

An Update on the Burden of Cardiovascular Disease Risk Factors in Jamaica

Findings from the Jamaica Health and Lifestyle Survey 2007–2008

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ABSTRACT

Background: Previous studies have documented a high burden of cardiovascular disease (CVD) risk factors in Jamaica and suggest that mortality from CVD may be increasing. This paper provides an update on the burden of CVD risk factors in Jamaica using data from the most recent national health survey and evaluates the impact of obesity and physical activity on other CVD risk factors.

Methods: The Jamaica Health and Lifestyle Survey 2007–2008 (JHLS-2) recruited a nationally representative sample of 2848 Jamaicans, 15–74 years old between November 2007 and March 2008. An interviewer administered questionnaire was used to obtain data on demographic characteristics, medical history and health behaviour. Blood pressure and anthropometric measurements were made using standardized protocols and capillary blood samples were obtained to measure fasting glucose and total cholesterol. Prevalence estimates for the various CVD risk factors were obtained within and across sex and other demographic categories. Data were weighted for the complex survey design, non-response to questionnaire items or failure to complete some segments of the evaluation.

Results: Prevalence estimates for traditional CVD risk factors were: hypertension, 25%; diabetes, 8%; hypercholesterolaemia, 12%; obesity, 25%; smoking 15%. In addition, 35% of Jamaicans had prehypertension, 3% had impaired fasting glucose and 27% were overweight. A higher proportion of women had diabetes, obesity and hypercholesterolaemia while the prevalence of prehypertension and cigarette smoking was higher in men. Approximately 50% of persons with hypertension, 25% of persons with diabetes and 86% of persons with hypercholesterolaemia were unaware of their risk status. In multivariate analysis, obesity was associated with increased odds of hypertension, diabetes and hypercholesterolaemia while physical inactivity was associated with higher odds of diabetes.

Conclusion: The burden of CVD risk factors in Jamaica remains very high and warrants interventions to reduce CVD risk.

Keywords: Blacks, cardiovascular risk, diabetes mellitus, hypercholesterolaemia, hypertension, Jamaica, national health surveys, obesity, physical activity.

Actualización Acerca de la Carga de los Factores de Riesgo de la Enfermedad Cardiovascular en Jamaica

Hallazgos de la Encuesta sobre Salud y Estilo de Vida, Jamaica, 2007–2008

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RESUMEN

Antecedentes: Estudios previos han documentado la existencia de una alta carga de factores de riesgo de la enfermedad cardiovascular (ECV), y sugieren que la mortalidad a consecuencia de la ECV puede estar aumentando. Este trabajo ofrece una actualización sobre la carga que los factores de riesgo de la ECV representan para Jamaica, para lo cual recurre a los datos de la más recientes encuesta nacional de salud. El trabajo también evalúa el impacto de la obesidad y la actividad física sobre otros factores de riesgo de la ECV.

Método: La encuesta sobre salud y estilo de vida en Jamaica, 2007–2008 (JHLS–2) reclutó una muestra nacionalmente representativa de 2848 jamaicanos, de 15–74 años de edad, entre noviembre 2007 y marzo 2008. Se usó un cuestionario aplicado por el entrevistador con el propósito de obtener datos acerca de las características demográficas, la historia médica y el comportamiento respecto a la salud. Se hicieron mediciones de la presión sanguínea así como mediciones antropométricas, usando protocolos estandarizados, y se obtuvieron muestras de sangre capilar para medir la glucosa en ayuno y el colesterol total. Se obtuvieron estimados de prevalencia para varios factores de riesgo de ECV dentro y fuera del género, así como otras categorías demográficas. Se sopesaron los datos para el diseño complejo de encuestas, la no respuesta a los ítems de los cuestionarios, o el dejar de responder algunos segmentos de la evaluación.

