



# The health sector in the face of disasters and climate change in Cuba\*

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## ABSTRACT

*Due to its impact on human health and its capacity to cause damage, disasters are one of the global problems that most concern the international community. However, and in spite of the efforts made by many health systems, the reduction of vulnerabilities and the lack of strategies to avoid or minimize risks have not received enough attention yet. As Cuba is located in an area of permanent danger of disasters, its health sector has accumulated considerable experience in the management of risks and in the assurance of less risky future scenarios, with active participation of the community and a planned and organized process to address the impact of climate change. This paper summarizes some of these experiences and describes the dangers, vulnerabilities, and risks of disasters in Cuba, its Civil Defense System, and planning and organization in the health sector for disaster reduction, as well as the main effects and challenges of climate change in the health system. Lessons learned and good practices support the key role of human resources to reduce vulnerabilities; the greatest challenges are to avoid or minimize risks, to advance research, to train professionals for climate change, and to optimize the organization of health systems and services in the country.*

## Keywords

Disasters; climate change; health policy; Cuba.

The crises affecting the planet today overlap, complement and reinforce one another. Ethical, economic, political and social conflicts are augmented by others no less complex, such as civil unrest, struggles over food and disputes over

the environment, the deterioration of which puts human life at stake.

Climate change is affecting human health. Studies of climatic variations and change show an increase in average temperature, rapid sea level rise, extreme alterations in rainfall patterns and the habits of certain animal species, as well as an increase in disasters of unprecedented magnitude and complexity (1, 2). In many countries, however, health systems remain focused on reactive responses and pay scant attention to reducing vulnerabilities and incorporating sustainable

preventive strategies to avoid or minimize risks.

The endorsement of the *Sendai Framework for Disaster Risk Reduction 2015–2030* provided a unique opportunity to evaluate the *Hyogo Framework for Action* and look for efficient, consensus-based solutions to disasters and risks from multiple sources in the context of sustainable development (3).

This paper summarizes some of the Cuban health sector's experiences dealing with disasters and the impacts of climate change. It describes disaster hazards, vulnerabilities and risks in

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Cuba; the country's Civil Defense System; and planning and organization for disaster reduction in the health sector. The main impacts and challenges of climate change on the health system are also described.

## DISASTER HAZARDS, VULNERABILITIES AND RISKS

The *analysis of hazards or threats* is the foundation for identifying vulnerabilities and assessing risk.

Due to its geographic location in the Caribbean, Cuba shares with its regional neighbors the recurring danger of hydrometeorological events—the formation and movement of tropical cyclones, heavy rains, floods, local storms of great magnitude, and droughts—, causing major material and economic losses, and affecting human health (4). Between 1926 and 1944, tropical storms in Cuba caused 3 935 deaths. The most destructive hurricanes were the October 1926 cyclone that hit Isla de Pinos (now Isla de la Juventud) and Havana, causing 583 fatalities; the November 1932 hurricane that destroyed Santa Cruz del Sur in Camagüey province, causing 3 033 deaths; and the October 1944 cyclone that swept Isla de Pinos and Havana, causing 319 deaths. In October 1963, another devastating event, Hurricane Flora, left more than 1 200 dead in eastern Cuba, thousands of victims, and extensive damage to agriculture, housing and infrastructure (5).

Over the past 20 years, Cuba has been struck by 30 major atmospheric events: 10 tropical storms and 20 hurricanes. Of the latter, 11 were classified high intensity (Table 1), causing 54 deaths and

more than US\$30 billion in damage to housing infrastructure, agriculture and industry. Thanks to the alerts built into the early warning system for tropical cyclones (6) and measures adopted to protect the population, Cuba has been able to reduce the number of human victims caused by these events.

Cuba is also exposed to geological hazards, especially in the southeastern region of the country, due to seismic activity from the movement of tectonic plates (7). The strongest earthquake—which occurred in 1932 near Santiago de Cuba and measured 6.75 on the Richter scale—left 20 people dead and more than 400 injured, and caused major damage to 80% of the buildings in the city.

