Health situation and issues in the Seychelles in 2012

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Abstract. Located off the coast of Kenya, the Republic of the Seychelles is an island archipelago nation whose citizens are mostly of African origin. The population, independent from the United Kingdom since 1976, has largely completed its demographic and epidemiological transitions. Major investments in infrastructure and social services have fostered a steady economic growth. Health services and education are free. The predominance of chronic non-communicable diseases and rapid aging of the population cause significant new challenges for public health and the health system. However, like the other small island states in the region, the Seychelles remains under the threat of outbreaks, particularly of arboviruses. Health indicators from 2012 are generally very good. There are concerns, however, about the future of health care in the country. Geographic isolation, the small and aging population and limited resources provide major challenges for maintaining and sustaining an effective workforce of health professionals, a constantly evolving technical platform and an increasing number of available medications. This is true particularly in view of the increasing burden of chronic diseases and the continued threat to the population of current or emerging infectious diseases.

The purpose of this article is to provide a brief introduction to the geography, history, and political context of Seychelles to provide an account of the current situation regarding major diseases in the Seychelles and to review health priorities of the last few decades. To our knowledge, no comprehensive inventory of sporadic, endemic or epidemic events has been attempted before, except for a remarkable report from the 1950s [1]. Using health data from the past few decades, information from health personnel who live and practice in the Indian Ocean, we attempt to identify major current and future health challenges in the Seychelles.

Key words: health, diseases, public health, Seychelles, Indian Ocean, Africa.

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In the southwest Indian Ocean, the Seychelles mostly completed their demographic and epidemiological transitions. As the incidence and prevalence of communicable diseases diminished because of improved hygiene, nutrition, and the development of the health services, attention has shifted to diseases related to changing lifestyles and an aging population. A significant increase in non-communicable and chronic diseases has posed new challenges to public health and the health care system. This article presents a simplified picture of the overall health situation of Seychelles in 2012 and its challenges. To appreciate the extent of the changes, the reader is referred to an article on the overall health status of the Seychelles in 1956-1957. [1]

Presentation of the Seychelles archipelago

Geography, geology, climate [2]
The archipelago has 115 islands and islets scattered over a sea area of 1.3 million km² with a total land area of 455 km². The Seychelles maritime boundary passes one hundred kilometers north of Madagascar and 200-300 km northeast of Tanzania (figure 1). The surface of the Seychelles exclusive economic zone is as large as the area of France.

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abolished in 1835, as there were then, almost unbelievably, became British by the Treaty of Paris in 1814. Slavery was the nationality of the ships calling in. Seychelles officially bearing alternately the British and French flags, depending on the authority of the Governor Jean-Baptiste Que’ au de Quincy, Controller of Finances under Louis XV.

Governor of the “Isle de France” (now Mauritius) and “Bourbon” (now Reunion Island) took possession of the Seychelles. Mahé Island was declared a French possession on 1 November 1756 and the other islands “in sight and beyond the view” were declared French in 1768. The first settlers came from “Isle de France”; they landed in 1770 and named the archipelago in honour of Jean Moreau de Sèchelles, General Controller of Finances under Louis XV.

The colony really began its development in 1794, under the authority of the Governor Jean-Baptiste Queüe de Quincy, bearing alternately the British and French flags, depending on the nationality of the ships calling in. Seychelles officially became British by the Treaty of Paris in 1814. Slavery was abolished in 1835, as there were then, almost unbelievably, 6600 slaves among the 7500 inhabitants. The population substantially increased with many freed slaves brought in by slave ships of the Royal Navy, which also gave them pieces of land with which to settle in Seychelles.

