

The Barbados Health of the Nation Survey: Core Findings



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Foreword

In Barbados, non-communicable diseases (NCDs) have become the major cause of morbidity and mortality, while malnutrition and infectious diseases have declined in response to improved public health and social conditions. Fortunately, sickness and premature death from NCDs are preventable, using simple lifestyle interventions including abstinence from tobacco, limitation of alcohol consumption, daily physical activity and exercise, and adoption of healthy dietary practices. Having timely and accurate understanding of what puts the average Barbadian at risk for NCDs will assist policy-makers to create appropriate population-based interventions to reverse the current upward trend of NCDs. The global target set by the United Nations for a 25% reduction in premature mortality from NCDs by 2025 is achievable; therefore we need to have credible and timely information through surveillance and research. Good surveillance and research practice was also identified in the Port-of-Spain Declaration on NCDs as a necessary requirement for evidence-based decision-making to protect the health of a population.

The Health of the Nation (HotN) survey represents a collaborative effort involving The University of the West Indies and the Ministry of Health, with assistance from the Barbados Statistical Service, and gives an overview of the health status of the population with respect to risk factors for NCDs. The survey is cross-sectional in design and includes Barbados residents from all demographic and socio-economic strata.

This study is a follow-up to the national Behaviour Risk Factor Survey in 2007 and uses a similar methodology to the Pan American Health Organization's Steps Surveys. The HotN results will provide vital information to assist governmental agencies, civil society and the private sector in the creation of a robust policy and programme environment for the prevention and control of NCDs in Barbados.

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Executive summary

The Caribbean is experiencing increasing levels of illness and death from non-communicable disease (NCD) causes. Regional leaders pledged to combat this epidemic through increased surveillance and intervention, implementing healthcare policies and programmes across our countries. In Barbados, one of the Ministry of Health (MoH)'s initiatives has been the Health of the Nation (HotN) Survey, to provide information on the prevalence and social determinants of risk factors for lifestyle-related NCD. This will allow identification of potential targets for future interventions to improve prevention and control of these diseases in the Barbadian population.

In this comprehensive, cross-sectional survey, data were collected for 1234 participants aged at least 25 years (response rate: 55%) on demographics, behavioural risk factors, medical history, place of treatment and costs incurred, blood pressure and anthropometry, and biochemical measures. The survey sample under-represented young adults (particularly men) and over-represented the elderly (particularly women), so a weighting scheme was utilised to balance the sample distribution for age and sex with that of the Barbados 2010 Census. Prevalence of each risk factor was estimated overall, for each sex separately, and stratified by three broad age-groups.

Main findings show that Barbadian adults are at high risk from NCDs due to high prevalence of biological and behavioural risk factors. Most alarming is that two in every three adults in our population (and three-quarters of women) are overweight and/or obese. In addition, more than one in three adults in Barbados (more than one in two of those aged at least 45 years) are hypertensive, and one in five have diabetes (almost one in two of those aged 65 years or older). At least one in three of those with known hypertension or diabetes who were receiving treatment had sub-optimal control.

Daily tobacco use was reported by one in 10 men, vs one in 50 women. Harmful alcohol use followed a similar pattern, i.e. was mainly reported by young men, with excessive weekly alcohol consumption over the past 30 days reported by roughly the same proportions of men and women reporting daily tobacco use. One in three men aged 25–44 years reported binge drinking in the past 30 days.

Core survey results show that Barbadian residents have low fruit and vegetable consumption, while half of the sample reported low levels of physical activity. About one in four adults had

healthcare insurance (one in three of those who were employed). More in-depth information on diet, physical activity and cost/insurance will be provided from the relevant survey sub-studies at a later date.

Urgent action is required to address the low levels of healthy behavioural risk and high levels of biological risk present in the Barbadian adult population. Community and civil society involvement could help support healthier behaviours. A multi-sectoral approach is required to combat NCD risk on all levels, with creation of national guidelines to supplement an appropriate regulatory framework within an enabling environment.

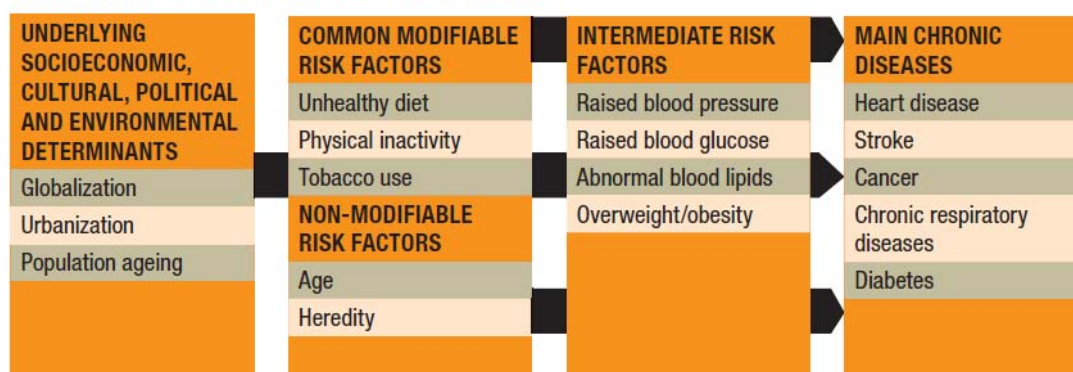
List of abbreviations

ADA	American Diabetes Association
ATP III	National Cholesterol Education Programme's Adult Treatment Panel III report ¹
BARSOC	Barbados Standard Occupational Classification
BMI	Body mass index
BSS	Barbados Statistical Service
CLFSS	Continuous Labour Force Sample Survey
CVD	Cardiovascular disease
ED	Enumeration district
FCTC	Framework Convention on Tobacco Control
HDL	High-density lipoprotein
HotN	Health of the Nation
IDF	International Diabetes Federation
ISH	International Society of Hypertension
LDL	Low-density lipoprotein
MoH	Ministry of Health
NCD	Non-communicable disease
PAHO	Pan American Health Organization

Background and aims

The English-speaking Caribbean region is estimated to have one of the highest prevalences of diabetes in the world, with between one in 10 and one in 5 of adults affected.² In fact, available data imply that this region is in the grip of a non-communicable disease (NCD) epidemic. Despite this, and data which show that cardiovascular disease (CVD; i.e. heart attack and stroke) is the main cause of death in the region, there are few recent data available on behavioural and biological risk factors for CVD or NCD. In particular, there are no data on the cost of this epidemic, or detailed investigations into any specific modifiable risk factors. In 2007, regional governments committed to combat the NCD burden, through the Port-of-Spain Declaration.³ The Caribbean response requires some initial knowledge of baseline data, which can be provided through national surveillance systems, ad hoc surveys, research studies, or a combination of these. The flowchart below (taken from the World Health Organisation report on investment to prevent chronic diseases⁴) details the determinants of common modifiable risk factors and shows their link to the main chronic NCDs through intermediate risk factors.

Causes of chronic diseases



While it is clear that diabetes is a commonly and costly problem in Barbados, current estimates of its prevalence are largely based on a study conducted two decades ago.⁵ More than a decade ago, our CMO's report cited CVD and cancer as the leading causes of morbidity and mortality in this population. There is evidence that 80% of NCD deaths worldwide are associated with modifiable risk factors (e.g. smoking, low physical activity, unhealthy diet and excess alcohol). Obtaining up-to-date reference estimates for NCD risk factors in Barbados is therefore vital to inform policy-makers in the design of intervention programmes to both prevent and improve the treatment of NCD in general and CVD in particular.

The Health of the Nation (HotN) core survey aimed to provide information on the prevalence and social determinants of risk factors for lifestyle-related NCD, in order to identify potential targets for future interventions to improve the prevention and control of these diseases in the Barbadian population. A summary of the main findings can be found in the Fact Sheet in Appendix I. The core was also complemented by five sub-studies to add significant public health and scientific value, all in areas that have been identified as high priority by the Ministry of Health (MoH), and whose results will help to support current policy and programme initiatives. Separate reports for each of these sub-studies will be provided to the MoH, although they are also described briefly in Appendix II.

Methods

The HotN was designed as a national, cross-sectional, population-based survey to determine the prevalence and distribution of diabetes, CVD and associated behavioural and biological risk factors in the Barbadian population, by age, sex and socioeconomic status. The design was based on island-wide sampling of enumeration districts (EDs), following the methodology of the Pan American Health Organisation (PAHO)'s Steps Survey for CVD Risk Factors.⁶ The survey comprised the three following steps, all performed in the participant's home: (1) The initial (questionnaire-based) step, in which research staff enquired directly about risk factors from a random selection of the population through face-to-face interviews; (2) the second step, which involved taking anthropometric measurements; (3) the third step, in which blood samples were drawn for estimates of biological markers for diabetes, kidney function, lipids, etc. The complete questionnaire, including the clinical record form, can be obtained on request from the MoH or from the Chronic Disease Research Centre.

Data were therefore collected on demographic information (age, sex, education, occupation, parish), behavioural risk factors (tobacco smoking, alcohol consumption, physical inactivity), medical history, place of treatment and costs incurred, blood pressure and anthropometry, and biochemical measures (glucose, HbA1c, lipids). In addition, plasma samples and a spot urine sample were stored for use in possible future research.

Recruitment

The random selection of participants for HotN was performed through the sampling of EDs selected by the Barbados Statistical Services (BSS) for the Barbados Continuous Labour Force Sample Survey (CLFSS). The CLFSS covers the entire non-institutionalised civilian population. The sample for the CLFSS is based on a stratified, two-stage design with probability proportional to size sampling of the primary sampling units (EDs) in the first stage, and sampling of households with systematic sampling after a random start in the second stage. Sample stratification is based on four geographical island subdivisions, with each subdivision reasonably homogeneous in terms of social and economic development. While conducting the CLFSS during the second, third and fourth quarters of 2011 inclusive, the BSS team of interviewers provided each household with basic information about the HotN survey, and

obtained verbal consent for the HotN team to contact the household. The BSS then provided the HotN team with information on all households willing to participate. Details of the sampling strategy can be found in Appendix III.

Statistical methods

The HotN sample size was estimated at 2000 participants aged 25 years and older, without oversampling of age/sex subgroups. With this overall sample size and using national population estimates from the 2010 Census,⁷ we anticipated in excess of 250 participants in each of six age/sex subgroups (women and men, aged 25-39, 40-54, 55 years and older). Sample size considerations were based on obtaining overall prevalence of diseases and risk factors with a precision of at least $\pm 5\%$, and to enable meaningful subgroup analyses, such as comparing men with women, and across different age and socio-economic groups.

Sampling weights for the data collected from the sampled households were used so that members of subgroups thought to be over- or under-represented in the survey data could be brought more into balance. This was done through calculations involving several factors, including original selection probabilities, adjustment for non-response, and benchmarking to known population estimates provided by the BSS. This gave over-represented groups a weight of less than one, while under-represented groups were given a weight of greater than one. All survey estimates were calculated using these weights, so that our results contain weighted averages (rather than averages), weighted percentages, and so on, with the intention that the results from the survey would be generalizable to the entire civilian, non-institutionalised population of Barbados.

Findings

Study population

Numbers and response rates

The response rate to the survey is shown in Figure 1. The CLFSS approached 3589 households in the 45 selected EDs. Of these, 491 (14%) refused to have their details passed on to HotN, 240 (7%) were classified as “unable to contact”, and 775 (22%) were excluded from the sample.

