

# Controlling arterial hypertension in the French West Indies: a separate strategy for women?

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**Background:** To estimate the prevalence, awareness and treatment of arterial hypertension in Guadeloupe. **Methods:** In 2007, a cross-sectional study of 1005 men and women (54%) aged 25–74 years from Guadeloupe, stratified by sex, age and region was set up to determine the prevalence of hypertension. Blood pressure (BP) was measured using an automated device and hypertension was defined as having a mean BP  $\geq 140/90$  mmHg or receiving drug treatment. **Results:** The prevalence of hypertension was 33% for men and 37% for women ( $P=0.62$ ). Among hypertensive respondents, 57% of men and 80% of women were aware of being hypertensive ( $P<0.001$ ). BP was controlled for 22 and 44% of hypertensive men and women, respectively ( $P<0.001$ ). Compared with men (14%), 31% of women were obese ( $\geq 30$  kg/m<sup>2</sup>). In multivariate analyses, body mass index (BMI) was associated with hypertension in both sexes after controlling for age, occupation, education, alcohol consumption, smoking status and physical activity. Compared with subjects with a normal BMI, obese men were three times [odds ratio (OR)=3.4, 95% confidence interval (CI)=1.8–6.6  $P<0.001$ ] and obese women two times more likely (OR=2.0, 95% CI=1.2–3.4,  $P=0.017$ ) to be hypertensive. In women, low educational attainment was also associated with hypertension (OR=2.1 95% CI=1.1–4.0,  $P=0.030$ ) and mean diastolic BP decreased as educational attainment increased after controlling for confounders ( $F=5.0$ ,  $df$  2,  $P=0.007$ ). **Conclusions:** Strong gender disparities in hypertension were identified. Separate strategies in addressing hypertension in men and women are needed, with an improvement in men's follow-up care and health promotion, focussed on nutrition, targeted at women.

**Keywords:** blood pressure, Caribbean, education, hypertension, obesity

## Introduction

Guadeloupe is a French 'Département d'Outre Mer', situated in the Caribbean. It has an established social welfare system, whereby all citizens are entitled to medical care on a par with the health care available in mainland France. However, the geographical location of Guadeloupe, in a region where poverty and social inequalities are rife,<sup>1</sup> makes it of interest as a place where quality health care for all and steep social inequalities are likely to co-exist. The incidence of stroke in the French West Indies is high in comparison with mainland France.<sup>2</sup> Furthermore, the unemployment rate for Guadeloupe is 26%<sup>3</sup> compared with 9%<sup>4</sup> in metropolitan France. A study of unemployed individuals in Guadeloupe showed that 25% of men and 22% of women were hypertensive, and indicated high levels of awareness and treatment,<sup>5</sup> whereas, a study of hypertension in the workplace found a prevalence of 20% in men and 19% in women.<sup>6</sup> Neither of these studies were representative of the Guadeloupean population. Though no official statistics are available on the ethnicity in France, the population is Black in its majority and therefore is at a higher risk for hypertension.<sup>7</sup> The last time a study set out to estimate the overall prevalence of hypertension in Guadeloupe was in 1985.<sup>8</sup>

Previous studies from the French West Indies have highlighted considerable dissonance between men and women with regards to awareness, treatment and control of

hypertension, showing higher rates among women.<sup>5,6</sup> The Connaissances sur la santé, croyances et pratiques en terme de prevention cardiovasculaire dans la population Guadeloupéenne (CONSANT) study may provide insight into etiological considerations of hypertension specific to the French West Indies population, allowing for important public health and awareness campaigns to be set in place as preventive measures, as well as highlighting areas where further research is necessary. The results from this study will contribute to our understanding of the population's cardiovascular profile which will allow for better adapted prevention programs. This is of particular relevance in a region where a high incidence of stroke has been reported,<sup>8</sup> and a recent study showed that 54% of deaths from stroke worldwide can be attributed to high blood pressure.<sup>9</sup> The aim of the CONSANT study is to estimate the prevalence, awareness and treatment of hypertension in a representative sample from Guadeloupe.

