Health in Brazil 4

Chronic non-communicable diseases in Brazil: burden and current challenges

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Non-communicable diseases (NCDs) have become a major health priority in Brazil—72% of all deaths were attributable to NCDs in 2007. They are also the main source of disease burden, with neuropsychiatric disorders being the single largest contributor. Morbidity and mortality due to NCDs are greatest in the poor population. Although the crude NCD mortality increased 5% between 1996 and 2007, age-standardised mortality declined by 20%. Declines were primarily for cardiovascular and chronic respiratory diseases, in association with the successful implementation of health policies that lead to decreases in smoking and the expansion of access to primary health care. Of note, however, the prevalence of diabetes and hypertension is rising in parallel with that of excess weight; these increases are associated with unfavourable changes of diet and physical activity. Brazil has implemented major policies for the prevention of NCDs, and its age-adjusted NCD mortality is falling by 1·8% per year. However, the unfavourable trends for most major risk factors pose an enormous challenge and call for additional and timely action and policies, especially those of a legislative and regulatory nature and those providing cost-effective chronic care for individuals affected by NCDs.

Introduction

Chronic non-communicable diseases (NCDs) are a global health problem and a threat to human health and development. The burden of these diseases falls mainly on low-income and middle-income countries.[1] Leading scientists[2] and WHO[3] have raised a call to action, as effective interventions are available,[4] which define strategies to be taken. The United Nations is convening a high-level meeting of the General Assembly in September, 2011, on the prevention and control of NCDs.[5] To contribute to the preparation of this meeting, *The Lancet* Series of papers was launched in November, 2010,[6] in which 23 countries, including Brazil, were assessed with respect to NCD burden and national capacity to respond to the NCD challenge.[7] A comprehensive and critical view of the NCD scenario in Brazil, a large middle-income country, is thus timely.

The burden of chronic NCDs

In 2007, about 72% of all deaths in Brazil were attributable to NCDs (cardiovascular diseases, chronic respiratory diseases, diabetes, cancer, and others, including renal diseases), 10% to infectious or parasitic diseases, and 5% to maternal and child health disorders. This distribution contrasts with that of 1930, when infectious diseases accounted for 46% of all deaths in Brazilian state capitals.[8] As addressed in greater detail elsewhere in this Series,[9] this radical change happened within the context of economic and social development, in which major advances toward the resolution of the then reigning public health concerns were made. In parallel with this change in disease burden was a rapid demographic transition in Brazil that produced an age pyramid weighted more towards adults and elderly people.[10] Greater income, more mechanisation and industrialisation, improved access to food, urbanisation, and globalisation of unhealthy habits have produced a rapid nutritional transition[11] and have increasingly exposed the population to a greater risk of chronic disease. Within this context, less privileged ethnic and racial groups bear a disproportionately large share of the resultant burden (panel 1).

From 1996 (when Brazil adopted the 10th revision of the International Classification of Diseases [ICD10] coding and enumerated its population) to 2007, the NCD mortality increased by 5%, from 442 per 100 000 people to 463 per 100 000, showing the augmented burden of NCDs. However, once age-adjustment was done to permit comparisons over time and across populations, the mortality decreased. Figure 1 shows that mortality

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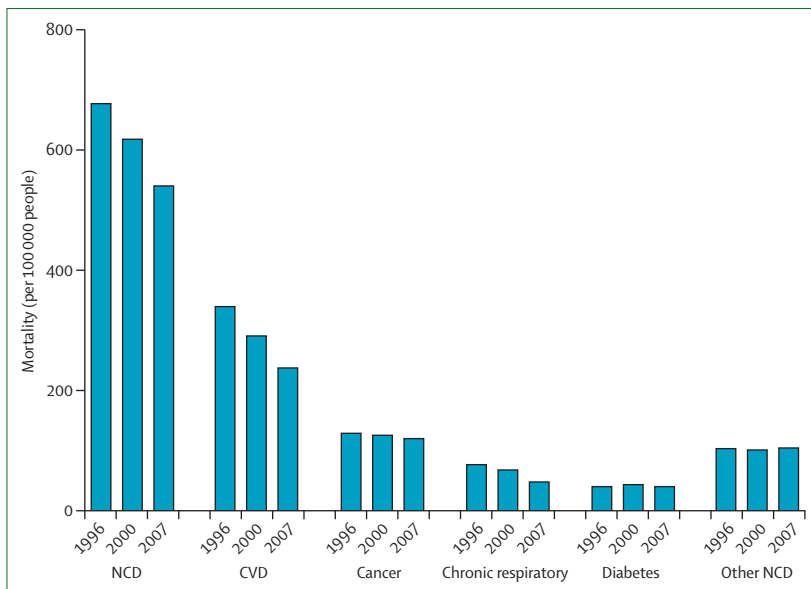
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Key messages

- Non-communicable diseases (NCDs) are the main sources of disease burden in Brazil, and major policies for their prevention and control have been implemented
- Cardiovascular and chronic respiratory disease mortality rates are declining, probably as a result of tobacco control and improved access to primary care
- The widespread obesity epidemic with the resultant increased prevalence of diabetes and hypertension, threatens further increase in NCDs
- Unfavourable trends in most major risk factors show the need for additional and timely action, especially in the form of legislation and regulation and those allowing for quality chronic care
- Strengthening links between government, academic institutions, and civil society will facilitate the response of society to the challenge of NCDs

Panel 1: Ethnic and racial inequalities and chronic diseases

As in other societies burdened with a history of colonisation and slavery, there is ethnic and racial prejudice and discrimination in Brazil, as well as inequalities unfavourable to black people, Indigenous peoples, and so-called browns (a denomination suggesting a racial mixture).[12] As an example, black and brown people are over-represented in the unemployed and illiterate groups of Brazil,[13] suggesting ethnic inequalities that can potentially affect the distribution of NCDs.