Reasons for exclusion from the CLFSS sample are shown in Table 1.

Table 1: Reasons for exclusion from CLFSS sample

Reason	Number of households
Vacant ^a	576
House physically removed	8
Occupants overseas	58
Listing error ^b	30
Sampling error ^c	1
Occupant not resident in Barbados	30
Under construction	1
Renovation, with no occupants	7
Other ^d	64

^aField team verified with neighbours that the house was unoccupied.

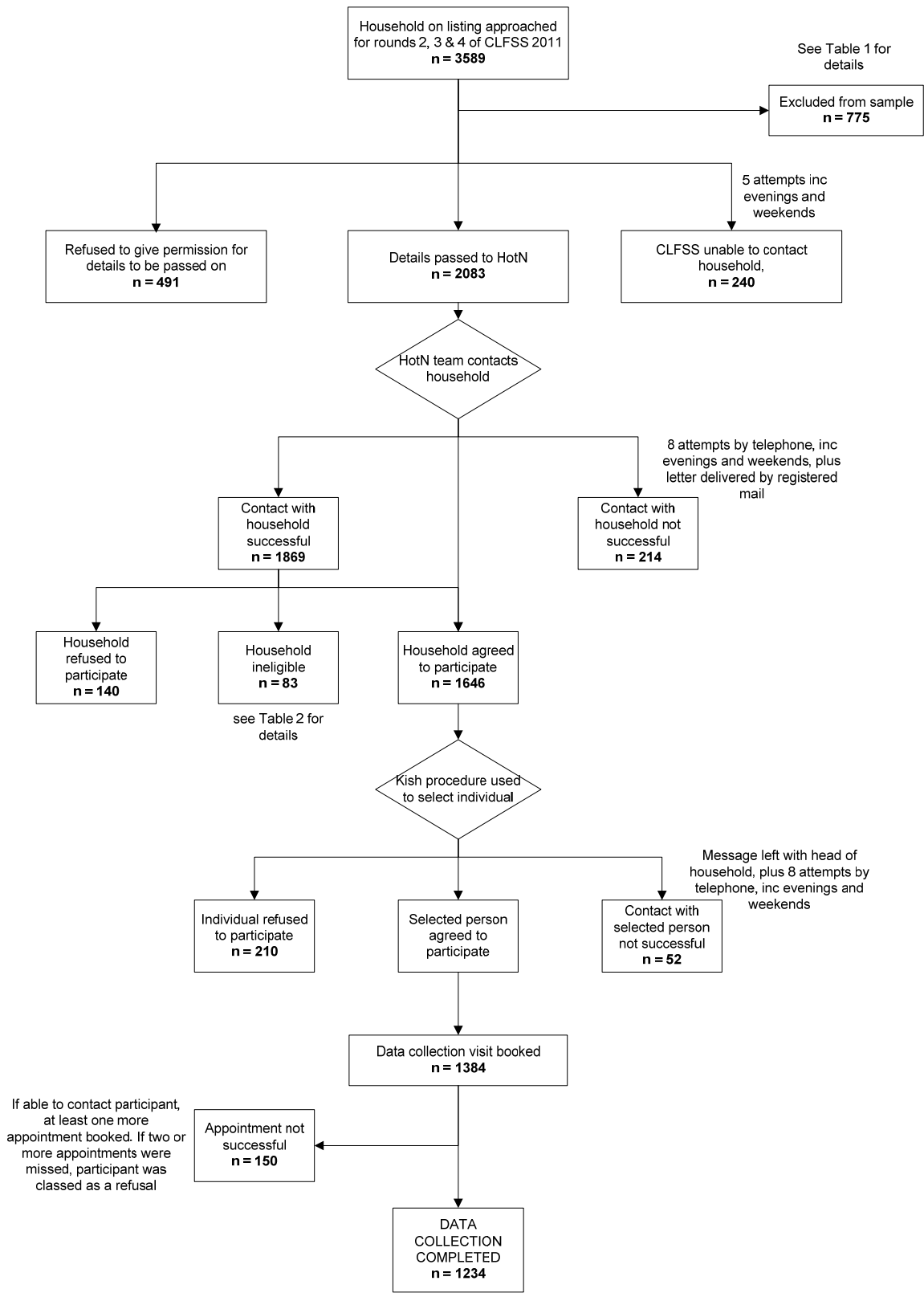
^bError in the listing prepared by the field team supervisor.

^cError in the sample provided by the BSS statistician.

^dFor example: occupant in hospital, prison, incapacitated.

In total, 2083 households who took part in the CLFSS agreed to have their details passed to the HotN survey. The HotN team were unable to make contact with 214 (10%) of these, despite eight attempts to contact them by telephone (including at least four evening or weekend attempts), and a letter inviting them to take part in the study, which was sent by registered post. Of the households where contact was successful, 140 (7%) refused to participate, and 83 (4%) were not eligible for the survey (reasons for ineligibility are shown in Table 2). For the remaining 1646 households, the Kish procedure was used to select one individual to participate in the survey. In 52 cases (2%), the study team was unable to make contact with the selected individual, despite a message being left with the head of the household, and eight attempts to contact them by telephone (including evening and weekend attempts).

Figure 1: Flowchart of households and persons selected to take part in HotN



A further 210 individuals (10%) refused to participate in the survey, and 150 individuals (7%) were designated ‘unsuccessful appointments’ and assumed to be refusals. An appointment was unsuccessful if missed by the participant on two or more occasions. A total of 1234 people took part in the survey.

Table 2: Reasons for HotN ineligibility

Reason	Number of households
Deceased	10
Duplicate household ^a	12
No resident older than 24 years	3
Not resident in Barbados	1
Vacated house	10
Participant hospitalised	3
Participant left address ^b	19
Participant not known at address	25

^aHousehold information provided twice by BSS.

^bNew address could not be located in postal service database.

The participation rate was 55% (1234/2225). The denominator here was calculated as all eligible households that either took part in the survey (1234) or refused to do so (491 CLFSS refusals and 500 HotN refusals), and excluded those that were found to be ineligible. An accurate response rate should also include non-contacted households, though this will yield a conservative estimate, as an unknown proportion of these will be ineligible, and should therefore have been excluded. Inclusion of non-contacted households in the denominator (240 for CLFSS; 266 for HotN) yielded a response rate of 43%. The true response rate lay somewhere between the two estimates, i.e. between 43% and 55%.

Numbers and response rates for key aspects of the survey are shown in Table 3.

Table 3: Numbers and response rates to key aspects of the survey

Risk factor	Number of responses (%)
Current tobacco use	1234 (100)
Heavy episodic alcohol consumption	1221 (99)
Inadequate fruit and vegetable intake	1205 (98)
Physical inactivity	1226 (99)
Self-reported hypertension	1233 (100)
Self-reported diabetes	1233 (100)
Blood pressure measurement	1232 (100)
Height measurement	1169 (95)
Weight measurement	1197 (97)
Hip circumference measurement	1197 (97)
Waist circumference measurement	1197 (97)
Blood sample collection	1117 (91)

Comparison of age, sex, education and occupation structure with 2010 Census results

Compared with the official population, provided by the 2010 Barbados Population and Housing Census,⁷ the HotN survey generally under-sampled young adults (particularly men) and over-sampled the elderly (particularly women). Figure 2 shows the age distribution by sex for HotN compared with the 2010 Census.

These discrepancies were addressed by the survey weighting scheme, which was designed to force the HotN sample to conform to the official population age and sex structure (shown in Figure 3).

Comparison with Barbados Census 2010: Education

A comparison of the distribution of education categories between the weighted HotN sample and the 2010 Census is presented in Table 4. Compared with the census, men and women with education to primary level or below, and those with secondary education, were under-represented in the weighted HotN sample. Men with a technical education, and men and women with a tertiary education, were over-represented in the weighted HotN sample.

Figure 2: Numbers of women and men sampled in the Health of the Nation (HotN) survey compared with the 2010 Barbados Population and Housing Census

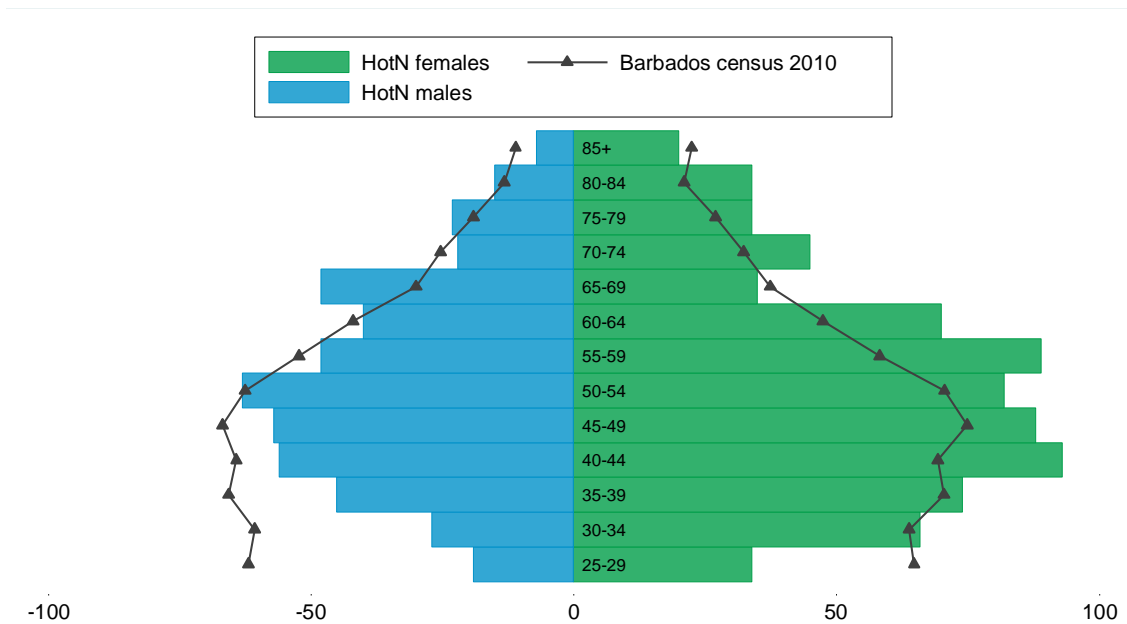
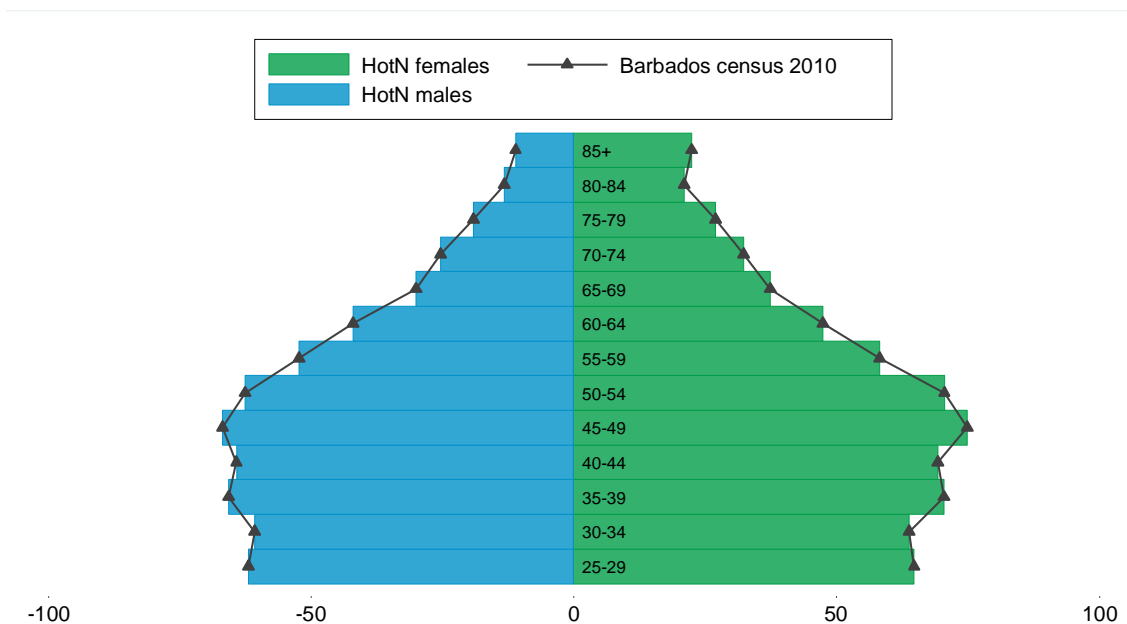


