40 (0.24–0.67)	0.0005
Blood glucose monitoring (yes/no)	17.9 (36/201)	25.0 (48/192)	0.65 (0.40–1.06)	0.088
BMI (kg/m^2)	25.6 ± 0.61 (117/205)	26.8 ± 0.36 (194/194)	0.96 (0.92–1.004)	0.075
Pulse rate (per min)	88.1 ± 1.2 (195/205)	77.2 ± 0.83 (194/194)	1.06 (1.04–1.08)	<0.001
Sitting SBP (mmHg)	131.6 ± 1.45 (191/205)	145.4 ± 1.43 (194/194)	0.97 (0.96–0.98)	<0.001
Claudication (yes/no)	30.6 (52/170)	16.2 (23/142)	2.28 (1.31–3.96)	0.0035
Absent foot pulses (yes/no)	84.1 (138/164)	21.6 (42/194)	19.2 (11.2–33.0)	<0.0001
ABI (low/normal)	42.8 (71/166)	16.1 (31/192)	3.88 (2.37–6.35)	<0.0001
Composite PVD index positive	94.1 (160/170)	60.0 (75/159)	17.9 (8.80–29.48)	<0.0001
Ever foot ulcer (yes/no)	61.0 (125/205)	1.0 (2/194)	149.4 (36.2–617.1)	<0.0001
Current limb infection (yes/no)	26.6 (54/203)	1.0 (2/194)	34.5 (8.32–143.22)	<0.001
Callus (yes/no)	33.2 (67/202)	17.5 (34/194)	2.34 (1.46–3.74)	0.0004
Absent lower-limb reflexes (yes/no)	65.8 (104/158)	41.3 (78/189)	2.74 (1.77–4.25)	<0.0001
VPT right malleolus (volts)	2.0 ± 1.46 (113/205)	23.0 ± 0.76 (192/194)	1.07 (1.05–1.10)	<0.001
Monofilament insensitivity (yes/no)	94.1 (111/118)	33.2 (64/193)	31.9 (14.06–72.48)	<0.0001
GHb	11.1 (0.27)	9.1 (0.19)	1.24 (1.15–1.34)	<0.001

Data are means ± SE or % (*n*), unless otherwise indicated. ABI, ankle brachial index; VPT, vibration perception threshold.

greater proportion of case than control subjects were male, confirming the male predisposition for amputation (P = 0.035). Single persons (living without a spouse as a result of being unmarried, widowed, divorced, or separated) were at higher risk for amputation, as were those with a low income. Twice as many case patients reported claudication, whereas similar proportions of case and control subjects had ever smoked.

Case patients had a longer duration of known diabetes. Usual (prehospitalization) treatment with insulin was associated with an increased likelihood of amputation (OR 3.13 [95% CI 1.79–5.47]), and mean GHb levels were higher in case than control subjects (11.1 and 9.1%, respectively). Self-monitoring of blood glucose was associated with a nonsignificant trend to decreased amputation risk (OR 0.65; P = 0.09). Although similar proportions of case and control subjects received foot inspection advice (78.3 and 82.0%) and had their feet examined in the previous year (96.1 and 98.4%), case patients were far less likely to examine their feet every day (71.9 vs. 86.5%; $P < 0.001$).

At examination, case patients had higher mean pulse rate and lower sitting systolic blood pressure than control subjects (despite less frequent antihypertensive treatment: 61.6 vs. 87.0%) and had more signs of PVD. Amputees were more likely to ever have had a foot ulcer previously (61.0 vs. 1.0%) or limb infection, callus, or sensorimotor neuropathy.

