High Prevalence of Cardiovascular Risk Factors in the Seychelles (Indian Ocean)


In recent years, increasingly high rates of cardiovascular diseases have been recorded in the Seychelles. A survey was performed to investigate the prevalence of cardiovascular risk factors in that population, which is shifting from its traditional habits to a westernized lifestyle. The Seychelles population is of predominantly black African origin. A sex- and age-stratified random sample of 1,309 subjects was drawn from 21,256 people aged 25–64 years. A response rate of 86% was achieved. The data showed a high prevalence of hypertension (25%) and cigarette smoking (54%) in men and a high prevalence of hypertension (20%) and obesity (21%) in women. Hypercholesterolemia (>6.5 mmol/l) was found in 9% of men and 15% of women. High density lipoprotein cholesterol levels (mean±SD) were higher in men (1.42±0.49 mmol/l) than in women (1.6±0.34 mmol/l). High levels of lipoprotein(a) (mean±SD) were found both in men (319±362 mg/l) and women (328±415 mg/l). The high prevalence of cardiovascular risk factors identified in the Seychelles indicates a pressing current need for effective preventive strategies. (Arteriosclerosis and Thrombosis 1991;11:1730–1736)

Cardiovascular diseases are becoming increasingly important in developing countries and will be the leading cause of death in many of them by the year 2000. This transition to chronic diseases is due to a combination of the aging of these populations; the improved control of infectious diseases; and detrimental changes in diet, smoking, and other lifestyle factors. These issues should receive appropriate attention because strategies for limiting the impact of cardiovascular diseases have been formulated and could, if introduced promptly, be more effective and less demanding on the limited resources of developing countries than a solely therapeutic approach.

In the Seychelles, 39.5% of all deaths were attributable to cardiovascular diseases in 1989 according to the official mortality statistics. Hypertensive disease, ischemic heart disease, and cerebrovascular disease were responsible for 8.4%, 8.0%, and 5.9% of all deaths, respectively.

Therefore, it has become desirable to survey the current levels of modifiable and nonmodifiable risk factors for cardiovascular diseases in the population of the Seychelles to provide substantial information for planning in the health field.

The Republic of Seychelles is a group of 115 islands located in the Indian Ocean between longitudes 46° and 56° east and latitudes 3° and 1° south. Fifty-eight percent of the total 66,370 population was less than 25 years old in 1987. The islands had no indigenous population until 1771, when French settlers arrived. They were joined later by people of African, Indian, and Chinese origin. It is considered that about 65% of the population is of predominantly black African origin, 10% is of Caucasian origin, and 5% is of Indian or Chinese origin, with the remaining 20% being mixed between these various groups. Since the opening of the international airport in 1971, tourism has become the major industry of the Seychelles. The Central Bank of the Seychelles indicates that the gross national product per capita in constant prices rose from 2,260 to 3,452 US dollars between 1983 and 1987. The World Bank suggests that the Seychelles has now become a middle level-income country.

Methods

The study area was located on the island of Mahé, which accounts for 90% of the total population of the Seychelles. The survey was designed as a cross-sectional study. Data from a national census performed in 1987 were used for sampling. A simple age- and sex-stratified random sample of 1,309 subjects was drawn from the study population of 21,256.
Seychellois inhabitants aged 25–64 years. In the time interval between sampling and the examinations, 58 individuals were lost due to migration and death. Among the 615 men and 636 women eligible to take part in the survey, 513 men (83.4%) and 568 women (89.3%) participated in the study. The survey was performed from April to September 1989.

The data were gathered from interviews and physical examinations, following the standardized guidelines of the international MONICA (MONItoring of trends and determinants of CARDiovascular diseases) study launched by the World Health Organization (WHO).5,6

Body mass index (BMI), calculated as weight in kilograms divided by height in meters squared, was used to characterize the relative weights of responders. Obesity was defined as a BMI greater than or equal to 30.7 Blood pressure (BP) was measured with mercury sphygmomanometers under standardized conditions.6,8 Two BP recordings were taken 2 minutes apart after completion of the interview, so that each person had been in a sitting position for at least 1 hour before the two BP levels were measured. All results involving BP values were based on the calculation of the average of these two BP readings. Hypertension was defined for individuals with a systolic blood pressure (SBP) greater than or equal to 160 mm Hg, a diastolic blood pressure (DBP) greater than or equal to 95 mm Hg, and/or who currently taking antihypertensive medication. Data on smoking status were assessed by standardized questions.6,8 A "cigarette smoker" was a participant who reported smoking at least one cigarette per day on average.

