Strategy for Health

National Adaptation Plan
to Climate Change

9 Strategy for Health

9.8 Introduction

Assessment of the effects of climate change on human health is a complex process requiring an interdisciplinary approach to examine relationships between social, economic, biological, ecological and physical systems (Barcellos *et al.*, 2009). Evidence indicates that climate change, associated with socioeconomic and environmental factors, will influence the impacts of disease on health, affecting demand for healthcare, surveillance, and health promotion services provided by the Unified Health System (*Sistema Unico de Saude* - SUS)[44].

This strategy presents the vulnerabilities, impacts and risks of climate change on human health, and provides guidelines and strategies for the SUS, in line with the National Policy on Climate Change (PNMC).

It is hoped that it will promote, within the Ministry of Health (MS) and other SUS management levels, public and private institutions and organised civil society involved with the sector, deeper consideration of information on the impacts of climate change on health, and lead to upgrading and adaptation of policies and measures for appropriate action.

The expected outcome is adoption of adaptation measures to increase resilience of healthcare services and mitigation of the effects of climate change on the health of the population, thereby promoting a climate-change adaptation agenda for the health sector.

The Ministry of Health's Secretariat for Health Surveillance (SVS/MS) is the focal point for coordination of this agenda within the SUS and coordinated preparation of this Strategy, in cooperation with other secretariats of the Ministry of Health, the Oswaldo Cruz Foundation (FIOCRUZ), the National Health Foundation (FUNASA), the National Health Surveillance Agency (ANVISA), the Evandro Chagas Institute (IEC) and other partner institutions, with support of the Secretariat for Climate Change and Environmental Quality (SMCQ) of the Ministry of Environment (MMA).

9.9 Institutional ownership of the theme "Adaptation of Health to Climate Change"

Discussion and formulation of public policies targeted toward issues relating to climate change, including mitigation and adaptation actions, gained prominence on the Brazilian Government's agenda and of health authorities in 2007, when the Ministry of Health first participated in processes relating to the National Policy

[44] The *Sistema Unico de Saude* (SUS) was created by Law 8080, of 19th September 1990. More information is available at: <http://portalsaude.saude.gov.br/index.php/cidadao/entenda-o-sus and http://bvsms.saude.gov.br/bvs/sus/legislacao.php>.

on Climate Change. At the sectoral level, studies and research were pursued as inputs for the Management Commission and Executive Committee for Climate and Health (GM/MS Order 3244/2011)[45] under coordination of the Executive Secretariat and the Secretariat for Health Surveillance and for preparation of the Sectoral Health Plan for Mitigation and Adaptation to Climate Change (PSMC).

SVS/MS, through its Department for Environmental Health Surveillance and Worker's Health (DSAST), is responsible for surveillance of determining factors and environmental conditions that affect human health and for coordination of application of the National Policy on Climate Change in the Health Sector.

In 2011, a task force (*Força Nacional do Sistema Único de Saúde* - FN-SUS)[46] was set up to address disasters, service failure, and epidemiological emergencies under the Public Health Emergency Response Plan, and Contingency Plans were drawn up for coping with public-health aspects of such events (flooding, drought, injuries and diseases)[47] .

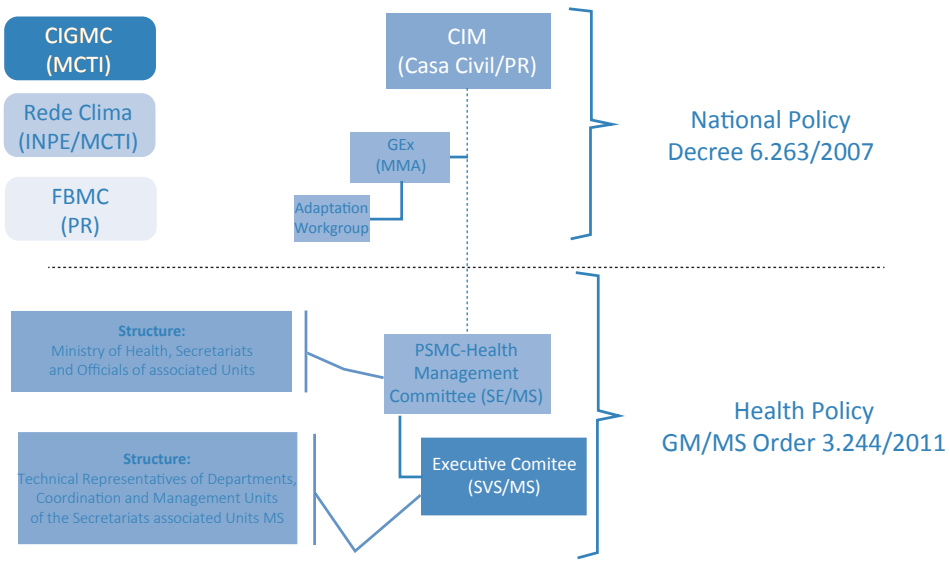

Figure 14. Ministry of Health Institutional Structure for Climate Change
Source: CGVAM/ DSAST/SVS/MS, 2011

[45] <http://bvsms.saude.gov.br/bvs/saudelegis/gm/2011/prt3244_30_12_2011.html>.