Table 2 presents data about footwear practices associated with LEA risk. None of the case patients, including those with previous amputations, wore insoles or therapeutic footwear. Going barefoot in the garden almost tripled LEA risk in men and was commonly practiced by case and control subjects. Wearing sneakers regularly to work doubled LEA risk in women (OR 2.15 [95% CI: 1.25–3.69]), whereas wearing sneakers to town was associated with a fourfold increased risk. Wearing rubber thong sandals daily doubled LEA risk in men and women with diabetes. Although the majority of men and women reported wearing broad leather shoes to formal activities once weekly, principally church (71.0 and 69.7% of male and female case patients and 91 and 81.9% of male and female control subjects), wearing fashion shoes was associated with a fourfold increased amputation risk. We derived a high-risk footwear variable as a composite of at least one of the following: going barefoot in the garden, wearing sneakers to work or town, and wearing rubber thong sandals daily or fashion footwear once weekly. This was associ-

Table 2—*Types of footwear associated with increased amputation risk*

	Case patients	Control subjects	OR (95% CI)	*P*
Barefoot in the garden				
Men (yes/no)	38.5 (35/91)	17.9 (12/67)	2.86 (1.35–6.09)	0.005
Women (yes/no)	31.2 (34/109)	25.2 (32/127)	1.35 (0.76–2.38)	0.31
All (yes/no)	34.5 (69/200)	22.7 (44/194)	1.80 (1.15–2.80)	0.01
Sneakers at work				
Men (yes/no)	31.9 (29/91)	22.4 (15/67)	1.62 (0.80–3.34)	0.19
Women (yes/no)	45.0 (49/109)	27.6 (35/127)	2.15 (1.25–3.69)	0.005
All (yes/no)	39.0 (78/200)	25.8 (50/194)	1.84 (1.20–2.83)	0.005
Sneakers to town				
Men (yes/no)	40.0 (36/90)	39.4 (26/66)	1.03 (0.54–1.96)	0.94
Women (yes/no)	39.4 (43/109)	12.6 (16/127)	4.52 (2.36–8.66)	<0.001
All (yes/no)	39.7 (79/199)	21.8 (42/193)	2.37 (1.52–3.69)	<0.001
Rubber thong sandals worn daily				
Men (yes/no)	40.7 (37/91)	23.9 (16/67)	2.18 (1.08–4.40)	0.027
Women (yes/no)	47.7 (52/109)	29.1 (37/127)	2.22 (1.30–3.79)	0.003
All (yes/no)	44.5 (89/200)	27.3 (53/194)	2.13 (1.40–3.25)	<0.001
Fashion footwear once weekly				
Men (yes/no)	7.7 (7/91)	1.5 (1/67)	5.49 (0.66–45.71)	0.08
Women (yes/no)	23.9 (26/109)	6.3 (8/127)	4.66 (2.01–10.80)	<0.001
All (yes/no)	16.5 (33/200)	4.6 (9/194)	4.06 (1.89–8.74)	<0.001
High-risk footwear*	86.5 (173/200)	64.9 (126/194)	3.46 (2.09–5.71)	<0.001

*Composite variable comprising going barefoot in the garden, wearing sneakers to work or town, daily wearing of rubber thong sandals, or fashion footwear once weekly.

ated with a tripling of LEA risk (3.46 [2.09–5.71]).

Table 3 describes patterns of amputations and related factors among case patients. Sixty percent of amputations were minor and 40% were major (22.9% below-knee and 17.1% above-knee). Antecedents of LEA reported by the managing surgeons included PVD (55.6%), acute infection (44.4%), and chronic ulcers (33.2%). Nonpenetrating injury probably caused by breaks in the skin (in contrast to acute puncture wounds) were associated with 12% of amputations. Delays in seeking care were clear. On average, 1 week elapsed (interquartile range, 3 days to 3 weeks) before a doctor's help was sought. At evaluation, most case patients (43.9%) were treated and asked to return for review, with only one in six eventual amputees being hospitalized immediately. The median time to hospital admission after the critical event was 3 weeks (interquartile range, 1.5 weeks to >1 month). More than 25% of diabetic amputee subjects had been admitted to the hospital in the preceding year, mainly for foot problems.