Resultados: Los estimados de la prevalencia para los factores de riesgo tradicionales de la ECV fueron: la hipertensión, 25%; la diabetes, 8%; la hipercolesterolemia, 12%; la obesidad, 25%; el hábito de fumar 15%. Además, el 35% de los jamaicanos padecen de prehipertensión, el 3% muestran glucosa alterada en ayuno, y el 27% tienen sobrepeso. Una proporción más alta de mujeres tenía diabetes, obesidad e hipercolesterolemia, mientras que la prevalencia de la prehipertensión y el hábito de fumar fue más alta entre los hombres. Aproximadamente el 50% de las personas con hipertensión, el 25% de las personas con diabetes, y el 86% de las personas con hipercolesterolemia, no tenían conciencia del estado de riesgo en que se hallaban. En el análisis multivariado, la obesidad estuvo asociada con un aumento de las probabilidades de hipertensión, diabetes e hipercolesterolemia, en tanto que la inactividad física se hallaba asociado con una probabilidad más alta de diabetes.

Conclusión: La carga de factores de riesgo de ECV en Jamaica sigue siendo muy alta y justifica las intervenciones para reducir el riesgo de ECV.

Palabras claves: Negros, riesgo cardiovascular, diabetes mellitus, hipercolesterolemia, hipertensión, Jamaica, encuestas nacionales de salud, obesidad, actividad física

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INTRODUCTION

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels. The main conditions include coronary heart disease, cerebrovascular disease and peripheral arterial disease (1). Other cardiovascular disorders include rheumatic heart disease, congenital heart disease, deep vein thrombosis and pulmonary embolism (1). Heart attacks and strokes are usually acute events and are mainly caused by atherosclerotic occlusion in the coronary and cerebral vascular beds respectively. Strokes can also be caused by rupture of cerebral blood vessels, resulting in intracranial haemorrhage. Acute occlusion of vessels in the peripheral arteries of the lower limbs produces acute limb ischaemia with the attendant risk of gangrene and amputation.

Epidemiological studies over the last fifty years have identified a number of risk factors of cardiovascular disease. These include modifiable factors such as hypertension, prehypertension, diabetes mellitus, impaired glucose tolerance, dyslipidaemia, overweight or obesity, tobacco smoking, sedentary lifestyle and poor nutrition [in particular high salt intake, high fat diets and low intake of fruits and vegetables] (2). Non-modifiable risk factors include older age, sex and genetic predisposition (2).

Cardiovascular diseases are the leading causes of death globally. An estimated 17.1 million people died from CVDs in 2004, representing 29% of all global deaths (1). Of these

deaths, an estimated 7.2 million were due to coronary heart disease and 5.7 million were due to stroke. By 2030, about 23.6 million people will die annually from CVDs (1).

Low and middle-income countries are disproportionately affected by CVDs, with over 80% of CVD deaths taking place in such countries (1). In addition, a large number of deaths from CVDs in low and middle-income countries occur at a younger age than in developed countries resulting in substantial loss of productive years (3).

In Jamaica, cardiovascular diseases accounted for four of the five leading causes of death in 2004 (4). Leading causes of death were cerebrovascular disease, diabetes mellitus, ischaemic (coronary) heart disease, hypertensive disease and "other heart disease". The pattern was similar in other member countries of the Caribbean Regional Epidemiology Centre (CAREC). For CAREC member countries, excluding Jamaica, ischaemic heart disease was the leading cause of death, followed by diabetes mellitus, cerebrovascular disease, hypertensive disease and HIV (4). Previous studies in Jamaica have also documented a high burden of CVD risk factors including obesity, hypertension, diabetes mellitus and the metabolic syndrome (5–8). With this high burden of risk factors and the high proportional mortality from CVDs in Jamaica, CVDs remain one of the greatest challenges to the health of the nation. National health surveys have been used to periodically assess the burden of CVD, its risk factors and

other disease conditions in Jamaica and provide data to advise policy-makers and practitioners. This paper, therefore, provides an update on the burden of CVD risk factors in Jamaica using data from the most recent national health survey. We also evaluated the impact of obesity and physical activity on other CVD risk factors.