[46] *Força Nacional do SUS* was created by Decree 7616, of 17th November 2011 and regulated by GM/MS Order 2952, of 14th December 2011. For further information, access: <http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/secretarias/sas/dahu/forcanacional-do-sus>.

[47] Plans for Response to Public Health Emergencies., see: <http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/leia-maiso-ministerio/197-secretaria-svs/12109-planos-vigilanciaambiental>

Through partnerships with FIOCRUZ and the National Institute for Space Research (INPE), the National Observatory for Climate and Health[48], and the Environmental Information System Integrated to Environmental Health (SISAM)[49] were established. Support was provided for founding of the Studies and Research Centre on Emergencies and Disasters (CEPEDES)[50] and for training and specialisation courses in environmental health at various institutions, including the Institute of Collective Health Studies of the Federal University of Rio de Janeiro (IESC/UFRJ)[51]. With a view to strengthening the disaster-relief activities of the SUS, a number of activities were carried out in close coordination with the National Center for Monitoring and Early Warning of Natural Disasters (CEMADEN) and the Brazilian National Risk and Disaster Management Centre (CENAD) of the National Secretariat for Protection and Civil Defence (SEDEC).

9.10 Climate Change and Health: impacts, vulnerabilities and risks

Sensitivity of human health to the adverse effects of climate change is associated to individual and collective vulnerabilities and to specific territorial aspects. The determinants for individuals are variables such as age, health profile and physiological resilience; whereas collective resilience is determined by socio-environmental factors such as population growth, poverty, environmental degradation, economic models, sanitation, and degree of urbanization (BARCELLOS *et al.*, 2009).

Precisely how each of these factors is affected by climate change determines the degree of health vulnerability as a whole. Extreme climate events with alternating waves of cold and heat, and disasters such as flooding and prolonged drought directly affect human health. Indirect effects tend to be induced by gradual and long-term changes in rainfall, temperature and humidity patterns, which alter ecosystems and biogeochemical cycles. Such changes increase exposure of individuals and populations to atmospheric pollutants, expand areas susceptible to transmission of infectious diseases (PAHO/MS, 2009) and to emergence of new diseases and re-emergence of known ones, to water shortages and deterioration of the quality of drinking water, to crop failure and economic losses, cause upheavals in social-welfare systems, weakening the work force and the functioning of healthcare systems (IPCC, 2014).

[48] National Observatory for Climate and Health, see <http://www.climasaude.icict.fiocruz.br/>.

[49] See: <http://sisam.cptec. inpe.br/msaude/informacoes.html#>.

[50] CEPEDES, see <http:// andromeda.ensp.fiocruz.br/desastres/>

[51] IESC/ UFRJ courses related to environmental health, see: <http://www.labead.iesc.ufrj.br/eadportal/index.php/cursos>

Identification and monitoring of such challenges to the Health sector is of fundamental importance for definition of crosscutting sectoral adaptation actions for addressing vulnerabilities. Responses must entail strengthening of the SUS's risk-mitigation, emergency-management and recovery capabilities.

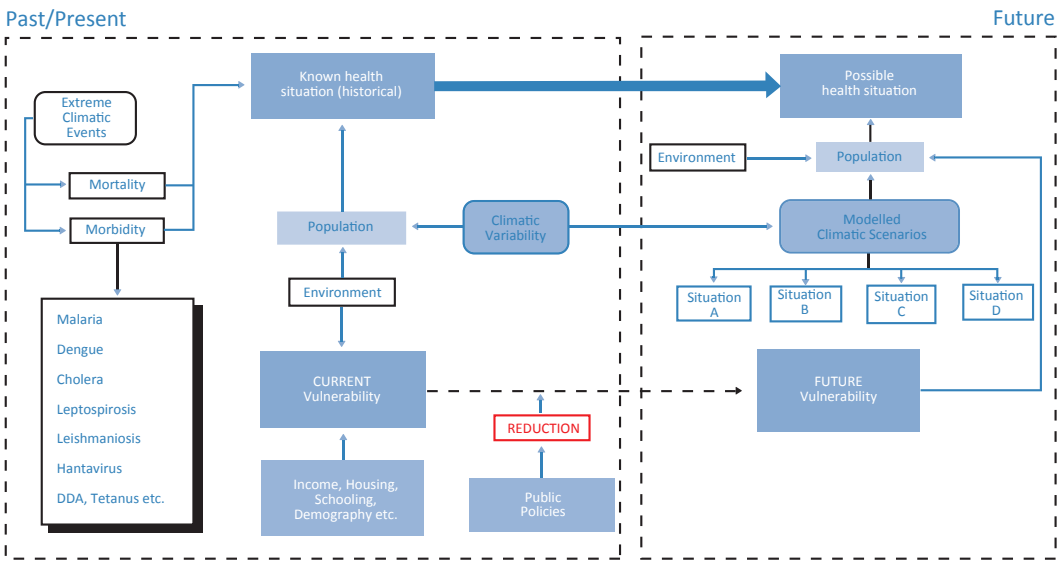

Figure 15. Climate Change Risks, vulnerabilities and impacts on human health (Source: Adapted from Barcellos *et al.*, 2009)

In view of potential social, economic and environmental vulnerabilities associated with disasters, air pollution, infectious diseases and water scarcity that are likely to be exacerbated by climate change, the SUS faces the challenge of strengthening its prevention, readiness and rapid-response capabilities. Vulnerabilities and effects of climate change on human health and on the SUS are shown in the following table.