The Indigenous Brazilian populations are undergoing intensive change in their relationship with the land, work, and urbanisation, which is affecting their health in an unprecedented manner. As in other countries, there is a rapid change in the Indigenous peoples with respect to food, characterised by rapid and generalised weight gain that is greater than the national norm. For example, Xavantes located in the Sangradouro-Volta Grande and Pimentel Barbosa Indigenous Reserves region, in 1998–99, had a prevalence of obesity of about 25% in men and 41% in women. An increasingly western diet and a reduction in physical activity because of macrosocial changes are thought to be the direct causes of these levels of obesity.[14–16] As a result, obesity, hypertension, and diabetes are becoming serious public health issues in this population.[14–17]

The debate on racial prejudice and discrimination is a recent one in Brazil. We know little about the inter-relations between socioeconomic and racial inequalities that have generated these health differences, which negatively affect the full development of Brazil's people. Affirmative action policies in Brazil are very recent and their effect is still unknown. Nevertheless, the topic is on the agenda of politicians and academics, as well as on that of the general Brazilian population.

were age-standardised to the WHO standard population,[18] corrected for under-reporting and with redistribution of ill-defined causes of death pro rata across non-external causes. The webappendix accompanying the Series paper by Victora and colleagues has details of the mortality calculation.[19]

Age-standardised NCD mortality for 2004 in Brazil (625 per 100 000 people), as reported by WHO, was less than that in Russia, Nigeria, India, and Tanzania (all >700 per 100 000), but greater than that of the UK and Canada (both <400 per 100 000),[1] and almost all other South American countries.[20] Of note, the WHO rate for Brazil is somewhat higher than the rates shown in figure 1 (617 per 100 000 for 2000; 540 per 100 000 for 2007), due in part to different assumptions about under-reporting and ill-defined causes of death, which have undergone steady improvement. Additionally, our correction for ill-defined disorders (7·7% in 2007) is more precise, having been done separately for each calendar year in each age, sex, and state strata.

Figure 2 shows that, in 1996, the NCD mortality was greatest in the northeast, declined in all regions between 1996 and 2007, but more so in the south and southeast, leaving the north and northeast (the poorest regions of Brazil) with the highest NCD mortality in 2007. These latter two regions also had the largest increases in diabetes mortality over this period.

However, mortality provides an incomplete picture of disease burden. A major study of Brazil's disease burden[21] that used 1998 health statistics and employed discounted disability-adjusted life years (DALYs) showed that chronic disorders accounted for 66% of DALYs; infectious, maternal, and perinatal disorders and nutritional deficiencies for 24%; and external causes for 10%. Principal among the chronic disorders were neuro-psychiatric disorders (19%), cardiovascular diseases (13%), chronic respiratory diseases (8%), cancers (6%), musculoskeletal diseases (6%), and diabetes (5%).

Additionally, conservative estimates by WHO for Brazil suggest that changes in key economic inputs, such as losses in the labour force and decreased savings resulting from just three NCDs (diabetes, heart disease, and stroke), will lead to a loss of economic output of US$4·18 billion between 2006 and 2015.[22]

The burden of neuropsychiatric disorders
Most of the burden from neuropsychiatric disorders is due to depression, psychoses, and disorders attributable to alcohol misuse. In the World Health Survey,[23] done in 2003 with internationally standardised methods, 18·8% of Brazilians reported having received a diagnosis of depression in the past 12 months. The positive association of education or income with the need for care of or being diagnosed with depression suggests that these figures might be due to a greater awareness and access to care than actual change of disease burden. In fact, surveys with direct standardised assessments

Figure 1: **Recent trends in NCD mortality for 1996 to 2000 and 2007**
Age-standardised to the WHO standard population,[18] corrected for under-reporting, with redistribution of ill-defined causes of death pro rata across non-external causes. NCD=non-communicable disease. CVD=cardiovascular disease.

attributable to NCDs declined between 1996 and 2007 by 20%, primarily because of declines in cardiovascular (31%) and chronic respiratory (38%) diseases; for diabetes and other chronic disorders mortality remained stable (a 2% increase and a 2% decrease, respectively). These data and others that we report, unless specified,

according to ICD10 criteria found that depression affects 5–10% of adults.[24,25] A recent survey in ten developed and eight developing countries found the highest prevalence of depression in metropolitan São Paulo.[26]

Studies with broader criteria for common mental disorders (CMD; mixed depressive and anxiety states) reported that about 30% of Brazilian adults experienced such symptoms.[27–30] Depression and CMD were more prevalent in people with lower levels of education and income, and in people who were unemployed.

Epidemiological data on psychoses in Brazil are scarce. In São Paulo, the 1-month prevalence of bipolar disorders and non-affective psychoses was estimated as 1·1%.[17] The estimated incidence of psychoses in São Paulo (15 per 100 000 person-years) was lower than incidences reported from developed countries.[31] Yet, mortality in people with psychoses, mostly because of suicide, was as high as that in developed countries.[32]

In view of the rapid ageing of the population, dementia is quickly becoming a major public health issue. Local population-based surveys yielded prevalence estimates for people aged 65 and older varying from 5·1% to 8·8%, similar to those found in developed countries.[33–35] Social adversity and poor nutritional status early in life seem to increase the risk of late life dementia in Brazilian people.[36] Age-standardised dementia mortality increased from 1·8 per 100 000 in 1996 to 7·0 per 100 000 in 2007.

Key NCDs and their shared risk factors

The WHO 2008–13 action plan for NCDs[3] focuses on four NCDs (cardiovascular diseases, diabetes, cancer, and chronic respiratory disease) and their four shared risk factors (tobacco use, physical inactivity, unhealthy diets, and harmful use of alcohol).[4] These four NCDs accounted for 58% of all deaths in Brazil in 2007 and are, along with neuropsychiatric disorders, the main causes of disease burden.[21]