Vanilla, introduced in 1866, and copra made the fortunes of the planters, who were mostly from the Bourbon. The British began implementing the Colonial Development Welfare Act in 1944. In 1967, the Seychelles refused independence. In 1970 the country knew its first constitution. Independence was declared in 1976. James Mancham, leader of the majority Democratic Party became President of the Republic. The socialist France Albert René, leader of Seychelles Peoples United Party - which later became the Seychelles People’s Progressive Front - was named Prime Minister. On June 5, 1977, France Albert René seized power and established a socialist single-party rule. The multiparty system was reinstated in 1991 and René and his party obtained the presidential and parliamentary majorities in elections in 1991, 1993 and 1998. René resigned in 2004 in favour of his vice-president, James Michel, who was confirmed in his position by the elections of 2006 and 2011. The Republic of Seychelles is a member of the United Nations, the African Union, the British Commonwealth, the Organisation Internationale de la Francophonie, the Indian Ocean Commission and the Common Market for Eastern and Southern Africa (Southern African Development Community).

Demographic and socio-economic statistics
Nearly 90% of the population lives on the island of Mahé. We can estimate that approximately 65% are of African origin, 5% Indian, 2-5% Caucasian, 2-3% Chinese. The remaining 25% are a mixture of these different groups. The Roman Catholic religion predominates (90%). Demographic and socio-economic data are summarized in Table 1.

Economy
Economic indicators are summarized in Table 2.

GDP has increased seven-fold since independence. Tourism, which accounts for over a quarter of GDP with 120,000 visitors a year, employs 5,000 workers among the 30,000 employed persons in the country. Fishing accounts for 8% of

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GDP, with a quarter of the global catch of tuna. The public sector employs 27% of active persons [4]. The formal employment rate is above 90%. The country exports tea, spices, medicinal plants and copra.

Major investments in infrastructure and social services have been made for decades, including free education and health care, social security for persons aged over 63 years, transport and rent control. Many Seychellois have felt significant price increases, perhaps in relation to various factors such as structural economic reforms implemented since the mid 2000s because of a large national debt, liberalization of the economy; liberalization of exchange rates; overhaul of the tax system; reorganization of the public sector and new regulations of the financial system.

The rapid socio-economic development and proactive social policies for several decades have enabled the country to achieve the first seven of eight Millennium Development Goals set by the UN in 2000 [5].

Since 2009, Somali piracy has been threatening tourism and fishing. Seychelles takes an active part in the military and judiciary aspects of the “Atalanta” operation to prevent and combat acts of piracy off the coast of Somalia.

Great natural wealth [6]

As many as 13 species of birds and 81 plants are endemic to the granitic islands, such the legendary “coco de mer” or Lodoicea maldivica (figure 2). To preserve these natural treasures, 40% of the land area is either protected or classified as national parks (figure 3).

Education

Education has long been under Catholic Church supervision, as a legacy of the French culture. English has been taught since 1944, and French is less used since independence. Creole pidgin (of French origin) has the status of an official language, along with English and French. Education is mandatory until the age of sixteen. The best students receive government scholarships to continue their studies abroad. The newly created university (University of Seychelles, www.unisey.ac.sc) offers courses in business administration, computing and information systems, in partnership with other universities. In addition to the university, there is a vocational school that offers full training in many technical and social areas (“polytechnic”). Only 6% of the population (mainly seniors) are illiterate, reflecting good education systems for several decades [4].

Health system organization and structure

According to the constitution of the country, access to health care is free for all Seychellois. The health system has three levels (primary, secondary and tertiary) with a strong emphasis given to primary care in 18 health centres. Health expenditures are shown in table 3.

The public provision of hospital care

With 211 beds, the Seychelles Hospital located in Victoria provides secondary and tertiary care (figure 4): intensive care unit, hemodialysis, oncology, imaging by CT and MRI, and a wide range of laboratory tests. There is also a psychiatric hospital (Les Canelles, 46 beds) and a rehabilitation center (North-East Point Hospital, 68 beds). The islands of Praslin and La Digue have their own small hospitals.

The private provision of care

There are approximately 10 private medical practices. The management of emergencies falls entirely under the public system. Institutions and health workers are shown in table 4.