Blood samples were obtained from all study subjects between 8 and 11 AM after an overnight fast. All blood samples were centrifuged within 6 hours of drawing, and serum was kept frozen at −20°C until analyzed. Serum total cholesterol and high density lipoprotein (HDL) cholesterol were analyzed in the Laboratory of the Medical Policlinic, University of Lausanne, Switzerland. Apolipoprotein A-I (apo A-I), apo B, and lipoprotein(a) (Lp(a)) were determined in the Lipid Laboratory of the University of Bern, Switzerland. Total cholesterol was measured enzymatically (CHOD-PAP method) with reagents supplied by Boehringer, Mannheim, FRG. HDL cholesterol was similarly quantified in the supernatant obtained after precipitation of non-HDL lipoproteins with phosphotungstate and MgCl2 (reagents of Boehringer, Marburg, FRG). Lp(a) was quantified by radioimmunoassay (Apolipoprotein [a] RIA 100, Pharmacia, Uppsala, Sweden). Cholesterol and HDL cholesterol were not measured in 36 individuals, and apo A-I, apo B, and Lp(a) were not measured in 36 individuals because of inadequate storage procedures or a shortage of serum. A detailed description of both the sampling frame and methods is given elsewhere.9

Hypercholesterolemia was defined for cholesterol values higher than 6.5 mmol/l (250 mg/dl).10 Hypo-HDL cholesterolemia was defined for values lower than 0.9 mmol/l (35 mg/dl).10 Increased levels of Lp(a) referred to values higher than 300 mg/l. Total-cholesterol-to-HDL-cholesterol ratio values between 5 and 6.5 characterized individuals at intermediate risk, while ratio values larger than 6.5 characterized individuals at high risk of developing coronary heart disease.10

Statistical Analysis

Crude age- and sex-stratified means, standard deviations, and prevalences are presented. To obtain estimates of population parameters, overall age-weighted estimates for the entire 25–64-year age groups are also provided, based on the demographic data of the Seychelles available in 1987 as a standard. The weights allocated to the 25–34, 35–44, 45–54, and 55–64-year age groups were 48/100, 22/100, 17/100, and 13/100 for men and 42/100, 21/100, 20/100, and 17/100 for women, respectively. When compared with the results of the multinational WHO-MONICA Project, the standard world population weight for ages 35–64 were used for all median and prevalence estimates.11

Results

Mean body mass index values (±SD) are presented in Table 1. BMI did not vary with age in men. BMI increased with age in women, with the steepest increase (from 23.2 to 26.8 kg/m²) being recorded between the two younger age groups. Obesity was rare in all age classes of men but was relatively common in women aged 35 years and older (Table 2).

Mean values of SBP and DBP (±SD) and the prevalence of hypertension are shown in Tables 1 and 2, respectively. More men had hypertension before 55 years, but the steeper age gradient observed for women made the prevalence comparable among women older than 35 years. In this older age group, 39% of men and 46% of women had hypertension. Among the 158 men and 149 women of the sample found to have hypertension, 47% and 33% were unaware of their disease; 27% and 17% were aware but untreated; 17% and 29% were aware, treated, but uncontrolled (BP≥160/95); and 9% and 21% were aware, treated, and controlled (BP<160/95).