Figure 3: Numbers of women and men sampled in the Health of the Nation (HotN) survey compared with the 2010 Barbados Population and Housing Census after applying the final weighting scheme



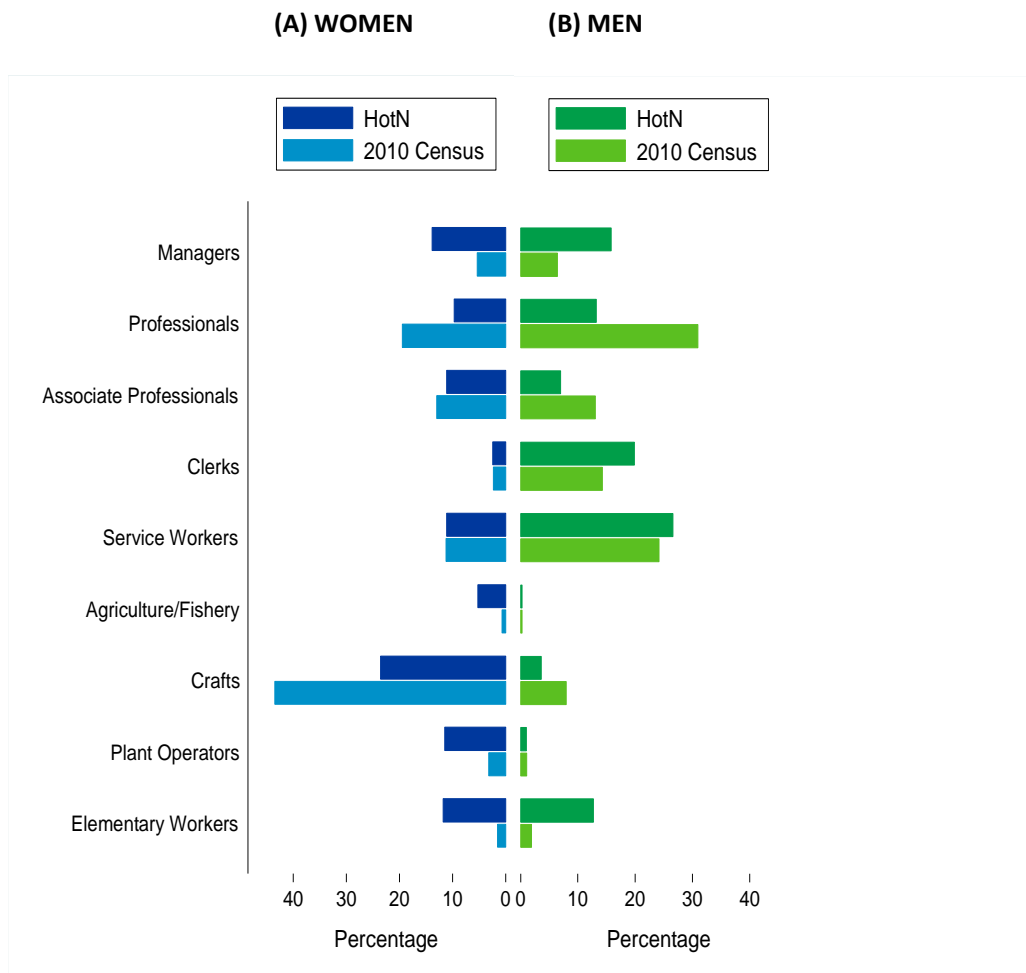
Comparison with Barbados Census 2010: Occupation

A comparison of the distribution of occupation categories between the weighted HotN sample and the 2010 Census is presented in Figure 4. The manager and elementary worker categories for both men and women, and the plant operator category for women, were over-represented in this HotN sample. Professional men and women, associate professional men, and female craft workers, were under-represented. These discrepancies may, however, have been a result of differences in the coding of occupation between HotN and the census. In both, a text description of main occupation was collected and then converted to a four-digit numeric occupational code using the BARSOC-89 occupational classification.⁸ Individual judgment is required for this process, as some occupations could be placed into multiple categories. For HotN, all coding was checked by the same individual to ensure consistency within the study (HotN staff were self-trained in occupational coding).

Table 4: Self-reported education among participants of the Health of the Nation (HotN) survey compared with the 2010 Barbados Population and Housing Census

Education group	HotN (unweighted) %	HotN (weighted) %	2010 census %
Women			
Primary or less	19.6	17.5	15.0
Secondary	38.7	40.4	48.5
Technical	15.7	16.0	16.7
Tertiary	25.9	26.1	19.1
Men			
Primary or less	17.5	12.6	13.4
Secondary	44.9	47.0	54.2
Technical	17.0	19.1	16.5
Tertiary	20.6	21.2	15.1
ALL			
Primary or less	18.8	15.2	14.3
Secondary	41.1	43.5	51.2
Technical	16.2	17.5	16.6
Tertiary	23.9	23.8	17.2

Figure 4: Percentage of women and men in nine major occupational groups in the Health of the Nation (HotN) survey and in the 2010 Barbados Population and Housing Census



Prevalence of chronic disease risk factors

The prevalence of various NCD risk factors was calculated overall, in men and women separately, and stratified by three broad age-groups. Risk factor definitions are presented in Box 1, while the numbers and weighted percentages for each of these categories are shown in Table 5.

Box 1: Definition of behavioural and biological risk factors in the Health of the Nation (HotN) survey

Current tobacco use	Self-reported smoking of tobacco products, such as cigarettes, cigars, or pipes.
Daily tobacco use	Self-reported tobacco smoking on a daily basis
Heavy episodic alcohol consumption	Self-reported consumption of at least 4 (for females) or 5 (for males) standard alcoholic drinks in a single drinking occasion at least once in the past 30 days
Excessive weekly alcohol consumption	Self-reported weekly consumption of more than 14 (for women) or 21 (for men) units of alcohol
Inadequate fruit and vegetable consumption	Self-reported consumption of less than 5 combined servings of fruit and vegetables per day
Physical inactivity	Self-reported activity of less than 150 minutes of moderate intensity per week
Overweight or obese	Body mass index of 25 kg/m ² or more
Obese	Body mass index of 30 kg/m ² or more
Central obesity (IDF ⁹)	For women, a waist circumference of 80 cm or more For men, a waist circumference of 94 cm or more
Central obesity (ATP III ¹⁰)	For women, a waist circumference of 88 cm or more For men, a waist circumference of 102 cm or more
Hypertension	Self-reported current use of antihypertensive medication or a systolic blood pressure \geq 140 mmHg or a diastolic blood pressure \geq 90 mmHg
Pre-diabetes (WHO, ¹¹ ADA ¹²)	Fasting plasma glucose of 6.1 to 6.9 mmol/l
Diabetes	Self-reported doctor-diagnosed diabetes or fasting plasma glucose \geq 7mmol/l. If both data points were missing, or one was negative and the other missing, the participant was excluded from the denominator
Raised total cholesterol	Total cholesterol of 5 mmol/l or more ¹
Raised total cholesterol: HDL ratio	Ratio > 5

Table 5: Age and sex characteristics of the Health of the Nation (HotN) survey sample

Age-group (years)	Women		Men		All	
	n	weighted % ^a	n	weighted % ^a	n	weighted % ^a
25–44	292	39.4	158	36.2	450	38.2
45–64	310	41.4	206	44.0	516	42.4
65+	162	19.2	106	19.8	268	19.4
All	764		470		1234	

^aBase and non-response weights applied.

Behavioural risk factors

Tobacco use and alcohol consumption

Current and daily tobacco use in the adult Barbadian population are shown in Tables 6 and 7, respectively. Tobacco use was mainly a problem in men: 15.5% of men report current tobacco use and 11.0% of men reported daily use, compared with 3.7% and 2.3% in women. In men, the prevalence of current and daily tobacco use decreased with age. In the age-group 25–44 years, the prevalence of current tobacco use was 20.8%; this decreased to 5.3% in the group aged 65 years and older. In those aged 25–44 years, 13.4% of men reported daily tobacco use; only 3.1% reported smoking in the 65 years and older category. The mean age at which people started smoking was 18.6 years (95% CI 16.8, 20.5). Desire to quit smoking was assessed by asking smokers whether they had stopped smoking for 1 day or longer in the past 12 months because they were trying to quit. The desire to quit smoking was more common in women vs men: only 21.5% (95% CI 11.6, 36.2) of male smokers responded positively to this question, compared with 66.4% (95% CI 36.3, 87.2) of female smokers.

Recent heavy episodic alcohol consumption (binge drinking) and excessive alcohol consumption in the adult Barbadian population are shown in Tables 8 and 9, respectively. Harmful alcohol use followed much the same pattern as tobacco use, in that it was mainly reported by young men. The prevalence of binge drinking in the previous 30 days was 25.2% in men, compared with only 5.4% in women. Excessive weekly alcohol consumption over the past 30 days was reported by 9.3% of men, but only 2.4% of women. In men, the prevalence of binge drinking was highest in those aged 25–44 years at 32.9%; this decreased to 8.6% in the 65 years and older group. The prevalence of excessive weekly alcohol consumption in men was also greater in the younger vs older age-groups, at 12.3% and 3.5%, respectively. Women were more likely to abstain from alcohol consumption than men: 43.5% (95% CI: 38.7, 48.4) of women reported consuming no alcohol in the past 12 months, and 70.2% (95%CI 65.9, 74.1) abstained in the past 30 days. In men, only 29.8% (95% CI: 24.4, 35.9) reported consuming no alcohol in the past 12 months, with 43.2% (95% CI: 38.2, 48.3) abstaining in the past 30 days.