Table 4 presents age- and sex-adjusted multivariate regression analysis of factors associated with risk of LEA. In multivariate models adjusting for the confounding effects of foot self-examination, glycemic status, PVD, and neuropathy, high-risk footwear was independently associated with more than doubling the risk of minor amputation (OR 2.52 [95% CI 1.07–5.92]). There was a nonsignificant association with increased risk of major amputation (OR 3.85; $P = 0.06$). The summary model indicated that high-risk footwear was independently predictive of an almost threefold increased risk of LEA. Daily self-examination of the feet was independently associated with an 80% reduced amputation risk, whereas elevated GHb, PVD (reduced ankle brachial index), and neuropathy (vibration perception threshold measured at the medial malleolus) were independently associated with increased overall amputation risk.

CONCLUSIONS

Anecdotal reports of high rates of diabetes-related LEA in the Caribbean black population were confirmed in this study. Seventy five percent of incident LEAs took place in persons with diabetes. We demonstrated that regular use of inadequate or no footwear combined with infrequent use of tight-fitting shoes substantially increased the risk of amputation. Documented risk factors such as poor glycemic control, PVD, and neuropathy were also important.

Despite the clinical and public health importance of LEAs, few reports present standardized data that allow comparisons between studies. Compared with incident LEA rates in North American, European, and East Asian female populations, amputation rates in Barbadian women (both distal and proximal to the tarsometatarsal joint) were exceeded only by those in the U.S. Navajo population (19).

Rates of diabetes-related amputation in the Barbadian diabetic population were nearly identical to rates in blacks (950 per 10^5), (4) but threefold higher than those in Caribbean migrants to the U.K. (7). Rates were also substantially higher than those reported in white populations (3,20–22). Inordinately high amputation rates among blacks appear to be partly caused by greater exposure to social and environmental risk factors as well as inequities in health care (5,6). In the U.K., where health care inequities are thought to be less marked than in the U.S., African Caribbeans are at lower risk for LEA than Europeans, with this difference being largely explained by lower rates of neuropathy, PVD, and smoking (7). Given the easy access to comprehensive health

Table 3—*Types, causes, and care related to current amputation*

Level of current amputation	
Toe only	118 (57.6)
Above toe, below ankle	5 (2.4)
Below knee, above ankle	47 (22.9)
Above knee	35 (17.1)
Reported antecedents of amputation*	
PVD	114 (55.6)
Acute infection	91 (44.4)
Chronic ulcer	68 (33.2)
Nonpenetrating injury	24 (11.7)
Source of medical help after event	
Private primary care physician	82 (40.0)
Polyclinic	75 (36.6)
Outpatient department	16 (7.8)
AED	12 (5.9)
Specialist	11 (5.4)
Treatment	
Treated and reviewed	90 (43.9)
Referred to AED	48 (23.4)
Admitted to hospital	32 (15.6)
Referred to outpatient department	20 (9.8)
Treated and discharged	6 (2.9)
Initial treatment received	
Antibiotics	53 (25.9)
Wound care	34 (16.6)
Source of usual care	
Polyclinic	102 (56.0)
Private doctor	67 (36.8)
Hospital	13 (7.1)
Hospitalized in previous year	55 (26.8)
Reason for hospitalization (n = 55)	
Foot problem	40 (72.2)
Coronary heart disease	6 (10.9)
Hypoglycemia	3 (5.5)
Hyperglycemia	2 (3.6)

Data are *n* (%). *More than one cause possible. AED, accident and emergency department.

care in Barbados (now ranked as the leading developing nation globally), the high rates of diabetic amputations are disappointing.

The Caribbean climate favors use of casual footwear or walking around barefoot outdoors, as confirmed by other workers (23). This study highlights the importance of footwear as a risk factor for LEA. Although thong sandals provide limited protection and tight fashion footwear may lead to trauma, sneakers being worn to work implied manual employment with specific associated risks. In addition, bedside inspection of sneakers worn by case patients revealed that such footwear was often extremely worn down, offering little protection. High-risk footwear independently predicted a threefold increased likelihood of LEA, a finding of particular significance given that 60% of diabetic amputations involved the foot.

A randomized trial of therapeutic footwear demonstrated reduced incidence of reulceration after 1 year (24). Therapeutic footwear interventions are likely to benefit groups with high rates of diabetic foot disease, and there are potential clinical and public health implications in the Caribbean, where our findings suggest that poor footwear increases amputation risk.