In terms of anthropogenic disasters, the most notable are technological, fundamentally transportation-linked accidents, both automotive and rail (8, 9), and chemical accidents involving spills and toxic leaks at industrial sites and surrounding areas, such as the 1990 ammonia spill in the city of Matanzas, capital of the province of the same name (10).

Among health hazards, the most frequent are those caused by epidemics associated with the international epidemiologic situation and violations of health laws, especially in places characterized by unfavorable health and sanitary conditions combined with low perception of risk among the population (11). Other threats include the possibility of biological attack. (12).

Existing *principal vulnerabilities* can be classified as: a) structural, varying according to the condition of housing stock and level of exploitation or lack of preventive maintenance; b) non-structural,

related to the susceptibility of lifelines (water and sewage systems, power lines, communications, storage facilities and roads); and c) functional, referring to organization, availability of resources to meet medical needs, patient transport, hospitalization, monitoring and control of actions, as well as risk perception, preparation and professional performance (13–15).

*Disaster risk* refers to potential losses from one or more hazardous incidents (simultaneous or conjoined) affecting one or more vulnerable elements at a specific time and place, under specific conditions. A multidisciplinary approach is used to make a qualitative or quantitative risk assessment for each probable disaster, according to its recurrence and potential tangible and intangible losses. These risk assessments consider not only potential physical damage to structures, but also conditions derived from the economic, financial, food-and-nutrition, health-and-hygiene, psychosocial, energy and communications situation, among others (16).

All of this requires a holistic approach that facilitates understanding of each type of event, and determines the nature and conditions of vulnerability of the population, goods, services, exposed livelihoods and the environment. Decision-making is based on the following two principles: first, protect human lives and avoid economic losses; second, guarantee disaster reduction activity at the lowest possible cost. This analysis is used to define preventive actions that reduce vulnerabilities, mitigate impacts, and take measures that minimize losses and lead to rapid recovery.

## THE CUBAN CIVIL DEFENSE SYSTEM

Cuba had no efficient civil defense system before 1959. Such activities were basically limited to shelters administered by the Ministry of Health and deployment of the Fire Department, which did not receive effective support from the State.

Civil defense (CD) activities were institutionalized in Cuba in 1962 under the title People's Defense, with the primary mission of organizing the population for the defense of cities and protection of industries and service centers (17). After the impact of Hurricane Flora in 1963, People's Defense was

**TABLE 1. Number of deaths and people protected in high-intensity hurricanes. Cuba, 2001-2017**

Hurricane	Category <sup>a</sup>	Date	Deaths	People protected
Michelle	4	November 2001	5	783 259
Charley	3	August 2004	4	232 9291
van	4	September 2004	0	2 266 066
Dennis	4	July 2005	17	1 551 667
Wilma	5	October 2005	0	760 168
Gustav	4	August 2008	0	467 579
Ike	4	September 2008	7	2 615 794
Paloma	4	November 2008	0	1 319 433
Sandy	3	October 2012	11	343 230
Matthew	4	October 2016	0	1 373 595
Irma	4	September 2017	10	1 863 589

<sup>a</sup>According to the Saffir-Simpson Hurricane Wind Scale, which defines and classifies hurricane categories based on wind speed.

**Source:** Created with data from National Civil Defense General Staff summary reports of meteorological events.

refined and eventually converted into a State system of measures aimed at protecting the population and its property, the national infrastructure and economy, under normal conditions as well as disaster situations, and against the impact of climate change.

The President of the Council of State leads CD through the Ministry of the Revolutionary Armed Forces (FAR). The National General Staff ensures compliance with measures and regulations relating to civil defense, international conventions, cooperation programs and international disaster aid (Figure 1) (18).