Overall organization

The Seychelles belongs to the category of upper middle-income countries, which makes the country ineligible for international aid to low income countries. As an emerging country, Seychelles is, however, far from autonomous in the field of health. The good results in terms of indicators should not hide the fragility of the health system and increasing difficulties:

– The shortage of health medical professionals requires massive employment of foreigners from Cuba, China, Eastern

<table>
<thead>
<tr>
<th>Table 2. Economic Indicators</th>
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<tr>
<td>Indicators</td>
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<tr>
<td>GDP (million US$)</td>
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<tr>
<td>GDP per capita (US$)</td>
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<tr>
<td>GDP (in %)</td>
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<tr>
<td>Employment by sectors</td>
</tr>
</tbody>
</table>


Europe, India, Nigeria, Sri Lanka, etc.). Three-quarters of doctors are foreigners;
– The health expectations of the people are high. Knowledgeable or economically privileged patients increasingly go abroad for treatment, even when adequate treatment is available locally.
– Medical evacuations abroad for tertiary care that is not available in Seychelles (mainly to Chennai in India), are free, and bear a significant economic pressure.
– Several buildings have recently been or are currently being renovated, yet the patient housing conditions are often still quite far below Western standards.

Besides the cooperation with India, which currently handles the vast majority of tertiary care sought abroad, there is a medical cooperation with other countries, such as Réunion, in the field of oncology. Other collaborations exist, e.g., with Mauritius and China.

**Epidemiological profile and health status**

**Key health indicators**

The main health indicators are presented in table 5.

*Figure 3. Dipsochelys elephantine (Source: Philippe Durasnel).*

From 2005 to 2008, the five leading causes of hospitalization were: obstetrics and gynaecology (20.2%), infectious diseases (9.6%), respiratory ailments (9.4%), digestive problems (8.4%) and cardiovascular disease (8.3%). The longest hospital stays were due to obstetric-gynaecologic (19.9%), psychiatric (8.6%) and cardiovascular conditions (8.1%) [8].

**Epidemiological profile and health status**

**Infectious diseases with a large current or potential impact on public health**

- **Sexually transmitted infections**
  The prevalence of syphilis was 2.1% in 1956 [1]. While the prevalence per 10,000 tests performed (RPR / TPHA) was nil in 2008, it was 60 in 2010 and 44 in 2011. Gonorrhoea was detected in 1010 persons from January to September 2012, 16% of tests performed, of which 85% were men and 46% were aged 20-29 years. Chlamydia infections were diagnosed in 63 persons between January and September 2012, 15% of tests performed (men 73%, women 27%). Thirty-eight percent were aged 20 to 29 years. [9]

- **HIV / AIDS**
  The current prevalence is 0.4%, predominantly sexually acquired (84%). Prevalence among IV drugs users is 5.8%, with a high risk of comorbidity of HIV and HCV (hepatitis C virus). From 1987 to September 2012, 523 people were identified as positive for HIV, 58% male (M) and 42% females (F). Currently, 334 people (189 M / 145 F) are living with HIV. From 1993 to September 2012, the number of cumulative AIDS cases is 233 (142 M and 91 F), 61% of men and 39% women. During the same period, the cumulative number of deaths was 102 (62 M / 40 F).
From 1987 to September 2011, 88 pregnant women were found to be infected, of whom 63 received monotherapy or combination therapy with antiretroviral drugs. Before the implementation of the prevention of mother-to-child transmission, 9 of 25 children born from HIV positive mothers were infected (36%), versus 2 of the 63 children born after the implementation of prevention of mother-to-child transmission (3%). There were 182 cumulative cases (98 M / 84 F) receiving antiretroviral treatment since 2001 (54% M / 46% F). The HIV incidence was 3 per 1000 HIV tests performed from 2008 to 2009, 8 per 1000 in 2009, and 3 per 1000 in 2012.

**Viral hepatitis A and B**

In 1979, the seroprevalence of anti-HAV antibody was 90%, the anti-HBs 26.8%, anti-HBc 27.3% and anti-HBe 7.4% from 417 persons screened [10]. In a 1988 study comparing the prevalence among blood donors or in cohorts of patients in the Indian Ocean, the prevalence of hepatitis B virus was 34.5% and the prevalence of HBs antigen 1.2% [11]. In 1994, among 1006 adults aged 25 to 64 years, the seroprevalence of anti-HBe was 8%, three times lower than in 1979; higher in people with low levels of education and in alcoholics. The prevalence among men and women in the age group of 25-34 years and 55-64 groups was 7.0 / 3.1 and 19.1 / 13.4, respectively. This improvement is most likely due to socio-economic development and screening of blood donors since 1981. From 2008 to September 2012, 24 cumulative cases of hepatitis B were detected, including one case of co-infection HBV / HIV.