## Methods

CONSANT is a cross-sectional study with a stratified sample of men and women aged 25–74 years selected using age and sex quotas based on the most recent census data from the French statistical office (INSEE, 1999). The sample was selected using demographic methodology where sampling points were drawn randomly after stratification by district of residence. The random route method was then used to select subsequent households within each district for inclusion in the study. This is done by following instructions to call upon every nth household turning left/right at junctions. Respondents were then selected at random among household members. Individuals were eligible if they were aged between 25 and 74 years and resident in mainland Guadeloupe. A total of 1274 households were contacted and 1005 surveys were completed, giving a response rate of 79%. Data collection and entry were carried out throughout 2007. Each subject gave informed

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consent to participate in the study, and all data were anonymized.

Questionnaires administered by trained researchers were used to collect information on health behaviours, health status, the socioeconomic environment and access to health care during interviews at the respondent's home. At the same visit, anthropometric measurements were taken and blood pressure was measured using a validated automated device (OMRON M5-1). Systolic and diastolic BP (SBP and DBP) were measured at the 5th, 6th and 7th min in the sitting position with a cuff adapted to arm size. The researchers received a 2-day training session to ensure that measurements were collected reliably and all apparatus used correctly. The participants were given their results with a brief explanation and where relevant, the nurse provided health promotion information. The data were then anonymized and sent for entry into the database. Hypertension was defined as having a mean SBP  $\geq 140$  mmHg and/or mean DBP  $\geq 90$  mmHg, or currently receiving anti-hypertensive treatment.

Body mass index (BMI) was calculated as weight divided by height squared ( $\text{kg/m}^2$ ) and the WHO standard cutoffs were used to define underweight ( $\text{BMI} < 18.5$ ), normal ( $\geq 18.5$ – $24.9$ ), overweight ( $\geq 25.0$ – $29.9$ ) and obese ( $\geq 30.0$ ).<sup>10</sup> Data from the questionnaire were used to establish tobacco and alcohol consumption, occupational status, educational attainment and physical activity level. Respondents were defined as being smokers if they reported currently smoking on a regular basis. Alcohol consumption was quantified in glasses per day converted into units, and heavy drinkers were defined as consuming four or more units per day. Data on physical activity were extracted from a question on participation in sporting activity whereby a sedentary lifestyle was defined as having  $< 60$  min of sporting activity per week. Occupational status was extracted using the standard 'professions et catégories socioprofessionnelles' defined by the French statistical office (INSEE). This measure has been developed in France since the 19th century, and is strongly associated with educational level, integrates differences between the public and private sectors and hierarchical differences in earnings.<sup>11,12</sup> The respondents were grouped into five categories: executives and intermediates; manual and non-manual workers; agricultural and independent occupations; retired; and other inactive. Educational attainment was grouped into three categories:  $\leq 6$  years; 7–11 years;  $\geq 12$  years of formal education.

### Statistical analyses

Categorical variables were compared using the  $\chi^2$  analysis, and continuous variables were analysed using the Student's *t*-test and one-way ANOVA. Multivariate analyses were conducted using logistic regression. All analyses were performed with the statistical package Stata SE 9.2. A multivariate logistic regression analysis of hypertension was conducted separately for men and women. The model included age, occupational category, educational attainment, BMI categories, physical activity, alcohol consumption and smoking status. Alcohol consumption was excluded from the women's analysis due to insufficient reporting of consumption of four or more units per week ( $n = 3$ ).