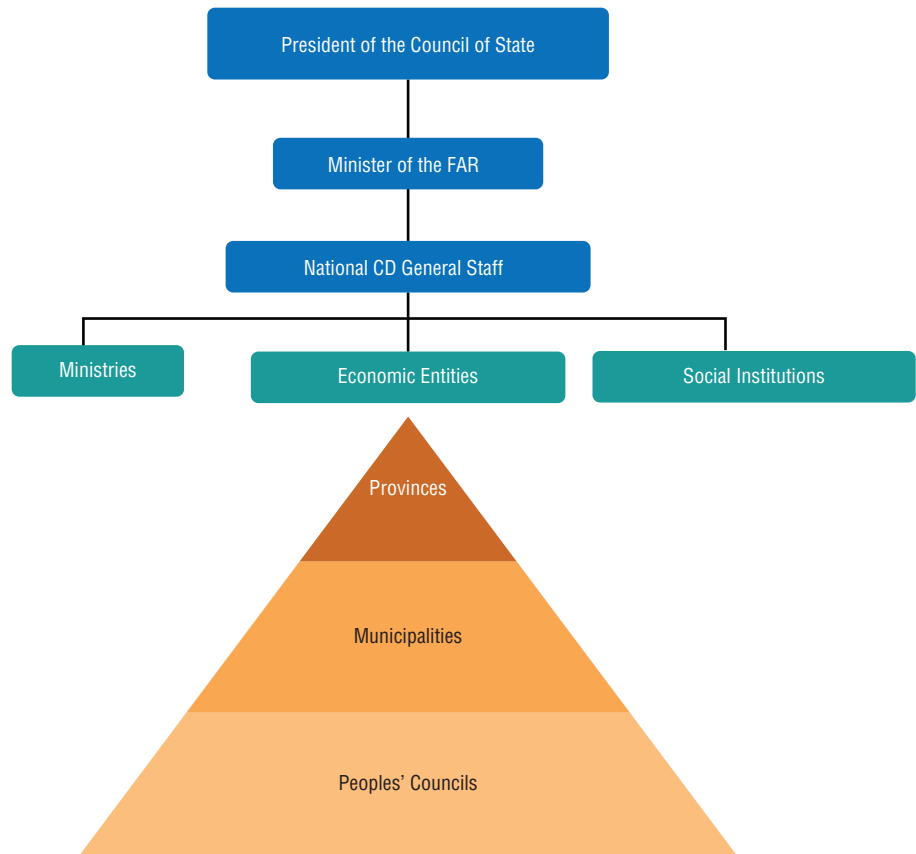
When there is no emergency, the presidents of provincial and municipal government assemblies are in charge of ensuring ongoing planning and organization of preventive measures established by CD. In turn, the heads of ministries and other central government agencies, economic entities and social organizations are responsible, at their respective levels, for planning and organizing CD measures, backed by legal norms establishing responsibilities in all social sectors for disaster reduction and facing climate change (19).

In the event of a disaster, defense council headquarters are set up according to Cuba’s political-administrative structure, with the participation of selected government bodies and State agencies. Disaster response measures are led and monitored from these headquarters, which maintain a direct link with entities working at diverse levels to implement decisions taken to protect lives and economic resources of all kinds (Figure 2).