Cardiovascular diseases

Hypertension, aside from being a treatable disease, is a major, clinically measurable milestone along the causal pathway to symptomatic cardiovascular disease. Nationally representative data obtained in 2008 from almost 400 000 interviews,[37] estimate that 24·0% (95% CI 23·7–24·4) of women and 17·3% (17·0–17·6) of men, aged 20 years or older, and about half of men and more than half of women aged 60 years or older, reported a previous diagnosis of hypertension. A validation survey suggests that self reporting probably overestimates hypertension by about 10% compared with clinical diagnosis.[38] Recent self-reported prevalence has increased by about 0·5% per year.[39] Moreover, the control of hypertension (<140/90 mm Hg) is poor, ranging from 20% to 39% in two recent household surveys.[40,41] Hypercholesterolaemia (cholesterol >5·18 mmol/L), another clinically measureable risk factor, was reported in 22% of adults and a third of those aged
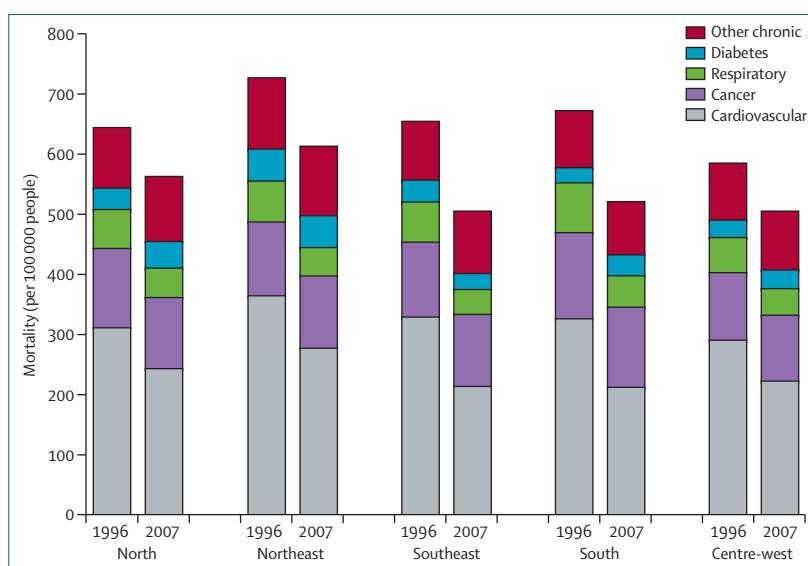
Figure 2: **Mortality rates for non-communicable diseases by region for 1996 and 2007**
Age-standardised to the WHO standard population,[18] corrected for under-reporting, with redistribution of ill-defined causes of death pro rata across non-external causes.

45 years or older in a 2004 sample representative of adults living in cities with 100 000 inhabitants or more.[42]

Cardiovascular diseases have been and continue to be, despite their decline, the principal cause of death in Brazil (figure 1). The decline in cardiovascular disease is greatest for cerebrovascular diseases (34%) and the category of other forms of heart disease (44%). Mortality from ischaemic heart disease declined by 26%. Hypertensive heart disease mortality, by contrast, increased 11%, growing to 13% of total deaths attributable to cardiovascular disease in 2007, compared with 30% for ischaemic heart disease and 32% for cerebrovascular disease. By contrast, rheumatic fever and its complications represented less than 1% of deaths in 2007.

Despite these declines, Brazilian cardiovascular mortality remains high. Based on uniformly standardised WHO data,[20] Brazil's 2004 mortality attributable to cardiovascular disease, 286 per 100 000 people, is only surpassed among the reported South American countries by Guyana and Surinam. Similar rates were, 207 per 100 000 for Argentina, 209 per 100 000 for Venezuela, and 160 per 100 000 for Chile. Brazil's rate was higher than that reported for most North American and European countries (eg, 179 per 100 000 for the USA, 175 per 100 000 for the UK, and 200 per 100 000 for Portugal).

The mortality burden, especially premature deaths attributable to cardiovascular diseases, disproportionately affects poor people. For example, in Porto Alegre, a large Brazilian city, premature deaths attributable to cardiovascular diseases, defined as those in individuals aged 45–64 years, was 163% higher in neighbourhoods classified as being in the worst socioeconomical quartile than in those classified in the best.[43]

Cardiovascular diseases generate the greatest cost of hospital admission within the national health system. In 2007, 12·7% of all non-pregnancy related admissions to hospital and 27·4% of those for individuals aged 60 years or older were due to cardiovascular diseases. Of special note is the burden of congestive heart failure: in people older than 60 years, it is the most common cause of admission to hospital, and in people over 80, it causes 27% of admissions to hospital in women and 33% in men.[10]

Diabetes

In the late 1980s, the prevalence of diabetes in individuals aged 30-69 years residing in large metropolitan areas was 7·6% (estimated from both oral glucose tolerance testing and self report); prevalence of self-reported diabetes being 4·1%.[44] More recent, large, nationally representative data of Brazilians aged 20 years or older show an increase in self-reported diabetes, from 3·3% (95% CI 3·1–3·5) in 1998 to 5·3% (5·2–5·4) in 2008.[45] The ongoing epidemic of obesity and greater access to diagnostic testing explain much of this rise.

Diabetes as the underlying cause of death rose 11% from 1996 to 2000 and then decreased 8% to 2007 (figure 1). When defined as any mention on the death certificate, diabetes-associated mortality increased by 8% from 2000 to 2007. Although the rising prevalence of diabetes probably explains this greater mortality, a mixture of improved diagnosis and changes in reporting practices might also be involved. The burden of diabetes can also be gauged by the fact that 7·4% of all non-pregnancy related admissions to hospital and 9·3% of all hospital costs in the period 1999–2001 could be attributable to diabetes.[46]
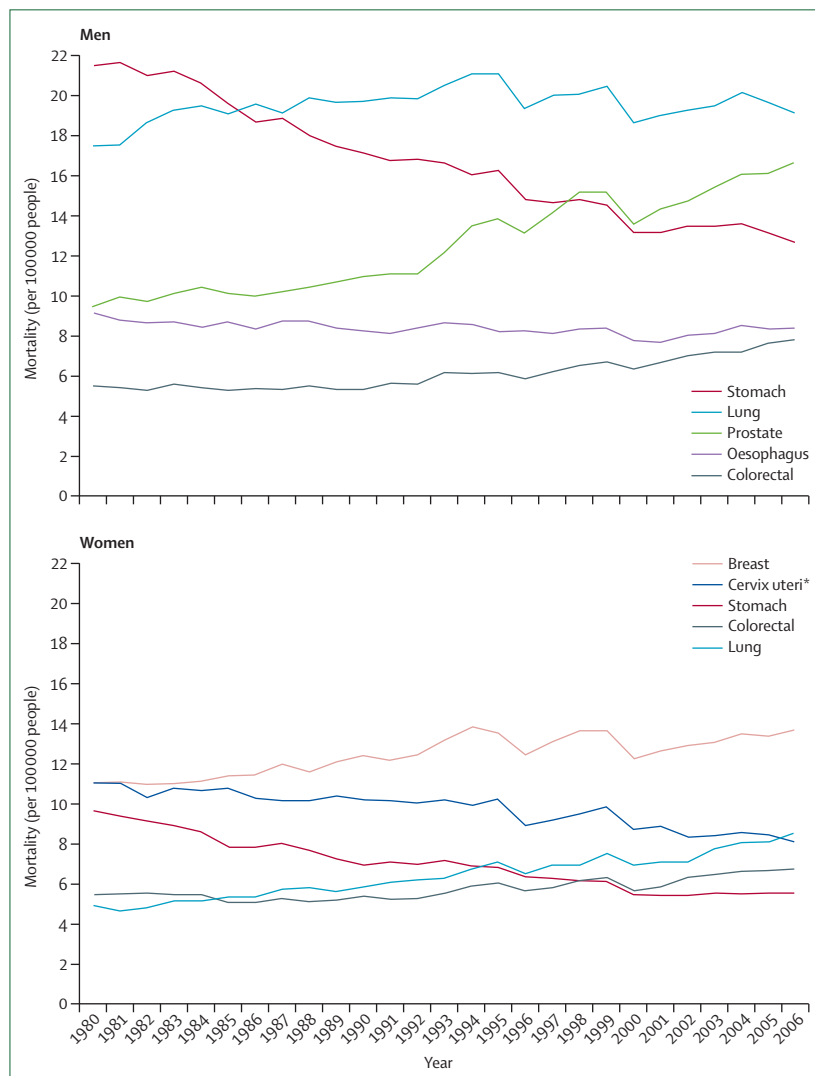
A national registry for diabetes and hypertension, SisHiperDia, was started in 2002. The burden associated with the disease is documented in the data of the more than 1·6 million cases of diabetes registered: 4·3% of those registered had a diabetic foot disorder and 2·2% a previous amputation, 7·8% had renal disease, 7·8% had a previous myocardial infarction, and 8·0% had a previous stroke. Linking these data with the mortality registry shows the mortality burden attributable to diabetes: age and gender standardised mortality in people with diabetes was 57% greater than that of the general population. Of all deaths, 38% were due to cardiovascular disease, 6% to renal disease, and 17% were coded as multiple or other chronic complications of diabetes. Only 2% were due to the acute complications of diabetes.