## Results

Overall 1005 respondents were recruited to participate in the study, among them 465 men and 540 women (54%) (table 1). This represents 0.4% of the Guadeloupian population aged 25–74 years. The occupational categories were broken down as follows: 17% of men and 5% of women were independents

**Table 1** Characteristics of the population

| Characteristics                                                | Men<br><i>n</i> = 465  | Women<br><i>n</i> = 540 |
|----------------------------------------------------------------|------------------------|-------------------------|
| Age groups, <i>n</i> (%)                                       |                        |                         |
| 25–34                                                          | 123 (26.5)             | 141 (26.1)              |
| 35–44                                                          | 120 (25.8)             | 135 (25.0)              |
| 45–54                                                          | 90 (19.4)              | 99 (18.3)               |
| 55–64                                                          | 58 (12.5)              | 66 (12.2)               |
| 65–74                                                          | 74 (15.9)              | 99 (18.3)               |
| Occupational categories, <i>n</i> (%)                          |                        |                         |
| Executives                                                     | 23 (5.0)               | 33 (6.2)                |
| Agricultural or independents                                   | 80 (17.3)              | 28 (5.2)                |
| Workers                                                        | 155 (33.5)             | 181 (33.9)              |
| Retired                                                        | 59 (12.7)              | 77 (14.4)               |
| Other inactive                                                 | 146 (31.5)             | 215 (40.3)              |
| Education level, <i>n</i> (%), years                           |                        |                         |
| $\leq 6$                                                       | 125 (27.2)             | 155 (29.4)              |
| 7–11                                                           | 212 (46.2)             | 201 (38.1)              |
| $\geq 12$                                                      | 122 (26.6)             | 171 (32.5)              |
| Married or cohabiting, <i>n</i> (%)                            | 260 (56.2)             | 249 (47.1)              |
| Smokes, <i>n</i> (%)                                           | 111 (23.9)             | 40 (7.4)                |
| Units alcohol $\geq 4$ per week, <i>n</i> (%)                  | 15 (3.2)               | 3 (0.6)                 |
| Physical activity level $< 1$ h per week, <i>n</i> (%)         | 317 (70.1)             | 435 (81.6)              |
| Currently receiving anti-hypertensive treatment, <i>n</i> (%)  | 70 (15.3)              | 144 (26.8)              |
| 1st BP visit, <i>n</i> (%)                                     | 459 (98.7)             | 535 (99.1)              |
| 2nd BP visit*, <i>n</i> (%)                                    | 131 (28.2)             | 194 (35.9)              |
| BMI ( $\text{kg/m}^2$ ) mean $\pm$ SD ( <i>n</i> )             | 25.4 $\pm$ 4.3 (458)   | 27.8 $\pm$ 5.8 (531)    |
| Units of alcohol consumed per week: mean $\pm$ SD ( <i>n</i> ) | 4.7 $\pm$ 14.4 (458)   | 0.9 $\pm$ 3.4 (534)     |
| Heart rate mean $\pm$ SD ( <i>n</i> )                          | 73.3 $\pm$ 12.9 (456)  | 75.3 $\pm$ 11.3 (527)   |
| Blood pressure (BP)                                            |                        |                         |
| Systolic BP: mean $\pm$ SD ( <i>n</i> )                        | 128.4 $\pm$ 17.9 (459) | 120.7 $\pm$ 19.4 (535)  |
| Diastolic BP: mean $\pm$ SD ( <i>n</i> )                       | 79.3 $\pm$ 12.2 (459)  | 77.7 $\pm$ 11.8 (535)   |

a: Second BP visit carried out among respondents aged 35–74 years.

or agricultural workers, 5% of men and 6% of women were executives, 34% of both men and women were manual or non-manual workers, 13% of men and 14% of women were retired and 32 and 40% of men and women were in the 'other inactive' group (unemployed, disabled, at home, etc). The prevalence of obesity ( $\text{BMI} \geq 30 \text{ kg/m}^2$ ) was 14% for men and 31% for women.