### The health sector and disaster reduction in Cuba

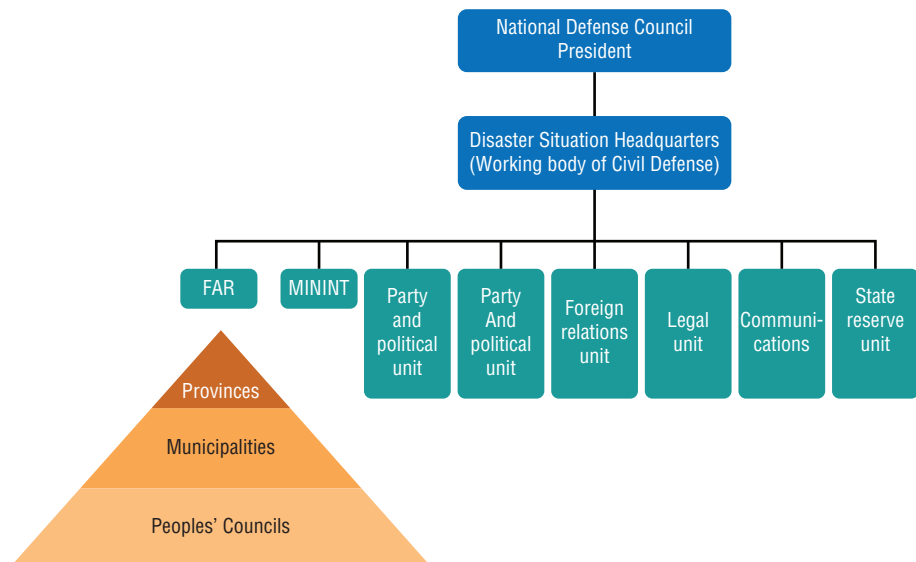
The Cuban Ministry of Public Health is part of the socioeconomic working body of the National Health System at all levels: municipal, provincial and national. It is empowered to issue regulations related to surveillance, prevention and control of diseases that can cause epidemics. Likewise, it is in charge of preparing the community, through the Cuban Red Cross, in light rescue, first aid, lifesaving, and providing physical and psychological support to victims. It also imparts decisions and develops guidelines for territorial health administrators and their institutions regarding

**FIGURE 1. Structure of the Cuban Civil Defense System**



**Note:** CD: Civil Defense; FAR: Revolutionary Armed Forces  
**Source:** Created by the authors based on reference 18.

**FIGURE 2. Leadership structure for disaster response and recovery in Cuba**



**Note:** FAR: Revolutionary Armed Forces; MININT: Ministry of the Interior.  
**Source:** Created by the authors based on reference 18.

medical care and social assistance, health, epidemiology and logistics (20).

The disaster reduction plan is the basic tool for planning, organizing and

preparing the health sector for any potential disaster (21). Accordingly, all territorial health administrations and institutions in Cuba prepare these plans,

based on lessons learned during response and recovery to past events, hazards identified, and levels of vulnerability and risk. Measures have economic backing and are organized in four stages—*prevention, preparedness, response and recovery* (Figure 3)—according to existing forces and means. These measures must also be measurable and updated annually. Actions that cannot be carried out during a given year are included in medium-term planning needs.

The *prevention stage* begins early, starting with the investment process and general national planning, with the goal of avoiding damages and losses that can lead to disaster situations. These measures, which include risk studies and all actions aimed at controlling future risk, are linked to health institutions' development plans and are reflected in the legal, physical planning, public works, architecture and technical-scientific research spheres. The process of reconciling socio-economic development with CD interests requires thorough disaster prevention management by controlling institutional investments, repairs and maintenance; assembly of medical and non-medical equipment; and design of cooperation and scientific research projects (22).

Prevention also encompasses all actions that increase the population's resilience and reduces vulnerabilities, for example, improving immune status and chemoprophylaxis; measures to reduce exposure to hazards; biosafety; epidemiologic, entomologic and environmental surveillance; health promotion;

improving safety culture among workers and the general population; as well as climate change adaptation measures (23). Prevention is considered the most economical way to reduce damage from disasters.

The *preparatory stage* aims to organize capacities, forces and means for an effective response and rapid restoration of services following the event's impact. This stage takes into account the findings of hazard, vulnerability and territorial risk assessments (24) to organize protective measures and evacuate the population of particularly vulnerable and high-risk areas to safe institutions; advance deployment of specialized medical units to territories lacking sufficient response capacity or that could become isolated; as well as priority attention to people with chronic diseases or disabilities, the elderly, pregnant women and children. It also includes updating manuals and guides; inventories of supplies; protecting equipment and resources; transfer and evacuation to temporary shelters; cleaning rainwater drainage networks, ditches, storm drains and sewers; and pruning trees where needed (25).

Health personnel also receive standard preparedness training at this stage, and emergency responders are assigned and prepared. These include mobile and surgical medical brigades; Red Cross search-and-rescue teams; units tasked with the mass handling of corpses; medical teams comprised of toxicology specialists, administrators, professionals, technicians, workers and students; as well as specialists from other sectors, including psychological care (26).