The prevalence of cigarette smoking and the median number of cigarettes smoked per day among smokers are shown in Tables 2 and 1, respectively. The smoking prevalence and especially the number of cigarettes smoked per day among smokers were lower in the 25–34-year age group compared with the older age groups. There was a higher prevalence of smoking among men (54%) than among women (10%). Male smokers smoked about two times more cigarettes per day than did female smokers. The estimated consumption of cigarettes (both sexes combined) was 1,320 cigarettes per year and per capita for the population aged 25–64 years.
Table 1. Mean Values of Body Mass Index, Systolic Blood Pressure, Diastolic Blood Pressure, and Number of Cigarettes Smoked per Day Among Smokers, Stratified by Sex and Age

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Body mass index (kg/m²)</th>
<th>Systolic blood pressure (mm Hg)</th>
<th>Diastolic blood pressure (mm Hg)</th>
<th>Cigarettes/day (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34 yr</td>
<td>105</td>
<td>22.9±3.3</td>
<td>124.3±16.3</td>
<td>82.7±12.9</td>
<td>2.0±7.9</td>
</tr>
<tr>
<td>35-44 yr</td>
<td>127</td>
<td>23.8±3.5</td>
<td>131.3±17.4</td>
<td>87.3±13.4</td>
<td>13.1±8.0</td>
</tr>
<tr>
<td>45-54 yr</td>
<td>145</td>
<td>23.1±3.9</td>
<td>137.6±22.0</td>
<td>90.6±15.0</td>
<td>12.6±9.6</td>
</tr>
<tr>
<td>55-64 yr</td>
<td>136</td>
<td>23.2±4.4</td>
<td>143.1±25.1</td>
<td>89.9±13.7</td>
<td>11.1±7.9</td>
</tr>
<tr>
<td>25-64 yr*</td>
<td>12,110</td>
<td>23.2±3.6</td>
<td>130.5±18.7</td>
<td>85.9±13.5</td>
<td>12.2±8.2</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34 yr</td>
<td>123</td>
<td>23.2±5.1</td>
<td>113.6±13.4</td>
<td>73.8±8.7</td>
<td>4.1±2.9</td>
</tr>
<tr>
<td>35-44 yr</td>
<td>143</td>
<td>26.8±5.6</td>
<td>125.0±17.7</td>
<td>83.7±14.7</td>
<td>8.5±6.2</td>
</tr>
<tr>
<td>45-54 yr</td>
<td>145</td>
<td>27.0±5.6</td>
<td>136.5±27.8</td>
<td>88.1±14.4</td>
<td>7.9±8.2</td>
</tr>
<tr>
<td>55-64 yr</td>
<td>157</td>
<td>27.5±5.2</td>
<td>145.1±25.4</td>
<td>90.2±14.8</td>
<td>6.0±10.7</td>
</tr>
<tr>
<td>25-64 yr*</td>
<td>11,508</td>
<td>25.4±5.3</td>
<td>125.9±19.2</td>
<td>81.5±12.1</td>
<td>6.1±6.0</td>
</tr>
</tbody>
</table>

*Standardized for age.

Table 3 shows the mean levels (±SD) of serum total cholesterol, apo B, HDL cholesterol, apo A-I, and Lp(a). Cholesterol level did not vary with age in men but increased steadily with age in women. Among the 1,055 screened persons, only four had a cholesterol level higher than 9 mmol/l (one person with currently uncontrolled diabetes mellitus and three others with a BMI > 30). Cholesterol and apo B were highly correlated both in men (r=0.78) and women (r=0.81).

HDL cholesterol values did not vary with age in men and women. A higher mean level (±SD) was found in men (1.42±0.49 mmol/l) than in women (1.36±0.34 mmol/l). Within the 500 men of the sample for whom HDL cholesterol values were available, a significantly (p<0.001) higher mean level (±SD) of HDL cholesterol was found in the 195 individuals drinking more than 50 g of ethyl alcohol per day (1.61±0.61 mmol/l) than in the 127 non-drinkers (1.22±0.33 mmol/l). In multiple regression analysis including four independent variables (R²=0.14) in men, HDL cholesterol was correlated with BMI (r=-6.7, p<0.001) and alcohol consumption (r=4.8, p<0.001) but not with age or smoking. Among the 555 women of the sample, a significantly (p<0.001) higher mean HDL cholesterol level (±SD) (1.40±0.41 mmol/l) was found in the 254 lean (BMI <25) women than in the 140 obese (BMI > 30) women (1.23±0.45 mmol/l). Hypo-HDL cholesterolemia (<0.9 mmol/l) was found in 10% of men and in 11% of women aged 25-64 years. HDL cholesterol and apo A-I were highly correlated both in men (r=0.76) and women (r=0.70).