Figure 3: Mortality for main sites of cancer in men and women, 1980–2006
Age standardised to the World Standard Population,[47] with proportional redistribution of ill-defined deaths.
*Corrected with proportional redistribution of deaths classified as malignant neoplasm of uterus, part unspecified (ICD10 code C55).

Cancer

Figure 3 shows the change of mortality in Brazil for the principal cancers over the past 27 years, age standardised to the World Standard Population.[47] In men, mortality rates of lung, prostate, and colorectal cancer are increasing, that of gastric cancer decreasing, and that of oesophageal cancer stable. In women, mortality rates of breast, lung, and colorectal cancers have risen, while those of cervical and gastric cancer have declined.

The substantial decline in deaths attributable to gastric cancer in both sexes, detected initially in the 1990s,[48,49] is similar to that described in other countries.[50,51] Declines in deaths attributable to cervical cancer over the past two decades, especially in state capitals,[52,53] have paralleled improved screening practises, which were introduced in the 1980s and enhanced since 1998.[54,55] From 2003 to 2008, the frequency of women aged 25–59 years who reported at least one Pap smear over the previous 3 years rose by 25%,[37] reaching 84·6% in 2008. However, large variation exists across income levels. In rural parts of the north and northeast regions (areas with restricted access to screening) mortality rates are still rising. Breast cancer deaths are increasing throughout Brazil, particularly in metropolitan areas, despite somewhat improved coverage

for mammography from 2003 to 2008 in women aged 50–69 years (self-reported rates increased from 42·5% to 54·8%). Lung cancer deaths for people younger than 60 years are falling in men but rising in women, probably related to antecedent smoking trends.[56] Mortality from colorectal cancer varies substantially by region, with higher rates in the most developed regions.[57]

The first Population-Based Cancer Registry was created in 1960 in Recife, and now 17 cities regularly provide information.[58] Based on data from four of these registries, some international incidence comparisons are possible.[59] For breast cancer, incidences are similar to those of high-income countries. For lung, prostate, and colorectal cancers, Brazilian incidence rates are at an intermediate level. Oesophageal cancer rates, in men, are very high, approaching levels seen in Asian countries with the world's highest incidence. Cervical cancer incidence in Brazil, overall, is still very high, with rates close to those of countries with the highest incidence: Peru and some African states. This finding is consistent with the very high prevalence (14–54%) of human papillomavirus in surveyed Brazilian women.[60]

The 5-year survival rates for patients with breast, prostate, and lung cancer in two Brazilian cities were low when compared with those of high-income countries,[61] suggesting difficulties or inequalities in access to diagnostic procedures and treatment in Brazil in the 1990s. This finding is consistent with recent international data that show that survival from curable cancers (cervical, breast, and testicular cancer, and lymphoblastic leukaemia in children) is closely and positively related to country income.[62]

Chronic respiratory diseases

The drop in age-adjusted mortality rate for chronic respiratory diseases (figure 1) was noted for both chronic obstructive pulmonary disease (COPD; 28·2% decline) and asthma (34·1% decline). Admissions to hospital in adults aged 20 years or older decreased by 32% for COPD and 38% for asthma between 2000 and 2007. The extent to which these secular trends are because of improvements in access to health care, decline of smoking, or other factors remains to be assessed.

There is a lack of prevalence data on COPD at the national level, partly because of difficulties in the use of spirometry (the gold standard for COPD diagnosis). One spirometry-based representative sample of adults aged 40 years or older in metropolitan São Paulo—part of the Latin American PLATINO Study—recorded a COPD prevalence ($FEV_1/FVC < 0.7$ post-bronchodilator) of 15·8% (95% CI 13·5–18·1).[63] Similar with that noted for other Latin American cities,[64] most of the people sampled lacked a previous medical diagnosis. Aside from the usual COPD risk factors, tuberculosis and indoor pollution also inferred risk: adjusted odds ratio (OR) for COPD in people with a medical diagnosis of tuberculosis were 3·99 (1·92–8·30) for men

	2006	2009	Change
Smoking			
Current smoker*	16·2% (15·4–17·0)	15·5% (14·5–16·5)	–0·6% (0·27)
Ex-smoker†	22·1% (21·3–22·9)	22·0% (20·6–23·3)	–0·1% (0·72)
Physical activity‡			
Adequate leisure time physical activity	14·8% (14·2–15·5)	14·7% (14·0–15·4)	–0·1% (0·72)
Alcoholic beverage consumption§			
Binge drinking¶ in the past 30 days	16·2% (15·5–16·9)	18·9% (17·9–19·9)	2·7% (<0·001)
Excess weight			
Excess weight (BMI ≥25 kg/m²)	42·8% (41·8–43·8)	46·6% (45·2–48·0)	3·8% (<0·001)
Obesity (BMI ≥30 kg/m²)	11·4% (10·8–12·0)	13·9% (13·1–14·7)	2·5% (<0·001)

Data are % (95% CI) or % (p value)—p value established by Poisson regression, which compared percentages over the years 2006, 2007, 2008, and 2009. BMI=body-mass index. *A person who regularly smokes tobacco, irrespective of the time he or she has been smoking; includes daily and occasional smokers. †A person who in the past smoked tobacco, occasionally for at least 3 months or daily for at least 1 month. ‡Validated by Monteiro and colleagues.[74] §Validated by Monteiro and colleagues.[75] ¶Defined as men consuming more than five alcoholic drinks and women more than four drinks on a single occasion.