Disaster preparedness of health professionals began in the 1970s with incorporation of Disaster Medicine content into the undergraduate curriculum in Cuban medical schools. In 1998, it became an assigned course by the same name in all health field majors at the university level, and was extended to postgraduate instruction through courses, workshops and diploma programs in every province (27). Teachers and medical professionals also receive instruction for international missions; foreign students strengthen their education and training through internships, courses and diploma programs; and students at the Latin American Medical School are trained. A Masters program in Health and Disasters is also underway and entered its fourth year in 2017 (28).

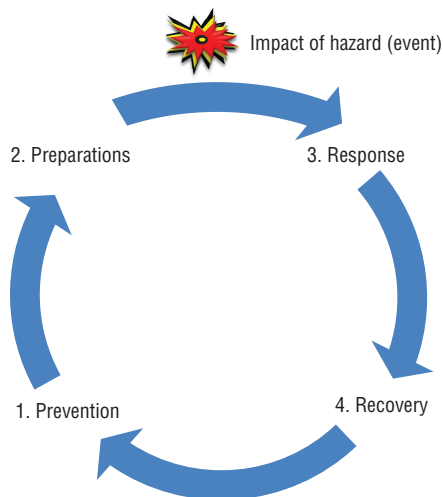
The *response stage* begins when the impact of a potentially destructive event is imminent, or when it occurs. During this stage, the decisions and disaster reduction plans approved at every level are carried out in accordance with the phase decreed by CD for each territory. In the event of a health emergency, specific action plans to contain possible spreading are established in advance in cooperation with certain economic sectors and with significant community participation.

The *recovery stage* begins the moment there is no longer any danger, or when the situation that caused the response has been controlled. Initial actions are directed toward recovery of vital services and reestablishing elements supporting those services and infrastructure. Verification, control, review, transfer and distribution of means and resources to health institutions are organized, as well as the reception, distribution and control of foreign aid. The process of recovery and reconstruction of damaged buildings and infrastructure is guided by the principle of not reproducing new vulnerabilities. This process is directed by different government bodies, and its duration depends on the degree of loss and damage suffered (19).

The health system's intersectoral approach has been an essential disaster reduction tool that can be applied by different social sectors (29). The health sector receives support from State bodies and agencies, and, at the same time, offers services through coordination and agreements between the entities involved. As a result, scientific institutions have incorporated risk awareness and early warning systems, and health facilities conduct vulnerability assessments and identify of risk reduction measures. Other measures include the fight against disease vectors; quality control of water and food for human consumption; availability of medicines, medical supplies, transportation and communications; medical care for foreign personnel; reception of international aid; and dissemination of participatory measures for improving health education (30).

Another important aspect of health sector participation in disaster mitigation is Cuba's solidarity with other countries through medical aid. This effort began in 1960 when Cuba sent a medical brigade and several tons of equipment and supplies to Chile after an earthquake that caused thousands of deaths. Since then,

**FIGURE 3. Disaster reduction plan in Cuba: Measures by stages**



**Source:** Created by the authors based on reference 18.

**TABLE 2. Participation of the Henry Reeve International Medical Contingent in disaster situations, 2005–2016**

Year	Country	Situation	Number of collaborators
2005	Guatemala	Floods	668
	Pakistan	Earthquake	2 564
2006	Bolivia	Floods	602
	Indonesia	Earthquake	135
2007	Peru	Earthquake	81
	Belize	Heavy rains	10
	Mexico	Floods	54
2008	China	Earthquake	43
2009	El Salvador	Floods	17
2010	Haiti	Earthquake	1 712
	Chile	Earthquake	76
	Haiti	Cholera epidemic	887
2014	Sierra Leona	Ebola epidemic	165
	Conakry, Guinea	Ebola epidemic	38
	Liberia	Ebola epidemic	54
2015	Chile	Heavy rains	15
	Nepal	Earthquake	48
	Dominica	Hurricane	15
	Sahrawi Arab Democratic Republic	Heavy rains	8
2016	Fiji	Heavy rains	2
	Ecuador	Earthquake	23

