

Cardiovascular Disease and Associated Risk Factors in Cuba: Prospects for Prevention and Control

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Objectives. An adequate description of the trends in cardiovascular disease (CVD) is not available for most of the developing world. Cuba provides an important exception, and we sought to use available data to offer insights into the changing patterns of CVD there.

Methods. We reviewed Cuban public health statistics, surveys, and reports of health services.

Results. CVD has been the leading cause of death since 1970. A 45% reduction in heart disease deaths was observed from 1970 to 2002; the decline in stroke was more limited. There are moderate prevalences of all major risk factors.

Conclusions. The Cuban medical care system has responded vigorously to the challenge of CVD; levels of control of hypertension are the highest in the world. Nonindustrialized countries can decisively control CVD. (*Am J Public Health*. 2006;96:94–101. doi:10.2105/AJPH.2004.051417)

Cardiovascular disease (CVD) is now recognized as an important public health problem for many nonindustrialized countries.^{1–4} Increasing death rates and prevalences of risk factors have been observed in Asia, Africa, and South America, leading to dire predictions about the size of the coming epidemic.^{1,3,4} In most industrialized countries, on the other hand, the rapid declines in CVD continue,^{5–8} demonstrating the effectiveness of current strategies for prevention and control. Whether any of these strategies can be applied with equal success in nonindustrialized countries is not known. The process of adaptation will clearly face many difficult challenges, including the need to strike a balance between primary prevention and reliance on medical care to treat affected patients.

As in any area of public health, surveillance systems are essential for helping countries define the scope of the CVD epidemic and develop appropriate local strategies.^{9,10} Unfortunately, almost without exception, the epidemiological data that are required for an accurate description of the trends in mortality and causal risk factors at a national level are not available in poor countries. Within the general framework of the ongoing global health transition, whereby infectious diseases and malnutrition are replaced by chronic CVD and cancer,¹¹ it is still unclear whether most

developing countries will simply recapitulate the epidemiology of CVD observed in North America and Europe or whether the transition will display distinct new varieties shaped by regional culture and geography, or even by the economic models that have been adopted. Tropical island countries and indigenous peoples in the Americas, for example, have typically been confronted with severe epidemics of diabetes at the onset of the health transition, rather than coronary heart disease (CHD), as was the case in the United States and Europe.¹² Other countries, such as India, struggle with persistently high rates of infection and undernutrition along with CVD.^{1–3,13}

Cuba occupies an unusual position in the nonindustrialized world. The political and economic path of development is based on the ideology of revolutionary socialism.^{14,15} As part of the state's commitment to collective welfare, a sophisticated and comprehensive public health sector has eliminated epidemic infectious diseases and reduced infant mortality to 6.3 per 1000.^{16,17} With the extension of life expectancy to 76 years and the rapid growth of the population aged older than 65, the potential for a large disease burden from CVD and other chronic diseases has likewise increased. A further essential condition for a high prevalence of atherosclerosis is the transition of the majority of the population into a lifestyle made

possible only by industrial technology. The productive capacity of Cuban society as a whole is very modest, however—average annual income is variously estimated as \$1000 to \$5000 per year, and access to consumer goods is limited.¹⁵ Whereas Cuba's cultural orientation over the last century has been primarily toward Spain and the United States,¹⁸ in terms of personal consumption patterns—ranging from the reliance on convenience meals to the availability of private cars—a wide gap currently persists between material conditions on the island and those found in North America and Europe. No precedents exist on which to predict the burden of CVD that would emerge from such a mixture of factors. Whereas CVD among the elite in many developing countries is well recognized, the dispersion of the disease throughout the general population has not yet been described. Because the Cuban health system produces complete and accurate statistical data on both vital events and health services, it should be possible to describe the process there in substantial detail.

Our review was undertaken with several purposes in mind. First, we set out to determine whether the data resources available from Cuba would actually make possible a comprehensive description of the current state of the CVD epidemic and a characterization of the secular trends in a nonindustrialized country. Second, we wanted to assess the response of the public health and medical care systems to the emergence of CVD as the most common cause of death. Finally, we hoped to place the Cuban situation in the context of its closest geographic neighbors, the other Caribbean countries, and to compare the situation in Cuba with that in North America and Europe through use of available data from the latter 2 regions. Results of these analyses should make it possible to assess the unique strengths and weaknesses of the Cuban experience, the extent to which this experience can be attributed to the model of economic

development that was adopted, and its implications for other nonindustrialized countries.