Table 1: **Prevalence of selected risk factors for chronic diseases as ascertained through Vigitel, a telephone interview of residents of Brazilian capitals, 2006 and 2009**

and 1·71 (0·95–3·09) for women, compared with those without such a diagnosis.[65]

Regarding asthma, the World Health Survey, which assesses representative samples of adults aged 18 years or older in 70 countries in 2002–03, showed Brazil to have the highest prevalence of self-reported wheezing (24·3%), and the 6th highest self-reported medical diagnosis of asthma (12%; 95% CI 11·0–13·1).[66] A Brazilian nationally representative survey showed that self-reported medical diagnosis of asthma, adjusted for sex, age, and region, was 28% lower in rural than urban areas,[67] consistent with findings of other Latin American studies,[68,69] and in accordance with the hypothesis that industrialisation and urbanisation are related to its occurrence.[70]

Risk factors

Two nationwide surveys show that the prevalence of smoking in people aged 18 years or older declined substantially in Brazil, from 34·8% in 1989 to 22·4% in 2003.[71] A further decline to 17·2% (21·6% of men and 13·1% of women aged 15 years or older) was recorded up to 2009—estimated by the Global Adult Tobacco Survey, a nationally representative survey that included more than 50 000 households across all Brazilian states.[72] Large variation was noted in this latter study by educational attainment: 25·7% of people with less than 1 year of formal education smoked versus 11·9% with 11 years or more. However, recent data from Vigitel,[73] a yearly telephone-based survey adjusted to be representative of residents of Brazilian capital cities (table 1), suggest that smoking prevalence stabilised between 2006 and 2009.

A recent survey of 8th grade children (ie, children aged 14 years) who reside in state capitals,[76] designed to capture the development of risk factors showed that, in 2009, 6·3% of the children surveyed reported smoking during the previous 30 days, which is more

than the mean for the Americas (4·9%), but less than that of Europe (19%).[77]

Despite the major achievements in the control of smoking over the past two decades, an estimated 13·6% of all deaths in adults who reside in 16 Brazilian capitals in 2003 were attributable to smoking, probably related to the effect of higher earlier smoking prevalences.[78]

Although 45% of Brazilian adults abstain from the consumption of alcohol,[79–81] the proportion of excessive drinking and dependence is high. An estimated 25% of adults reported at least one problem of a social, occupational, familial, legal, or physical nature related to alcohol.[81] Estimates for alcohol dependence vary from 9% to 12% of the entire adult population, the prevalence being three-to-five-times greater in men than women.[79–81] Alcohol dependence is also higher in young adults and those with intermediate levels of education and income.

Exposure to alcohol begins early: a large survey of 8th grade students (mean age 14 years) in public and private schools of Brazilian state capitals showed that 71% had already experimented with alcohol and 27% had consumed alcohol in the previous 30 days.[76] Almost 25% of these students said they had been drunk at least once in their lives.

The problem with alcohol seems to be worsening. Table 1 shows that the prevalence of reporting at least one episode of excessive drinking in the past 30 days increased significantly between 2006 and 2009. This increase was more prominent in women (up 27%) than in men (up 13%). Additionally, age-adjusted mortality from mental and behavioural disorders due to use of alcohol (ICD10 code F10) rose 21% in 11 years, from 4·26 per 100 000 people in 1996 to 5·17 per 100 000 in 2007.

Patterns of physical activity have only been studied recently in Brazil and, therefore, secular trends in energy expenditures are unknown. In 1996–97, a nationwide survey showed that only 3·3% of Brazilian adults reported doing the minimum recommended level of 30 min of leisure-time physical activity at least 5 days per week.[82] Self-reports through Vigitel surveys suggest that levels of physical activity have improved (table 1); but this is probably still not enough to compensate for the decline in occupational energy expenditures. Between 1970 and 2004, the fraction of economically active people who were employed in agriculture declined from 44% to 21%, whereas the fraction employed in services increased from 38% to 58%.[10]

Brazil does not have repeated national surveys on dietary patterns at present. Data from four large representative surveys of family food expenditure done in metropolitan areas of Brazil from the mid-1970s to the mid-2000s suggest a decline in the household purchase of basic traditional foods, such as rice, beans, and vegetables, and notable increases (up to 400%) in the purchase of processed foods, such as cookies and biscuits, soft drinks, processed meats, and ready meals. Over the same period, the proportion of energy from fat in total food purchases increased from 25·8% to 30·5% and energy from saturated fats went from 7·5% to 9·6%.[83] National estimates on sodium intake show a daily consumption of about 4 g per person, twice the maximum recommended intake.[84] Added sugar corresponds to 16% of total available energy according to a national household food expenditure survey done in 2003, or to 18% according to food balance data for the same year,[85] exceeding the maximum recommended intake by 60–80%. Although no estimate exists on the intake of trans fats in Brazil, excessive content of trans fatty acids is present in several processed foods, such as fried potatoes, ice creams, and cream crackers.[86]

Repeated, nationally representative household anthropometric surveys, done since the mid-1970s, show a substantial rise in the frequency of excess weight. The development of this increase differs by age group, sex, socioeconomic status, and period.[87–91]

From 1975 to 1989 the prevalence of adolescents who were overweight[92] doubled for boys and girls and, from 1989 to 2003, more than doubled in boys, while increasing very little in girls (table 2). Although the rise in the prevalence of overweight was similar for all income and sex groups between 1975 and 1989,[87] between 1989 and 2003 family income modified the intensity of changes over time, with the increase shifting towards poor people. Figure 4 shows the relative rise in the number of people who were overweight was much higher for the lower than the upper income quintile in boys. In girls, those from lower income families had an increase whereas those from upper income families actually had a decline. Recent changes in number of people who are overweight has reduced but not eliminated the positive association between family income and being overweight that was initially noted.[87]