**Source:** Created with data from the “Cuban Participation in Disaster Situations” lecture by Dr. Iván Alexis Mora Pérez, first deputy director of the Central Unit for Medical Cooperation, during the Preparations for Responding to High-Intensity Earthquakes and Tsunamis course, Havana, Cuba, April 11–13, 2017.

more than 50 brigades and 8 023 collaborators have come to the aid of 27 countries hit by earthquakes, hurricanes, flooding, epidemics or volcanic eruptions. In 2005, the Henry Reeve Contingent, officially named the International Contingent of Medical Specialists in Disasters and Serious Epidemics, was created. Its brigades have delivered assistance to 19 countries with 7 217 collaborators (Table 2), including medical care for 1 000 people stricken with Ebola in Conakry, Guinea; Sierra Leona and Liberia during the 2014 epidemic. In recognition of the work and altruism of its members, the contingent was awarded the World Health Organization’s Dr Lee Jong-wook Memorial Prize for Public Health 2017 (31).

## IMPACTS AND CHALLENGES OF CLIMATE CHANGE

Climate studies in Cuba began in the 1970s. The observed impact of the intensification of the greenhouse effect on the earth’s atmosphere, rising surface temperature of air, lowering daily temperature range, increased frequency and severity of droughts, rising sea levels, and increases in total rainfall all pose major risks to human health, the

environment and the economy, as well as an enormous challenge to healthcare institutions (32).

Research conducted in 2000–2010 revealed conditions favoring increased acute respiratory infections and changes in their seasonal distribution from a bimodal pattern (with highs in March and October) to a trimodal pattern (with a third peak in May–June) (32, 33). A shift in the seasonal incidence of chickenpox from March to April–May was also observed, as was a change in the seasonal pattern of acute diarrheal diseases (in which the seasonal peak shifted from May to June–July), and more frequent epidemics of Hepatitis A (whose peak shifted from August–September to October–November, with a new seasonal increase in March–April). The density of the *Aedes aegypti* vector also increased (34), with greater spatial scope (in altitude and extension) and an accelerated reproductive cycle.

In April 2017, the Cuban Council of Ministers approved *Tarea Vida*, a State plan for facing climate change encompassing five strategic actions and 11 tasks oriented toward identifying and undertaking actions to protect coastal cities; relocate human settlements; comprehensively restore beaches, mangroves and

other protective natural ecosystems; assure availability and efficient use of water; reduce deterioration of coral reefs and promote their recovery and conservation; as well as projects linked to renewable energy, energy efficiency, food security, and the social and environmental determinants of health (35).

The health sector is developing a program to confront climate change, planned until 2030 (36). Focused on research, training, surveillance and early warning, this program is designed to update the health sector’s responses in alignment with the State plan. Its objective is to raise awareness about the influence of climate variability on disease and the organization of health services.

## SOME LESSONS LEARNED

In the process of reducing risks and losses from disasters of any origin, the Cuban health sector has been strengthened by adopting good practices but also faces difficulties. Table 3 summarizes the lessons learned.

## CONCLUSIONS

Based on the work carried out and the difficulties encountered, it can be concluded that:

- The Cuban health sector’s experience facing disasters emphasizes the corrective management of current risks and construction of future less risky scenarios through planned, organized management that includes confronting climate change and the active participation of society as a whole.
- Lessons learned and good practices confirm the key role played by human resources in reducing vulnerabilities and supporting policies and strategies aimed at avoiding or minimizing disaster risks, a challenge that demands constant attention.
- Research on health issues, and preparation of current and future professionals toward achieving more effective mitigation and adaptation, continue to pose challenges in the face of observed and potential impact of climate change, as well as for the organization of health systems and services.