METHODS AND MATERIALS

Cuba, the largest of the Caribbean islands, was estimated to have a population of 11 250 979 in July 2002.¹⁹ The fertility rate as of 2002 was 1.6 children per woman and the average annual growth rate of the population was 0.14%. Within the unified public and medical care system, there are 31 059 family physicians supported by local polyclinics and regional hospitals.

For this study, information on vital events, spanning the period 1970 to 2002, was obtained from the annual statistical reports of the Ministry of Public Health in Havana.¹⁶ Vital records are essentially complete, and in at least some regional hospitals there is a high rate of postmortem examination (about 85%), thus assuring that assignment of cause of death is accurate.²⁰ During our study period, mortality was coded to *International Classification of Diseases, Eighth Revision (ICD-8)*,²¹ *ICD-9*,²² and *ICD-10*,²³ with appropriate adjustments. The *ICD-10* codes are as follows: heart disease, I05 to I52; coronary heart disease, I20 to I25; hypertensive heart disease, I10 to I15; stroke refers, I60 to I69. Secular trends were analyzed through use of data adjusted by the direct method to the population structure of Cuba in 1981. Age-specific data for trends in CHD were available only for persons aged 45 to 79. The statistical significance of the trends in mortality was tested through linear regression modeling.

Data on incidence and survival are limited to hospitalized cases, and, like the health services data, were available primarily from the province of Cienfuegos. Cienfuegos is located on the south coast of the island, approximately 125 miles southeast of Havana. The provincial capital was founded in 1819 by settlers from French Louisiana. Historically, the flat lands of the surrounding region have been used for the production of sugar.

One of the smallest of Cuba's provinces, with a population of 399 000 in 2002, its demographic structure approximates that of the island as a whole. Heart disease death rates in Cienfuegos were also similar to the national average in 2002 (178 per 100 000 and 170

per 100 000, respectively). In-patient medical care is provided by a single institution, Hospital Universitario "Dr. Gustavo Aldereguia Lima," which also serves as the teaching hospital for the provincial medical school. Basic indicators are abstracted from medical records and entered into a system that includes comprehensive data for the whole province. Hospitalized cases were used to approximate incidence rates for cardiovascular conditions requiring in-patient care. One of the authors (M.D.I.F.) supervised the abstraction of data on cardiovascular cases from clinical records in the emergency room and the intensive care units. A diagnosis of acute myocardial infarction was made on the basis of clinical history and characteristic electrocardiographic findings; diagnosis of stroke was based on clinical findings, with increasing use of computed tomography scanning over the last decade.

Individual-level risk factor data were obtained from sample surveys. A comprehensive literature search was conducted in the Cuban and external literature. Sources were chosen for presentation if they included an appropriately large sample size, were population based, and reported enough information on methodology to allow evaluation of the quality of the data collection process. Risk factor surveys repeated over time that used standardized, comparable methods were not available. Two comprehensive national risk factor surveys have been completed in Cuba in the last decade; unfortunately, however, only preliminary results are available, and they are not appropriate for this report.

RESULTS

Mortality

The distribution of the leading causes of death in Cuba in 2002, the most recent year for which final statistics are available, is summarized in Table 1. Of the 73 000 deaths recorded in that year, 19 000 were coded to heart disease (26%). Total CVD (in which we include heart disease, stroke, and other unspecified diseases of the arteries and veins) accounted for 41% of all deaths. The male-to-female ratio of deaths from CVD was 1.1 to 1.0.

CHD accounted for 73% of reported cases of heart disease. Hypertensive heart disease represented the second most common diagnostic category. Rheumatic fever had virtually disappeared, and the number of deaths from chronic rheumatic valvular disease was extremely low. Heart disease was 40% higher in urban areas than in rural areas, with the highest rates observed in the city of Havana. In 2000, it was estimated that 11 potential years of life per 1000 persons were lost as a result of CVD, ranking second behind cancer.¹⁶

Heart disease has been the leading cause of death in Cuba since at least 1970, when the current time series of age-adjusted data begins. The secular trend in heart disease mortality since 1970 has followed an uneven downward course (Figure 1). Rates declined moderately over the period 1970 to 1980 (1.5% per year), declined slightly over the following decade (0.2% per year), and entered a more rapid phase of decline in the 1990s, particularly in the latter half of the decade