Table 15: Assessment of vulnerabilities and impacts of climate change, and their effects on human health

Exposure	Vulnerabilities		Effects	
	Environmental Conditioning Agent	Socioeconomic Conditioning Agent	Population	SUS
Disasters: Flooding and Drought	Terrain, hydrography, silting of rivers, deforestation of hillsides, irregular settlement, river-flow levels (water-use quotas), vegetation cover, land use altitude.	Housing conditions, water supply systems, solid-wastes collection, inadequate wastewater treatment and drainage, settlements in high-risk areas, population density, most vulnerable populations (elderly, children, pregnant women), residents of high-risk areas (favelas and hillsides).	**Short term:** Deaths and hospitalisations related to external causes (drowning, landslides, fractures, trauma etc.); Homeless, evicted, displaced. **Medium term:** Increase in infectious diseases, Epidemics. **Long term:** Mental and cardiovascular problems; Malnutrition and food insecurity.	Overloading of health facilities; Disruption of service networks; Impacts on infrastructure (buildings, inputs, equipment and personnel); Discontinuity of routine healthcare services.
Air pollution	Terrain, hydrography, vegetation, deforestation, seasonality, wildland fire.	Age composition of the population (children and elderly); Combustion of fuels; Industrial activity, Forest fires; Population density, housing and schooling levels.	Increase in infant, and under-5 and elderly over 60 mortality from respiratory diseases, and of adults over 40 from cardiovascular disease (arrhythmias and heart failure); Neoplasms (lung cancers), dermatological diseases, etc.	Overloading of health facilities; Increase in numbers of deaths, hospitalisations and outpatients care.

Table 15 (Continued): Assessment of the impacts of climate change, vulnerability and its effects on human health

Exposure	Vulnerabilities		Effects	
	Environmental Conditioning Agent	Socioeconomic Conditioning Agent	Population	SUS
Reduced capacity and quality of water resources	Rising sea levels, reduction in bulk-water supply for treatment and human water supply, and extreme weather events (drought or flooding)	Poor or no sanitation; Reduced treated water supply for human consumption; Poor treated water supply distribution network; Poor availability of alternative sources; Intermittent water supply; Total or partial interruption of water-supply services.	Water-borne and food-related diseases (diarrhea, hepatitis A and E, typhoid, leptospirosis, dengue, yellow fever, cholera, dehydration, schistosomiasis, trachoma, among others)	Overloading of health facilities due to increased demand, hospitalisations and deaths. Collapse of routine operation of the health units
Climate-sensitive infectious diseases	Rise or fall of temperature, humidity and rainfall, greater frequency of extreme weather events (too much or not enough rain), changes in the quality of drinking water, land use and vegetation cover, deforestation, fires.	Territorial planning, housing model and changes in land use; Population movements and migrations; Proximity of households to hazardous locations and mobility of populations of high-risk areas; Immunisation coverage; Occupational exposure (extractive, rural workers) or leisure (rural-tourism, ecotourism); Existence and quality of basic sanitation; Quality of drinking water; Availability of household hygiene measures; Such social indicators as: schooling and income levels.	Increased numbers of cases such health hazards as: illnesses associated with thermal discomfort, dengue fever, malaria, yellow fever, leishmaniosis, schistosomiasis, trachoma, leptospirosis, viral hepatitis, acute diarrhoeal diseases, cholera, Chagas disease, severe acute respiratory syndrome (SARS), influenza syndrome (influenza and other agents).	Overloading of health facilities owing to increased demand, hospitalisations and deaths. Re-emergence of controlled diseases.

Source: Adapted from Observatory of Climate and Health[52]

[52] Observatory of Climate: <http://www.climasaude.icict.fiocruz.br/>

9.10.1. Disasters and impacts on Health

Recent data point to flooding and drought as accounting for more than 90% of the disasters occurring in Brazil. Such events affect populations unevenly, directly and indirectly and in a variety of different long and short-term ways, depending on characteristics of the event and local socio-environmental vulnerabilities (ALDERMAN *et al*., 2012). Owing to precarious living conditions, poor social-welfare services and environmental degradation, certain population groups, especially the poorest, are especially vulnerable to disasters occurring as a consequence of extreme climate events.

Disaster-induced health effects may afflict such populations not only in the direct aftermath but also for months or even years after such extreme climate events. Such afflictions may range from deaths, injuries and infectious diseases, to exacerbation of chronic psychosocial disorders, malnutrition and accidents with venomous animals. (PAHO/MS, 2014).

Reducing the impacts of disaster damage on human health is one of the functions of the public health system. With a view to promoting adaptation strategies and increasing resilience, the SUS has considered a risk management model for service delivery at the federal, state and municipal levels. Among the measures already in place for addressing these issues are the System for Surveillance of Environmental Health Risks associated with Disasters (VIGIDESASTRES)[53], the *Força Nacional*/SUS, and state and municipal Disaster-Health Committees.