Table 2. Prevalence±95% Confidence Intervals of Obesity and Major Modifiable Cardiovascular Risk Factors, Stratified by Sex and Age

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Obesity* (%)</th>
<th>Hypertension† (%)</th>
<th>Hypercholesterolemia‡ (%)</th>
<th>Smoking§ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34 yr</td>
<td>105</td>
<td>3.8±4.9</td>
<td>15.2±7.0</td>
<td>5.8±4.4</td>
<td>52.4±9.7</td>
</tr>
<tr>
<td>35-44 yr</td>
<td>127</td>
<td>4.7±4.9</td>
<td>29.9±8.1</td>
<td>13.8±6.2</td>
<td>44.9±8.8</td>
</tr>
<tr>
<td>45-54 yr</td>
<td>145</td>
<td>2.8±3.6</td>
<td>35.2±7.9</td>
<td>9.8±5.0</td>
<td>65.5±6.9</td>
</tr>
<tr>
<td>55-64 yr</td>
<td>136</td>
<td>6.6±5.5</td>
<td>39.0±8.4</td>
<td>9.2±5.1</td>
<td>59.6±8.4</td>
</tr>
<tr>
<td>25-64 yr*</td>
<td>12,110</td>
<td>4.2±4.7</td>
<td>24.9±7.6</td>
<td>8.7±5.0</td>
<td>53.8±8.9</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-34 yr</td>
<td>123</td>
<td>8.9±6.7</td>
<td>3.3±3.2</td>
<td>12.0±5.5</td>
<td>6.5±4.4</td>
</tr>
<tr>
<td>35-44 yr</td>
<td>143</td>
<td>29.4±9.9</td>
<td>18.2±6.5</td>
<td>14.0±6.0</td>
<td>10.5±3.1</td>
</tr>
<tr>
<td>45-54 yr</td>
<td>145</td>
<td>26.9±9.6</td>
<td>32.4±7.7</td>
<td>14.2±6.9</td>
<td>14.5±5.8</td>
</tr>
<tr>
<td>55-64 yr</td>
<td>157</td>
<td>33.1±9.7</td>
<td>45.9±7.9</td>
<td>26.8±7.1</td>
<td>13.4±5.4</td>
</tr>
<tr>
<td>25-64 yr*</td>
<td>11,508</td>
<td>20.9±8.5</td>
<td>19.5±7.6</td>
<td>15.3±6.2</td>
<td>10.1±7.6</td>
</tr>
</tbody>
</table>

*Defined as body mass index>30 kg/m².
†Defined as systolic blood pressure ≥160 mm Hg, diastolic blood pressure ≥95 mm Hg, or currently taking antihypertensive medication.
‡Defined as serum cholesterol >6.5 mmol/l; 26 missing values.
§Defined as ≥1 cigarette/day.
$Standardized for age.
TABLE 3. Mean Values of Blood Lipids, Stratified by Sex and Age

<table>
<thead>
<tr>
<th>Group</th>
<th>Cholesterol (mmol/l)</th>
<th>Apo B* (g/l)</th>
<th>HDL cholesterol (mmol/l)</th>
<th>Apo A-I* (g/l)</th>
<th>Lp(a)* (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–34 yr</td>
<td>104</td>
<td>4.8±1.0</td>
<td>1.01±0.32</td>
<td>1.41±0.47</td>
<td>1.43±0.52</td>
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<tr>
<td>35–44 yr</td>
<td>123</td>
<td>5.2±1.2</td>
<td>1.09±0.39</td>
<td>1.39±0.49</td>
<td>1.40±0.42</td>
</tr>
<tr>
<td>45–54 yr</td>
<td>143</td>
<td>5.0±1.1</td>
<td>1.05±0.36</td>
<td>1.49±0.59</td>
<td>1.44±0.40</td>
</tr>
<tr>
<td>55–64 yr</td>
<td>130</td>
<td>5.1±1.1</td>
<td>1.08±0.34</td>
<td>1.44±0.46</td>
<td>1.42±0.29</td>
</tr>
<tr>
<td>25–64 yrt</td>
<td>12,110</td>
<td>5.0±1.1</td>
<td>1.04±0.34</td>
<td>1.42±0.49</td>
<td>1.43±0.45</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25–34 yr</td>
<td>120</td>
<td>4.9±1.0</td>
<td>1.02±0.30</td>
<td>1.32±0.31</td>
<td>1.31±0.30</td>
</tr>
<tr>
<td>35–44 yr</td>
<td>136</td>
<td>5.2±1.1</td>
<td>1.11±0.34</td>
<td>1.41±0.35</td>
<td>1.40±0.33</td>
</tr>
<tr>
<td>45–54 yr</td>
<td>142</td>
<td>5.6±1.1</td>
<td>1.20±0.34</td>
<td>1.41±0.39</td>
<td>1.38±0.30</td>
</tr>
<tr>
<td>55–64 yr</td>
<td>157</td>
<td>5.8±1.2</td>
<td>1.30±0.41</td>
<td>1.36±0.37</td>
<td>1.42±0.38</td>
</tr>
<tr>
<td>25–64 yrt</td>
<td>11,508</td>
<td>5.3±1.2</td>
<td>1.12±0.34</td>
<td>1.36±0.30</td>
<td>1.36±0.30</td>
</tr>
</tbody>
</table>