TABLE 1—Ten Leading Causes of Death (Age Adjusted, per 100 000): Cuba, 2002

	Mortality Rate			%
	Men	Women	Total	
1. Diseases of the heart	195	174	185	26
2. Cancer	168	131	150	21
3. Stroke	71	73	72	10
4. Influenza/pneumonia	66	58	62	9
5. Accidents	53	34	43	6
6. Diseases of arteries, veins	37	36	36	5
7. Chronic obstructive pulmonary disease	27	22	25	4
8. Suicide	22	8	15	2
9. Diabetes mellitus	9	18	14	2
10. Cirrhosis, liver disease	12	6	9	1
Total				86

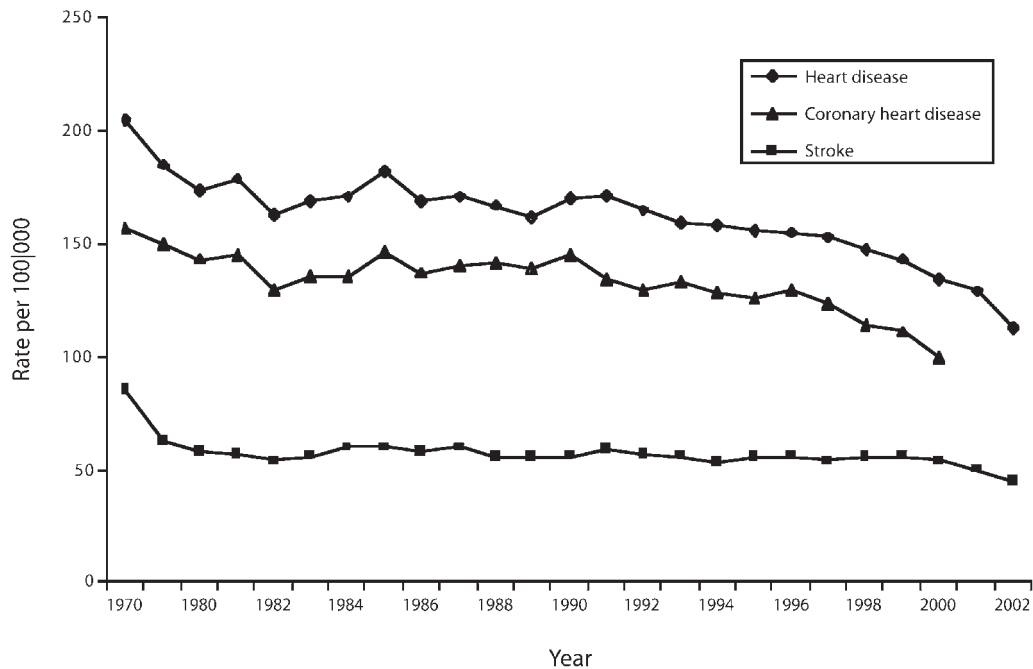


FIGURE 1—Age-adjusted trends in mortality from cardiovascular disease: Cuba, 1970 to 2002.

(2.0% per year). The age-adjusted mortality from heart disease in 2002 was 45% lower than in 1970. As the dominant cause of death from heart disease, CHD has been responsible for the observed trends (data not available for 2001 and 2002). From the 1980s to the 1990s, among persons aged 45 to 79, age-specific death rates from heart disease declined by approximately the same percentage in each age (data not shown).

Contrary to the trend for heart disease, mortality from stroke declined very slowly until the most recent 3-year period (Figure 1). Given these patterns, stroke now accounts for a slightly increased proportion of all deaths from CVD (25% in 1980 and 28% in 2001).

To determine rates of change, regression models were constructed for each of the mortality categories over 2 time periods: 1980 to 1991 and 1992 to 2002. For heart disease, CHD, and stroke, the rate of decline in the first period was not significantly different from zero; however, for each of the categories the decline was highly significant in the period after 1992 ($P < .01$).

Incidence and Survival

Incidence and survival data are available from a single defined catchment area, Cienfuegos

Province, which is served by Hospital Universitario “Dr. Gustavo Aldereguia Lima” in Cienfuegos. The number of admissions for both acute myocardial infarction and stroke doubled over the period 1990 to 2003 (Figure 2), reflecting in part the increasing average age of the population. It is not possible, however, to determine whether the rising incidence reflects a greater number of new events or increased access to hospital care, although an aggressive program was conducted to increase awareness of signs and symptoms. Over this same period, the case fatality rates declined 40% to 50%. This rapid decline suggests that less severe cases were being admitted, although the quality of care was also improving, leading to better survival. Over this period, for example, thrombolytic therapy became widely available and prehospital treatment units were created.