Table 6: Prevalence of current tobacco use in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	4.3	(1.9, 9.3)	20.8	(14.4, 29.2)	12.2	(8.8, 16.7)
45–64	2.7	(1.4, 5.4)	13.4	(9.2, 19.1)	7.8	(5.6, 10.8)
65+	4.4	(1.8, 10.4)	5.3	(2.4, 11.5)	4.7	(2.6, 8.6)
All	3.7	(2.3, 6.1)	15.5	(11.9, 20.0)	9.2	(7.2, 11.7)

Table 7: Prevalence of daily tobacco use in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	2.4	(0.7, 8.1)	13.4	(8.4, 20.5)	7.7	(5.1, 11.4)
45–64	1.9	(0.9, 4.1)	11.6	(7.7, 17.1)	6.5	(4.5, 9.4)
65+	3.0	(1.0, 8.2)	3.1	(1.1, 8.4)	3.0	(1.4, 6.4)
All	2.3	(1.3, 4.3)	11.0	(7.9, 15.2)	6.4	(4.8, 8.5)

Table 8: Prevalence of heavy episodic alcohol consumption in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	8.5	(4.4, 15.9)	32.9	(24.5, 42.5)	19.9	(15.1, 25.9)
45–64	3.4	(2.1, 5.5)	23.4	(17.5, 30.5)	12.9	(10.0, 16.5)
65+	2.2	(0.7, 7.0)	8.6	(4.4, 16.0)	4.8	(2.8, 8.1)
All	5.4	(3.2, 8.8)	25.2	(20.9, 30.1)	14.5	(12.0, 17.4)

Table 9: Prevalence of excessive weekly alcohol consumption in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	3.8	(1.7, 8.4)	12.3	(7.6, 19.1)	7.8	(5.0, 12.0)
45–64	1.0	(0.3, 2.9)	8.2	(5.0, 13.0)	4.4	(2.8, 7.0)
65+	1.8	(0.7, 4.7)	3.5	(1.3, 8.9)	2.5	(1.3, 4.8)
All	2.4	(1.3, 4.3)	9.3	(6.6, 12.8)	5.5	(4.0, 7.7)

#

Diet and physical activity

The prevalence of inadequate fruit and vegetable consumption in the adult Barbadian population is shown in Table 10, indicating that the majority of Barbadians (90%) did not consume sufficient fruit and vegetables each week. This was consistently high across both sexes and all age-groups, although a slightly lower prevalence was reported by older women (83.9% in those aged 65 years and over), indicating that they were doing slightly better than other groups. Table 11 shows the number of meals consumed each week that had been prepared outside the home. This information was collected to determine how an intervention to improve diet quality could be designed. On average, for the overall population, about 2 meals per week were prepared outside of the home. Table 12 shows the characteristics of salt use. Adding salt to meals at the table was relatively rare (yes: 5.1%; sometimes: 7.2%), while adding salt during cooking was more commonly reported (65.1%). More men than women report adding salt to their meals at the table (8.3% vs 2.3%), but the reverse is true of salt use during cooking, with more women reporting this behaviour than men (73.4% vs 55.4%).

Table 10: Prevalence of inadequate fruit and vegetable consumption in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	90.2	(85.6, 93.5)	91.6	(84.5, 95.6)	90.9	(86.4, 94.0)
45–64	88.8	(83.8, 92.4)	92.5	(86.9, 95.8)	90.5	(87.4, 92.9)
65+	83.9	(75.0, 90.1)	91.0	(80.2, 96.2)	86.8	(80.0, 91.5)
All	88.5	(85.1, 91.2)	91.8	(87.0, 95.0)	90.0	(87.0, 92.4)

Table 11: Average weekly consumption of meals that are not prepared in the home for the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	mean	95% CI	mean	95% CI	mean	95% CI
25–44	1.9	(1.7, 2.2)	2.9	(2.5, 3.3)	2.4	(2.1, 2.6)
45–64	1.1	(0.8, 1.4)	1.8	(1.4, 2.1)	1.4	(1.2, 1.6)
65+	0.3	(0.2, 0.5)	0.7	(0.4, 1.1)	0.5	(0.3, 0.7)
All	1.3	(1.1, 1.5)	2.1	(1.9, 2.4)	1.7	(1.5, 1.9)

Table 12: Characteristics of salt use in the Barbadian population aged 25 years and over

	Women		Men		Total	
	%	95% CI	%	95% CI	%	95% CI
Salt added at table						
Yes	2.3	(1.4, 3.8)	8.3	(5.5, 12.4)	5.1	(3.7, 7.0)
No	91.8	(89.1, 93.9)	82.9	(78.8, 86.4)	87.7	(85.2, 89.8)
Sometimes	5.8	(4.2, 8.2)	8.8	(5.6, 13.4)	7.2	(5.4, 9.6)
Salt added during cooking						
Yes	73.4	(68.1, 78.1)	55.4	(49.6, 61.2)	65.1	(61.0, 68.9)
No	23.2	(19.7, 27.1)	25.1	(20.3, 30.6)	24.1	(20.9, 27.5)
Does not cook	3.4	(1.8, 6.5)	19.5	(15.5, 24.2)	10.9	(8.8, 13.3)

The prevalence of physical inactivity in the adult Barbadian population is shown in Table 13. Almost half of the population (49.9%) did not meet the minimum activity recommendations of the World Health Organization (WHO). A greater proportion of women (67.2%) reported being inactive than men (30.0%). In both sexes, inactivity increased with age, from 41.5% in the youngest age-group to 71.1% in the oldest. Furthermore, we know that these figures underestimate the true prevalence of physical inactivity, as they rely on participants' reporting their own activities. Although self-reported physical activity estimates are commonly used, they are known to be biased, and objective measures provide more accurate assessments. Preliminary results from the Physical Activity sub-study, providing objective measures for the Barbadian population, showed significantly higher estimates of inactivity compared with self-reported: the overall prevalence of objectively measured physical inactivity in adults aged 25–54 years was 75.2% (68.7, 80.8), and was higher in women (90.5%; 83.3, 94.7) than men (58.9%; 48.4, 68.7). More detailed information on these objective measures of physical inactivity will be provided in the Physical Activity sub-study report.

Table 13: Prevalence of physical inactivity in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95%CI	%	95%CI	%	95%CI
25–44	63.6	(56.5, 70.2)	17.5	(10.1, 28.6)	41.5	(35.9, 47.3)
45–64	62.6	(55.2, 69.4)	35.4	(26.6, 45.2)	49.6	(42.8, 56.5)
65+	83.0	(76.0, 88.2)	53.7	(40.3, 66.5)	71.1	(63.3, 77.8)
All	67.2	(63.1, 71.1)	30.0	(24.6, 36.1)	49.9	(46.1, 53.7)

Promoting active transport is seen as a potentially effective way of increasing population levels of physical activity. Transport is a necessary part of everyday life, unlike recreational activity, which may be an additional burden and harder to sustain. Active transport is relatively uncommon in the Barbadian population: 13.5% (95% CI: 10.6, 17.1) report ever walking to work (includes those who always, usually or occasionally walk), and there were no reports of cycling to work. Table 14 shows the relative contribution of physical activity in each activity type (home, work, leisure, and travel) to total energy expenditure. The majority of physical activity is carried out at work (48.6%), and the least during transport (2.1%). Men and women had similar patterns of activity within each activity type; the only significant difference by gender being that women expended more energy than men during home activities (16.5% vs 11.3%, respectively).

Table 14: Relative contribution of each domain to total energy expenditure in the Barbadian population aged 25 years and older

Activity type	Women		Men		Total	
	%	95%CI	%	95%CI	%	95%CI
Home activities	16.5	(14.4, 18.4)	11.3	(9.5, 13.2)	14.0	(12.6, 15.4)
Activity at work	45.3	(41.2, 49.2)	52.3	(47.7, 56.9)	48.6	(45.6, 51.6)
Recreational activities	36.4	(32.5, 40.3)	33.9	(29.9, 38.1)	35.2	(32.6, 37.9)
Transport	1.8	(1.5, 2.1)	2.4	(1.9, 3.0)	2.1	(1.8, 2.4)

Biological risk factors

Overweight and obesity

Overweight and obesity are highly prevalent in the adult Barbadian population (Table 15). Overall, two out of three adults are overweight, and one out of three is obese. The prevalence of obesity is almost twice as high in women (43%) than in men (23%). Of more concern still is the prevalence of 'gross' obesity, with almost one in five women, and one in 20 men, having a body mass index (BMI) of 35 or greater (Table 16).

Table 17 shows the prevalence of central or abdominal obesity. This measure is often preferred because of its stronger association with diabetes and CVD than obesity, based on BMI. The American (ATP III) definition of central obesity¹ is the most conservative, and yet 62% of women and 20% of men in Barbados are centrally obese using this measure.

Table 15: Prevalence of overweight and obesity based on BMI measurement in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
Overweight or obese (BMI ≥ 25 kg/m ²)						
25–44	73.7	(67.8, 78.9)	51.5	(41.8, 61.1)	62.5	(56.7, 68.0)
45–64	78.0	(70.9, 83.7)	67.0	(56.4, 76.1)	72.7	(66.0, 78.5)
65+	68.3	(58.8, 76.4)	53.5	(40.4, 66.1)	62.2	(53.6, 70.1)
All	74.2	(70.3, 77.7)	57.5	(51.2, 63.7)	66.2	(62.8, 69.5)
Obese (BMI ≥ 30 kg/m ²)						
25–44	45.9	(38.8, 53.3)	24.1	(16.5, 33.9)	35.0	(28.9, 41.5)
45–64	42.7	(37.0, 48.7)	25.7	(19.1, 33.6)	34.6	(29.6, 40.0)
65+	39.1	(30.6, 48.2)	15.5	(8.8, 26.0)	29.4	(23.7, 35.8)
All	43.4	(39.5, 47.3)	23.4	(18.9, 28.5)	33.8	(30.7, 37.1)

Table 16: Distribution of BMI in the Barbadian population aged 25 years and older

Age-group (years)	BMI (kg/m ²)	Women		Men		All	
		%	95% CI	%	95% CI	%	95% CI
25–44	<25	26.3	(21.1, 32.2)	48.5	(39.0, 58.3)	37.5	(32.0, 43.3)
	25–29	27.8	(22.0, 34.4)	27.3	(19.0, 37.6)	27.6	(22.2, 33.7)
	30–34	20.0	(13.9, 28.1)	18.7	(11.7, 28.5)	19.4	(14.6, 25.3)
	35–40	13.8	(8.9, 20.9)	3.4	(1.5, 7.7)	8.6	(6.0, 12.2)
	40+	12.1	(8.2, 17.5)	2.0	(0.7, 5.5)	7.0	(4.9, 10.0)
45–64	<25	22.0	(16.3, 29.1)	33.0	(23.9, 43.6)	27.3	(21.5, 34.0)
	25–29	35.2	(30.5, 40.3)	41.3	(34.1, 49.0)	38.1	(33.2, 43.3)
	30–34	27.3	(22.4, 32.8)	17.8	(12.5, 24.8)	22.8	(18.4, 27.8)
	35–40	10.4	(7.0, 15.1)	5.7	(2.6, 12.3)	8.2	(5.2, 12.7)
	40+	5.1	(2.9, 8.9)	2.1	(0.6, 6.8)	3.7	(2.1, 6.4)
65+	<25	31.7	(23.6, 41.2)	46.5	(33.9, 59.6)	37.8	(29.9, 46.4)
	25–29	29.2	(21.3, 38.6)	38.0	(25.9, 51.8)	32.8	(26.3, 40.1)
	30–34	27.1	(19.1, 37.0)	10.5	(5.2, 19.9)	20.3	(14.8, 27.1)
	35–40	7.5	(3.5, 15.2)	4.7	(1.2, 16.5)	6.3	(3.3, 11.8)
	40+	4.4	(2.0, 9.6)	0.3	(0.0, 2.6)	2.7	(1.3, 5.8)
All	<25	25.8	(22.3, 29.7)	42.5	(36.3, 48.8)	33.8	(30.5, 37.2)
	25–29	30.8	(27.2, 34.8)	34.2	(29.2, 39.6)	32.4	(29.0, 36.0)
	30–34	24.2	(20.0, 28.9)	17.1	(13.0, 22.1)	20.8	(17.8, 24.1)
	35–40	11.3	(8.5, 14.8)	4.5	(2.8, 7.1)	8.0	(6.2, 10.3)
	40+	7.9	(6.0, 10.5)	1.8	(0.8, 4.0)	5.0	(3.7, 6.7)

