

Government strategies in confronting COVID-19 in the republic of Cuba

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Abstract.

BACKGROUND: In Cuba, the first cases of coronavirus 2019 (COVID-19) were confirmed on March 11, 2020, when the World Health Organization (WHO) officially declared the pandemic and the Ministry of Public Health of Cuba (MINSAP) began to execute the COVID-19 Prevention and Control Plan. This plan was prepared two months earlier by MINSAP working together with the National Civil Defense and the government approved it at the end of January.

OBJECTIVE: The aim of this research is to assess the effectiveness of the government strategies to deal with COVID-19, by analyzing the role of the different agencies involved in the pandemic management.

METHODS: A bibliographical review of the following documents was conducted: information issued by MINSAP and other ministries, archives of the Pedro Kouri Institute (IPK) and Cuban journals regarding the high impact in the field of medicine. The data were processed with different tools (diagrams, bar graphs, analysis and synthesis, etc.) that allowed measuring the effectiveness of the strategies implemented.

RESULTS: The government's strategies focused on: the integration of all state agencies and some private institutions to confront COVID-19; the collaboration between MINSAP specialists, country's research centers and universities for the creation of vaccines to contain the pandemic; the production of medical equipment and instruments; the design of the organization processes of the services, such as planning techniques and distribution of ambulances, allocation of hospitals and isolation centers for sufferers and direct contacts respectively.

CONCLUSION: The analysis carried out showed that the interrelations between the different organizations involved had positive influences on the treatment of the pandemic.

Keywords: COVID-19, strategies, public health, government, role integration

1. Introduction

When the first cases of coronavirus 2019 (COVID-19) appeared in Wuhan, the World Health Organization (WHO) classified this disease as a health emergency of international concern. Then, on March 11, 2020, COVID-19 was declared a global pandemic, due to its extension to more than 180 countries in the world and a cumulative of over 4.4 million deaths since its appearance [1, 2]. This pandemic hit

communities and economies around the world in an unprecedented way, to the point of being a global disaster. Its rapid spread caused many countries [3–5] to take measures to stop its expansion, which was affecting health care capacities worldwide, these being insufficient to carry out the treatment of patients. Additionally, since the beginning of this pandemic, each country responded to this threat with different measures in each of the most critical moments they had gone through [6–9]. However, in the exploratory study carried out in [10], it was evident that the command and control mechanisms in response to disasters were effective when integration had been achieved between the personnel of different civil and

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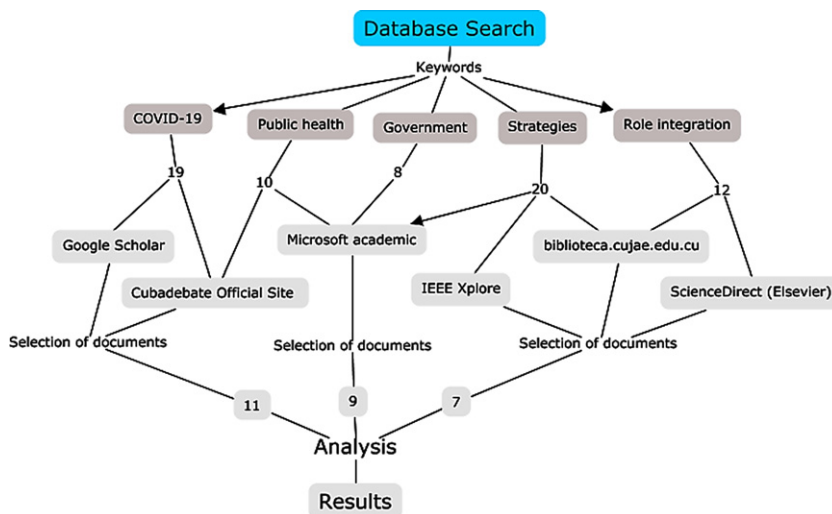


Fig. 1. Data search and analysis method. Source: Authors.

military agencies that were quickly combined in a structure of common management, providing logistical and administrative services for technical support to operational staff. This means that not only the epidemiological curves of the affected countries behaved differently, but the social and economic cost of the respective responses to confrontation were different too.