### Hypertension prevalence, awareness, control and severity

Within the sample, 33% of men and 37% of women ( $P = 0.62$ ) were identified as being hypertensive (table 2). These figures decreased to 21 and 30%, respectively ( $P = 0.02$ ) when the BP threshold for defining hypertension was increased from 140/90 to 160/100 mmHg (defined as 'moderate level hypertension'). The proportion of hypertensive individuals rose steadily across the age groups with 61% of men and 74% of women aged 65–74 years being hypertensive. Among subjects identified as being hypertensive, the majority was aware of their condition, with a lower overall proportion of men (57%) being aware compared with women (80%,  $P < 0.001$ ). In the sample, 82% of men and 91% of women ( $P = 0.06$ ) identified as being hypertensive who were aware of their condition were receiving anti-hypertensive treatment. The percentage of treated individuals was highest in subjects aged 55–64 years for both sexes. Among hypertensive individuals receiving treatment, blood pressure control increased across the age

**Table 2** Prevalence, awareness, treatment and control of hypertension by age and sex

| Age groups       | Prevalence of hypertension ( $\geq 140/90$ ) in total pop n (%) | Prevalence of moderate hypertension ( $\geq 160 \times 100$ ) in total pop n (%) | Awareness among hypertensive n (%) | Antihypertensive treatment among hypertensive ( $\geq 140/90$ ) subjects aware of hypertension n (%) | BP control among hypertensive subjects ( $\geq 140/90$ ) n (%) |
|------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| <b>Men</b>       |                                                                 |                                                                                  |                                    |                                                                                                      |                                                                |
| <35              | 17 (14.3)                                                       | 3 (2.5)                                                                          | 3 (17.7)                           | 0                                                                                                    | 0                                                              |
| 35–44            | 31 (26.1)                                                       | 16 (13.5)                                                                        | 12 (40.0)                          | 6 (50.0)                                                                                             | 3 (9.7)                                                        |
| 45–54            | 35 (38.9)                                                       | 25 (27.8)                                                                        | 21 (60.0)                          | 18 (85.7)                                                                                            | 7 (20.0)                                                       |
| 55–64            | 24 (42.1)                                                       | 18 (31.6)                                                                        | 18 (75.0)                          | 17 (94.4)                                                                                            | 9 (37.5)                                                       |
| 65–74            | 45 (60.8)                                                       | 36 (48.7)                                                                        | 32 (72.7)                          | 29 (90.6)                                                                                            | 14 (31.1)                                                      |
| Total (n)        | 152                                                             | 98                                                                               | 86                                 | 70                                                                                                   | 33                                                             |
| Total, % (95%CI) | 33.1 (28.8–37.4)                                                | 21.4 (17.6–25.1)                                                                 | 57.3 (49.3–65.3)                   | 82.4 (74.1–90.6)                                                                                     | 21.7 (15.1–28.3)                                               |
| <b>Women</b>     |                                                                 |                                                                                  |                                    |                                                                                                      |                                                                |
| <35              | 19 (13.7)                                                       | 6 (6.5)                                                                          | 11 (57.9)                          | 6 (54.6)                                                                                             | 4 (21.0)                                                       |
| 35–44            | 28 (20.7)                                                       | 20 (14.8)                                                                        | 19 (67.9)                          | 16 (84.2)                                                                                            | 10 (35.7)                                                      |
| 45–54            | 40 (40.8)                                                       | 30 (30.6)                                                                        | 29 (72.5)                          | 27 (93.1)                                                                                            | 16 (40.0)                                                      |
| 55–54            | 41 (62.1)                                                       | 38 (57.6)                                                                        | 36 (87.8)                          | 35 (97.2)                                                                                            | 23 (56.1)                                                      |
| 65–74            | 72 (73.5)                                                       | 64 (65.3)                                                                        | 64 (88.9)                          | 60 (93.8)                                                                                            | 34 (47.2)                                                      |
| Total (n)        | 200                                                             | 161                                                                              | 159                                | 144                                                                                                  | 87                                                             |
| Total, % (95%CI) | 37.3 (33.2–41.4)                                                | 30.0 (26.1–33.9)                                                                 | 79.5 (73.9–85.1)                   | 90.6 (86.0–95.1)                                                                                     | 43.5 (36.6–50.4)                                               |
| Men versus women | 0.62                                                            | 0.02                                                                             | <0.001                             | 0.06                                                                                                 | <0.001                                                         |
| P-value          |                                                                 |                                                                                  |                                    |                                                                                                      |                                                                |

groups peaking 55–64 years with 38% for men and 56% for women.