Values are mean±SD.
Apo, apolipoprotein; HDL, high density lipoprotein; Lp(a), lipoprotein(a).

*Ten missing values.
†Standardized for age.

The total-cholesterol-to-HDL-cholesterol ratio did not vary consistently with age in men, whereas higher values were found in the older age groups in women. When standardized for age, 14.7% of men and 15.4% of women aged 25-64 years had a total-cholesterol-to-HDL-cholesterol ratio higher than 5, whereas 4.4% of men and 4.8% of women had an index higher than 6.5.

Similar mean levels of Lp(a) (±SD) were measured in men (319±362 mg/l) and women (328±415 mg/l). No consistent variation of Lp(a) occurred with age. Age-weighted median levels were 216 mg/l for men and 192 mg/l for women aged 25-64 years. Elevated levels of Lp(a) (>300 mg/l) were found in 36% of men and 35% of women aged 25-64 years. Within the 1,045 individuals of the sample for whom Lp(a) values were available, a significantly higher proportion of black individuals had elevated levels of Lp(a) (263 of 701 [38%]) compared with white individuals (26 of 86 [30%]).

The proportions of persons with three or fewer simultaneous major risk factors (i.e., actual hypertension, hypercholesterolemia, and cigarette smoking) were used to present the prevalence of different risk factor combinations in the 500 men and 555 women for whom data on all three risk factors were available (Table 4). With aging, the prevalence of persons free of all major risk factors decreased from 38% to 24% in men and from 81% to 33% in women.

**Discussion**

A very high prevalence of obesity was observed among Seychellois women, whereas a low prevalence of obesity was seen among Seychellois men when compared with adult populations from both industrialized and developing countries.12 The contribution of obesity to cardiovascular diseases as an independent factor is still debated.13 Preventing and treating obesity is important, however, because obesity shortens life and precipitates or aggravates many disorders, including hypertension, diabetes, and hypercholesterolemia.3,14 The finding that in the Seychelles obesity was more common among older women may explain the sex differential in the prevalence of both hypertension and hypercholesterolemia observed after the age of 55 years.

Hypertension has long been recognized as a major health problem in the Seychelles. It was found from the study that as many as 25% of men and 20% of women aged 25–64 years either had elevated BP.

**Table 4. Proportions of Men and Women With Three or Fewer Simultaneous Major Cardiovascular Risk Factors, Stratified by Age and Sex**

<table>
<thead>
<tr>
<th>Group (yr)</th>
<th>No. of risk factors present</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25–34</td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
<tr>
<td>0 (%)</td>
<td>38.1</td>
</tr>
<tr>
<td>1 (%)</td>
<td>51.4</td>
</tr>
<tr>
<td>2 (%)</td>
<td>9.5</td>
</tr>
<tr>
<td>3 (%)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Major risk factors are actual hypertension, smoking, and hypercholesterolemia.
M, men; W, women.
†Standardized for age.
values or were taking antihypertensive medication. There was a higher prevalence of hypertension among men before 55 years, but the steeper age gradient observed for women made this prevalence higher in women after the age of 55. The multinational WHO-MONICA Project (which delineated guidelines for this study) provides an opportunity to put the data of the Seychelles into a standardized perspective. The median BP levels measured in the Seychelles (for men, 131/88 and for women, 131/85) were among the highest when compared with those obtained in the predominantly industrialized countries participating in the MONICA Project (e.g., California, 127/82 and 120/79; Finland, 145/90 and 143/85; Scotland, 134/87 and 131/82; Switzerland, 130/81 and 123/77). The prevalence of hypertension was also higher in the Seychelles than that reported in many developing countries.