In the case of Cuba, the strategies outlined to control the pandemic and minimize the lethality caused by this disease were carried out by the highest level of the government [11, 12]. In January 2020, the Cuban government, together with the Ministry of Public Health (MINSAP) and with the participation of all the economic and social institutions involved, activated the National Temporary Group to face COVID-19. It deployed the mobilization the important scientific, technological, and professional capacities of the whole country, a strategy that was the basis of the COVID-19 Prevention and Control Plan [13]. This plan was made up of 500 measures and defined the policies of government, communication, science, and technology, guaranteeing the equity of public health actions in the application of coping strategies. In addition, it established the preparation of human and material resources to accompany the implementation and the necessary adjustments to overcome this challenge [14].

The National Temporary Group, headed by the President of the Republic of Cuba, was created in order to implement and follow up of the COVID-19 Prevention and Control Plan. This group held

daily meetings to assess the health situation, made the appropriate decisions, and adopt the necessary measures. In municipalities, the Defense Councils were activated. These institutions were responsible for the adaptation and implementation of the Prevention and Control Plan, according to the specific realities of each municipality [15].

The purpose of this research was to assess the effectiveness of the government strategy for the treatment of COVID-19 in Cuba, based on the analysis of the role and participation of the different organizations. The importance of this research lied in verifying whether the strategies decided to control the pandemic were effective or not.

2. Materials and method

The method used in the investigation was constructed based on studied methodologies and techniques in the consulted articles [16, 17]. Figure 1 shows that this method was applied for the search, selection and analysis of the existing data in the consulted bibliography.

A review of the literature available in digital format was conducted, including that issued by the Ministry of Public Health (MINSAP) and other ministries of the country, archive documents of the Teaching Department of the Pedro Kourí Institute (IPK), Cuban journals of high-impact in the field of medicine, Official websites of the Ministry of International Relations (MINREX), Granma news-

paper, Pan American Health Organization (PAHO) and World Health Organization (WHO). Also, MEDLINE, BIREME-PAHO, and SciELO databases were consulted.

Documents that met the following inclusion criteria were taken into consideration: scientific articles in Spanish and English published from the outbreak of COVID-19 at the end of 2019 to September 2021, of the national and international context and related to the government strategies and the measures implemented in Cuba to confront COVID-19.

The novelty of the topic required consulting other sources of information not indexed in scientific databases, such as technical reports and websites of organizations and institutions that published news.

After reading the summaries and conclusions of the information found, a pre-selection of the articles that were aligned with the research was made. All the pre-selected information was classified considering elements such as novelty of the research, year of publication, type of bibliography (scientific articles published in journals of national and international impact, book or book chapter, news, technical reports, etc.).

The pre-selected articles were completely reviewed and analyzed using the matrices designed for this purpose. From this information, it was possible to establish relationships between the consulted literature and to determine the most significant elements for this research. As a result, articles that contributed significantly to the research were selected.

Using content analysis, all the information was studied and analyzed according to the selected categories and was presented in textual form and through graphics. The processing of the data was carried out in Microsoft Excel whereas for texts processing, Microsoft Word was used, both programs of Microsoft Office.

3. Results

The bibliographic search showed that the Cuban confrontation strategy consisted of linking all the Central State institutions and bodies to work towards a single objective: the fight against the pandemic. From within the health sector itself, the entire network of institutions was articulated to guarantee the response required by the country.

There were distinctive elements that characterized this strategy [18]:

- ✓ Early start of the preparation and presentation of the COVID-19 Prevention and Control Plan, on an intersectoral basis, adapted to the unique situation of each territory of the country.
- ✓ Objectives designed to respond to three main scenarios that the country could face (critical, medium, and favorable).
- ✓ Inclusion of new measures according to the progress of the epidemic and based on the positive experiences of other countries, as well as the technical guidelines of the Global Health Organizations (WHO and PAHO).
- ✓ The preventive scenario as a key aspect in the pandemic management model. The actions began and ended in the community.
- ✓ Integration of the entire science and research system of the country (MINSAP, BioCuba-Farma, Ministry of Science, Technology and Environment and the Universities), to jointly study international experience; develop specific proposals and present clinical trials.