All components of the National Protection and Civil Defence System (SINPDEC) need to adopt coordinated and synergistic measures to assist in the adoption of adaptation measures for strengthening the performance of the SUS. Mapping of vulnerable areas, monitoring of climate events, early-warning and management of risk-reporting systems are essential elements for timely actions on the part of the SUS.

9.10.2. Air pollution and impacts on health

Air pollution has been identified a major environmental risk to human health, which increases the incidence of respiratory, cardiovascular, dermatological diseases, neoplasms, etc. (WHO, 2015; Cançado *et al*., 2006).

Vulnerabilities to diseases associated with air pollution are affected by environmental factors that influence dispersion of pollutants; by socioeconomic factors that lead to emission of pollutants; and finally, by factors relating to individual immunological-response mechanisms.

Climate change is taking place against a background of economic development based on establishment, maintenance and growth of industrial clusters and constant urban expansion, changes in land-use and settlement patterns and increased deforestation and burning, all of which affect deterioration of air quality and impact the health of populations in

[53] VIGIDESASTRES <http://portalsaude.saude.gov.br/index.php/vigilancia-de-a-a-z>

various regions of Brazil.

It is against this background that the Ministry of Health has implemented an Instrument for Identification of High-Risk Municipalities (IIMR)[54] for mapping of priority healthcare actions and to address problems associated with exposure to air pollution. The objective is to identify major pollution-emissions sources that compromise air quality, such as mining and manufacturing operations, vehicle fleets, and heat sources caused by burning and deforestation, etc., in the highest-risk municipalities. A significant group of these municipalities is located in parts of the Amazon region known as the "Arc of Fire", where dry-season burning, deforestation and mining and logging activities cause high levels of air pollution. Another significant group comprises municipalities located in metropolitan regions of the South and Southeast, where Brazil's largest vehicle fleets and industrial facilities are located.

Another health surveillance mechanism adopted by the Ministry of Health for the purpose of identifying health risks is the Sentinel Units for monitoring of Populations Exposed to Air Pollution (VIGIAR)[55]. This system monitors incidences of respiratory diseases attributable to atmospheric pollutants in children under the age of 5 years and the elderly over the age of 60, the age-groups most vulnerable to air pollution.

[54] Instrument for Identification of the Risk Municipalities (IIMR) <http://177.153.6.85/iimr/>

[55] VIGIAR <http://portalsaude.saude.gov.br/index.PHP/vigilancia-de-a-a-z>

Notwithstanding adoption of these instruments, the SUS needs to expand its capacity for detecting changes in healthcare profiles, with a view to adopting timely measures for addressing diseases caused by exposure to pollutants. Among the essential tools available for this purpose are Health Status Analyses, based on inter-sectoral data and information. Currently, poor access to environmental data poses one of the main limitations to this approach.

Thus, definition of a strategy for reducing health risks must entail combined multi-sectoral efforts to reduce exposure of the population and strengthen and enhance the readiness and prompt-response capacity of the health services.

9.10.3. Reduced availability and quality of water resources

Change in rainfall patterns and increased frequency of extreme climate events, associated with factors such as poor sanitation, lead to reduced availability of drinking water and, in consequence, populations are exposed to water shortages and to water, food and vector-borne diseases, all of which overload and compromise healthcare services.

Disasters, such as flooding and drought may also cause changes in drinking-water quality, and thereby increase the incidence of diseases. In such situations, water supply is often intermittent. Many households suffer acute shortages, and thus seek alternative forms of access to water that may not be adequate for human consumption. This can lead to

additional health risks through spread of contamination and transmission of diseases. Drought and extended dry seasons may lead to proliferation of cyanobacteria in water sources, seriously compromising the quality of drinking-water supplies.

Among the infectious diseases associated with the low drinking-water quality and inadequate sanitation, the most serious concerns in Brazil are dengue fever, zika, chikungunya, schistosomiasis, leptospirosis, viral hepatitis, acute diarrhoeal diseases (ADD), cholera, typhus, trachoma and acute dehydration.

Besides these diseases, other ailments that require monitoring are: the risk of poisoning, which may occur as a consequence of exposure to water contaminated by chemical substances of anthropogenic origin, such as pesticides, medical drugs, hormones, and industrial or domestic chemicals. Poisoning may also result from exposure to substances present in the natural environment, such as cyanobacteria and cyanotoxins.

From a climate-change perspective, all these risk factors, and especially those relating to compromised sources of drinking water, influence the adaptation and resilience capacity of populations.

In a country as large and diverse as Brazil, guaranteeing access to appropriate quantities of high-quality drinking water requires sectoral public policies that take into account the importance of the role of basic sanitation services in: disease prevention and control, by breaching contamination chains and hindering proliferation of vectors; reducing environmental impacts; and in fostering preservation of surface-water sources and groundwater tables. This relationship further illustrates the importance of maintaining ecosystem services for the various sectors involved in this NAP, including public health.