BP was categorized into grades of severity (grade 1: SPB 140–159 or DBP 90–99 mmHg; grade 2: SPB 160–179 or DBP 100–109 mmHg; grade 3: SPB  $\geq 180$  or DBP  $\geq 110$  mmHg). Among hypertensive subjects, 37 (24%) men had grades 2 and 9 (6%) had grade 3 hypertension. Among hypertensive women, 28 (14%) subjects were classified in grades 2 and 8 (4%) in grade 3. Neither sex was more likely to have a greater severity of hypertension. Among hypertensive men, 64 (43%) were unaware of having elevated blood pressure, and among them 20 had grade 2 or grade 3 hypertension (BP  $\geq 160/100$  mmHg); among hypertensive women, 41 (21%) were unaware of their condition and 10 of these had a severity grade of 2 or grade 3.

### Multivariate analysis of hypertension

The results (table 3) indicate that in both men and women hypertension was associated with age. Male and female subjects with a BMI  $\geq 30$  kg/m<sup>2</sup> were significantly more likely to have hypertension compared with those with a normal BMI after controlling the other variables. Obese men had 3.4 times the odds [95% confidence interval (CI) = 1.5–7.6,  $P = 0.003$ ] of being hypertensive. In women, the association was weaker, whereby obese women were twice as likely to be hypertensive compared with those with a normal BMI [odds ratio (OR) = 2.0, 95% CI = 1.2–3.4,  $P = 0.011$ ]. Women with a low educational level ( $\leq 6$  years) were twice as likely to be hypertensive (OR = 2.1, 95% CI = 1.1–4.0,  $P = 0.030$ ) compared with those who had a high level of education ( $>12$  years). Educational attainment and smoking status were not associated with hypertension in men. An association between heavy alcohol consumption and having high blood pressure was observed, though not significant at the 5% level. This trend suggests that men who consumed 4 or more units of alcohol per week had three times the odds of being defined as hypertensive (OR = 3.1, 95% CI = 1.0–9.7,  $P = 0.055$ ). Furthermore, female smokers were significantly less likely to have hypertension compared with non-smokers (OR = 0.15, 95% CI = 0.03–0.72,  $P = 0.017$ ). In neither of the

**Table 3** Multivariate logistic regression analysis of hypertension for men and women

|                                       | Odds ratio (95% CI) | P-value |
|---------------------------------------|---------------------|---------|
| <b>Men<sup>a</sup> (n = 433)</b>      |                     |         |
| <b>Age</b>                            |                     |         |
| 25–44 (ref.)                          |                     |         |
| 45–54                                 | 2.0 (1.1–3.6)       | 0.017   |
| 55–64                                 | 2.6 (1.2–5.4)       | 0.013   |
| 65–74                                 | 5.4 (1.4–21.0)      | 0.015   |
| <b>BMI categories</b>                 |                     |         |
| Normal (ref.)                         |                     |         |
| Underweight                           | 0.3 (0.1–1.8)       | 0.191   |
| Overweight                            | 1.4 (0.9–2.4)       | 0.135   |
| Obese                                 | 3.4 (1.8–6.6)       | <0.001  |
| <b>Alcohol consumption</b>            |                     |         |
| <4 U/week (ref.)                      |                     |         |
| >4 U/week                             | 3.1 (1.0–9.7)       | 0.055   |
| <b>Women<sup>b</sup> (n = 503)</b>    |                     |         |
| <b>Age</b>                            |                     |         |
| 25–44 (ref.)                          |                     |         |
| 45–54                                 | 2.6 (1.5–4.6)       | 0.001   |
| 55–64                                 | 5.9 (3.0–11.7)      | <0.001  |
| 65–74                                 | 5.4 (1.7–17.1)      | 0.004   |
| <b>Educational attainment (years)</b> |                     |         |
| $\leq 6$                              | 2.1 (1.1–4.0)       | 0.030   |
| 7–11                                  | 1.5 (0.9–2.6)       | 0.154   |
| 12 y + (ref.)                         |                     |         |
| <b>BMI categories</b>                 |                     |         |
| Normal (ref.)                         |                     |         |
| Underweight                           | 0.65 (0.04–10.37)   | 0.760   |
| Overweight                            | 1.2 (0.7–2.0)       | 0.543   |
| Obese                                 | 2.0 (1.2–3.4)       | 0.011   |
| <b>Smoking status</b>                 |                     |         |
| Non-smoker (ref.)                     |                     |         |
| Currently smokes                      | 0.15 (0.03–0.72)    | 0.017   |