Circulatory disorders make heavy demands on the health system. In 2002, they represented the third most common reason for hospitalization, being coded as the principal diagnosis on 8.7% of all admissions.

Risk Factors

Hypertension. The number of cases of hypertension is difficult to estimate given the requirement that measurement procedures be

highly standardized.¹⁰ The opportunities for surveillance have been greatly enhanced in recent years, however, with improvements in survey technique. A survey from Cienfuegos completed in the period 2001–2002 provides results of sufficient quality for external comparisons.²⁴ The survey used a population-based sampling scheme, by which 1667 persons aged 15 to 74 were enrolled. The crude prevalence of hypertension—defined as either systolic blood pressure greater than 140, diastolic blood pressure greater than 90, or treatment—was 25% (95% confidence interval [CI]=23%, 27%; men=27%, women=23%). Mean systolic/diastolic blood pressure was 119/74 mm Hg. As in a similar previous study of hypertension in Cuba,^{25,26} smaller differences were observed between Blacks and Whites in this survey than in the United States. Mean blood pressure levels in the Cienfuegos survey are virtually identical with results from the US National Health and Nutrition Examination Survey III (1988–1994).²⁷ A recent review of national surveys in North America and a sample of European countries yielded the following comparison of hypertension prevalence for the population aged 35 to 64: for Cuba, men = 36%, women = 32%, total = 34%;

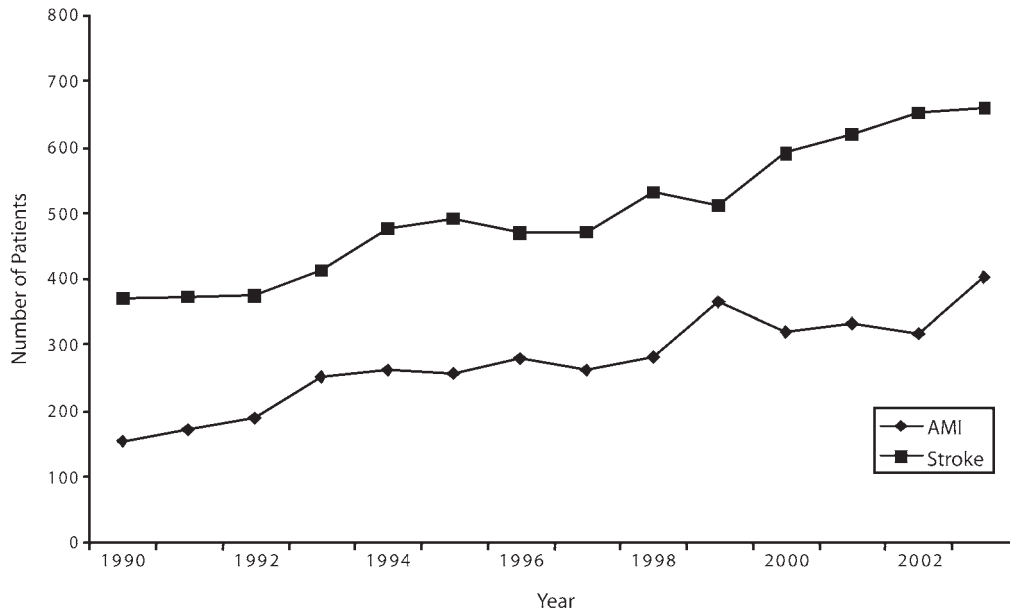


FIGURE 2—Trends in the number of patients hospitalized with acute myocardial infarction (AMI) and stroke: Cienfuegos Province, Cuba, 1990 to 2003.

for the United States/Canada, men=30%, women=25%, total=28%; for Europe, men=50%, women=38%, total=44%.²⁸

The Cuban health system has developed a highly effective strategy for the management of patients with hypertension. On the basis of reporting from the primary care network, 18% of the entire population was under the care of a physician for hypertension. In the recent Cienfuegos survey, 39% of persons aged 35 to 64 with hypertension were taking medications and had systolic/diastolic blood pressure lower than 140/90.²⁴ These results indicate that levels of treatment and control in Cuba are the highest that have been achieved anywhere in the world, comparing favorably with rates in the United States (29%), Canada (17%), and Europe ($\leq 10\%$).²⁹