With the aim of reducing risks to public health, the SUS issues specific regulations for drinking water standards (MS Order 2914, of 12th December 2011)[56]; conducts surveillance of drinking-water quality (VIGIAGUA)[57]; provides support for quality control for all forms of water supply, in urban, rural and indigenous areas[58]; and carries out sanitation actions in rural areas[59] (MS, 2005; MS,2013).

In the light of current vulnerabilities and the potential impacts of climate change, strengthening of institutional coordination and integration among sectoral public policies (including water resources, environment, health, sanitation, and Civil Defence) are essential for overcoming challenges and ensuring access of the population to appropriate quantities of high-quality drinking water.

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[56] MS Order. 2914/2011 <http://bvsms.saude.gov.br/bvs/saudelegis/gm/2011/prt2914_12_12_2011.html>

[57] VIGILANCIA (*Surveillance*) <http://portalsaude.saude.gov.br/index.php/vigilancia-de-a-a-z>

[58] Sanitation and quality of water for human consumption in indigenous people areas <http://portalsaude.saude.gov.br/index.php/o-ministerio/principal/secretarias/secretaria-sesai/mais-sobre-sesai/9482-destaques>

[59] Sanitation and support for control of water quality for human consumption <http://www.funasa.gov.br/site/>

9.11 Infectious diseases sensitive to climate

The areas and dynamics of the spread of infectious diseases are influenced by multiple factors. These include climate, environment, socio-economic and demographic, biological (life-cycles of vectors) and socio-medical factors (immunological status of the population, effectiveness of local healthcare services, specific disease-control programmes, etc.) and the epidemiological history of each location (BARCELLOS *et al*., 2009).

In Brazil, (as mentioned earlier) the main infectious and endemic diseases relating to climatic variability that afflict the population are: dengue fever, malaria, yellow fever, Chagas disease, cuteneous and visceral leishmaniasis, schistosomiasis, trachoma, leptospirosis, viral hepatitis, acute diarrhoeal diseases, cholera, acute respiratory infection, influenza syndromes (influenza and other agents) and severe acute respiratory syndrome (SARS) among others.

The socioeconomic vulnerability factors that influence infectious disease scenarios are: encroachment of human settlements on natural areas, unplanned land use; globalised trade; voluntary and forced migration; tourism; rising population, development and unplanned urban densification; distortions of the economic model; social and structural problems; and lack or ineffectiveness of sanitation systems.

Of the world's ten most neglected diseases, according to the World Health Organisation (WHO) nine are prevalent in Brazil (LINDOSO *et al*., 2009). Some 40 million Brazilians have one or more of these illnesses, thus compiling the highest burden of neglected diseases in the Latin America and Caribbean region. These include practically all the cases of trachoma and of leprosy and most of the cases of ascariasis, dengue fever, hookworm, schistosomiasis and visceral leishmaniosis (HOTEZ, 2008).

Surveillance and healthcare approaches, such as vaccination, fumigation, campaigns for promoting food hygiene, etc., aim initially to address causes of disease by interrupting transmission chains and, secondly, to avoid spread of the disease and apply treatment.

Implementation, within the SUS and other sectors of adaptation measures that influence environmental and socioeconomic factors that affect health and directly or indirectly interrupt climate-sensitive transmission chains of infectious diseases, can play an important role in reducing the incidences of such diseases.

9.12 Health Status Analysis and Indicators

Health status analysis enables description, measurement and explanation of the health/disease profiles of populations, including health impairments or problems and their determinants, thereby facilitating identification of healthcare needs and priorities, choice of interventions and appropriate programmes, and impact evaluations (MS, 2015). To draft such profiles, indicators

that reflect the different variables involved must be established.

Indicators are tools that facilitate understanding and monitoring of determinants and variables affecting human health and that assist in decision-making processes of the SUS. Some indicators, including those for epidemiology and environmental health used by the Ministry of Health, are agreed upon within the framework of the Interagency Health Information Network (RIPSA) which organises and maintains a database on the health status of the population (RIPSA, 2015).

With a view to studying and assessing the influence of climate change on human health, the Ministry of Health and FIOCRUZ have created the Brazilian Climate & Health Observatory[60] in partnership with the National Institute for Space Research (INPE). This observatory brings together environmental, climatic, epidemiological, social, economic and health data and information from different institutions, needed for analysis of relationships between climate and human health and of long-term trends. This partnership also created the Environmental Information System Integrated to Environmental Health (SISAM)[61] to facilitate access and handling of interactive and geo-referenced environmental data and indicators from various areas.

These projects are useful for public managers, researchers and organised civil society, assist in decision-making and complement other sources during monitoring of the health status. They may also assist in the selection or review of indicators for measuring impacts and outcomes of implementation of this NAP, and for setting new indicators, as required.

Health status analysis and reducing scientific and decision-making uncertainties with respect to climate and its impacts on human health remain outstanding challenges for government. They require information of various types (environmental, climatic, geographic, economic, health, etc.), data-sharing and collaboration among institutions, and integration and interoperability of information systems.