Table 17: Prevalence of central obesity in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
IDF cut-points						
25–44	76.3	(70.2, 81.5)	24.8	(17.2, 34.4)	50.8	(44.7, 56.9)
45–64	85.5	(80.5, 89.4)	47.4	(38.7, 56.2)	67.3	(61.8, 72.5)
65+	84.1	(77.3, 89.2)	47.5	(35.1, 60.2)	69.4	(61.7, 76.0)
All	81.3	(78.5, 83.8)	36.8	(30.9, 43.1)	60.3	(56.6, 63.9)
ATP III cut-points						
25–44	59.1	(52.5, 65.5)	14.7	(9.3, 22.6)	37.1	(31.3, 43.4)
45–64	61.4	(55.5, 67.0)	25.5	(18.6, 33.8)	44.3	(38.9, 49.8)
65+	67.4	(58.7, 75.0)	21.2	(13.0, 32.5)	48.7	(41.7, 55.8)
All	61.7	(58.0, 65.2)	19.8	(16.0, 24.2)	41.9	(38.6, 45.3)

Raised cholesterol

Raised cholesterol is a risk factor for ischaemic vascular disease, including heart attack and stroke. Table 18 shows the prevalence of raised total cholesterol, based on the WHO cut-point of 5 mmol/l. Based on this cut-point, around one in five Barbadian adults have hypercholesterolaemia. Total cholesterol, however, is made up of both ‘good’ HDL cholesterol and ‘bad’ LDL cholesterol. A measure that has been shown to be more strongly related to CVD risk than total cholesterol is the ratio of total to HDL cholesterol, and this is shown in Table 19. Using this measure, a very different picture emerges, with around half the population having less than optimum cholesterol levels. The differences between the proportions in Tables 18 and 19 represent the fact that more than half of all adults in Barbados have low HDL cholesterol. Low HDL cholesterol is associated with obesity, physical inactivity, and raised glucose levels – all common amongst adults in Barbados.

Table 18: Prevalence of raised total cholesterol in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	15.5	(10.9,21.6)	17.5	(10.9,27)	16.5	(12.7,21.2)
45–64	27.3	(22.3,33)	22.2	(15.3,31.3)	24.9	(20.7,29.6)
65+	31.1	(23.2,40.3)	17.2	(10,28)	25.2	(19.9,31.5)
All	22.9	(19.1,27.1)	19.3	(15.1,24.2)	21.2	(18.4,24.2)

Table 19: Percentage of the Barbadian population aged 25 years and over having total to HDL cholesterol ratio > 5

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	45.9	(38.5, 53.5)	53.7	(44.7, 62.5)	49.6	(44.0, 55.1)
45–64	45.6	(39.4, 51.9)	72.2	(64.9, 78.6)	58.3	(53.5, 63.0)
65+	48.9	(40.1, 57.6)	49.1	(36.7, 61.5)	48.9	(42.5, 55.4)
All	46.4	(42.1, 50.7)	59.9	(53.8, 65.7)	52.7	(49.4, 55.9)

Prevalence, coverage and control of hypertension and diabetes

Hypertension

Raised blood pressure is a risk factor for CVD, especially stroke and heart attack. The adverse risk associated with raised blood pressure begins from a systolic blood pressure of around 115 mmHg. Table 20 shows that mean systolic blood pressure was higher than 115 mmHg in both women and men in Barbados, even in the youngest age-group. As expected, blood pressure rose with age.

Table 21 shows the prevalence of diagnosed and treated hypertension. This was based on respondents who reported both a physician’s diagnosis of hypertension and that they were taking medication for their condition. The prevalence of diagnosed hypertension was significantly higher in women, with around one in three being treated, vs one in five men. Of those who were being treated, roughly 40% were found to have sub-optimal blood pressure (Table 22), implying that they would benefit from further control measures – whether increased medication, changes in lifestyle, or both.

Hypertension tends to be ‘silent’, rarely causing direct symptoms, and typically a large proportion of those with hypertension are undiagnosed. Table 23 shows the prevalence of hypertension based on those with treated hypertension *plus* those with hypertension identified in the survey. The true prevalence of hypertension was estimated to be 42%, compared with the 26% who were actually receiving treatment. It is striking that, above the age of 45 years, more than half of all men and women were hypertensive. Finally, it is worth noting that the prevalence of treated hypertension was higher in women than men, but when

the new cases identified in the survey were included, the prevalence in men and women was similar (Table 23). This suggests that women are more likely than men to have hypertension diagnosed and treated.

Table 20: Mean systolic and diastolic blood pressure in the Barbadian population aged 25 years and over

Age-group (years)	Systolic or Diastolic	Women		Men		All	
		Mean (mmHg)	95% CI	Mean (mmHg)	95% CI	Mean (mmHg)	95% CI
25–44	Systolic	119.8	(117.8, 121.7)	126.1	(123.2, 129.0)	122.8	(121.0, 124.6)
	Diastolic	75.7	(74.1, 77.3)	75.3	(72.8, 77.9)	75.5	(74.1, 76.9)
45–64	Systolic	130.2	(127.8, 132.6)	134.4	(131.3, 137.5)	132.2	(130.2, 134.3)
	Diastolic	79.7	(78.6, 80.9)	81.4	(79.9, 82.9)	80.5	(79.7, 81.4)
65+	Systolic	143.1	(139.5, 146.7)	145.0	(140.3, 149.6)	143.9	(140.9, 146.9)
	Diastolic	74.2	(72.5, 75.9)	78.2	(75.5, 81.0)	75.9	(74.3, 77.4)
All	Systolic	128.3	(126.6, 130.1)	132.3	(130.3, 134.3)	130.2	(128.9, 131.5)
	Diastolic	76.8	(75.9, 77.8)	78.1	(76.7, 79.5)	77.4	(76.6, 78.2)

Table 21: Proportion of the Barbadian population aged 25 years and over who were on medication for hypertension (n= 367)

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	7.3	(4.1, 12.7)	3.3	(1.3, 8.1)	5.3	(3.3, 8.6)
45–64	46.0	(38.9, 53.4)	27.9	(21.2, 35.6)	37.4	(32.3, 42.7)
65+	64.7	(55.7, 72.8)	43.5	(33.2, 54.4)	56.1	(49.0, 62.9)
All	32.9	(28.8, 37.3)	19.0	(15.2, 23.5)	26.4	(23.5, 29.6)

Table 22: Prevalence of known hypertension with sub-optimal control* in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	29.4	(12.2, 55.6)	80.9	(29.1, 97.8)	44.4	(23.0, 68.1)
45–64	36.9	(28.4, 46.2)	36.7	(22.1, 54.3)	36.8	(29.4, 44.9)
65+	50.2	(39.8, 60.6)	43.8	(27.2, 61.9)	48.2	(39.4, 57.1)
All	41.6	(34.8, 48.6)	42.8	(31.3, 55.2)	42.0	(36.8, 47.3)

*i.e blood pressure > 140 mmHg systolic and/or 90 mmHg diastolic.

Table 23: Total prevalence of hypertension* in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	16.2	(11.2, 22.7)	14.1	(8.8, 21.9)	15.2	(11.3, 20.0)
45–64	56.5	(49.3, 63.5)	48.9	(40.2, 57.6)	52.9	(47.4, 58.3)
65+	80.9	(73.0, 86.9)	74.3	(63.8, 82.6)	78.2	(71.8, 83.5)
All	44.0	(38.8, 49.2)	36.9	(30.9, 43.3)	40.7	(36.5, 44.9)

*i.e. on medication for hypertension and/or blood pressure >140 mmHg systolic and/or 90 mmHg diastolic.

Pre-diabetes and diabetes

Raised fasting blood glucose is a risk factor for CVD, especially stroke and heart attack, and when it rises above the diagnostic threshold for diabetes it is additionally associated with the risk of microvascular disease, such as diabetic retinopathy, nephropathy and neuropathy. The diagnostic cut-point for diabetes is 7.0 mmol/l. Diagnostic cut-points are also defined for ‘pre-diabetes’, a level at which individuals are at increased risk of developing diabetes and CVD. The WHO recommends a cut-point for pre-diabetes of 6.1 mmol/l,¹¹ whereas the American Diabetes Association (ADA) recommends a cut-point of 5.6 mmol/l.¹²

Mean fasting glucose is shown in Table 24, and at the age of 45 years and above, the mean is greater than the ADA cut-point for pre-diabetes. Tables 25 and 26 show the prevalence of pre-diabetes according to WHO and ADA cut-points, respectively. By the former, the prevalence of

pre-diabetes is around 5%, however, using the latter it is roughly three times higher, at around 15%. The prevalence of pre-diabetes tends to be higher in men than women with both definitions and in all age-groups, although this finding is not statistically robust, as the numbers are small.

The prevalence of known (doctor-diagnosed) diabetes is shown in Table 27. Between the ages of 45 and 64 years, roughly one in seven Barbadian adults report a diagnosis of diabetes, and at 65 years and older, more than one in three adults report that they have diabetes. Similar to hypertension, diabetes is often ‘silent’, with few specific symptoms. Table 28 shows the prevalence of diagnosed diabetes plus individuals with fasting glucose above the diagnostic threshold. The overall prevalence of all diabetes using these criteria is close to one in five (19%) of all Barbadian adults, and in those aged 65 years and over it approaches one in two (46%).