a: Included in the model: age, occupational category, educational attainment, BMI categories, physical activity, alcohol consumption, smoking status; Model statistics:  $R^2 = 0.12$ ; log likelihood ratio = −241.1.

b: Included in the model: age, occupational category, educational attainment, BMI categories, physical activity, smoking status; Model statistics:  $R^2 = 0.21$ ; log likelihood ratio = −261.5.

sexes was occupational category or physical activity associated with hypertension.

## Discussion

CONSANT is the only study of hypertension in a representative sample of the Guadeloupean population carried out in recent years. The findings reveal clear gender disparities in the prevalence, treatment and control of hypertension, though the results are not significant for prevalence at the 140/90 mmHg cutoff. Among women, there is a higher prevalence of hypertension compared with men, an overall high level of awareness among hypertensive subjects, and high levels of blood pressure control among hypertensives. Among all hypertensive subjects, 6% of men and 4% of women had grade 3 severity hypertension. Obesity is highlighted as the main factor linked to hypertension in both sexes, after controlling lifestyle and socioeconomic factors. High levels of alcohol consumption in men and a low education level in women were also independently associated with being hypertensive.

There are several drawbacks to the CONSANT study that need to be discussed. First, the results are based on one set of blood pressure measurements, whereas international guidelines recommend that a diagnosis of hypertension be based on measurements taken on separate occasions to improve the accuracy and precision of blood pressure measurements.<sup>13</sup> A second set of measurements taken among subjects eligible for a biological exam allowed us to report results based on two visits, revealing lower prevalence rates within the subsample. Unfortunately, BP data was only collected for 42% of the sample eligible for the second visit. Second, the definition of hypertension may lead to an overestimation of the prevalence, since a person receiving anti-hypertensive drug treatment is considered to be hypertensive, neglecting possible overtreatment due to BP measurement error. Third, as with all epidemiological studies, error or bias may have been introduced via the sample selection. In this case, sampling was done using age and sex quotas to obtain a sample representative of the general population rather than randomly selecting individuals within stratified groups. This means that the chance of being selected is not equal, and that certain types of individuals may be more likely to participate, with no information on those who declined or were not available.

These results can be compared with two studies carried out in the French Caribbean departments: the INHAPAG worksite study on 6136 men and women from Martinique, French Guyana and Guadeloupe, and the PHAPPG study of 2420 unemployed subjects from Guadeloupe. Our analysis indicates that women have a higher prevalence of hypertension and moderate/severe hypertension than men. These results differ from the other studies in Guadeloupe where hypertension was more prevalent among men.<sup>5,6</sup> The PHAPPG study was on a sample of unemployed subjects revealing a prevalence of 38% among men and 30% among women at the first visit.<sup>5</sup> The INHAPAG study on hypertension in the workplace in three French Caribbean departments (INHAPAG) reported 26% of men and 22% of women as being hypertensive.<sup>6</sup> It is important to note that the latter study is likely to be subject to bias due to a 'healthy worker effect' which should be taken into consideration when comparing results to those in CONSANT. In an analysis of worldwide data on hypertension by Kearny *et al.*,<sup>14</sup> all countries defined as being 'established market economies' showed higher rates of hypertension among men than women. Our finding highlights a difference between Guadeloupe and mainland France, where the most recent