Smoking. Among CVD risk factors, cigarette smoking represents the most urgent challenge for Cuba. The cultivation of tobacco is an important chapter in Cuba's history, and cigars are still a source of export earnings. Within the country, however, cigarettes are used by 95% of regular smokers. Current rates of daily tobacco use are 40% among men, peaking at 60% in middle age.²⁴ At younger ages, women have rates similar to those of men; however, there is little increase with age, and the average prevalence is around 25%. There is some evidence of a

decline in the last decade—in Cienfuegos, the rates in 1992 were 44% for men and 33% for women.³⁰ A study of the elderly provides comparable survey data for Cuba and other Latin American and Caribbean countries. Whereas 32% of Cubans older than 60 were current smokers, the rates in other countries were substantially lower: Barbados, 6%; Argentina, 14%; Mexico, 18%; Brazil, 16%; Chile, 13%; Uruguay, 16%.³¹

Hypercholesterolemia. Relatively limited survey data are available on serum lipids from population studies in Cuba. In a population survey in the early 1990s, mean levels of total cholesterol in a sample of 1660 persons aged 15 to 74 were 160 mg/dL in men and 170 mg/dL in women.³⁰ Elevated serum cholesterol (>200 mg/dL) was present in 12% of men and 14% of women. These data were collected during the so-called "special period," however, when food shortages were widespread, and may not be typical of the current situation.

Obesity. Obesity occurs less frequently in Cuba than in many other countries. The mean body mass index among adults in the Cienfuegos survey was 25 (SD=4), and the prevalence of obesity (body mass index >30) was 14% for women, 8% for men, and 11% in the total population.²⁴ Current rates of obesity are 20% in the United States and

15% in Canada. No differences in obesity were found by educational level or between Blacks and Whites.²⁵

Diabetes. Over the last 20 years, 2 community surveys using oral glucose tolerance testing have been conducted in Cuba. In Santiago in 1987, a total of 500 people (>15 years) were enrolled in a study that yielded a diabetes rate of 4.6 per 100.^{31,32} In Havana, a crude rate of 14.8 per 100 was recorded in 1998 among 250 people older than 65.³³ Case definitions for both studies were based on 1985 World Health Organization criteria (i.e., fasting glucose >140 mg/dL). In age-adjusted comparisons of the Havana data with data from other Latin American and Caribbean countries, rates in the latter grouping were generally higher (Barbados, 16%; Mexico, 10%–15%; Jamaica, 13%).³⁴

Data are also available from a multinational survey of Latin American and Caribbean countries of persons aged older than 60. The prevalence of self-reported diabetes in Havana was 15 per 100, compared with 22 per 100 in Barbados and Mexico and 12 and 13 per 100 in Argentina and Chile, respectively.³¹

Physical inactivity. For much of the Cuban population, physical activity is enforced by limitations on mass transportation or lack of mechanized equipment. Among respondents to the Cienfuegos survey, 93% reported

engaging in moderate activity during several days of the week and 30% reported vigorous physical activity.³⁵ A small study employing stable isotopes to measure levels of nonresting energy expenditure (i.e., physical activity) documented high levels of physical activity (1.8 times resting metabolic rate) among children in a rural mountain area.³⁵

Diet. Formal nutrition epidemiology studies focused on CVD were not identified. Traditionally, Cubans have derived a large proportion of their calories from rice and beans, with a preference for pork and beef when available. The downturn in the economy in the 1990s was associated with serious food shortages. From 1991 to 1994, mean caloric intake was reduced approximately 20%.³⁶ The virtual disappearance of animal protein and fresh vegetables led to severe deficiencies of micronutrients and the occurrence of an associated neurological disorder.³⁷ As a result, national programs to increase local gardening were initiated, and availability has improved markedly in recent years.

Consumption of vegetables is still low, however; in a recent survey, daily intake was reported by only 5% of respondents and weekly intake by 47%.²⁵ On the other hand, fruits were eaten at least daily by a third of the population and at least weekly by 50%. No data are available on levels of salt intake.

Cardiovascular Disease in Cuba in an International Context

Comparisons of death rates within the Caribbean are constrained by the limitations of available data. The Pan American Health Organization serves as a data repository and provides age-adjusted rates for most countries^{38,39}; however, a review of published data from the English-speaking islands reveals many deficiencies. Vital statistics from the largest of them (Jamaica and Trinidad) are incomplete or inconsistent; the smaller islands, on the other hand, have too few deaths to produce stable rates.