**Hepatitis C**

Whereas the prevalence of hepatitis C was low in 2004 [12], 256 cumulative cases of hepatitis C virus (HCV) screened positive between 2007 and September 2012 (209 men, 47 women). Sixteen were HCV / HIV co-infections (11 men and 5 women). The incidence of HCV in 1000 tests carried out between 2007 and 2012 increased by four times in 2008, 16 cases in 2009, 26 in 2011 and 47 between January and September 2012. This sharp increase in HCV cases is primarily related to intravenous drug use, which has emerged as a problem since the mid-2000s: out of 256 cases, 251 cases (99%) are related to injecting drug use (survey in 2012, results not yet published). There is no program to provide new syringes to injecting drug users, but a debate is underway on risk reduction measures to be adopted [9, 12]. It is crucial that risk reduction programs should be intensified, including the distribution of sterile needles. The growing use of hard drugs has clearly become a major public health concern, giving rise to both medical and social problems.

**Leptospirosis**

The incidence is high with 101 cases per 100 000, mainly in men. The Icterohemorrhagiae serogroup is the most common (55%), followed by the Hurstbridge serogroup (20%), which is
responsible for the severe forms associated with pulmonary hemorrhage and death [13]. In 2012 (weeks 1-39), 14 leptospirosis cases have been confirmed and 7 more suspected deaths without serological evidence (negative HLA) [9]. Rat control campaigns are conducted on a regular basis.

**Tuberculosis**

From 1979 to September 2012, 548 cases were confirmed with 25 deaths (389 men, 159 women). From 2000 to 2012 there was a cumulative total of 24 cases co-infected with TB / HIV. No case of MDR or XDR resistant TB has been reported [9]. The main indicators are reported in Table 6.

**Water-borne diseases**

Almost all households are connected to the public water supply. Gastroenteritis mainly affects children under five years, accounting for 2.1% of all medical consultations [9]. The prevalence of intestinal parasites in children (mainly whipworm, roundworm, hookworm), which was 92.3% in 1956 [1], declined dramatically after school education and deworming programs in the 1990s, access to potable water and improvement of the socio-economic status [14]. Previously, these intestinal parasites were an important source of anemia, malnutrition and poor performance at school [1, 14].

**Diseases preventable by immunization**

In 2011, no cases of the following reportable diseases have been recognized: diphtheria, measles, mumps, polio, congenital rubella syndrome, rubella and tetanus. One case of leprosy, 2 cases of whooping cough and 17 cases of tuberculosis [7] have been reported. The first case of infection with methicillin-resistant *Staphylococcus aureus* was detected in December 2009. Pneumonia strikes children in 80% of cases; 17 cases of hand, foot and mouth disease (HFMD) were suspected in 2012; the Coxsackie A16 virus was isolated from two specimens [9].

The only vaccine-preventable diseases reported to the WHO in recent years include pertussis (2 cases in 2010 and 5 cases in 2011); *Hemophilus influenzae* type B (Hib) meningitis (2 cases in 2010) and tuberculosis (17 cases in 2010). No cases of measles, polio or tetanus have been reported since 2000 and 99% of children are reported to be immunized with vaccines recommended by the Expanded Programme on Immunization: BCG, DTP3, HepB3, Hib3, MCV, Pol3. Routine immunization against hepatitis B was introduced in 1994 and in 2010 against Hib. Routine immunization against human papilloma virus, HPV, is planned to begin in 2014 among girls aged 11 years.