Changes in obesity in adults[94] had similar patterns to those noted in adolescents, except that the shift towards poor people was recorded in both 1989 and 2002–03 (figure 4). As a consequence, the strong protection against obesity noted in the mid-1970s for lower-income groups was reduced across the 28-year period for men and was totally eliminated for women.[90]

Perhaps surprisingly, the prevalence of Brazilian boys and girls younger than 5 years who were overweight[93] has remained stable (around 7–8%) from 1989 to 2007 (table 2), with no significant changes in the positive association between family income and being overweight.[89,91] In the same period, child linear growth improved substantially in Brazil (child stunting was reduced from 19·9% to 7·1%), which could be one of the reasons underlying the absence of an increase in overweight children.[88]

Estimates from Vigitel (table 1) show a continuing increase in obesity in adults from 2006 to 2009—from 11·4% to 13·9%. The increased prevalence in men was similar for all socioeconomic groups, although in women the major socioeconomic gap has widened—obesity increased from 15·2% to 18·2% for those with 8 years or less of schooling, but only from 7·5% to 8·4% in those with 12 years or more.[73] A 2008–09 nationally

representative survey with anthropometric measurements confirms these increases, reporting an overall obesity prevalence of 14·8% for those aged 20 years or older.[95]

The specific role of the immediate determinants of obesity—diet and physical activity—in causing the higher obesity increases noted in Brazil in adolescents and adults from lower-income groups is unknown since the country lacks reliable data on socioeconomic-specific secular trends in patterns of food intake and physical activity.

Rapid population ageing

Brazil has one of the fastest ageing populations in the world.[96,97] Most of today's older Brazilian adults were born in rural areas, but now live in large urban centres; have endured significant socioeconomic adversity throughout their lives; have received little or no formal education; and worked in poorly paid unskilled occupations.[98] Moreover, changes such as smaller families and more women in the paid workforce have reduced families' ability to provide support and health care for elderly people.

The healthy life expectancy at birth of Brazilians is estimated to be 59·8 years, 12 years shorter than total life expectancy. Of those aged 60 years or older, the prevalence of limited capacity to properly and independently perform basic activities of daily life has been estimated as 15·2% (95% CI 14·6–15·8); however, the frequency is greater for those with lower household income or less schooling.[37]

Behavioural, neuropsychological, environmental, and economic interventions are needed to respond to progressive population ageing. An important step in this direction, which results mainly from new legislation that altered retirement pension minimums, was the reduction in the proportion of elderly people whose per-head family income was less than half of the minimum wage, from 21·5% in 1993 to 10·1% in 2008. Additionally, Brazil launched its national policy for the health of elderly people in 2003, patterned after WHO's Active Aging approach.[99]

Successes and failures of prevention policies

Although various initiatives for the prevention and control of NCDs had been adopted over the past two or three decades, after the resolution of the 53rd World Health Assembly[100] Brazil has progressively implemented a comprehensive plan of action and a surveillance system for NCDs and their risk factors (panel 2).

Health promotion and intersectoral action

Brazil has increased its focus on NCDs, and policies implemented[39] have widened the scope of action from the traditional concern of medical care to prevention, health promotion, and intersectoral action.

In 2006, after discussion and agreement by represent-atives at federal, state, and municipal levels, a broad health promotion policy was approved. The policy included a series of actions in intersectoral articulation and policy development, health education, disease and

	1974–75	1989	1996	2002–03	2006–07
0–4 years					
Both sexes	..	8·4% (0·5)	7·4% (0·5)	..	7·3% (0·6)
10–19 years					
Boys	2·4% (0·2)	5·7% (0·5)	..	13·2% (0·5)	..
Girls	6·0% (0·2)	11·8% (0·6)	..	12·5% (0·5)	..
≥20 years					
Men	2·7% (0·2)	5·1% (0·3)	..	8·8% (0·3)	..
Women	7·4% (0·3)	12·4% (0·5)	..	13·0% (0·3)	..

Data are prevalence (SE). Excess weight criteria: for children <5 years was weight-for-height ≥2 Z scores of the WHO standards,[93] for adolescents was BMI-for-age higher than the International Obesity Task Force overweight cutoff,[92] and for adults was BMI ≥30 kg/m².[94] Adapted from Conde,[87] Monteiro,[90] and Monteiro.[91] BMI=body-mass index.

Table 2: Prevalence of excess weight by sex and age group, 1974–2007
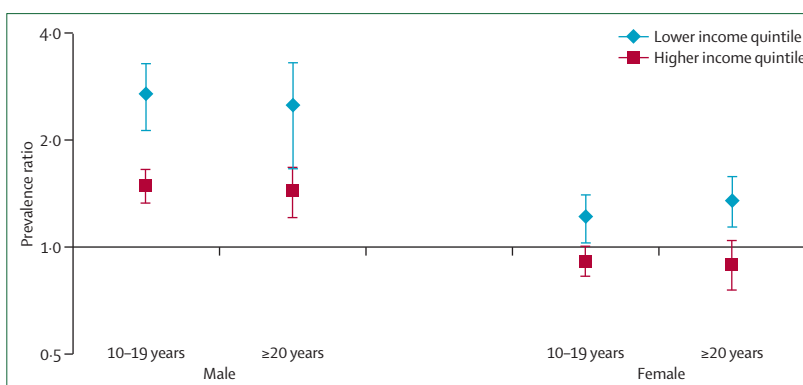
Figure 4: Age-adjusted prevalence ratio of excess weight in 2002–03 compared with 1989 in adolescents and adults by family income
Adapted from Conde[87] and Monteiro.[90]

risk factor monitoring, and health care provision centred on healthy diets, physical activity, reduction of smoking, and the harmful use of alcohol. To support local health-promotion activities, the Ministry of Health transferred R$5 million (about US$2 million) to 27 state capital cities in 2005. By 2009, the allocation had climbed to R$56 million (about US$25 million), distributed on a competitive basis to 1277 states and municipalities. This initiative merits expansion, within a framework that stimulates adoption of effective interventions.