From the public health point of view, it is important to note that about one half of hypertensive men and one third of hypertensive women may not be currently diagnosed, while only 13% of hypertensive men and 20% of hypertensive women have their BP controlled.

Cigarette smoking was a major problem among men (54% are smokers), whereas women seemed to be relatively protected for the time being (10% are smokers). Unlike those in Western countries, a lower prevalence and number of cigarettes smoked per day among smokers were found in the younger age groups compared with the older age groups. This may result from stricter policies regarding smoking in the new national education system implemented during the last decade. Alternatively, this may be a beneficial side effect related to the vigorous official promotion of sports in the country. Fortunately, the rather low number of cigarettes smoked per day among smokers resulted in a still lower (approximately one half) consumption of cigarettes per capita of the total adult population in comparison with most industrialized countries.

When compared with populations for which a similar methodology was used, median cholesterol levels were lower in the Seychelles (men, 5.0 and women, 5.4 mmol/l) than in most industrialized countries (e.g., California, 5.3 and 5.2; Finland, 6.2 and 6.2; Scotland, 6.2 and 6.4; Switzerland, 6.3 and 6.0 mmol/l) but higher than in Beijing (4.1 and 4.2 mmol/l). The cholesterol values found in the Seychelles were higher than those observed in Nigeria and some other African countries but were similar to those prevailing in black Americans. In the Seychelles, fish and rice are part of almost every lunch and dinner. However, large amounts of fat are used for cooking, with highly saturated ones (mostly hydrogenated vegetable oil) being used most commonly because of its lower price. According to a household expenditure survey performed in 1984, the daily energy consumption for adults was estimated at 2,094 calories, and fat consumption was found to deliver 21% of total energy (both figures are likely to be underestimates due to omission of some food items). Moreover, fatty fast food ("take away") is becoming popular for lunch, and there is a trend to eat more meat and eggs. These findings suggest a major role of changing dietary factors in the higher-than-expected levels of cholesterol presently observed in the Seychelles.

The high levels of HDL cholesterol found in the Seychelles are welcome, as high levels are associated with lower incidence rates of coronary heart disease. Genetic factors are important, with high HDL cholesterol levels found in Eskimos and some black populations. In the Seychelles, HDL cholesterol values were higher in men than in women, whereas the opposite generally occurs in most industrialized and developing countries. Alcohol consumption is associated with higher levels of HDL cholesterol. This factor may play a major role because a high consumption of alcohol by men is locally well recognized and has been recently documented. Conversely, obesity is known to be associated with lower levels of HDL cholesterol, and the very high prevalence of female obesity in the Seychelles contributes to lower average HDL cholesterol levels in women.

Lp(a), a lipoprotein with thrombogenic and atherogenic properties, appeared in higher mean levels both in male and female Seychellois than those measured with the same methodology in a Swiss population of similar composition. Plasma Lp(a) levels are largely determined genetically, with little environmental influence. The high levels of Lp(a) obtained in this study can be compared with the high values reported in other groups of blacks in the United States and Africa. In view of the significance of Lp(a), these results suggest an additional important (although nonmodifiable) risk factor for cardiovascular diseases in the Seychelles population.