**Table 5. Life expectancy, mortality, major health indicators [4, 7].**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2012</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality rate per 1,000</td>
<td>6.90</td>
<td>6.10</td>
<td>7.70</td>
</tr>
<tr>
<td>Birth rate per 1,000</td>
<td>17.10</td>
<td>16.10</td>
<td>18.10</td>
</tr>
<tr>
<td>Births attended by health professionals (%)</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immunisation coverage in children aged &lt;1 year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immunisation coverage in children aged 1 year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neonatal mortality rate (per 1000 live births), 2010</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infant mortality rate (&lt;1 year) per 1,000 population</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality rate before age of 1 year per 1000 live births, 2010-2012</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality rate before age of 5 years per 1,000 alive births, 2010</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult mortality rate between age 15-60 for 1,000 alive births, 2010</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Table 6. Tuberculosis: key indicators.**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2000 (37)</th>
<th>2010 (31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence rate (per 100 000 inhabitants / year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence per 100 000 inhabitants / year</td>
<td>2000 (56); 2010 (48)</td>
<td></td>
</tr>
<tr>
<td>Screening rate for all TB types (%)</td>
<td>2000 (70); 2010 (64)</td>
<td></td>
</tr>
<tr>
<td>Successful treatment rate for positive cases (%)</td>
<td>2000 (82); 2010 (64)</td>
<td></td>
</tr>
<tr>
<td>Mortality rate (pour 100,000 inhabitants)</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

**Infectious diseases that are currently controlled**

- **Malaria**

The last indigenous case of malaria was reported in 1931 [20, 21]. *Anopheles gambiae* is present at Aldabra. Some imported malaria cases are however regularly diagnosed each
year (12 in 2012) [9]. The country has never seen – at least not since the 20th century – Japanese encephalitis, trypanosomiasis, leishmaniasis, schistosomiasis, yellow fever, malaria, yellow fever, rabies or cholera.

- **Lymphatic filariasis caused by Wuchereria bancrofti**
  As no new case has been reported recently, the 2011 WHO report does not mention the country as part of the global elimination program [22-24]. In 1982 the microfilaria index in Mahé was 3.6% among 417 individuals tested with an antigen extract Brugia pabangi. Other results showed that 17% of the population was exposed to W. bancrofti and 7% had specific antibodies.

- **HTLV-1 infection**
  Infection with Human T-Lymphotrophic Virus (HTLV-1) is the causative agent for adult T-cell leukemia/lymphoma (ATL) and tropical spastic paraparesis (TSP). In 1987, a survey showed a prevalence of 0.13% of the population. Among 21 patients with TSP, 14 belonged to the disadvantaged population [25, 26]. Among 1500 blood donors detected. No publication on the situation in Seychelles has been made. However, among the 1500 blood donors and a few hundred other patients tested each year, there are 3-6 positive tests. Around 5 cases of lymphoma related to HTLV-1 appeared since 1991. However, among 1500 blood donors and a few hundred other patients tested each year, there are 3-6 positive tests. Around 5 cases of lymphoma related to HTLV-1 appeared since 1991. However, among 1500 blood donors and a few hundred other patients tested each year, there are 3-6 positive tests. Around 5 cases of lymphoma related to HTLV-1 appeared since 1991. However, among 1500 blood donors and a few hundred other patients tested each year, there are 3-6 positive tests.

- **Smallpox**
  In 1888, a Seychellois disembarking from a ship from Zanzibar triggered a smallpox epidemic. Hundreds of people died. Mahé was quarantined and deprived of any supply from Mauritius for two years.

- **Leprosy**
  Leprosy was present in the 18th century, with deportation of lepers to Providence Atoll. In 1829, the British Government moved lepers to a less remote island, Curious Island. The first residents were former African slaves. From 1930 to 1978, 143 lepers were reported including 98 with the lepromatous form. The number of cases has sharply decreased since 1959, thanks to the use of dapsone, BCG vaccination and better socioeconomic conditions [28-30]. In 2007, the prevalence was 0.12 per 10 000. In 2011, one new case was detected.