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**TABLE 3. Lessons Learned**

Achievements	Challenges
<ul style="list-style-type: none"> <li>Integration of national and international experiences on risk and damage reduction from all types of disasters and their incorporation into international medical cooperation</li> <li>Elaboration of methodological tools for use in health practices for harm reduction</li> <li>Assessment through technical visits to all Cuban provinces to improve the disaster planning, organization and preparation process</li> <li>Multidisciplinary, intersectoral and social participatory approach, with strict adherence to Cuban legislation</li> <li>Professional training in health and disasters: This has been an unquestionable strength enabling the National Health System to minimize human loss and damages to installations from disasters, although its implementation in health practice is still insufficient</li> <li>Information and documentation management, national and international scientific exchange, and documentation of the most valuable strategies and outcomes; the scientific production of Cuban authors is compiled in 10 volumes of the series <i>Salud y desastres: Experiencias cubanas</i> (37)</li> </ul>	<ul style="list-style-type: none"> <li>Greater understanding of disaster risks is needed</li> <li>More awareness raising and better leadership training of health personnel is needed to improve and reduce health vulnerability</li> <li>Health personnel must be more engaged in health sector climate change mitigation and adaptation strategies</li> <li>Better use of the benefits of climate as therapeutic procedures is needed</li> <li>Support must be increased for generating scientific evidence to raise perception of climatic risk</li> </ul>

**Source:** Created by the authors.

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## El sector de la salud frente a los desastres y el cambio climático en Cuba

### RESUMEN

Por su impacto sobre la salud humana y su capacidad para generar daños, los desastres son uno de los problemas globales que más preocupan a la comunidad internacional. Sin embargo, y pese a los esfuerzos realizados por numerosos sistemas de salud, aún no se ofrece la atención necesaria a la reducción de vulnerabilidades y la falta de estrategias que eviten o minimicen los riesgos. Por estar ubicada Cuba en una zona de peligro permanente de desastres, su sector de la salud ha logrado acumular una notable experiencia en cuanto a la gestión correctiva de los riesgos y el aseguramiento de escenarios futuros menos riesgosos, con la activa participación de la comunidad y un proceso planificado y organizado para enfrentar el impacto del cambio climático. En este trabajo se resumen algunas de estas experiencias y se describen los peligros, las vulnerabilidades y los riesgos de desastres en Cuba, su Sistema de Defensa Civil, y la planificación y la organización en el sector de la salud para la reducción de desastres, así como los principales efectos y desafíos del cambio climático en el sistema de salud. Las lecciones aprendidas y las buenas prácticas ratifican el papel determinante de los recursos humanos para reducir las vulnerabilidades; el mayor desafío es evitar o minimizar los riesgos, avanzar en la investigación y la preparación de los profesionales ante el cambio climático, y optimizar la organización de los sistemas y los servicios de salud del país.

### Palabras clave

Desastres; cambio climático; políticas de salud; Cuba.

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## O setor da saúde diante de desastres e mudanças climáticas em Cuba

### RESUMO

Devido ao seu impacto na saúde humana e na sua capacidade de causar danos, os desastres são um dos problemas globais mais preocupantes para a comunidade internacional. No entanto, e apesar dos esforços feitos por numerosos sistemas de saúde, a atenção necessária ainda não foi oferecida para a redução de vulnerabilidades e a falta de estratégias que evitem ou minimizem os riscos. Como Cuba está localizada em uma área de permanente perigo de desastres, seu setor de saúde acumulou uma experiência considerável no gerenciamento de riscos e na garantia de cenários futuros menos arriscados, com a participação ativa da comunidade e um processo planejado e organizado para enfrentar o impacto das mudanças climáticas. Este artigo resume algumas dessas experiências e descreve os perigos, vulnerabilidades e riscos de desastres em Cuba, seu Sistema de Defesa Civil e planejamento e organização no setor da saúde para a redução de desastres, bem como os principais efeitos e desafios das mudanças climáticas no sistema de saúde. As lições aprendidas e as boas práticas ratificam o papel determinante dos recursos humanos para reduzir vulnerabilidades; o maior desafio é evitar ou minimizar riscos, avançar pesquisa, preparar profissionais para mudanças climáticas e otimizar a organização de sistemas e serviços de saúde no país.

### Palavras-chave

Desastres; mudança climática; política de saúde; Cuba.

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