prevalence rates range between 28 and 40% for men and 19–32% for women in the general population depending on different studies.<sup>15</sup> Other studies from the Caribbean show trends similar to those seen in Guadeloupe. A study of hypertension in Jamaica by Mendez *et al.*<sup>16</sup> reported 20% of men and 29% of women as being hypertensive, using the same definition of hypertension in a sample aged 25–74 years. In a study of seven populations of West African origin, Cooper *et al.*<sup>17</sup> found that in all three Caribbean countries included in the analysis, men had a lower prevalence of hypertension compared with women. Similarly, Ordunez *et al.*<sup>18</sup> found a higher prevalence of hypertension among Black women (24%) compared with Black men (22%) in a Cuban population aged 15–74 years which contrasted with rates of 23 and 15% in White men and women, respectively. Trends among non-Whites in the USA also reveal higher prevalences among women than men.<sup>19</sup> Age- and sex-specific data for the 'Latin America and Caribbean' region overall show markedly higher prevalences compared with other geographical regions.<sup>14</sup>

Despite women having a higher overall rate of hypertension in Guadeloupe, they have lower mean SBP and DBP compared with men, which is consistent with all the studies cited above where mean BP data were quoted. This is due to the wider variance in the distribution of SBP among women as well as between women and men ( $SD \pm 17.9$  men vs.  $SD \pm 19.4$  women). Mean SBP and DBP in men were the same as estimates provided in the INHAPAG study from the French Caribbean departments<sup>6</sup> and lower than those reported in the PHAPPG study of unemployed individuals in Guadeloupe.<sup>5</sup> In women, mean SBP and DBP found here were higher than those reported in the INHAPAG study<sup>6</sup> and the same as those found in the PHAPPG study on unemployed people.<sup>5</sup>

Gender differences persisted in the findings for awareness, treatment and control of hypertension. Awareness of hypertension among hypertensives in the CONSANT study (57% for men and 80% for women) was high in relation to the other studies from Guadeloupe, where awareness among men ranged from 33 to 40% for men and 52 to 68% for women,<sup>5,20</sup> but resembles rates reported for Jamaica (59% for men and 79% for women)<sup>16</sup> and Cuba (Whites: 73% for men 86% for women, Blacks: 61% for men and 87% for women) as well as data from the USA.<sup>21,22</sup> Consistent with the other studies, a gender disparity was observed, whereby men's awareness of their condition was lower than women's. Among subjects aware of being hypertensive, the rate of antihypertensive treatment was also high relative to the IHPAF study on hypertension in the workplace<sup>20</sup> but the same as the results found among the sample of Guadeloupean unemployed subjects.<sup>5</sup> In each age group, women had higher rates of treatment than men. Our findings on blood pressure control among hypertensives showed women to have a higher rate of control by 22% compared with men. Overall, the rates of BP control we reported here are higher than those from the IHPAF study (7% for men and 21% for women); however, the findings from the INHAPAG study reveal a lower rate for men (13%) and a similar rate for women (46%) compared with the CONSANT results. We also found that men in Guadeloupe were more likely to have severe levels of hypertension, with higher proportions having grades 2 or 3 severity.