### Non communicable diseases

- **Major non-communicable diseases (NCDs)**
  The increase of NCDs is linked to the aging of the population and behavioural factors, such as smoking, excessive alcohol intake, physical inactivity and unhealthy diet. The decrease in the consumption of traditional foods based on fish, rice, and tea in favour of fatty and/or sugary foods also partly explains the increase in NCDs [31, 32]. Main risk factors for NCDs are shown in table 7.

<table>
<thead>
<tr>
<th>Table 7. Average rates and prevalence of risk factors for NCDs in the population aged 25-64 years in 1989 and 2004. [33]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body mass index</strong></td>
</tr>
<tr>
<td><strong>Overweight, BMI ≥25</strong></td>
</tr>
<tr>
<td><strong>Obesity, BMI ≥30</strong></td>
</tr>
<tr>
<td><strong>Fasting glycemia ≥5.6 mmol/L</strong></td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
</tr>
<tr>
<td><strong>Treated for diabetes</strong></td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
</tr>
<tr>
<td><strong>HDL cholesterol &lt;1.0 mmol/L</strong></td>
</tr>
<tr>
<td><strong>Total cholesterol ≥5.2 mmol/L</strong></td>
</tr>
<tr>
<td><strong>Smoking cigarettes</strong></td>
</tr>
<tr>
<td><strong>Systolic blood pressure mmHg</strong></td>
</tr>
<tr>
<td><strong>Diastolic blood pressure mmHg</strong></td>
</tr>
<tr>
<td><strong>BP ≥140/90 mmHg or treatment</strong></td>
</tr>
<tr>
<td><strong>BP ≥140/90 mmHg</strong></td>
</tr>
<tr>
<td><strong>BP ≥160/100 mmHg</strong></td>
</tr>
<tr>
<td><strong>Treated for BP</strong></td>
</tr>
<tr>
<td><strong>Alcohol (ethanol)</strong></td>
</tr>
<tr>
<td><strong>Consuming home brews</strong></td>
</tr>
<tr>
<td><strong>Total ethanol &gt;60 mL/day</strong></td>
</tr>
</tbody>
</table>

*p<0.05*
cases stays constant because of the aging of the population over time. Some risk factors have increased in the population (obesity, diabetes, metabolic syndrome); other risk factors are stable or slightly decreasing (hypertension, hypercholesterolemia). Smoking has decreased significantly [35-37]. CVs accounted for 10% of all admissions and hospital days. Stroke mortality remains high (about 100/100,000), and is twice as high as the mortality from coronary heart disease [38], consistent with high blood pressure in the population despite fairly high cholesterol levels in the population. The predominance of stroke versus coronary heart disease contrasts with the inverse epidemiological situation in Europe, but is consistent with the picture seen in most middle-income countries and neighbouring African nations.

Twenty years ago, a significant number of cases of CVD were linked to alcohol intake and vitamin B1 deficiency (shoshin beriberi) [39], mainly among low socio-economic level males and in heavy drinkers of local alcohol, compounded by the fact that the traditional diet (polished rice, fish) was low in vitamin B1 [40]. Nowadays, vitamin B1-deficient cardiopathy is rare due to the gradually decreased consumption of “home-brew” alcohol beverages and to a more varied diet, which is richer in vitamins and nutrients.

Once common in the past, rheumatic heart disease has now almost disappeared, probably mainly due to the rapid socio-economic progress and routine treatment of febrile children with antibiotics.

### Hypertension

The prevalence of hypertension is high (table 7) but stable over the last decade. In 2004, 64% of hypertensive patients knew they were hypertensive, 93% of them were treated and 34% of them had controlled [38] pressure. The prevalence of hypertension in children has decreased, despite a sharp increase in obesity [41]. The decreasing age-adjusted prevalence of hypertension and hypercholesterolemia is due to various factors: a shift from palm oil to other healthier vegetable oils, increased consumption of fruit and vegetables [31], fairly low salt consumption, and increased use of medical facilities with almost 20% of adults with hypertension now under treatment [42] and increasing proportions under statins.

### Overweight

The prevalence of obesity is high (table 6) and has increased over time in all categories of sex and age. The prevalence is as high as 20% in children and adolescents and is continuing to increase [36, 37, 42]. The prevalence of overweight is higher in men with high than low income, but lower in women with high than low income.