9.13 Strengthening of Crosscutting Public Policies

At Rio+20, it was acknowledged that "health is a precondition for and an outcome and indicator of all three dimensions of sustainable development … (environment, economic and social) ", and that "action on the social and environmental determinants of health, both for the poor and the vulnerable and for the entire population, is important to create inclusive, equitable, economically productive and healthy societies" (UN, 2012).

This illustrates the crosscutting nature of health issues and underscores the importance of strengthening

[60] Brazilian Climate & Health Observatory is available at: <http://www.climasaude.icict.fiocruz.br/>

[61] SISAM is available on the website: <http://sisam.cptec.inpe.br/msaude/informacoes.html#>

environmental resilience of the SUS and of other government sectors, private institutions and organised civil society by adopting policies for adaptation to climate change.

Setting adaptive measures for health requires a multidisciplinary approach that takes into account vulnerabilities stemming from different economic sectors and from such characteristics as climate, geography, vegetation, economy, culture, social models and epidemiological profiles of each of Brazil's regions that may pose health risks to humans.

Figure 16 illustrates the relationship between sectoral actions and reduction of socio-environmental vulnerabilities, and demonstrates the need for crosscutting approaches for improvement of public policies.

Driving forces, Pressures and Situations that generate socio-environmental vulnerabilities	Actions for Reduction of Socio-environmental Vulnerabilities							
	Cities Statute	National Policy on Protection and Civil Defence	National Solid Waste Policy	National Basic Sanitation Policy	National Water Resources Policy	National Health Protection Policy	National Environment Policy	National Social Welfare Policy
Extreme poverty			●			●		●
Population density	●	●						
Housing deficit								
Inadequate urban infrastructure		●	●	●	●		●	
Environmental degradation of fragile areas		●	●	●	●		●	

Figure 16. Government actions for reducing socio-environmental vulnerabilities caused by driving forces and development pressures applied to territory (adapted from PAHO/ Ministry of Health, 2014)

Thus, to promote resilience of the population to climate change, it is essential that all sectors and spheres of government be committed, and that crosscutting approaches to management be adopted. This is necessary both for formulation and implementation of public policies and to reduce vulnerabilities of the population.

9.14 SUS Guidelines and Strategies

In view of the impacts of climate change and their effects on human health, SUS guidelines and strategies were drawn up to orient formulation of public policies, in compliance with the National Policy for Climate Change (Law 12187/2009) and adaptation measures targeted at strengthening activities of the SUS were adopted, with a view to reducing the impacts of such effects.

For purposes of this NAP, guidelines encompass accomplishment of goals that extend far beyond the lifespan of the Plan and that should be used during selection of strategies and priorities, in accordance with the epidemiological and organisational features of services.

Studies and research on the impacts of climate change on human health and action strategies drafted within the scope of the World Health Organisation (WHO), the Pan American Health Organisation (PAHO) and MERCOSUR also took into consideration 4 dimensions, namely: evidence and information management; awareness and education; alliances; and adaptation. (PAHO, 2014; PAHO, 2011).

With respect to the SUS management model, the guidelines and strategies presented in this NAP will serve, from a climate change perspective, as inputs for the definition of objectives, goals and actions of agencies and units of the Ministry of Health. Proposals for assimilation of these guidelines and strategies at the state and municipal levels of SUS, taking into consideration the particularities of each, will also be submitted the Health Councils.

The main federal-level planning instrument for mitigation measures and adaptation to climate change of the SUS is the Sectoral Health Plan for Mitigation and Adaptation to Climate Change (PSMC-Saúde) 2016-2019.

Table 16: Guidelines for incorporation of Adaptation to Climate Change into policies of the SUS

AXIS	GUIDELINES	STRATEGIES
"Information Management" Deals with expansion of scientific and technical knowledge; production and availability of official data and information for research on the relationship between health and climate; the burden of disease attributable to climate change; the economic costs and benefits of adapting to climate change; and mitigation measures to reduce the impact of climate risks on health in Brazil	**GUIDELINE 1.** Improvement of the quality of information and processes for risk reporting to assist with SUS activities in public-health emergencies associated with climate change.	Cross-reference reports of injuries and disease with hospital-admissions records relating to disasters, localities with high concentrations of air pollution and poor access to drinking water;
		Improve reporting of deaths classified as stemming from disaster events, air pollution, cold and heat waves;
		Set up, within the SUS, a system for reporting and warning of disasters, integrated with Civil Defence;
		Develop and deploy Risk Notification Management, involving all sectors and management levels of the SUS;
		Expand and encourage use of geographic and modelling information systems for understanding the dynamics and prevention of diseases;
		Establish indicators and monitoring systems to enable monitoring of impacts of climate change on health and the expected outcomes of this Plan.
	GUIDELINE 2. Promotion of studies and research on the effects of climate change on human health, considering traditional knowledge, regional characteristics and ecosystems when constructing knowledge.	Perform studies that establish costs/benefits of adaptation and mitigation actions for the health sector;
		Encourage and identify national climate and health research leaders;
		Encourage creation of climate and health research centres within research institutions and universities;
		Promote research on the burden of climate-sensitive diseases in Brazil to assess the influence of climate and of social, economic and environmental vulnerabilities in their occurrence;
		Promote studies and research to identify human health risk areas and vulnerable populations, in the context of the impacts of climate change in Brazil;
		Create stable funding sources for public investment and incentives for health-related science, technology and innovation (CT- Saúde).