Of the Brazilian initiatives to respond to the challenge of chronic diseases, the control of smoking is a prominent success and is probably responsible for much of the decline in NCDs. To legislate and implement tobacco control has been a major challenge, because Brazil is the world's largest tobacco exporter and the second-largest tobacco producer. Yet, Brazil has progressively enacted, since the late 1980s, a broad framework of laws to control tobacco and tobacco use. In 2000, advertising of tobacco products was prohibited, photos alerting consumers to the risks were placed on cigarette packets, and a national committee for the control of tobacco was created involving various sectors. In 2006, Brazil ratified the WHO Framework Convention on Tobacco Control.[102] A free

Panel 2: Health information systems and periodic surveys for chronic diseases

The main health information systems—SIM (mortality), SIAB and SIA (primary care), and SIH (admission to hospital)—are complemented with *Autorização de Procedimentos Ambulatoriais de Alta Complexidade/Custo*, a database for high cost and complex out-patient procedures such as renal dialysis and cancer chemotherapy; SisHiperDia, a voluntary registry of patients with diabetes, hypertension, or both; and population-based cancer registries.[58]

Periodic representative surveys capture data on socioeconomic and demographic characteristics, risk factors and behaviour, health-care facilities, and self-reported disease—covering core, expanded, and optional items of step 1 (behavioural), and weight and height of step 2 (physical measurements), of the WHO STEPwise approach to risk factor surveillance.[101] Principal of these studies are *Pesquisa de Orçamento Familiar* (POF),[95] *Pesquisa Nacional por Amostra de Domicílios* (PNAD),[37] *Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquerito Telefônico* (Vigitel),[73] *Pesquisa Nacional da Saúde do Escolar* (PeNSE),[76] and *Pesquisa Nacional de Saúde* (PNS).

POF is the national household budget survey, profiling nutritional status and spending, including nutrition-related purchases, of Brazilian families along with measured height and weight. It permits the creation of food consumption indexes and time trends in household food availability.

PNAD is the national household survey that includes questions related to health every 3 years, providing individual information on socioeconomic and demographic characteristics, and selected health indicators including risk factors and self reported chronic diseases. In 2008 it included for the first time, data on tobacco consumption, physical activity, and exposure to violence.

Vigitel is the the telephone-based survey of risk factors for chronic disease established in 2006, annually reporting information on key risk factors and self-reported diseases of residents of Brazilian state capital cities.

PeNSE is the national survey of school health, investigating nutritional, smoking, and physical activity health behaviours, and family and school relationships, while measuring weight and height in 8th grade children (14 years) in all Brazilian state capital cities.

PNS is the first Brazilian national health survey. It includes blood pressure and other clinical parameters and laboratory measurements. It is scheduled for 2013.

national hotline, whose number is placed within the cigarette pack warning, offers guidance on smoking cessation. Several new tobacco control bills have been widely debated and approved at the national, state, and municipal levels. In seven states, smoking was prohibited in all public or private indoor collective spaces.[103]

Although declines in smoking in Brazil produced prevalences that are among the lowest in the world outside of Africa,[104] recent declines have tapered (table 1). Additional advances in tobacco control are needed,[104] for example, through raising the price of cigarettes.

National food and nutrition policy from 1999, although directing efforts towards an integrated agenda for nutrition, makes clear the need to promote healthy diets and active lifestyles.[105] In accordance with the recommendations of the Global Strategy for Diet, Physical Activity, and Health,[106] this policy recognises the complex nature of obesity and other nutrition-related NCDs, and defines a set of actions within health and other sectors to ensure environments that favour healthy diets and active lifestyles for all.

The government has made recent advancements in this direction. Programmes offering free professionally supervised physical activity classes were implemented in several cities and have been assessed.[107] In 2009, national legislation was enacted that required at least 30% of the budget of the national school lunch programme be spent on fresh foods from local agricultural production and family farms. In 2010, a resolution regulating the marketing of foods rich in sugar, salt, or unhealthy fats was promulgated by the national surveillance agency.

Yet, the continued rapid rise in obesity, hypertension, and diabetes shows the inadequacy of present strategies, and raises the challenge of implementing additional steps as recommended by the Global Strategy.[106] These steps include fiscal ones that increase population access to healthy foods such as fruits and vegetables and that discourage consumption of highly processed foods, as well as interventions that guide urban design with the aim of promoting regular physical activity. Further actions to reduce the sodium content of foods are especially needed.

Important steps in the control of excessive drinking were taken, culminating in 2007 in the national policy for alcohol.[108] This policy includes educational actions, advertisement and sale regulations, law enforcement for drinking and driving, and provision of care for those with alcohol-related problems.

Yet, the implementation of this policy has varied across Brazil, and industry lobbying has exerted negative pressure—eg, to maintain beer advertisements in conjunction with major sports and cultural events. The recent rises in self-reported binge drinking, and the major rise in the age-adjusted mortality from mental and behavioural disorders because of the misuse of alcohol, herald future increases in alcohol-related disease burden and highlight a gap that deserves greater attention.

The most effective public-health actions are usually those that target populations,[109,110] often legislation or regulations. Health education actions directed at individuals, in the absence of such concomitant upstream actions, have limited effectiveness in altering behaviour, and their effect size is often small in relation to massive industry marketing of unhealthy products. Individual

responsibility for a healthy lifestyle must be seen as constrained by the social environment, especially in the presence of such undesirable marketing. An important role of government is to restrain inappropriate industry actions and to frame the environment such that it is easier to make healthy choices.[111]

Brazil's success in legislative and regulatory actions, including fiscal ones, for tobacco control should guide the current challenge of implementing additional actions related to a healthy diet and physical activity. International recommendations relating to risk factor control[2] and recent recommendations for public actions to prevent cardiovascular disease by the UK's National Institute for Health and Clinical Excellence[112] are good examples of what more is needed.

Provision of chronic disease care in the national health system

Brazil's Unified Health System (*Sistema Único de Saúde*; SUS) aims for universal access at all levels of care. Primary care, as discussed elsewhere in this Series,[9] is increasingly provided by Family Health Programme teams. Progressive expansion of the Family Health Programme has improved access to integral and continuous care, thus providing a platform for the prevention and management of chronic diseases.

The 2001 national reorganisation plan for the care of diabetes and hypertension, a nationwide screening programme, led to the detection and incorporation into the health system of an estimated 320 000 people with diabetes.[113] As a result of this programme, diagnosis and treatment of diabetes were scaled up at the primary care level. Evidence-based norms guiding diabetes care were implemented. Low-cost, generic medications such as aspirin and statins for those with high absolute risk for cardiovascular disease, as suggested for low-income and middle-income countries,[114] have been made widely available at no cost. In early 2011, the Ministry of Health expanded its People's Pharmacy programme, which will now offer basic medicines for diabetes and hypertension free of charge, as well as drugs for other chronic disorders such as asthma, rhinitis, Parkinson's disease, osteoporosis, and glaucoma at discounts up to 90%. Within the past few years, a nationally-coordinated smoking cessation programme has been started, based on group sessions and medications.[115] Guidelines and materials for the preventive management of other NCDs have also been implemented. Recent ecologic analyses suggest that the Family Health Programme might have produced a decrease of 8% in adult deaths nationally after 8 years of implementation,[116] and in Belo Horizonte, a major Brazilian metropolis, a 23% decrease in ambulatory care sensitive hospital admissions for chronic diseases after 4 years of implementation.