SUBJECTS AND METHODS

Details on the methods of the Jamaica Health and Lifestyle Survey 2007–2008 (JHLS–2) have been previously published (9, 10). This survey recruited a nationally representative sample of 2848 Jamaicans, 15–74 years old, between November 2007 and March 2008. An interviewer administered questionnaire was used to obtain data on demographic characteristics, medical history and health behaviour. Blood pressure and anthropometric measurements were made using standardized protocols and capillary blood samples were obtained to measure fasting glucose and total cholesterol. Previously collected data from the Jamaica Health and Lifestyle Survey 2000–2001 were used to evaluate whether there were any significant changes in CVD risk factor burden since the first survey.

Blood pressure was categorized using criteria from the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (JNC 7) and reported as prehypertension (SBP = 120–139 mmHg or DBP = 80–89 mmHg and not on medication for hypertension) or hypertension [BP \geq 140/90 mmHg or on medication for hypertension] (11). Body weight was categorized using the World Health Organization (WHO) body mass index (BMI) categories (12) with overweight defined as BMI of 25.0–29.9 kg/m² and obese defined as BMI \geq 30.0 kg/m². Central obesity was defined as waist circumference \geq 94 cm in men or \geq 80 cm in women, while elevated waist-to-hip ratio was defined as \geq 0.95 for men or \geq 0.80 for women (13). Measured capillary glucose was converted to the equivalent fasting plasma glucose using the formula “plasma glucose = 0.102 + 1.066 x capillary glucose” as recommended by the guidelines from the European Association for the Study of Diabetes (14). Diabetes was then defined as fasting glucose \geq 7.0 mmol/L and impaired fasting glucose as fasting glucose \geq 5.6 mmol/L but $<$ 7.0 mmol/L in accordance with the WHO and American Diabetes Association (ADA) criteria, respectively (15, 16). High cholesterol was defined as fasting total cholesterol of \geq 5.2 mmol/L (17). Physical activity was assessed using items from the questionnaire which evaluated work or leisure time-related physical activity, or scheduled physical activity sessions of twenty minutes or more. Persons engaging in physical activity (work, leisure-time or exercise) for three or more times per week were classified as high physical activity, those with 1–2 sessions per week as moderate physical activity and those less than once per week as low physical activity. Persons who reported no significant work, leisure time or

scheduled physical activity sessions were classified as inactive.

Data were entered into an electronic database and analysed using Stata statistical software (Stata 10.0, College Station, Texas). Data were weighted for the complex survey design, non-response to questionnaire items or failure to complete some segments of the evaluation. Prevalence estimates for the various CVD risk factors were obtained within and across sex and other demographic categories. The Pearson chi-squared statistic corrected for survey design and logistic regression were used to examine the association of the CVD risk factors with demographic variables, nutritional status and physical activity.

RESULTS

Prevalence estimates for the major CVD risk factors are shown in Table 1. The prevalence of hypertension was

Table 1: Prevalence of cardiovascular disease risk factors with comparison of sex differences in the Jamaica Health and Lifestyle Survey 2007–2008

Disease Condition	Male	Female	Total
Hypertension	25.0	25.5	25.2
Prehypertension***	41.8	29.0	35.3
Diabetes mellitus*	6.4	9.3	7.9
Impaired fasting glucose	3.3	2.4	2.8
Overweight	26.0	27.1	26.6
Obesity***	12.3	37.5	25.2
High cholesterol***	7.5	15.6	11.7
Cigarette smoking (current)***	22.1	7.2	14.5
Physical inactivity***	16.0	43.0	30.0

* $p < 0.05$; *** $p < 0.001$ for male:female difference

approximately 25% in both men and women. Another 42% of men and 29% of women had prehypertension. The estimated prevalence for diabetes mellitus was 7.9% with a higher prevalence in women compared to men, 9.3% and 6.4%, respectively ($p < 0.05$). In addition, another 3% of Jamaicans were estimated to have impaired fasting glucose. Sixteen per cent of women and 8% of men had high cholesterol. Approximately 27% of persons were overweight and another 25% obese. The prevalence of obesity was significantly higher in women compared to men, 38% *versus* 12%, respectively ($p < 0.05$). The prevalence of current cigarette smoking was reported by 22% of men and 8% of women, while 43% of women and 16% of men were classified as inactive.