Table 16 (CONTINUATION): Guidelines for incorporation of Adaptation to Climate Change into policies of the SUS

AXIS	GUIDELINES	STRATEGIES
"Awareness and Education" Entails promoting awareness of the risks of climate change to human health, by means of campaigns, events, courses, capacity-building, training, publications, policy guidance, etc. on the theme, to encourage changes of behaviour and enlist support of the public and authorities for development of strategies to reduce vulnerabilities and protect health, making the population more resilient to climate change.	**GUIDELINE 3.** Promotion of capacity-building and actions to raise awareness of the population and of SUS professionals on the effects of climate change on human health and the importance of sustainable development, and encouragement of community participation in definition of mitigation and adaptation policies.	Include climate-change and human health themes in specialisation courses, capacity-building and training programmes targeted at SUS professionals, within the context of the programme.
		Develop a capacity-building programme for SUS professionals on the impacts of climate change and its effects on health, within a sustainable-development approach;
		Provide inputs for actions within the framework of the Healthy Cities programme;
		Promote education and awareness on climate-change and its effects on human health within measures and actions targeted at SUS professionals and organised civil-society partner institutions to promote changes in risk perception;
		Develop specific training programmes to guide actions of SUS professionals in disaster situations;
		Strengthen community involvement in the definition of priority public-health policies, in compliance with Law 8142/90.
"Alliances" Entails strengthening of inter-sectoral and inter-institutional coordination and partnerships to stimulate knowledge and promote resilience of the population, through provision of data and information, technology transfers and actions to promote adaptation and mitigation.	**GUIDELINE 4.** Strengthening of the inter-sectoral and inter-institutional coordination, targeted at definition of crosscutting actions, including provision of data and information for knowledge production, technology transfers and actions to promote adaptation and mitigation in the health sector.	Establish mutually-agreed instruments to promote access to environmental and socioeconomic data and information;
		Establish methodologies and techniques for health-status analysis of the population in relation to risks associated with current climate factors and prepare future projections and scenarios;
		Promote technology transfers and exchanges of practices within the health sector to enable adoption of effective adaptation and mitigation measures in the health sector;
		Strengthen inter-institutional, and intra and inter-sectoral coordination spaces for continuous improvement of technical and management instruments and the effectiveness of crosscutting actions relating to the impacts of climate change and their effects on health.

Table 16 (CONTINUATION): Guidelines for incorporation of Adaptation to Climate Change into policies of the SUS

AXIS	GUIDELINES	STRATEGIES
"Adaptation" Covers adaptation measures required to strengthen prevention, preparation and response capacity of the health sector, to minimise vulnerabilities of the population in face of impacts of climate change, thereby contributing toward resilience of the health system and of the population.	**GUIDELINE 5.** Fostering of sustainable, resilient and secure infrastructure for public healthcare and Supplementary Health facilities, to ensure continuity of health services in disasters relating to water and energy-insecurity scenarios; promote sustainable development among the many segments of the health sector; and contribute to reducing GHG emissions.	Implement and expand clean renewable energy generation and increase energy efficiency within SUS and Supplementary Health facilities;
		Reduce water consumption and ensure continuity of drinking water supply in health facilities;
		Replace hazardous chemical substances used in health facilities for less polluting and safer alternatives;
		Reduce, treat and ensure secure disposal of waste from health services;
		Reduce use of oil-based substances and other pollutants in the manufacture of cosmetics, health products, household cleaning and medical-drugs;
		Reduce inadequate disposal of pharmaceutical products and consequent pollution;
		Adopt principles of the Programme for Sustainable Public Hiring during procurement of products, materials, furniture goods, and real estate and promote sustainable innovations within the SUS and Supplementary Health framework;
		Improve strategies for transport of patients and staff to reduce GHG emissions;
		Purchase and supply healthy and sustainably cultivated foods for the healthcare network;
		Build a GHG inventory for the health area (motor vehicles, industrial complex, disposal and treatment of health-services waste);
		Issue a technical regulation to address the planning, programming, preparation and evaluation of physical projects for healthcare facilities, covering: 1) recommendations and concepts of the Pan American Health Organisation for construction of hospitals and disaster-proof health units, with a view to ensuring their operation during and in the aftermath of public health emergencies, and 2) use renewable energy sources and reduce water consumption.