Overweight and obesity are highly prevalent among women in Guadeloupe, with 31% being obese and 34% being overweight. These rates are contrasted with those observed among Guadeloupean men, where 14% were obese and 37% overweight. Though these results on body mass are high, they are not inconsistent with those found in the IHPAF study carried out in the workplace in France.<sup>20</sup> However, they are

notably higher when compared with prevalence rates for mainland France (women: 11% obese and 24% overweight; men: 11% obese and 37% overweight).<sup>23</sup> Unsurprisingly, therefore, obesity was identified as a major factor linked to hypertension in this study based on the multivariate analyses after controlling for life style and socioeconomic factors. Indeed, body mass is a well-known risk factor for hypertension and other cardiovascular and metabolic diseases.<sup>24</sup> The strength of the association between obesity and hypertension was higher in men, due to the increased disease risk for abdominal obesity (more prevalent in men) vs. gynoid obesity (more prevalent in women).<sup>25,26</sup> However the excess risk of having hypertension attributable to obesity is higher in women, who have a much higher prevalence rate of obesity in this population compared with men. This finding highlights the importance of further investigation into the different types of obesity and their relation to cardiovascular risk factors in this study.<sup>25</sup> As well as identifying women, Truong *et al.*<sup>27</sup> also identify Blacks as a subpopulation susceptible to weight gain between 1986 and 2002. Black women were identified as having a higher mean BMI compared with White women by Seo *et al.*<sup>28</sup> These findings suggest that racial and gender disparities in obesity trends point towards Black women as being a particularly vulnerable subgroup at risk for diseases associated with increasing BMI such as hypertension.

The multivariate analyses highlighted two behavioural risk factors as being associated with hypertension and alcohol consumption in men, and smoking in women. Heavy alcohol consumption was identified as an important factor in the aetiology of hypertension for men in Guadeloupe. While other studies have shown that mild-to-moderate alcohol consumption can be beneficial to health, heavy use of alcohol at four or more units per day is a known risk factor for hypertension and cardiovascular disease.<sup>29–31</sup> Smoking in women was associated with a reduced risk of having hypertension, after controlling for age and BMI. Contradictory findings have been reported in the literature, concerning the impact of smoking on hypertension. Some of them suggested a protective effect of smoking on the incidence of hypertension.<sup>32</sup>

Low educational attainment was independently associated with hypertension among women. A woman with a low education level is therefore more likely to have poor health simply because she has a lower social position. A study on hypertension in Cuba also found a negative association between education and hypertension for women, and a positive association among men.<sup>18</sup> Results from Jamaica indicate a similar trend, whereby women with the lowest level of education had higher mean SBP and DBP and a higher prevalence of hypertension.<sup>16</sup> This study also shows that the inverse is true for Jamaican men, where those with the highest education levels were most likely to be hypertensive. The gender disparities found in both these studies point towards the need for further research into social inequalities in hypertension in Guadeloupe.

Overall, the prevalence of hypertension in Guadeloupe is higher than that of mainland France, especially among women. However, the rates estimated from our study resemble those observed from other countries in the Caribbean region. This finding is indicative of a geographic homogeneity in hypertension as a risk factor for cardiovascular disease and underlines geographic inequalities within French territories. The main finding from our analyses was the large differences observed in the prevalence, awareness, treatment and control of hypertension between men and women. Separate gender-specific strategies in the prevention of hypertension and the follow-up care of patients emerge from our study. Men have higher overall mean SBP and DBP,

but a lower prevalence of hypertension when compared with women. Their awareness, treatment and control remain lower than women's suggesting that the follow-up care of hypertensive men is where resources and efforts should be targeted. Women, however, have a high prevalence of hypertension, but awareness, control and treatment is also high. Social inequalities in hypertension were found among women based on their level of education. A prevention-oriented strategy among women needs to take into account the importance of body mass and social position in this population. Health policies aiming to decrease the prevalence of hypertension in Guadeloupe must take into account the gender differences highlighted above. More specifically, separate strategies focussing on health promotion for women and follow-up care for men have emerged from this study.

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## Key points

- Little is known about the prevalence and aetiology of hypertension in Guadeloupe. The last study on a representative sample was conducted in 1985.
- Studies since then have focussed on subpopulations, such as unemployed individuals.
- These up-to-date results reveal that the prevalence of hypertension is higher among women when compared with men.
- Hypertension in Guadeloupe is strongly linked to obesity, which is a major public health concern.
- In women, but not in men, low educational attainment was associated with an increased risk of hypertension.

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