Table 24: Mean fasting glucose (mmo/l) in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		All	
	Mean (mmol/l)	95% CI	Mean (mmol/l)	95% CI	Mean (mmol/l)	95% CI
25–44	5.1	(4.9, 5.2)	5.1	(4.9, 5.2)	5.1	(5.0, 5.2)
45–64	6.1	(5.8, 6.4)	5.8	(5.6, 6.1)	6.0	(5.8, 6.2)
65+	6.3	(5.8, 6.8)	6.1	(5.5, 6.7)	6.2	(5.8, 6.6)
All	5.7	(5.5, 5.9)	5.5	(5.3, 5.7)	5.6	(5.5, 5.7)

Table 25: Prevalence of pre-diabetes using World Health Organization Criteria (fasting plasma glucose > 6.1 mmol/l and < 7.0 mmol/l)

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	2.1	(0.8, 5.9)	3.7	(1.3, 9.8)	2.9	(1.1, 7.1)
45–64	4.4	(2.3, 8.5)	7.0	(3.6, 13.1)	5.6	(3.6, 8.8)
65+	7.0	(3.2, 14.4)	7.0	(3.4, 13.8)	7.0	(4.1, 11.8)
All	4.0	(2.5, 6.3)	5.5	(3.5, 8.5)	4.7	(3.2, 6.7)

Table 26: Prevalence of pre-diabetes using American Diabetes Association Criteria (fasting plasma glucose > 5.6 mmol/l and < 7.0 mmol/l)

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	10.7	(7.2, 15.7)	13.4	(8.2, 21.0)	12.0	(8.8, 16.1)
45–64	15.7	(11.0, 22.0)	20.8	(14.7, 28.6)	18.1	(14.3, 22.7)
65+	13.5	(8.4, 21.2)	16.3	(10.6, 24.4)	14.7	(10.7, 19.9)
All	13.1	(10.2, 16.6)	16.7	(12.9, 21.2)	14.7	(12.6, 17.2)

Table 27: Prevalence of known diabetes by doctor diagnosis

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	4.2	(2.4, 7.2)	0.8	(0.2, 3.3)	2.6	(1.5, 4.2)
45–64	16.3	(12.2, 21.5)	16.1	(11.0, 22.9)	16.2	(12.7, 20.4)
65+	39.6	(31.0, 49.0)	30.8	(21.5, 41.9)	36.0	(29.4, 43.2)
All	15.8	(13.1, 18.8)	11.4	(8.3, 15.5)	13.8	(11.7, 16.2)

Table 28: Prevalence of diabetes by doctor diagnosis and/or fasting plasma glucose > 7 mmol/l

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	6.6	(3.7, 11.3)	1.5	(0.4, 4.6)	4.2	(2.5, 6.9)
45–64	23.0	(18.1, 28.8)	21.2	(14.5, 30.0)	22.2	(17.7, 27.3)
65+	48.0	(37.6, 58.7)	42.4	(32.1, 53.3)	45.7	(38.2, 53.4)
All	21.0	(18.2, 24.2)	15.9	(12.0, 20.8)	18.7	(16.2, 21.4)

Control of blood glucose, blood pressure and cholesterol in those with known diabetes

The risk of adverse complications in people with diabetes can be substantially reduced by good control of blood glucose, blood pressure and cholesterol. Tables 29–31 show how well these factors were controlled in those individuals with diagnosed diabetes. Ideally, HbA1c, a measure of average blood glucose control, should be less than 7%. More than 60% of people with

known diabetes had an HbA1c at or above this value (Table 29A). An HbA1c of less than 8%, while not ideal, might be considered reasonable. However, 40% of adults in the Barbadian population were at or above this level (Table 29B). An HbA1c of 10% or greater is unequivocally ‘very poor glycaemic control’, and this was the case for one in six (17%) of those with known diabetes (Table 29C).

The findings are similar for blood pressure and blood lipid control. Two out of three (69%) had a blood pressure greater than or equal to 130/80 (Table 30A), while 40% had a blood pressure reading of greater than or equal to 140/90 (Table 30B).

Finally, control of cholesterol, as assessed by a total to HDL ratio of less than 5, was also poor, with 55% of persons with known diabetes being at risk (Table 31).

Table 29 A–C: Prevalence of sub-optimal glycaemic control in those with known diabetes (n=192) for those with HbA1c (A) $\geq 7\%$, (B) $\geq 8\%$ and (C) $\geq 10\%$ (age and sex distribution omitted due to small numbers and very wide confidence intervals)

A) HbA1c $\geq 7\%$			B) HbA1c $\geq 8\%$	
Sex, Age-group (years)	%	95% CI	%	95% CI
Women	63.6	(55.2, 71.2)	44.0	(36.0, 52.3)
Men	59.3	(50.1, 67.9)	34.1	(22.0, 48.7)
25–44	38.2	(17.5, 64.4)	24.1	(9.8, 48.1)
45–64	66.8	(54.7, 77.0)	51.7	(38.7, 64.5)
65+	64.6	(52.5, 75.2)	34.7	(22.2, 49.6)
All	62.0	(55.2, 68.4)	40.4	(33.3, 47.9)

C) HbA1c $\geq 10\%$		
Sex, Age-group (years)	%	95% CI
Women	15.9	(9.5, 25.5)
Men	18.2	(10.3, 30.3)
25–44	13.2	(4.3, 34.1)
45–64	25.7	(15.8, 38.8)
65+	9.5	(4.7, 18.4)
All	16.8	(11.4, 24.0)

Table 30 A–B: Prevalence of sub-optimal blood pressure control in those with known diabetes (n=192) for blood pressure (A) \geq 130/80 and (B) \geq 140/90 (age and sex distribution omitted due to small numbers and very wide confidence intervals)

A) Blood pressure \geq 130/80			B) Blood pressure \geq 140/90	
Sex, Age-group (years)	%	95% CI	%	95% CI
Women	64.1	(53.4, 73.6)	34.8	(25.6, 45.3)
Men	78.0	(66.0, 86.7)	50.0	(35.5, 64.5)
25–44	44.7	(23.2, 68.4)	10.7	(3.1, 30.9)
45–64	66.2	(51.3, 78.4)	35.1	(21.4, 51.8)
65+	78.9	(68.0, 86.8)	53.6	(42.4, 64.5)
All	69.1	(61.2, 76.1)	40.3	(32.3, 48.8)

Table 31: Sub-optimal lipid control in those with known diabetes (n=192): percentages with a total to HDL cholesterol ratio $>$ 5 (age and sex distribution omitted due to small numbers and very wide confidence intervals)

Sex, Age-group (years)	%	95% CI
Women	49.1	(38.2, 60.1)
Men	64.4	(52.1, 75.1)
25–44	45.6	(23.0, 70.2)
45–64	62.0	(49.8, 72.8)
65+	50.7	(38.1, 63.2)
All	54.7	(46.2, 63.0)

Overall levels of risk of heart attack and stroke in the population

One way to assess the health implications of the findings on behavioural and biological risk factors described above is to calculate a cardiovascular risk score, i.e. the probability of suffering a stroke or heart attack, whether fatal or not. This has been done using the WHO algorithm recommended for Barbados and similar countries. Factors taken into account included age, sex, diabetes, blood pressure, total cholesterol, and tobacco smoking. In addition, those who already had evidence of CVD were included, because it is known that they are at a very high risk of a future stroke or heart attack. The percentages of the HotN respondents who reported that they had some form of CVD are shown in Table 32.

Table 32: Prevalence of doctor-diagnosed CVD; i.e. one or more of stroke, angina, myocardial infarction or heart failure (age and sex distribution omitted due to small numbers and very wide confidence intervals)

Sex, Age-group (years)	%	95% CI
Women	4.4	(3.1, 6.1)
Men	3.1	(1.5, 6.3)
25–44	1.3	(0.5, 3.4)
45–64	3.7	(2.0, 6.9)
65+	10.0	(6.9, 14.3)
All	3.8	(2.6, 5.4)

Table 33 shows the prevalence of Barbadian adults aged 25 years and over with a 10% risk of a stroke or heart attack over the next 10 years, while Table 34 shows those at 20% risk. Overall, roughly one in eight of the adult population is at 10% risk, and one in 12 is at 20% risk. As expected, the risk increases dramatically with age, with close to 50% of adults aged 65 years and over being at 10% risk, and over 25% of those aged 65 years and older being at 20% risk.

Table 33: Prevalence of ≥10% WHO/ISH Risk in the Health of the Nation (HotN) Survey; adjusted for self-reported myocardial infarction, stroke, angina, and heart failure

Age-group (years)	Women		Men		Total	
	%	95%CI	%	95%CI	%	95%CI
25–44	2.4	(1.2, 4.5)	1.2	(0.3, 5.0)	1.8	(0.9, 3.8)
45–64	8.2	(5.0, 12.9)	7.9	(4.5, 13.5)	8.0	(5.7, 11.2)
65+	54.2	(45.2, 63.0)	32.7	(22.2, 45.2)	45.0	(38.0, 52.2)
All	14.8	(11.6, 18.7)	9.0	(6.2, 13.0)	12.1	(10.1, 14.5)

Table 34: Prevalence of ≥20% WHO/ISH Risk in the Health of the Nation (HotN) Survey; adjusted for self-reported myocardial infarction, stroke, angina, and heart failure

Age-group (years)	Women		Men		Total	
	%	95%CI	%	95%CI	%	95%CI
25–44	2.0	(1.0, 4.1)	1.2	(0.3, 5.0)	1.6	(0.7, 3.6)
45–64	5.2	(2.7, 9.7)	7.1	(3.9, 12.4)	6.1	(3.9, 9.3)
65+	29.2	(21.7, 38.0)	24.4	(14.8, 37.5)	27.1	(20.8, 34.5)
All	8.6	(6.3, 11.5)	7.3	(4.7, 11.3)	8.0	(6.1, 10.4)

Insurance cover

Overall, 24.0% of the adult population in Barbados have health insurance cover (95% CI: 17.9, 31.3). When restricted to those currently working, this proportion was 30.9% (23.7, 39.2).

Table 35: Proportion of population in Barbados with health care insurance (A) overall; (B) of those currently employed only

A)

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	27.2	(19.2, 36.8)	25.4	(16.4, 37.0)	26.3	(20.3, 33.3)
45–64	26.0	(18.6, 34.9)	30.3	(20.2, 42.7)	28.0	(20.1, 37.5)
65+	13.2	(6.1, 26.4)	7.4	(3.0, 17.1)	10.8	(5.3, 20.7)
All	23.8	(17.2, 31.9)	24.2	(17.4, 32.6)	24.0	(17.9, 31.3)

B)

Age-group (years)	Women		Men		All	
	%	95% CI	%	95% CI	%	95% CI
25–44	35.8	(26.9, 45.8)	27.1	(60.6, 81.3)	31.6	(24.4, 39.8)
45–64	31.0	(21.5, 42.3)	33.1	(23.6, 44.1)	32.0	(23.4, 42.0)
65+	4.6	(0.7, 24.7)	11.2	(3.7, 29.1)	7.8	(2.7, 20.6)
All	32.5	(24.1, 42.2)	29.5	(22.2, 38.0)	30.9	(23.7, 39.2)

Clustering of risk factors

The occurrence of multiple concurrent risk factors greatly increases the risk of NCD development, compared with risk factors occurring in isolation. Table 36 shows the prevalence of three or more of the following risk factors occurring together: current daily tobacco smoking, inadequate fruit and vegetable consumption, physical inactivity, being overweight or obese (based on BMI), and having hypertension. This combination of risk factors was more common in women than men (58.6% vs 37.2%), and in older adults compared with younger (69.5% in the 65 years and older group vs 34.4% in the 25–44 year group).

Table 37 shows the prevalence of three or more of a different combination of risk factors occurring together. The risk factors included here were those that required behavioural interventions rather than treatment: excessive alcohol consumption, current daily tobacco smoking, inadequate fruit and vegetable intake, physical inactivity, and obesity (based on waist

circumference and BMI). This combination of risk factors was twice as common in women compared with men (50.9% vs 24.2%), but did not change significantly with age.

Table 38 shows the prevalence of multiple risk factors that require treatment, i.e. more than one of the following: diabetes, hypertension, raised total cholesterol, and raised total cholesterol: HDL ratio. Almost 40% of the population had more than one of these risk factors, with no significant difference observed between men and women. This combination of risk factors occurred increasingly with age (66.1% in those aged 65 years and older vs 21.1% for those aged 25–44 years). It should be noted that these figures are likely to be conservative, as some participants had missing data on measurements for one or more of these risk factors (once there were measurements for at least two risk factors, the participant’s data were included in the analysis). As some of those with missing information could have had another risk factor, the prevalence shown here is a minimum.