The distributions of nutritional status and physical activity are shown in Table 2. Men were more likely to be classified as having high or moderate physical activity levels while women were more likely to be classified as being inactive or having a low physical activity level. Approximately 5% of both men and women were underweight while 57% of men and 31% of women had normal weight. Approximately 70% of women were classified as having central obesity by

Table 2: Distribution of physical activity levels and nutritional status by sex among participants in the Jamaica Health and Lifestyle Survey 2007–8

	Male	Female	Total
Physical Activity Categories			
Inactive***	16.0	43.0	30.0
Low *	12.2	19.2	16.0
Moderate***	24.3	20.0	22.1
High****	48.0	18.2	33.0
Nutritional Status			
Underweight (BMI < 18.5 kg/m ²)	4.7	4.7	4.7
Normal (BMI 18.5–24.99 kg/m ²)***	57.0	30.6	43.6
Overweight (BMI 25–29.99 kg/m ²)	25.8	27.0	26.4
Obese (BMI ≥ 30 kg/m ²)***	12.4	37.7	25.3
Increased WC***	19.6	69.8	45.2
Increased WHR***	8.8	70.4	40.2

* $p < 0.05$; *** $p < 0.001$ for male:female difference

WC = waist circumference; WHR = waist-to-hip ratio

both waist circumference and waist-to-hip ratio criteria; 20% of men had elevated waist circumference and 9% had increased waist-to-hip ratio.

Awareness and control levels for hypertension, diabetes and high cholesterol are shown in Table 3. Almost 50%

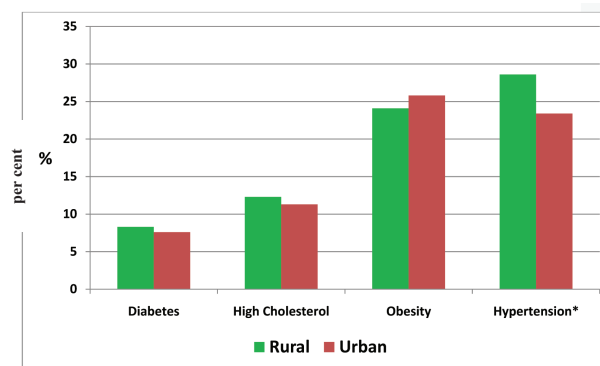
Table 3: Awareness and control levels for CVD risk factors

Condition	Male	Female	Total
Hypertension Awareness			
Aware	30.6	69.6	50.7
Unaware	69.4	30.5	49.3
Hypertension Control*			
Controlled	31.2	44.9	41.4
Not Controlled	68.2	53.9	57.5
Control Unknown	0.6	1.2	1.1
Diabetes Awareness			
Aware	73.2	78.0	76.1
Unaware	26.8	22.0	23.9
Diabetes Control*			
Controlled	46.8	42.1	43.9
Not Controlled	49.9	54.3	52.6
Control Unknown	3.4	3.6	3.5
High Cholesterol Awareness			
Aware	16.6	12.7	14.0
Unaware	83.4	87.3	86.0
High Cholesterol Control*			
Controlled	88.4	68.5	76.3
Not Controlled	11.6	21.6	17.7
Control Unknown	–	9.9	6.0

*Control rates were calculated for persons who were on treatment for the respective conditions.

of persons with hypertension were unaware of their risk status; 24% of persons with diabetes and 86% of persons with high cholesterol were unaware of their status. Women had higher levels of awareness for hypertension and diabetes. Women also had higher levels of control for hypertension but not for diabetes or hypercholesterolaemia.