As expected, neuropathy and PVD increased LEA risk (2–4,10,24,25), suggesting a role for early vascular interventions in persons with diabetic PVD. Neuropathy was an independent predictor of amputation risk, with each unit of volt increase being associated with a 5% increased amputation risk in the summary multivariate model. Poor long-term glycemic control underpins vascular and neuropathic complications, and the association between amputation and elevated GHb is well documented (25). One-third of case patients and one-sixth of control subjects were also found to have foot callus at examination, another antecedent of diabetic foot ulcers (12), whereas current limb infection or past lower-limb ulcer were also related to an increased risk of amputation. Detailed evaluation of factors such as Charcot joints and previous amputation was not possible because none of the control subjects (and only three case patients) had arthropathy and, by design, selection of control subjects excluded amputees.

Reduced systolic blood pressure and elevated pulse rates among case patients can be explained by acute ill health with infection, dehydration, pain, analgesics and other therapies, autonomic dysfunction, and possibly circulatory changes associated with recent limb loss.

Consistent with other reports, case patients delayed seeking medical care after a limb-threatening event, although 20% of this group had been hospitalized within the preceding year with foot ulcers. These delays were not inordinately long and therefore were not likely to result in major deterioration in the majority of case patients (26).

There are limitations in the way we have measured certain risk factors. But, when possible, we relied on objective rather than subjective measures. Our measures of type and duration of footwear, however, rely on self-report, and it was not possible to mask interviewers to amputation status. Research nurses were not told of the study hypotheses, and investigators did not take part in data collection. Interviewers were trained to

Table 4—*Multivariate ORs for key risk factors associated with amputation in diabetes*

	OR (95% CI)	*P*
Minor amputation		
High-risk footwear	2.52 (1.07–5.92)	0.03
Daily foot self-examination	0.28 (0.12–0.63)	0.002
GHb level (per % increase)	1.35 (1.20–1.52)	<0.001
ABI (per unit increase)	0.27 (0.10–0.74)	0.01
VPT (per unit volt increase)	1.06 (1.03–1.09)	<0.001
Major amputation		
High-risk footwear	3.85 (0.93–15.95)	0.06
Daily foot self-examination	0.09 (0.03–0.31)	<0.001
GHb level (per % increase)	1.51 (1.28–1.79)	<0.001
ABI (per unit increase)	0.15 (0.03–0.71)	0.02
VPT (per unit volt increase)	1.04 (0.99–1.08)	0.08
All amputations		
High-risk footwear	2.71 (1.23–5.97)	0.03
Daily foot self-examination	0.20 (0.10–0.42)	0.002
GHb level (per % increase)	1.40 (1.26–1.57)	<0.001
ABI (per unit increase)	0.25 (0.10–0.66)	0.01
VPT (per unit volt increase)	1.05 (1.03–1.08)	<0.001

ABI, ankle brachial index; VPT, vibration perception threshold.

administer the questionnaire without prompting or leading participants, and this was monitored throughout the study. Our experience has been that patients are likely to under-report high-risk behaviors. Under-reporting of high-risk footwear would have negatively biased the association with amputation, resulting in an underestimate of the true risk. A key strength of the study is the prospective nature of data collection.

We have quantified, for the first time to our knowledge, national rates of overall and diabetes-related LEA in a Caribbean population, which is known to have high rates of diabetes. Compared with control subjects, case patients were of lower socioeconomic status, paid less attention to self-care, had more diabetes-related complications, and used high-risk footwear, underpinning the role of patient and health care factors in amputation risk. These observations highlight the need to improve overall diabetes care by the multidisciplinary approach (including podiatric services) and patient and health care provider education.

Amputations are eminently preventable. Given that the majority of amputees were known to the hospital system and many had previously been admitted with foot problems, targeted interventions may be a valuable strategy to reduce the burden of LEA in the Caribbean. Such a strategy would aim to improve footwear, particularly in those with diabetic foot disease, foot care through podiatric and surgical services (including greater use of limb revascularization), and promotion of early health care–seeking behaviors.

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