Finally, a relatively high age-standardized prevalence of diabetes mellitus was also found in the Seychelles, using the same study sample for screening, with 6.7% of men and 7.3% of women aged 35–64 years having the disease. So far as risk factors are considered as determinants of cardiovascular diseases, it is of interest to note than only 21% of men and 42% of women aged 25–64 years were free of any of the six estimated, independent (although not necessarily unrelated) risk factors (i.e., hypertension, smoking, hypercholesterolemia, hypo-HDL cholesterolemia, elevated levels of Lp[a], and diabetes mellitus) (Table 5). Moreover, about 20% of men and 7% of women aged 25–64 years had at least two of all three modifiable risk factors (i.e., hypertension, smoking, or hypercholesterolemia) (Table 4). Estimation of the risk factor profile of a population depends very much on the chosen cutoff values. In this study the cutoff points chosen were conservatively high, especially regarding hypertension and hypercholesterolemia. The high prevalence of cardiovascular risk factors identified in the Seychelles indicates a pressing current need for effective preventive strategies.
vascular events according to standardized guide-

The control of obesity could have a substan-
grail in the society and culture. 1 As a conse-
sequence of the study, a collaborative nationwide
tries will be most cost-effective when they intervene

mainly aimed at controlling the three major modi-
fi able risk factors (i.e., hypertension, smoking, and
hypercholesterolemia).

The data provided by this study suggest that a
combination of both population-based and specific
high-risk target group strategies should be used to
control the modifiable cardiovascular risk factors. A
population strategy should be adopted to avoid an
increase of the mean cholesterol level of the whole
Seychellois population. The primary focus should
be to maintain the traditional diet, mainly com-
posed of fish, and to avoid the trend toward a diet
rich in animal fat. A specific and vigorous high-risk
strategy should be developed for controlling hyper-
tension by improving case finding and effective care
of the disease, while a complementary mass strategy
should aim at increasing the awareness of the
health consequences of hypertension in the popu-
lation. A combination of high-risk and population
strategies should be adopted to control both smok-
ing and obesity. Smokers (mainly men) should be
couraged to quit, and obese individuals (mainly
women) should be encouraged to adopt a more
reasonable diet. At the same time, general health
education measures should be implemented to dis-
courage nonsmokers (mainly women) from starting
and to encourage everyone to maintain an optimal
weight. The control of obesity could have a substani-

Conclusion

A high-risk-factor profile was identified in a popu-
lation with an increasingly high incidence of cardiovas-
cular diseases. It is likely that the obvious improve-
ment in the standard of living in the Seychelles within the last
decade has favored detrimental changes in the risk
factors for chronic diseases in general and cardiovas-
cular diseases in particular. More generally, these data
provide further evidence about the new formidable
health challenge that an increasing number of develop-
ing countries will face in addition to the ongoing
burdens of communicable diseases and other more
traditional health problems. Transforming these epi-
demiological data into prevention is now the main objec-
tive that should be developed.

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TABLE 5. Proportions of Men and Women With Six or Fewer Simultaneous Independent Cardiovascular Risk Factors, Stratified by Age and Sex

<table>
<thead>
<tr>
<th>No. of risk factors present</th>
<th>25–34</th>
<th>35–44</th>
<th>45–54</th>
<th>55–64</th>
<th>25–64*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>W</td>
<td>M</td>
<td>W</td>
<td>M</td>
</tr>
<tr>
<td>0 (%)</td>
<td>24.3</td>
<td>52.5</td>
<td>23.8</td>
<td>49.3</td>
<td>14.2</td>
</tr>
<tr>
<td>1 (%)</td>
<td>52.4</td>
<td>40.0</td>
<td>38.5</td>
<td>37.5</td>
<td>40.4</td>
</tr>
<tr>
<td>2 (%)</td>
<td>18.5</td>
<td>6.7</td>
<td>25.4</td>
<td>12.5</td>
<td>30.5</td>
</tr>
<tr>
<td>3 (%)</td>
<td>4.8</td>
<td>0.8</td>
<td>12.3</td>
<td>0.7</td>
<td>12.1</td>
</tr>
<tr>
<td>4 (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>5 or 6 (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Independent risk factors are actual hypertension, smoking, hypercholesterolemia, hypo-high density lipoprotein cholesterol, elevated level of lipoprotein(a), and diabetes mellitus.

M, men; W, women.

*Standardized for age.

KEY WORDS • cardiovascular disease risk factors • hypertension • hypercholesterolemia • cigarette smoking • obesity • cholesterol • apolipoproteins • lipoprotein(a) • cardiovascular diseases • epidemiology • Seychelles
High prevalence of cardiovascular risk factors in the Seychelles (Indian Ocean).

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