In order to identify correlates of CVD risk factors, we compared the prevalence of diabetes, hypertension and high cholesterol among rural or urban dwellers, across age categories, levels of physical activity and BMI categories. We also compared levels of obesity by rural/urban status, age categories and physical activity levels. These comparisons are shown in Figs 1–4. Except for a higher prevalence of hypertension among rural dwellers (29% compared to 23%), there were no significant differences in the prevalence of CVD risk factors studied for participants living in rural communities compared to participants living in urban communities (Fig. 1). All CVD risk factors showed significantly

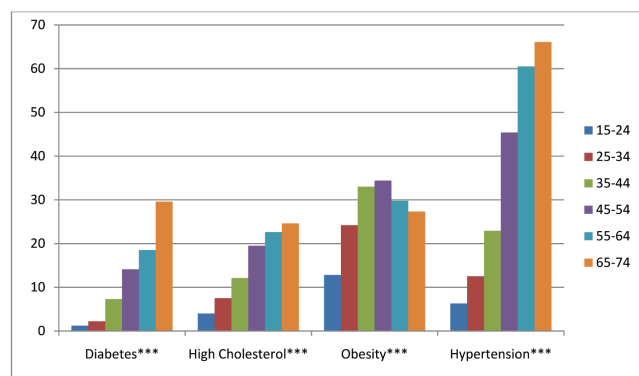


* $p < 0.05$

Fig. 1: Prevalence of cardiovascular disease risk factors by rural or urban residence.

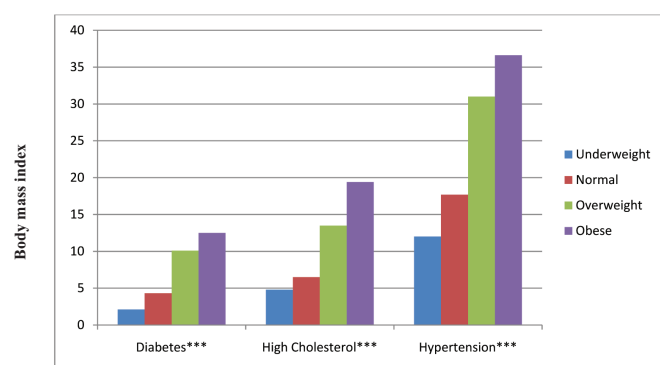
higher prevalence with older age (Fig. 2); for obesity, however, prevalence among the 55–64 and 65–74-year old age groups was lower than in the 35–44 and 45–54-year old age groups. Prevalence of diabetes, high cholesterol and hypertension increased with higher BMI category (Fig. 3) with a threefold increase in the prevalence of diabetes and high cholesterol in the obese compared to persons with normal BMI and a two-fold increase in the prevalence of hypertension in the obese compared to those with normal BMI. For physical activity levels, significant associations were found for diabetes, high cholesterol and obesity but not for hypertension (Fig. 4).

We also compared the prevalence estimates from this study with the findings for the Jamaica Health and Lifestyle Survey 2000–2001 (JHLS–1). Prevalence estimates for selected CVD risk factors are shown in Table 4. The prevalence of hypertension in JHLS–1 was 20% compared to 25% in this study. Similarly, the prevalence of prehyper-



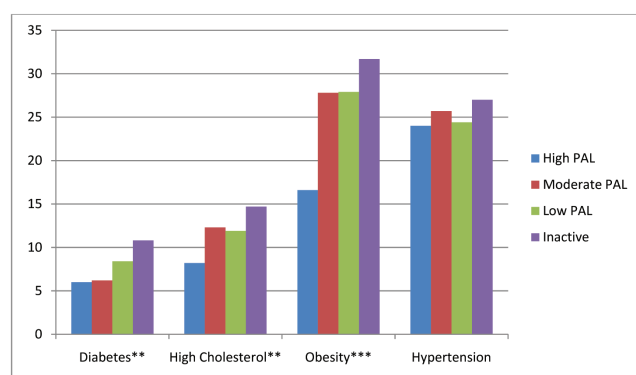
*** $p < 0.001$

Fig. 2: Prevalence of cardiovascular disease risk factors within age categories.



*** $p < 0.001$

Fig. 3: Prevalence of cardiovascular disease risk factors by body mass index (BMI) category.