Nonetheless, on the basis of available data, Cuba has lower rates of total CVD than the other Caribbean countries, particularly for stroke and diabetes (Table 2). Stroke is the most frequent cause of death in Jamaica and Barbados, as well as in the English-speaking Caribbean as a whole. CHD is the leading

TABLE 2—Death Rates (Age Adjusted, per 100 000) for Cardiovascular Disease and Diabetes: Cuba and Selected Countries, Late 1990s

	Cardiovascular Disease				Diabetes
	Stroke	CHD	HHD	Total	
Cuba	48	105	8	161	15
Argentina	48	44	9	102	16
Barbados	82	56	12	149	67
Jamaica	121	72	45	237	84
Trinidad	95	151	32	278	108
USA	27	86	8	121	14
Canada	24	78	2	104	10

Note. CHD = coronary heart disease; HHD = hypertensive heart disease.

Source. Pan American Health Organization.³⁸

cause of death only in Trinidad.³⁸ Perhaps most striking, diabetes is reported as a cause of death much more frequently in other parts of the Caribbean than in Cuba, and it exceeds CHD as a cause of death in Jamaica and Barbados. Of course, death certificate data are not generally a useful measure of the burden of diabetes, and some important variation in coding practices must exist. Nonetheless, these trends are supported by the survey data on the population prevalence of diabetes.³⁴ Reliable trend data on CVD from the English-speaking Caribbean are not available.

In contrast to the wide variation seen between Cuba and the rest of the Caribbean, both the overall mortality structure and the pattern of CVD in Cuba resemble those in Canada and the United States to a remarkable degree (Table 2).^{40–43} On a variety of measures—including the levels of both stroke and CHD, the urban-to-rural pattern of prevalence, the rising incidence and decreasing case fatality of acute myocardial infarction, and the predominance of smoking as the key risk factor—Cuba mimics exactly the picture seen in the United States in the late 1960s, at the beginning of 3 decades of rapid decline in mortality from CVD.⁴²

DISCUSSION

Cardiovascular Disease in Cuba

The CVD epidemic has reached full maturity in Cuba, where it accounts for 40% of deaths. Heart disease, the predominant component, is

the underlying cause of two thirds of CVD deaths. At present, considerable progress is being made to reduce the mortality burden. Over the last decade, death rates from heart disease declined at a rate of 1% to 2% per year, which is close to the maximum rate practically achievable for most countries. The recent onset of the decline in death rates for stroke suggests that the impact of high levels of treatment and control of high blood pressure is just now being felt. True incidence data for acute myocardial infarction and stroke are not available, although hospitalization rates, as a proxy measure, continued to increase over the last decade. This latter trend probably reflects a combination of the increasing average age of the population, improvements in ascertainment and referral of cases, and declining case fatality leading to longer survival.

By contrast, in the English-speaking Caribbean, stroke is the most commonly reported cause of death, although in at least one country CHD has risen to first place. Insufficient data were available to characterize the secular trends in CVD anywhere in the Caribbean. The pattern of CVD in Cuba deviates little from the trend seen in Europe and North America, where CHD is also falling at a rate of 1% to 3% per year.^{5,8,40–45} After a long period of precipitous decline, stroke rates have leveled off in several industrialized countries, including the United States and Japan, although this has occurred only after the rates reached considerably lower levels than are currently observed in Cuba.^{43,44,46} If one assumes comparable coding methods, the absolute levels of CHD and stroke in Cuba at this time are very close to what is currently observed in Europe, and are higher than in the United States and Canada.

The Cuban diet, which tends to lack variety, does not include a large percentage of calories from animal products or atherogenic fats. Consequently, the reported serum cholesterol levels in the general population are below those observed in most industrialized societies. As noted, blood pressure levels and prevalence of hypertension are virtually identical to those of the United States, and with very high levels of treatment, few persons have severe untreated elevations in blood pressure. Cuba manufactures most of the important classes of drugs used in the treatment

of hypertension, and provides them at minimal cost to the patient. Given restrictions on patents and sales, statins are not available for the treatment of hypercholesterolemia; however, other classes of drugs are being developed and used.⁴⁷ Of paramount concern, Cuba has continued its “special historical relationship to tobacco” and suffers from relatively high smoking rates, although they are well below rates in Asia. The population attributable risk from smoking for all causes is currently around 20%, and it is substantially higher for CVD. Although the description of diabetes is incomplete, its prevalence is clearly lower than in other Caribbean countries, in keeping with Cuba’s higher levels of physical activity and only moderate levels of obesity.