3.1. *The role of each of the Central State institutions and bodies involved in the Cuban strategies to confront COVID-19*

The following paragraphs describe the different actions adopted by each of the institutions and bodies linked by the government to confront the pandemic (Fig. 2).

3.1.1. *National health system*

The National Health System was considered the key element in the fight against COVID-19. Its most remarkable characteristics were that it is public, free, and accessible to 100% of the population, inclusive, and based on Primary Health Care (PHC), with the family doctors and nurses as its main strength.

The strategies to confront COVID-19 from the health institution were structured in three key elements [19]:

- a) *Epidemiological management characterized by the active search for cases through the investigation of the entire population (with emphasis on vulnerable groups), specialized surveillance of suspected cases, isolation of contacts and performance of diagnostic tests.*

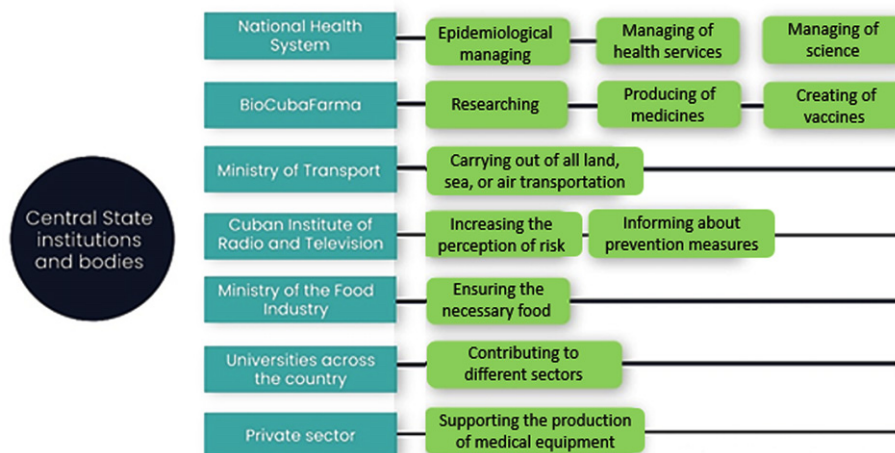


Fig. 2. Central state institutions and bodies involved in confronting the COVID-19 pandemic in Cuba. Source: Authors.

- Design and implementation of the COVID-19 Prevention and Control Plan, in constant evolution according to the recommendations of the WHO and the result of scientific research from all national and international levels.
 - Strengthening of epidemiological surveillance, within the framework of the International Health Regulations (IHR 2005) considering purpose, scope, and principles.
 - Review and reinforcement of the action protocols “International Sanitary Control Measures in Airports, Ports and International Marinas”, to be applied both to travelers and to the personnel working in these facilities.
 - Training of all health professionals in this new disease. Equipping the entire network of institutions that make up the National Health System with adequate means of protection, diagnosis, and treatment (more than 10,000 offices of family doctors and nurses, 449 polyclinics, 150 hospitals and 12 research institutes).
 - Incorporation of 28,000 students of the Medical Sciences in the communities, as part of the control measures of the Primary Health Care (PHC). Since the arrival of the pandemic in the country, the Universities of Medical Sciences together with MINSAP were involved in the active investigation of contacts of suspected and confirmed cases and in the follow-up of those patients who were treated at home. In addition, the students of Medical Sciences participated in the samples collection for PCR tests. They also supported the work at the borders for international health control and in the molecular biology laboratories.
 - Preparation of temporary isolation facilities for the handling of passengers or crewmembers with suspicion of communicable diseases. In these facilities, first actions of medical assistance and epidemiological survey were carried out until the evacuation of patients to the designated medical facilities.
 - Strengthening of the capacities of laboratories at the national level and in the Institute of Tropical Medicine “Pedro Kouri” (IPK), a reference center for research, diagnosis, management, and treatment of infectious diseases, and a WHO/PAHO collaborating center. In this scenario, IPK institution of utmost importance for the country.
 - Expansion of capacities thanks to the increase of molecular biology laboratories in the capital and the certification of provincial laboratories in the rest of the country for the confirmatory testing for diagnosis of COVID-19 through PCR tests. At the beginning of the pandemic, four institutions of this type were available, but the number has gradually increased to at least one in each province of the country. This allows quick diagnosis to take timely measures to control critical points of infection.
 - Co-creation by MINSAP and the University of Computer Sciences (UCI) of the Cuban Digital Research Program (virtual self-research program), an example of how information technologies can be used to improve the health system.
- b) *Management of health services, which made it possible to establish staggered and regionalized*