** $p < 0.01$; *** $p < 0.001$

Fig. 4: Prevalence of cardiovascular disease risk factors by physical activity levels (PAL).

tension was 30% compared to 35% in this study and the prevalence of obesity was 20% in JHLS-1 compared to 25% in this study.

Table 4: Prevalence of selected conditions in Jamaica Health and Lifestyle Survey 1 (JHLS-1) compared to Jamaica Health and Lifestyle Survey 2 (JHLS-2).

Disease Condition	JHLS-1	JHLS-2
Diabetes mellitus	7.2 (6.0–8.3)	7.9 (6.7–9.0)
Hypertension*	20.9 (18.4–23.2)	25.2 (23.3–27.2)
Prehypertension	29.9 (27.1–32.7)	35.3 (32.6–37.9)
High cholesterol	14.6 (12.7–16.5)	11.7 (10.2–13.1)

* $p < 0.05$; JHLS-1 was conducted from 2000–2001 and JHLS-2 2007–2008.

Multivariate logistic regression models were used to obtain odds ratios as an estimate of the relative risk of diabetes, hypertension and high cholesterol among the obese and physically inactive compared to the non-obese and those with high physical activity levels respectively. Explanatory variables included in the models were sex, age, obesity and physical activity level. The odds ratios with 95% confidence intervals are shown in Tables 5a and 5b. After adjusting for

Table 5a: Adjusted odds ratio for obese compared to the non-obese on CVD risk factors

Outcome	Odds Ratio*	95% Confidence Interval	p -value
Diabetes	1.57	1.16–2.13	< 0.001
High cholesterol	1.86	1.43–2.42	< 0.001
Hypertension	1.64	1.08–2.49	0.022

*Adjusted for sex, age, and physical activity level.

Table 5b: Adjusted odds ratios for physical inactivity compared to high physical activity on CVD risk factors

Outcome	Odds Ratio*	95% Confidence Interval	p -value
Diabetes	1.56	1.06–2.31	0.025
High cholesterol	0.99	0.74–1.32	0.958
Hypertension	1.32	0.80–2.20	0.263

*Adjusted for sex, age, presence or absence of obesity.

age, sex and physical activity level, obesity was associated with increased odds of all three risk factors with odds ratios of 1.57 for diabetes, 1.86 for high cholesterol and 1.64 for hypertension. In models adjusted for age, sex and obesity, physical inactivity was associated with a 56% increase in the odds for diabetes but was not significantly associated with hypertension or high cholesterol.

DISCUSSION

The findings from the Jamaica Health and Lifestyle Survey 2007–2008 show that the burden of CVD risk factors in Jamaica remains high. As shown in previous studies, the burden of risk factors is higher in women, with significantly higher proportions of women having diabetes, obesity and

hypercholesterolaemia, although the prevalence of prehypertension and cigarette smoking was higher in men. In multivariate analyses, obesity was associated with increased odds of hypertension, diabetes and hypercholesterolaemia while physical inactivity was associated with higher odds of diabetes. There was a high level of unawareness of risk status with almost 50% of persons with hypertension being unaware of their disease status, approximately 25% of persons with diabetes unaware of their disease status, and 86% of persons with high cholesterol unaware of their risk status.

The prevalence of CVD risk factors in Jamaica are lower than those reported among Blacks in the United States of America where the prevalence estimates for 2006 were: diabetes, 15%, hypertension, 44%, obesity, 37% and hypercholesterolaemia, 36% (18). Prevalence estimate for diabetes mellitus in the US population in 2006 was 7.7% (18). This suggests that if we continue to adopt a more westernized lifestyle without appropriate public health intervention, the situation is likely to worsen. When this is placed in the context of an under-resourced healthcare system, the high levels of unawareness of risk status and inadequate control of diabetes and hypertension, the high prevalence of modifiable CVD risk factors is likely to translate into an increasing incidence of major CVD (coronary heart disease, cerebrovascular disease and peripheral vascular disease) as well as increasing mortality from CVD.