Table 36: Prevalence of risk factor clustering according to PAHO definition* in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		Total	
	%	95%CI	%	%	95%CI	%
25–44	47.2	(41.4, 53.1)	20.5	(14.0, 28.9)	34.4	(29.4, 39.7)
45–64	63.4	(55.9, 70.23)	47.1	(38.1, 56.3)	55.6	(49.0, 62.1)
65+	74.9	(65.3, 82.5)	61.7	(52.8, 69.9)	69.5	(62.30, 75.4)
All	58.6	(53.8, 63.3)	37.2	(31.6, 43.1)	48.7	(44.6, 52.7)

*Three or more of the following: current daily tobacco smoking; inadequate fruit and vegetable consumption; physical inactivity; overweight/obesity (based on BMI); hypertension.

Table 37: Prevalence of behavioural risk factor and obesity clustering* in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		Total	
	%	95%CI	%	95%CI	%	95%CI
25–44	48.3	(41.6, 55.1)	23.6	(16.7, 32.2)	36.5	(30.5, 42.9)
45–64	51.8	(45.9, 57.7)	27.0	(19.9, 35.4)	39.9	(34.3, 45.9)
65+	54.7	(47.7, 61.5)	19.8	(13.4, 28.3)	40.5	(34.5, 46.9)
All	50.9	(46.9, 54.8)	24.2	(20.1, 28.9)	38.5	(35.0, 42.1)

*Three or more of the following: excessive alcohol consumption; current daily tobacco smoking; inadequate fruit and vegetable consumption; physical inactivity; obesity (based on BMI or central obesity).

Table 38: Prevalence of clustering risk factors requiring treatment* in the Barbadian population aged 25 years and over

Age-group (years)	Women		Men		Total	
	%		%		%	
25–44	21.7	(16.5, 28.3)	20.4	(13.9, 28.9)	21.1	(17.2, 25.5)
45–64	43.3	(38.1, 48.7)	49.4	(42.5, 56.3)	46.2	(41.7, 50.8)
65+	69.6	(62.4, 75.9)	61.0	(49.1, 71.6)	66.1	(60.0, 71.7)
All	39.3	(35.9, 42.7)	37.8	(32.4, 43.6)	38.6	(35.8, 41.5)

*More than one of the following: diabetes, hypertension, raised total cholesterol and raised total cholesterol:HDL ratio.

Implications for prevention, treatment, surveillance and further research

The HotN Survey has provided insight into the risk factors, both behavioural and biological, that are the major drivers of the NCD epidemic in Barbados. Many individuals have multiple risk factors that multiply their risk for diseases such as stroke, heart attack, diabetes mellitus and some cancers. The survey results have brought into focus the upstream associations of chronic disease and therefore have provided a basis for more effective public health interventions.

Barbados has completed the epidemiologic and demographic transition to a high-income, developed country with population growth below replacement fertility, continuing aging of the population, and causes of both ill-health (morbidity) and death (mortality) primarily due to chronic NCDs. Risk factors for NCDs, for completeness, must be examined from the overall perspective of the social determinants of health so as to develop national strategies to reduce their burden. In addition, health promotion approaches and strategies will add value to the overall policy and programme development for a national NCD response and will be used in the discussion of risk factors in the Barbadian context.

The Strategic Plan for NCD 2015–2019 identifies relevant stakeholders and provides a policy and programme roadmap with indicators and targets to strengthen the national NCD prevention and control response. In addition, the PAHO Strategic Plan 2013–2020 gives a regional perspective to NCD management, and has identified many already-verified public health strategies for risk factor control. The HotN survey, with its cross-sectional design, can only provide a ‘snapshot’ of information at a specific time. Hence it will be necessary to repeat

this risk factor study every few years in order to provide a continuous picture through comparisons with previous surveys.

Tobacco and alcohol

The HotN Survey results show that risky behaviours, including tobacco and alcohol consumption, occur predominantly in males; with men being 4 and 5 times more likely than women to report tobacco and alcohol consumption, respectively. Although Barbados is considered a low smoking jurisdiction, with a prevalence below 10%, preventative population-based programmes are necessary, with specific emphasis on young adults (25–44 years) and males. A similar relationship was seen with respect to alcohol consumption, with 30% of men abstaining vs 44% of women. Furthermore, heavy episodic drinking, a risk factor for NCDs, was much more likely to be reported in males. Approaches that reduce the demand and supply of both tobacco and alcohol are required and can include taxation, legislation, regulation, cessation and abstinence programmes and health promotion strategies. A multi-disciplinary approach involving government, the private sector and civil society will enhance the national effort to reduce alcohol and tobacco consumption. The Framework Convention on Tobacco Control (FCTC), to which Barbados is a signatory, provides an international guide to healthy public policy with respect to tobacco prevention and control. Efforts should be made for Barbados to be compliant with the FCTC with respect to packaging, labelling, advertising, promotion and sponsorship.

Diet and physical activity

Results showed low consumption of fruit and vegetables, and it may be useful to have a more detailed understanding of this phenomenon through qualitative studies. For example, food preferences and cost could be examined as possible barriers to fruit and vegetable consumption, which was universally low for all age-groups and both sexes. Programmes to support increased consumption of fruit and vegetables could include tax and other fiscal concessions, nutrition interventions that make fruit and vegetables more acceptable to the population, and school-based interventions that increase the acceptability and preference of these food items in the young. In addition, public education interventions that address the

benefits of fruit and vegetables and the negative effective of salt consumption can be promoted.

Half of the sample reported low levels of physical activity based on the WHO recommendations and this was more likely in older age-groups and in women. A more in-depth analysis of physical activity (such as was done in the Physical Activity sub study) involving objective measurements, e.g. for heart rate and energy expenditure, will provide further and more detailed findings of exercise in the Barbadian population. In addition, qualitative studies can assess the barriers and facilitators to exercise. There is a need in Barbados for safe and wholesome outdoor spaces for exercise, and both physical activity and exercise must be included in all stages of education – from primary through tertiary. In addition, “workplace wellness” programme should be strengthened to include physical activity at the place of employment. Efforts to increase leisure- and transport-related physical activity and exercise are needed and could include changes to the built environment to make walking and cycling more attractive and safe.

Biological risk factors

Overweight and obesity

Using BMI and IDF cut-points, results for overweight and obesity were the most alarming and the cause for much public health concern with two-thirds of the adult population and three-quarters of all women being overweight and/or obese. In addition, women were almost twice as likely to be obese than their male counterparts. Only through a multi-sectoral approach, embracing social determinants of health, will this intermediate risk factor be addressed. A co-ordinated approach that addresses obesity over the life course and emphasizes diet and exercise as major requirements to reverse this statistic is needed. Obesity increases the risk of diabetes mellitus type 2, hypertension, abnormal lipids and therefore CVD. Obesity also increases the risk of several cancers, including colon and breast. It is worth noting that central or abdominal obesity is particularly related to an increased risk of CVD.

Raised cholesterol

The lipid profile for total to HDL cholesterol >5 suggests a population at great risk for CVD, with men being at a higher risk across all age-groups than women. Greater awareness of lipid levels and their control for both patients and health care professionals may be required, along with increased access to statins and other cholesterol-lowering agents. Programmes addressing diet and exercise could have a direct impact on both total cholesterol and HDL.

Prevalence, coverage and control of hypertension and diabetes

The 2009–2013 annual reports from the Barbados National Registry for Chronic NCD have all indicated that the major drivers of incident cases of stroke and heart attack are hypertension and diabetes, with up to 80–90% of stroke and heart attack patients having one or both of these risk factors. From the HotN Survey results, 40% of all adults in Barbados and more than half of those over the age of 45 years were hypertensive. The prevalence of hypertension was higher in women aged 45 years and over than in men in the same age range. The study also indicated that even those on treatment often have sub-optimal control.

Primary health care should therefore be strengthened to identify persons at risk, encouraging them to begin lifestyle modification immediately upon diagnosis and instituting pharmacological treatment based on recommended standards and guidelines. Those at risk should be encouraged to take personal responsibility for their care and all members of the health care team should be trained in diagnosis of hypertension and institution of early prevention and treatment. National campaigns to provide healthier food options (e.g. low salt) and to promote fruit and vegetable intake should be commenced. In particular, collaboration with manufacturers and distributors of 'fast foods' and highly processed foods prepared with salt, sugars and fats must be considered in order to provide healthy alternatives .

As with hypertension, diabetes was more likely to be diagnosed in the elderly and in women. Results showed that one in five persons in Barbados had diabetes, rising to almost one in two adults aged 65 years and older. Of those who had been diagnosed with diabetes and who were on treatment, over 60% had sub-optimal control based on a HB A1c equal to or greater than 7%.

Persons at risk and those with pre-diabetes need to be identified early through their primary health care facilities. Screening is required using the traditional markers (advanced age, family

history, presence of hypertension, history of gestational diabetes, being overweight and/or obese). Diabetes treatment should be instituted early to prevent complications such as amputation, blindness and neuropathy, and should involve relevant pharmaceuticals including insulin, which are both guideline-based and appropriate for the age and metabolic circumstance of the individual. Clinical audits to assess adherence to national guidelines, and training to enhance knowledge and skills of all members of the primary health care team, could add value to the treatment of patients with hypertension and diabetes.

Overall risk for heart attack and stroke

In every age-group, women were at higher risk for stroke and heart attack than men, based on prevalence of diabetes, hypertension, and mean total cholesterol, while men were at greater risk based on alcohol and tobacco use.

The following interventions could be instituted:

- Primary care screening
- Early diagnosis and treatment
- Enhanced used of pharmaceuticals including insulin and statins
- Adherence to national protocols and guidelines for care
- Personal responsibility – healthy diets and physical activity
- Community and civil society involvement

The role of government is to create an enabling environment through the appropriate regulatory and policy framework to improve accessibility of care to persons at risk of and those with NCDs. To achieve this goal, it is necessary to have information that reflects the true picture of the nation's health care status; the HotN survey represents a commitment to this process through timely and credible information for decision-making purposes.

Conclusions

In conclusion, there were 1234 Barbadian residents aged 25 years and over interviewed in the HotN Survey (response rate: 55%). Main findings show that Barbadian adults are at increased risk from NCDs due to high prevalence of biological and behavioural risk factors. Most alarming was the prevalence of overweight/obesity, at 66% (74% for women). In addition, 41% (53% of those aged at least 45 years) were hypertensive, and 19% of the adult resident population had

diabetes (46% of those aged 65 years or older). Further, 42% of those with known hypertension and 40% with known diabetes who were receiving treatment had sub-optimal control.

Daily tobacco use was reported by 11% of men, vs 2% women. Harmful alcohol use followed a similar pattern, i.e. was mainly reported by young men, with excessive weekly alcohol consumption over the past 30 days reported by roughly the same proportions of men and women reporting daily tobacco use. About one-third of men aged 25–44 years reported binge drinking in the past 30 days. Core survey results also showed that Barbadian residents had low fruit and vegetable consumption, while half of the sample reported low levels of physical activity. About one in four adults had healthcare insurance (almost one in three for those who were employed).

Urgent action is required to address the low levels of healthy behavioural risk and high levels of biological risk present in the Barbadian adult population. Community and civil society involvement could help support healthier behaviours. A multi-sectoral approach is required to combat NCD risk on all levels, with creation of national guidelines to supplement an appropriate regulatory framework within an enabling environment.