### Diabetes and metabolic syndrome

The prevalence of diabetes, mostly type 2, increased by 50% between 1989 and 2004, with a prevalence of 10-15% in the population aged over 35 years [36]. The prevalence of pre-diabetes affects another 10-15% of the population. Half of all cases of diabetes can be attributed to excess weight [43]. Diabetics account for a third of the hundreds of people currently undergoing hemodialysis (while more than half of all hemodialysis cases are due to hypertension) and this consumes about 20% of the health budget. In 2004, half of diabetics knew they had diabetes and almost all were under treatment [38]. However, only a minority of diabetic patients had their glucose levels, cholesterol or blood pressure adequately controlled [27].

The prevalence of metabolic syndrome was 20% in adults [44]. As observed in developed countries, the distribution of several risk factors (hypertension, smoking, diabetes) has shifted to disadvantaged populations, a new challenge for health policy makers [45].

### Cancers

According to the Seychelles National Cancer Registry in 2010, 131 new cases of cancer were reported and 93 people died. The most common cancers are (per 100,000 population): prostate (27), breast (19), lung (15), colorectal (13), oropharyngeal (11), uterus and cervix (7), pancreas (7) and liver (7). It is planned to introduce immunization against human papillomavirus (HPV) for eleven year old girls in 2014. This is a key measure for the prevention of cancer of the cervix. Screening for cervical cancer by Pap smear is offered every two years to all sexually active women. Breast examination is also expected to be performed on these occasions and mammography screening is recommended for women at risk, particularly those who have a family history of cancer.

### Diseases related to alcoholism

Alcohol consumption is shown in table 7. Consumption is particularly high in men [43] and there is a fairly large social tolerance of overindulgence [46]. Total consumption has decreased over the past 20 years, especially the amount of “home brew” consumed (e.g., palm toddy and fermented sugar cane). Conversely, the consumption of marketed alcoholic beverages, including beer, has increased slightly [46].

### Smoking

The high smoking rates seen among men in 1989 have substantially decreased and this is probably an important factor in the observed reduction in age-adjusted CVD and total mortality. Effective prevention programs are probably responsible of the decreasing smoking rates: high tax on cigarettes, a ban on smoking in public places and indoor workplaces, a total ban on advertising and promotion of tobacco products, etc. In 2003, the Seychelles was the first country in Africa and the fifth in the world to ratify the WHO Framework Convention for Tobacco Control (FCTC). Tobacco control in Seychelles is a great public health success [38, 47, 48], but smoking remains common among young people and control programs must be further strengthened. In 2006, 30% and 21% of boys and girls aged 13-15 years smoked at least one cigarette per month, nearly 50% consumed alcohol at least once per month and 17-18% had ever used cannabis [49].

### Mental health

The most often encountered mental illneses are schizophrenia, manic-depressive psychosis, alcoholic psychoses, neu- roses, and depression. Alcohol abuse is common, as noted above. A high-level national committee for alcohol control has been task to design and implement effective programs and policies.
• **Hemoglobinopathies**

The prevalence of sickle cell disease is low with less than 1.5% in 1956 [1]. Hemoglobinopathies are not a major public health problem in the Seychelles, despite the majority African population.

• **Genetic diseases**

The most common monogenic disease is autosomal dominant polycystic kidney disease. With about one carrier of the genetic defect per 500 people, the prevalence is as high as in Europe and much higher than observed in Africa, where the disease is rarely found (perhaps because it is not looked for effectively). Seychelles cases are nearly all Caucasians who originated from a white family who immigrated to Seychelles from Mauritius in 1864 [50].

• **Ciguatera poisoning and other sea animals’ intoxication**

Poisoning by sea fish is very rare, although fish is widely eaten. Two forms of poisoning have been identified and are most often associated with people who have travelled to the remote islands: tetrodon (puffer fish) poisoning and hallucinogenic poisoning caused by Siganidae (rabbit fishes or spinefoots). Ciguatera was observed once in the Amirantes Islands in 1952. In 2006, cases of ciguatera have been reported after ingestion of fish caught in Farquhar. However, fishing on increasingly remote beaches may be expected to result more frequently in ingestion of toxic fishes [51, 52].