Diabetes is of particular concern when developing measures for controlling cardiovascular disease. Recent studies have shown a significant increase in diabetes-related mortality over the last three decades. In fact, diabetes was ranked as the second leading cause of death in Jamaica and in other Caribbean Epidemiology Centre (CAREC) member countries in 2004 (4, 19). In a recent survey at the University Hospital of the West Indies (UHWI) diabetes clinic, 35% of patients had a history of major CVD [coronary heart disease, cerebrovascular disease or peripheral vascular disease] (20). In that study, having a blood pressure at goal and engaging in at least three physical activity sessions per week was associated with reduced odds of CVD, thus emphasizing the need for good blood pressure control and increasing physical activity as measures to reduce CVD. In another study of inpatients with diabetes admitted to the UHWI, it was found that approximately 60% of such patients admitted in 2005 had at least one CVD (21). In light of the projected increase in the burden of diabetes, globally and more so in developing countries (22), the findings from these studies suggest that the incidence of major cardiovascular disease in Jamaica is likely to increase.

The full impact of CVD risk factors on incident disease and CVD mortality in Jamaica is still not known as there are no longitudinal studies on incident or fatal CVD in Jamaica. In an analysis of data from the JHLS-2, prevalent stroke was significantly associated with diabetes and hypercholesterolaemia; however, the number of cases of both strokes and

heart attacks were inadequate to fully assess the associations between CVD risk factors and prevalent heart attack or stroke (10). Data from the St James Study in Trinidad showed that blood pressure, diabetes and low density lipoprotein cholesterol were independent predictors of coronary heart disease in men (23) while data from the Barbados Registry of Stroke showed that of the patients with incident stroke in Barbados, 68% had a history of hypertension and 38% had diabetes (24). Again these findings suggest that it is reasonable to expect that the high prevalence of CVD risk factors in Jamaica will ultimately result in increasing incidence of major CVD and increased CVD mortality.

In order to reduce the likely impact of this increasing burden of CVD risk factors, public health policy in Jamaica must include a comprehensive strategy for reducing CVD risk factors, improving control and reducing complications (25). Strategies should emphasize health education, weight control, increased physical activity, reduction in tobacco use, screening for CVD risk factors and improved adherence to treatment. This focus on CVD risk factor reduction is supported by the findings of the INTERHEART study which estimated that 90% of CVD was due to nine easily measured CVD risk factors (26). We recommend that healthcare providers should screen all persons over 35 years of age for CVD risk factors as the vast majority of these persons will have at least one CVD risk factor. Education of individuals should also be encouraged to ensure that persons are aware of their potential risks and the need for screening. All persons should be encouraged to adopt healthy lifestyle practices regardless of age. Behaviour change professionals should also be engaged to identify barriers to change and ways to improve uptake of healthy lifestyle initiatives. In addition, initiatives aimed at creating a more health-friendly environment may facilitate individual participation in risk reduction programmes. With this approach, we can make significant strides in ameliorating the risk to health and development posed by this CVD epidemic.