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Appendices

Appendix I: Factsheet

Prepared by: Christina Howitt and Ian Hambleton

Fact sheet prepared on: 18-OCT-2014

Using dataset (version 4.1) released by Ian Hambleton on 08-October-2014

	N	Both Sexes N=1,234	Males N=470 38.1%	Females N=764 61.9%
Age (years)	1234	49.4 (47.9-50.8)	48.4 (46.5-50.3)	50.2 (48.2-52.2)
Currently smoke (%)	1234	9.2 (7.2-11.7)	15.5 (11.9-20.0)	3.7 (2.3-6.1)
Alcohol in last 30 days (%)	1234	42.4 (39.3-45.6)	56.8 (51.7-61.8)	29.9 (26.0-34.1)
Binge drinking (%)	1221	14.5 (12.0-17.5)	25.4 (21.0-30.3)	5.4 (3.2-8.8)
Mean number of days fruit consumed	1224	3.64 (3.43-3.86)	3.40 (3.14-3.66)	3.85 (3.58-4.13)
Mean number of servings of fruit consumed per day	1215	1.78 (1.62 -1.93)	1.83 (1.62-2.03)	1.73 (1.57-1.90)
Mean number of days vegetables consumed	1232	4.37 (4.19-4.55)	4.25 (3.99-4.50)	4.48 (4.25-4.71)
Mean number of servings of veg consumed per day	1217	1.54 (1.42-1.66)	1.54 (1.37-1.72)	1.54 (1.43-1.64)
Percentage who ate less than 5 of combined servings of fruit and veg per day	1210	81.9 (77.3-85.7)	82.0 (75.5-87.0)	81.8 (77.0-85.8)
Mean BMI (kg/m ²)	1166	28.2 (27.8-28.6)	26.5 (25.9-27.2)	29.7 (29.1-30.4)
Percentage who are overweight or obese (BMI ≥ 25kg/m ²)	1166	66.2 (62.8-69.5)	57.5 (51.2-63.7)	74.2 (70.3-77.7)
Percentage who are obese (BMI ≥ 30kg/m ²)	1166	33.8 (30.7-37.1)	23.4 (18.9-28.5)	43.4 (39.5-47.3)
Percentage with raised BP (SBP ≥ 140 and/or DBP ≥ 90) OR currently on medication	1232	40.7 (36.5-44.9)	36.9 (30.9-43.3)	44.0 (38.8-49.2)
Percentage with raised BP (SBP ≥ 140 and/or DBP ≥ 90) and NOT currently on medication	1232	14.2 (12.0-16.7)	17.9 (14.3-22.2)	10.9 (8.7-13.7)
Percentage with raised blood glucose (HbA1c ≥ 6.5 and/or fasting glucose ≥ 7) OR self-reported diabetes	1131	29.1 (26.1-32.2)	23.8 (19.5-28.7)	33.6 (29.9-37.5)
Percentage with raised blood glucose (fasting glucose ≥ 7) OR self-reported diabetes	1130	19.7 (17.0-22.8)	15.9 (12.0-20.8)	23.0 (19.9-26.3)
Percentage with raised total cholesterol (≥5mmol/l)	1115	21.2 (18.4-24.2)	19.3 (15.1-24.2)	22.9 (19.1-27.1)

Appendix II: The HotN sub-studies

An important part of the national survey comprised five additional sub-studies, which used the core HotN survey as a source of participants but will provide a wealth of additional information on key foci of NCD risk (e.g. physical activity and dietary sodium intake) in more detail. Each of these is described briefly below, along with their expected outputs.

The Barbados Physical Activity Study

Much evidence exists promoting the vital role physical activity (PA) plays in maintaining both metabolic and cardiovascular health, and it is well known that, on a population level, there are both public health and financial benefits from increased PA.¹³ Clinical trial results have shown the benefit of promoting lifestyle modification, including PA, in diabetes prevention programmes targeting those at high risk.

As PA had not yet been measured objectively in the Barbadian population, this sub-study was designed to include both subjective (questionnaire) and objective (use of a heart monitor) measures, and was conducted in collaboration with the Medical Research Council Epidemiology Group in Cambridge, UK. The principal aims of the sub-study were not just to estimate PA prevalence, but also to investigate population characteristics which may be associated with low PA levels (i.e. lifestyle, behavioural, sociodemographic, geographic and health factors).

Data have been collected on 364 persons resident in Barbados aged 25–54 years and analyses will provide, for the first time in Barbados, objective measures of PA levels. In addition, the study will identify specific high-risk groups for NCDs due to their low PA levels and will provide baseline data on PA against which future interventions can be evaluated.

The Barbados Salt Intake Study (BSIS)

It is well known that high salt intake is one of the main risk factors for CVD, and much evidence exists to show a direct relationship between salt consumption and hypertension. PAHO and WHO recommend reducing intake of dietary salt to less than 5g/day per person by January 2020.

Prior studies in Barbados have shown that about 20% of the adult population (> 20 years old) have hypertension. The principal aim of the BSIS is to provide baseline levels of the average intake of dietary sodium in adult Barbadians (aged 25-65 years), through measurements of salt concentration from 24 hour urinary salt excretion. The main dietary sources of salt in Barbados will also be estimated from analysis of data from the country-specific food frequency questionnaire.

Data have been collected on 370 persons resident in Barbados aged 25-64 years and analyses will provide, for the first time in Barbados, mean estimates of dietary sodium intake and the principal sources of salt in our diet. This information will provide evidence for educators and policy-makers to design and develop successful future salt intervention programmes for our population. Importantly, it will also provide the baseline measure of salt intake in Barbados, indicating how far we have to go to reach the WHO salt intake target by 2020.

The Cost of Healthcare Study

Prevalence of NCDs generally increases with age, and it is known that in the Caribbean we have a higher proportion of elderly than Asia (excluding Japan), Latin America and Africa. Further, we know that countries in Latin America and the Caribbean are rapidly ageing, even faster than in developed countries like the US.¹⁴ What this means is that, over time, we continue to add to the pool of elderly persons who are more susceptible to NCDs, including CVDs like heart attack and stroke. This clearly has a cost implication for the MoH as the public healthcare provider in Barbados.

Currently, the cost of healthcare for (a) the general public and (b) those with CVD is unknown in Barbados. This sub-study aimed to estimate the cost of healthcare for (a) through the HotN survey, whose participants were each asked a series of questions on healthcare use in the previous year. For (b), the same questions were asked of 1-year survivors of stroke and heart attack registered with the Barbados National Registry for Chronic NCD (the BNR).

Data have been collected from the 1234 individuals who participated in the core HotN survey and from 268 1-year survivors of heart attack (N=73) and stroke (N=195) who had their CVD event in 2011. Analyses of the responses to the healthcare use questions from these sources

(the BNR and HotN) will provide, for the first time in Barbados, an estimate of healthcare cost in the general population as well as the excess cost for 1-year survivors of CVD, from the healthcare provider perspective (the MoH).

The Study of the Prevalence of At-risk Diabetic Foot

Throughout the world, people with diabetes are at increased risk of foot problems, including loss of feeling (peripheral neuropathy) and reduced blood flow (peripheral vascular disease). Many persons with diabetes may even be unaware of these issues with their own feet. Having peripheral neuropathy and reduced blood flow to the feet both increase the risk of developing foot ulcers and, in the worst-case scenario, amputation.

This study was designed to assess foot health in Barbadians with diabetes, and in particular to find out how many people with diabetes have feet that are 'at risk'. This was done through a detailed examination of the feet, including measurements of the sense of touch and vibration and the blood flow to the feet, for people with diabetes (both previously diagnosed and newly identified) who participated in the HotN survey.

Every person with diabetes who participated in the HotN survey was invited for the foot examination, and 237 people (72% of those invited) took part. The data from this study will provide for the first time in Barbados the prevalence of peripheral neuropathy, peripheral vascular disease and 'at risk' feet in a population-based sample of people with diabetes. This is core information for planning health services for the prevention of diabetic foot ulceration and amputation.

The Study of Primary Healthcare Access for People with Diabetes

The benefits of appropriate health care use can only be realised through adequate access to health care services when needed. Physical or geographic presence of services may still harbour systematic exclusion of socio-economic or cultural groups through quality of services offered, costs to clients of using the services and availability of information for optimal use of services. In the context of the many possible influences/determinants of health care access, whose relative significance may vary in different places, it is key to discover the constellation of

local factors and any barriers which are contributing to adverse health outcomes for the Barbadian population.

This study aims to explore health seeking behaviours and issues influencing access to health care among persons with diabetes mellitus through a mixed-method approach which includes both quantitative and qualitative techniques. Data from 204 participants in the HotN survey with diabetes are being analysed for healthcare use and, for the qualitative arm, interviews are planned for 16–20 individuals, of whom at least six will be persons with diabetes.

These analyses will allow the characterisation of the pattern of health care utilisation among persons with diabetes mellitus, for the first time in Barbados. Further, they will allow us to explore health-seeking behaviours and provide insight to issues influencing access to healthcare among this vulnerable sub-group of the population and to suggest areas for remedial action to be taken so as to improve equity of access.

Appendix III: Details of sampling strategy for HotN

The HotN survey was cross-sectional in design, based on island-wide sampling of EDs. The EDs used by the HotN survey were selected by the BSS for the CLFSS, a survey of education, employment, working hours, and wages. The survey covers the non-institutionalised civilian population.

The main objectives of the HotN sampling process were: (a) self-weighting sample of households; (b) a sample from each selected ED of about 40 participants (from 40 households) aged 25 years and older, and (c) a total of 2000 completed interviews with participants aged 25 years and older. The sampling weights for the data collected from the sampled households were constructed so that the responses could be properly expanded to represent the entire civilian non-institutionalised population of Barbados. The weights were the result of calculations involving several factors, including original selection probabilities, adjustment for non-response, and benchmarking to known population estimates from several external sources, including the Barbados census from 2010, from 2000, and Barbados population estimates from the US Census Bureau and from the United Nations. Men and women aged 25 years and older were eligible to take part in this survey.

The sample for the HotN (based as it is on the CLFSS) used a stratified two-stage design with probability proportional to size sampling of the primary sampling units (EDs) in the first stage, and sampling of households with systematic sampling after a random start in the second stage. Sample stratification was based on four geographical island subdivisions, with each subdivision reasonably homogenous in terms of social and economic development. The CLFSS survey is repeated each quarter. From 2011, ED sizes were determined from the master sampling frame constructed for the 2010 national census. In each quarter, the CLFSS sample size is 1800 households from 45 EDs, or 2% of the private civilian non-institutional households (this represents a sampling fraction of approximately 1/50). The stratification process groups the 11 parishes of the island into four strata along geographical lines and the 45 EDs are then selected from these four strata.

Since the sample size of 2000 could not be achieved in a single CLFSS quarter, the HotN sample was drawn from three consecutive CLFSS samples in the second (Apr to Jun), third (Jul to Sep),

and fourth (Oct to Dec) quarters of 2011. The HotN survey did not re-contact those households that had been approached during a previous quarter.

To achieve 2000 completed questionnaires, and assuming a certain level of non-response, the HotN survey planned to approach more than 2000 households. For example, allowing for 5% non-response at the household level and a 20% non-response at the participant level, the survey would have needed to sample 2500 potential participants. This figure assumes one participant per household, and a Barbados population of 190 260 individuals aged 25 and older, giving an overall sampling fraction of one in 75 (1/75). For details of response rates, see page 14.

Importantly of course, sample replacement does not mitigate the effects of non-response, and non-response is present in every survey operation. The best way to guard against potential non-response bias is to utilize field procedures that maintain high co-operation rates. Non-response occurs even with the best field strategies. Statistical adjustment can help to adjust for levels of non-response, but can never correct for systematic bias introduced by non-response.