• **Mercury and impact on neurodevelopment**

Mercury is considered particularly toxic to the developing nervous system of the human foetuses and infants. It accumulates mainly in large predatory fishes: tuna, sharks and swordfish. A prospective study ongoing since 1989 on 779 mothers and their children shows no neurological impairment of children’s neurological systems, unlike the situation in Denmark’s Faroe islands. The difference would seem to be that the Seychelles are less contaminated by pollutants or other toxic metals from industrial areas [53].

**Accidents and external causes**

There were two fatal shark attacks in August 2011 on the beaches of Praslin, but there had been no fatalities reported over the previous 20 years. External causes of mortality are significant, including road traffic accidents (RTAs) or drowning, some related to alcohol abuse, but accidents of voluntary origin (hanging, stabbing, poisoning by organophosphate) are also reported. The frequency of external causes of death compared to other populations is currently being assessed.

**Discussion**

Along with favourable socio-economic development that contributes to public health successes, the Seychelles are actively fighting against infectious diseases and against NCDs, producing significant achievements, including high life expectancy [54].

Several pathologies that were frequent 10-20 years ago have almost disappeared (malnutrition, intestinal parasites). While several potentially threatening infectious diseases are controlled or contained, the threat of new epidemics of infectious diseases (e.g., dengue, chikungunya and malaria) remains real, especially in the presence of available vectors and the high population density in a tropical island setting. This requires maintaining a high-quality health monitoring system and adequate epidemics preparedness.

Diseases associated with advanced stages of the epidemiological transition are now responsible for the vast majority of morbidity and mortality. The decrease of 3% per year of the age-adjusted CVD rates suggests that the peak of the epidemic of CVD may have passed. However, the aging of the population and “modern” life styles are expected to lead to an inexorable increase in chronic and degenerative diseases producing major challenges to the health system. A unit to fight against cardiovascular disease has been operational in the Ministry of Health since the late 1980s and the NCD section in the Ministry of Health, now in the Public Health Department, is expanding to address increasing numbers of tasks and programs. Information and prevention campaigns have been conducted over the past twenty years, and the population is well aware of the need for healthy lifestyles. A global plan of action for the prevention and control of NCDs is being drafted by a national multisectoral committee. The programs against NCDs can be considered a model for other developing countries [48]. However, the obvious increase in the total burden of NCDs, largely related to the aging population, raises multiple challenges for the health care system and for the provision of adequate funding for the National Health Service. Also, other modern health problems such as drug abuse have become more prominent. It will be impossible to claim success in the control of hepatitis C, AIDS and other complications among injectors, unless risk reduction policies are implemented.

**Perspectives**

In the southwest Indian Ocean, Seychelles, Reunion and Mauritius stand out clearly from Madagascar and the Comoros, countries that have not yet completed their epidemiological transitions. However, the Seychelles face many problems specific to small island states: geographic isolation, small population size, reduced international cooperation, etc. This raises several challenges including training and retention of health professionals in sufficient numbers; procurement and maintenance of sophisticated and expensive equipment for small cohorts of patients, and degenerative diseases requiring increasingly expensive and complex long-term care.

In this context, prevention is paramount. Strong public health measures (structural, legislative and commercial) are needed to promote physical activity, reduce tobacco and alcohol use, limit salt, sugar and saturated fats in foods, as well as to further promote safe sex practices and risk reduction among drugs users. These measures require close collaboration between the private sector and civil society, good monitoring mechanisms and deliberate focus on cost effective therapeutic interventions. Politicians and health policy makers are well aware of these issues and there are active discussions on the future development of the health system and other measures outside of the health care system to reach these objectives in the Seychelles. A high quality information system is also of
paramount importance in order to monitor the epidemiological situation and guide adequate responses to known problems (e.g. NCDs, HIV), new issues (e.g. substance use) and the continued threats from a variety of potentially epidemic infectious diseases.

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References