Prospects for Control

Atherosclerosis of the coronary arteries, now the predominant form of CVD, is a highly preventable disorder. On the basis of accumulated knowledge of preventive and therapeutic interventions, the potential exists to eliminate CVD as a common illness (i.e., reduce the burden to less than 2%–5% of deaths). A comprehensive description of the causal sequence leading to CVD is available, providing firm guidance for policy. It is now estimated that 80% of CVD deaths are occurring in developing countries,³ signaling a fundamental shift in the global priorities for control. Given their resource base and the character of their risk profile, these countries must tailor their response to take best advantage of opportunities for preventing the development of risk factors, treating individuals who have already developed risk factors, and prolonging life among symptomatic patients.

In Cuba, the public health system combines without distinction communitywide activities, such as sanitation and vaccination, and medical care delivered to individuals. This approach has both strengths and weaknesses. So-called “intersectoral approaches” are easier to organize when barriers are eliminated between large-scale prevention and curative medicine, not to mention those separating the public and private systems. On the other hand, it may be hard to strike the appropriate balance between sectors, and there is always the risk that technology-based solutions will crowd out less sophisticated prevention campaigns.

Cuba has had remarkable success in controlling infectious diseases—it was the first country in the world to eliminate polio and measles (using the strategy that subsequently became the basis for the worldwide campaign), it maintains the most effective dengue control program in the Americas, and it has very low rates of HIV/AIDS.^{48–50} The principle ingredient of these successes has been the strategy of community mobilization. On the other hand, there has been a tendency to “medicalize” the approach to chronic adult illnesses, principally CVD and cancer.⁵¹ Paradoxically, the successes in reducing infant mortality and lengthening life are themselves often attributed to advances in medical care, when the provision of the basic necessities of life to the entire population must have played a crucial, if not predominant, role. The pursuit of equity and inclusiveness should therefore be seen as the basis for Cuba’s success in many areas of human development, including health.

Access to high-quality health care for the entire population has been one of the most important political goals of the Cuban state; for CVD, in particular, it appears to have dominated the public health approach at the expense of health promotion through control of tobacco and improvement of the diet. The combination of the highest rates of pharmacological control of hypertension in the world and continued high rates of smoking is clear evidence of this imbalance. This is not to say that health promotion aimed at chronic disease is absent, simply that the campaigns lack the enthusiasm and vigor that has made other health interventions so successful. For example, prohibition of smoking in public places is widely ignored.

Cuba has achieved a great deal with an annual health budget of less than US\$200 per capita; nonetheless, it will clearly be impossible to meet all the economic demands imposed by contemporary technology-based medical care. Fortunately, CVD prevention is both highly effective and cost-effective, particularly in a society with centralized controls and an absence of powerful private interests. The unique strengths of the Cuban system clearly lie with the “upstream” interventions that affect the whole population. Complementary efforts at secondary prevention, including widespread use of hypolipidemic drugs, would

be very effective as well, given universal access to the primary care system. Whereas tertiary care for CVD has substantial value, it will always be the least cost-effective choice; in the end, that reality must override other considerations in a resource-poor setting.

Social Origins of the Current Status of Cardiovascular Disease in Cuba

Exploration of the social determinants of disease has been a major preoccupation of public health.^{52–55} In most instances, however, the inquiry has been focused on the impact of socioeconomic disadvantage or harsh material living conditions. Recent scholarship on the association between health and community-level social structure has added important new dimensions to this field, focusing, for example, on income inequality and “social capital.”^{56,57} Only infrequently, however, has the organizational structure of society as a whole—what was once termed the mode of production—been considered a potential causal force in its own right. Virchow’s famous dictum—“mass disease means society is out of joint”—stands as one of the few theoretical statements of the role of structural elements in molding the disease patterns of populations.⁵⁸

Virchow’s contention was that humans are well adapted to the natural environment of this planet, and if a disease afflicts large segments of the population it must be the result of the breakdown of normal social processes. Alexander Semasko, the Soviet commissar of health in the early years after the Bolshevik Revolution, extended Virchow’s basic idea with the corollary assertion that the role of the state was to protect the health of the population, not sacrifice it to the demands of the economy.⁵⁹ In recent years, however, the social production of disease has most often been conceptualized as a marginal process, one that results from the unintended consequences of useful economic activity or simply poorly regulated industries, not a central mechanism in the causal process.