Table 16 (CONTINUATION): Guidelines for incorporation of Adaptation to Climate Change into policies of the SUS

AXIS	GUIDELINES	STRATEGIES
"Adaptation" Covers the adaptation measures required to strengthen prevention, preparation and response capacity of the health sector, to minimise vulnerabilities of the population to the impacts of climate change, and contribute toward resilience of the health system and of the population.	**GUIDELINE 6.** Formulation of specific policies to increase resilience of social groups with greater vulnerability to climate change in rural areas, wetlands, and among forest populations, indigenous peoples and the homeless.	Establish information mechanisms targeted at vulnerable populations, to encourage adoption of low environmental-impact practices and their benefits for human health, in partnership with environmental, agricultural and agrarian-development bodies, among others;
		Establish a methodology for production of information by communities that are vulnerable to the impacts of climate change on human health;
		Adopt sustainable technologies to enable deployment of health services in indigenous, quilombola and remote areas, e.g., renewable modern solar energy sources and alternative technologies for treatment of health-services wastes;
		Perform health surveillance actions to build knowledge on epidemiological profiles of rural, wetland and forest, indigenous, quilombola and homeless populations for adoption of measures for adaptation to climate change.
	GUIDELINE 7. Strengthen implementation of the national policy for sanitation and health, with the aim of universalization of access to drinking water and sanitation services.	Expand and strengthen the Network of Laboratories for the monitoring, follow-up and dissemination of information on the quality of soil and of water for human consumption;
		Improve diagnoses, evaluation and risk-management instruments for assessment of availability, access to and quality of drinking water, considering urban and rural vulnerability scenarios and the specific vulnerabilities of states and regions, within a climate-change context;
		Stimulate adoption of new water-treatment technologies to serve demand related to public-health emergencies, arising from effects of climate change.
	GUIDELINE 8. Strengthen health surveillance for identification of human-health risks associated with climate change, with a view to supporting adoption of adaptation measures within the SUS context.	Include climate-change and human-health themes on the agenda of inter-disciplinary and inter-sectoral regional Standing Committees for Health Surveillance, with public participation (Decree 7508/2011) in support of prevention, preparation and response actions of healthcare networks;
		Encourage preparation and implementation of Public Health Emergency Plans within state and municipal-level SUS facilities, with participation of all SUS sectors and of partner institutions;
		Expand the Network of Reference Laboratories for monitoring and follow up of vectors and of clinical analyses of infectious and non-communicable diseases;
		Establish mechanisms and tools for identification of populations dependent upon health facilities in-disaster risk areas, in partnership with Civil Defence and other agencies that produce data;
		Identify etiological causes in health-emergency associated cases;
		Deploy climate and environmental-risk analysis in health surveillance activities.

9.15 Specific Objectives, Goals and General Recommendations

Volume 1 of this NAP identified priority goals agreed upon among the various sectors involved in this Plan. Attainment of these goals could have extensive repercussions, depending upon the planning and institutional capacity of each sector. For the health strategy, two priority actions were selected to be implemented during the initial phase of this Plan:

Objective 3. Identify and propose measures to promote adaptation and reduction of climate risk	Sectoral and Thematic Strategy: Health		
	Goal 3.11	**Initiatives**	**Responsible**
	Expand the scope of the National Drinking Water Quality Surveillance Program (VIGIAGUA) to reach 85% of Brazilian municipalities, by 2019.	Enhance the National Drinking Water Quality Surveillance Information System (SISAGUA) incorporating new features and health-risk management reports.	MS(SVS)
		Expand and establish the network of laboratories for monitoring, follow-up and dissemination of information on the quality of drinking water.	
		Record on SISAGUA information on registration, control and surveillance of drinking-water quality.	
		Draw up risk maps on the supply of drinking water, based on the information generated by SISAGUA.	
	Indicator/Monitoring:	Percentage of municipalities with information on registration, control and surveillance of drinking-water quality recorded on SISAGUA.	
	Impacts:	Strengthened surveillance of drinking-water quality.	
		Enhanced information on water supply for human consumption.	
		Reduction of risks to human health related to drink-water supply.	
		Support for attainment of sustainable-development goals relating to access to water of quality compatible with current standards.	

Objective 3. Identify and propose measures to promote adaptation and reduction of climate risk	Sectoral and Thematic Strategy: Health		
	Goal 3.12	**Initiatives**	**Responsible**
	Establish a study, research, monitoring and communication network on climate and health, with a view to expanding technical-scientific knowledge and inputs for health-status analysis and for consolidated decision-making of the Unified Health System (SUS).	Integrate climatic, environmental and socioeconomic risk analysis into SUS procedures for monitoring of public-health emergencies.	MS (SVS/ FIOCRUZ)
		Establish centres for studies and research on climate and health within the SUS.	
		Establish a panel for strategic information on climate and health to support the strategic management in the SUS.	
		Establish a Centre for Integration of Health, Environment and Sustainability Technologies (CITSAS) within the National Climate and Health Observatory and the Knowledge Centre on Public Health and Disasters (CEPEDES).	
	Indicator/Monitoring:	Network established and consolidated.	
		Cooperation agreement drafted and implemented.	
		Network project drafted.	
		CITISAS project drafted.	
		Protocol for monitoring public-health emergencies integrated with analysis of climatic, environmental and socioeconomic risk drafted.	
		Panel for strategic information on climate and health established.	
		Integration Centre for Health, Environment and Sustainability Technologies established	
	Impact:	Enhanced quality of information, management capacity, and disclosure of information on climate risk to human health.	
		Stimulus for production of scientific and technical knowledge on the relationship between climate and health and climate-sensitive diseases, in support of decision-making and definition of adaptive measures, within the SUS.	

NOTE: (*) Implementation of Goal 2 is linked to provision of environmental data required for analysis of health status, considering environmental, climate and socioeconomic variables.

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