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REFERENCES

- World Health Organization. Cardiovascular Diseases (CVDs) Fact Sheet N° 317. [cited 2011 Feb 5]; Available from URL: <http://www.who.int/mediacentre/factsheets/fs317/en/index.html>
- Yusuf S, Reddy S, Ounpuu S, Anand S. Global Burden of Cardiovascular Diseases: Part I: General considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation* 2001; **104**: 2746–53.
- Leeder S, Raymond S, Greenberg H, Liu H, Esson K. A Race Against Time. The Challenge of Cardiovascular Disease in Developing Countries. The Centre for Global Health and Economic Development; 2004.
- Ferguson T, Tulloch-Reid M. Cardiovascular Disease Risk Factors in Blacks Living in the Caribbean. *Curr Cardio Risk Rep* 2010; **4**: 76–82.
- Wilks R, Bennett F, Forrester T, McFarlane-Anderson N. Chronic diseases: the new epidemic. *West Indian Med J* 1998; **47** (Suppl 4): 40–4.
- Wilks R, Rotimi C, Bennett F, McFarlane-Anderson N, Kaufman JS, Anderson SG et al. Diabetes in the Caribbean: results of a population survey from Spanish Town, Jamaica. *Diabet Med* 1999; **16**: 875–83.
- Ferguson TS, Younger NO, Tulloch-Reid MK, Lawrence Wright MB, Ward EM, Ashley DE et al. Prevalence of prehypertension and its relationship to risk factors for cardiovascular disease in Jamaica: analysis from a cross-sectional survey. *BMC Cardiovasc Disord* 2008; **8**: 20.
- Ferguson TS, Younger N, Tulloch-Reid MK, Forrester TE, Cooper RS, Van den BJ et al. Prevalence of the metabolic syndrome in Jamaican adults and its relationship to income and education levels. *West Indian Med J* 2010; **59**: 265–73.
- Wilks R, Younger N, Tulloch-Reid M, McFarlane S, Francis D. Jamaica Health and Lifestyle Survey 2007–8 Technical Report. 2008. Available from URL: http://www.mona.uwi.edu/reports/health/JHLSII_final_may09.pdf
- Ferguson TS, Younger NO, Morgan ND, Tulloch-Reid MK, McFarlane SR, Francis DK et al. Self-reported prevalence of heart attacks and strokes in Jamaica: a cross-sectional study. The Jamaica Health and Lifestyle Survey 2007–2008. *Research Reports in Clinical Cardiology* 2010; **1**: 23–31.
- Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo Jr JL et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003; **289**: 2560–72.
- Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. *World Health Organ Tech Rep Ser* 1995; **854**: 1–452.
- Lean ME, Han TS, Morrison CE. Waist circumference as a measure for indicating need for weight management. *BMJ* 1995; **311**: 158–61.
- Ryden L, Standl E, Bartnik M, Van den Berghe G, Betteridge J, de Boer MJ et al. Guidelines on diabetes, pre-diabetes, and cardiovascular diseases: executive summary. *European Heart Journal* 2007; **28**: 88–136.
- Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 2006; **29** (Suppl 1): s43–8.
- World Health Organization. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: report of a WHO/IDF consultation; 2006.
- Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA* 2001; **285**: 2486–97.
- Lloyd-Jones D, Adams R, Carnethon M, De Simone G, Ferguson TB, Flegal K et al. Heart Disease and Stroke Statistics – 2009 Update: A Report From the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 2009; **119**: e21–181.
- Ferguson TS, Tulloch-Reid MK, Wilks RJ. The epidemiology of diabetes mellitus in Jamaica and the Caribbean: a historical review. *West Indian Med J* 2010; **59**: 259–64.
- Ferguson TS, Tulloch-Reid MK, Younger NO, Wright-Pascoe RA, Boyne MS, McFarlane SR et al. Cardiovascular disease among patients attending a specialist diabetes clinic in Jamaica. *Research Reports in Clinical Cardiology* 2011; **2**: 41–50.
- Ferguson TS, Tulloch-Reid MK, Younger NO, Boyne MS, Wright-Pascoe RA, Elliott VE et al. Cardiovascular disease among diabetic inpatients at a tertiary hospital in Jamaica. *Diabetes and Vascular Disease Research* 2010; **7**: 241–2.
- Wild S, Roglic G, Green A, Sicree R, King H. Global Prevalence of Diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004; **27**: 1047–53.
- Miller GJ, Beckles GLA, Maude GH, Carson DC, Alexis SD, Price SGL et al. Ethnicity and other characteristics predictive of coronary heart disease in a developing community: principal results of the St James survey, Trinidad. *Int J Epidemiol* 1989; **18**: 808–17.
- Corbin DO, Poddar V, Hennis A, Gaskin A, Rambarat C, Wilks R et al. Incidence and case fatality rates of first-ever stroke in a black Caribbean population: the Barbados Register of Strokes. *Stroke* 2004; **35**: 1254–8.
- Reddy KS, Yusuf S. Emerging Epidemic of Cardiovascular Disease in Developing Countries. *Circulation* 1998; **97**: 596–601.
- Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004; **364**: 937–52.