Yet major gaps remain in primary care provision, as important aspects of the chronic care model[117–119] are only now beginning to be incorporated. A major initiative to increase access via walk-in specialist clinics needs to be well integrated with Family Health Programme chronic care to avoid becoming a step in the wrong direction, leading to a second, competing port of entry into primary care via a model which is inadequate for the management of chronic diseases. Another recent initiative, which permits the support of Family Health Programme teams by other health professionals, including nutritionists, physical educators, psychologists, and psychiatrists,[120] should be directed primarily toward prevention and management of NCDs.

Although training modules have been developed and implemented for the care of neuropsychiatric disorders in primary care, more interventions for prevalent neuropsychiatric disorders such as depression, dementia, and alcohol dependence need to be implemented and assessed. Much of this mental health care can be designed to be delivered with existing activities such as those of maternal and child care and HIV/AIDS.[121] Similarly, expeditious work-up of cases suggestive of potentially curable cancer, done in collaboration with relevant speciality physicians, must become widely available so as to ensure prompt diagnosis and effective treatment.[62] Primary care teams also need to have training and support for palliative care of cancer patients with poor prognosis.

Screening for cervical cancer is widely available, and self-reported coverage for the Pap test is adequate overall, but access remains problematic in the poorest areas. A policy for breast cancer screening on the basis of clinical examination after 40 years and biennial mammography between age 50 years and 69 years was started in 2004, but coverage assessed by self report is still less than desirable, and unequal distribution of mammography services across Brazil complicates access. Challenges include ensuring that women at higher risk for cervical cancer are being targeted; implementing screening for breast cancer throughout the country; and providing a complete follow-up of 100% of women screened for both types of cancer, thus allowing prompt and effective treatment for those diagnosed.

Two huge challenges are the elimination of long waiting lists for specialised ambulatory care, diagnostic services and surgeries, and the transfer of treatment of most acute flares of chronic conditions from hospital emergency rooms to outpatient settings. One explanation for the failure to provide adequate access to quality outpatient care and basic surgeries is the competing demands for resources from technology-intensive therapies for advanced NCDs. For example, spending for renal dialysis rose from about R$600 million (about US$340 million) in 2000 to R$1·7 billion (about US$713 million) in 2009. Additionally, industry and medical societies exert constant pressure for the incorporation of high-cost health technologies of uncertain or questionable cost-effectiveness. Within this scenario, the so-called judicialisation of medicine (ad hoc

For more on **the People's Pharmacy** see http://www.saud-enaotempreco.com/index.php

judicial rulings mandating the provision of services on the basis of courtroom judgements), addressed elsewhere in this Series,[122] has aggravated the already questionable distribution of scarce health resources.

Resisting these forces, which lead to inadequate resource allocation, is another major challenge. To rationalise spending, guidelines and protocols have been progressively produced, especially to guide the use of highly complex procedures, and a framework for the assessment and incorporation of health technologies has been created. Major expansion of this effort is ongoing and necessary to assure that cost-effective treatments are offered to all.

The challenge

The fall in age-adjusted NCD mortality of about 2% per year from 1996 to 2007 is a great achievement, even though rates for diabetes and for certain types of cancer are rising. The goal of reducing NCD mortality by 2% per year over and above existing trends, as has been recommended,[1,123] effectively requires a doubling of Brazil's current rate of decline—an enormous challenge. First, since trends for key diseases and risk factors are not favourable. Second, given the ascending obesity epidemic, these trends are unlikely to be reversed in the near future. Third, potentially avoidable social inequalities in the distribution of NCD risk will continue to act as a large and persistent generator of these conditions for the foreseeable future. Additionally, the challenge faced by Brazil is part of a larger global health challenge that needs concerted worldwide political action—eg, international pressure to remove unfair subsidies on cheap unhealthy foods.[124]

Conclusions and recommendations

NCDs are quickly becoming the main public health priority in Brazil, and policies for their prevention and control have been implemented. Although formal assessment is often lacking, the SUS has made major strides, among them the implementation of very cost-effective interventions such as tobacco control and the widespread delivery of drugs to those at high risk of cardiovascular diseases. However, much more, can be done.[2,4,125]

The priority and political support for preventing NCDs[124] needs to be increased through the emphasis of: their control through social, rather than individual, measures; their role in slowing economic growth and perpetuating poverty; and the existence of cost-effective interventions that permit their control.

National goals need to be developed for the reduction of chronic diseases and risk factors,[1,126] with special emphasis on obesity, and the scaling up of policies and actions to achieve them.[2,124,127–129]

A concomitant shift of resources, in relative terms, from hospital and high-technology end-stage care to health promotion and prevention is needed to augment budgetary support and central coordination for chronic disease prevention and care.

Strategies involving augmented intersectoral discussion and planning are needed to implement and scale-up cost-effective interventions that can help to produce an environment conducive to healthy lifestyle choices. Emphasis should be placed on so-called upstream strategies, for example, those reducing the salt content of foods and restricting advertisement of unhealthy foods to children.[2,114] Partnerships with civil society should be strengthened, and special attention should be given to crucial periods (pregnancy, early childhood, and adolescence).

The Brazilian health system needs to be strengthened for the care of chronic conditions through the development of a chronic-care model[117,118] on the basis of local experiences; expansion and qualification of the Family Health Programme, amplified access to cost-effective drugs, greater communication between primary and other levels of care; integration of chronic disease programmatic actions with ongoing ones, such as those related to women's health and HIV/AIDS; and a scaling up of prompt detection and treatment of those with curable cancer.

Strategies need to be implemented that concomitantly ameliorate health inequities, in accordance with recommendations of Brazil's National Commission on Social Determinants of Health.[13]

Links with academic institutions need to be expanded, in part via an adequately directed research agenda, engaging them in planning and assessments at all levels and in the training of health professionals working within the SUS.

Health technology assessment needs to be enhanced to provide a sound basis for the proper selection of new public health programmes and actions, and of new drugs, devices and diagnostic tests.

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