The social and political history of Cuba places it in a category of its own and therefore allows a consideration of how the productive forces might shape the pattern of disease. Before 1959, Cuba was simply one among many dependent nations in the Caribbean, although by no means the poorest,

and its disease pattern manifested all the characteristic features of undernutrition, high infant mortality, and rampant infectious diseases.¹⁴ For the last 4 and a half decades, Cuba has constructed a society using a model of centralized economic planning. The nearly half century of the US economic blockade and the more recent dissolution of the Soviet Union have greatly retarded the process of economic development in Cuba. Despite this unique historical course, Cuba has entered the 21st century with a mortality structure virtually indistinguishable from what is observed in North America and Europe.

Should one be surprised that different historical trajectories of development have converged on a single public health outcome? In its broadest outlines, the emergence of epidemic CVD, the most characteristic feature of the epidemiological transition, could be viewed as an inevitable consequence of industrialization. Stroke, which is a “residual disease” of preindustrialized societies, has generally emerged at the outset of this transition as the major cause of death in the elderly. Much of this apparent increase is likely to be the effect of removing other competing causes. Atherosclerotic CHD emerged as a mass phenomenon later in the epidemiological tradition, when agricultural productivity reached a high enough level that large segments of the population consumed animal products on a regular basis. In economically advanced countries, diabetes has occurred in the late, “postindustrial” phase, presumably driven by continued declines in physical activity and the hyperconsumption of manufactured food.

The postindustrial lifestyle has not yet transformed Cuban culture, nor have the consequences of free trade and globalization been felt to any substantial degree. Nonetheless, it appears that complete integration into the global economy is not necessary to lay the conditions for a full-scale CVD epidemic. The historical momentum of dietary change, by which complex carbohydrates are replaced with animal products, a high intake of salt is maintained, and tobacco is introduced, has been sufficient to fuel the epidemic, once competing causes are eliminated. This transition is generally thought to have been shaped in large part by economic incentives within the agricultural

and food-processing industries, and it is reasonable to assume that similar incentives operated within socialist systems as well.

As is well recognized, the emergence of a CVD epidemic was even more dramatic in the Soviet Union and Eastern Europe.^{60–65} Thus, despite their different approach to the organization of the economy and the distribution of goods and services, socialist countries must also develop new ways of thinking about chronic disease prevention and implement practical interventions to offset the consequences of industrialization on vascular disease. On the basis of its past and ongoing successes with infectious diseases, the socialist system in Cuba has demonstrated a capacity to develop and implement highly effective populationwide interventions. Such an approach could dramatically advance the efforts to control chronic disease as well⁶⁶; however, that opportunity has not yet been seized.

CONCLUSIONS

Whereas the social and political structure of societies can undergo rapid and dramatic change, such cultural norms as food, music, and religion are sometimes more resilient. The goal of socialist revolutions in poor undeveloped countries has been first and foremost to catch up with the industrial economies of the world. In public health, this has meant almost exclusively the elimination of infectious diseases and the assurance of low death rates in childhood.⁶⁷ Cuba stands as the prime example of the unequalled success of the socialist project in achieving that goal. Within that tradition, however, the need to aggressively intervene against engrained cultural patterns, particularly those related to consumption, was something of a foreign idea. A fundamental rethinking of this strategy will be required to take full advantage of the new knowledge in prevention science that could now make an important contribution to the future health of the Cuban people. The improvements in quality and duration of life in Cuba over the last 50 years have been astounding and set the standard for poor countries around the world. These achievements—for example, eliminating polio in 1962, two decades ahead of the United States—are evidence of the remarkable goals Cuba is capable of achieving. Similar

leadership in CVD prevention could make enormously valuable contributions to the worldwide campaign to control what has already become the most severe epidemic ever faced by humanity. The Cuban experience thus demonstrates that control of CVD in non-industrialized countries is by no means impossible, and it highlights the critical importance of population-based prevention strategies. ■

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Contributors

R. S. Cooper developed the framework of the study and wrote the article. P. Orduñez and A. Espinosa-Brito provided descriptions of the organizational structure and functioning of the Cuban health system and critical insight into the data. M. D. Iraola Ferrer collected and analyzed the data from the Province of Cienfuegos. J. L. B. Munoz assisted in the collection and analysis of the vital statistics data.

Human Participant Protection

Ethical approval was obtained from the review board of the Hospital Universitario “Dr. Gustavo Aldereguia Lima.”

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