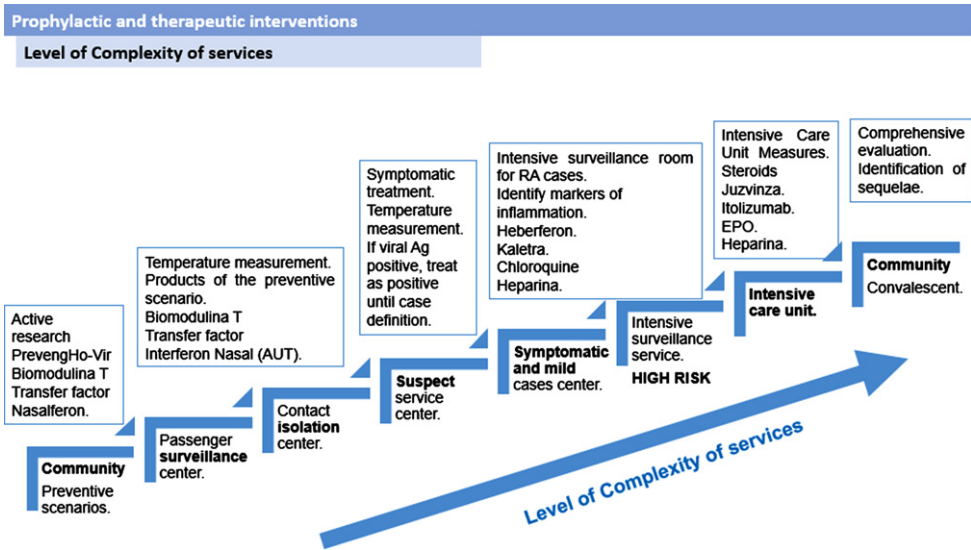


Fig. 3. Summary outline of the interventions that are carried out as part of the care protocol. Source: National Action Protocol for COVID-19 [21].

care of patients with the disease, guaranteeing the availability of beds for hospitalization, including Intensive Care Units, sufficient ventilators, as well as the rest of the medical and technological requirements.

- Twenty hospitals, comprising 4,291 beds (477 for intensive care) were set up for the exclusive care of confirmed, symptomatic, asymptomatic, and suspected high-risk patients, 54 centers for suspected cases and 248 for contact cases surveillance.
- As part of the surveillance system, isolation centers were set up throughout the country to house all contacts of confirmed cases, suspected cases, and travelers, who were surveilled for a period of 15 days. This measure allowed a better use of hospital beds for those with higher vulnerability.
- Gradual and staggered deployment of the capacities to be activated in a network of services and institutions, which allowed response to the clinical-epidemiological surveillance of travelers, contacts of confirmed cases, as well as suspected and confirmed cases of COVID-19. Initially, 26 institutions were involved in this task and at the time of publication of this article, the number reached 41.
- Gradual increase of hospital beds, from the 3,419 initially available, to a final number of 7,710.

Regarding the beds of the Intensive Care Units, a growth from 202 to 679 was planned, with an availability of 701 pulmonary ventilators.

- Design of a care protocol for health workers. Biosecurity protocols were established and means of protection were guaranteed at all levels of the National Health System (SNS).
 - In addition, the country secured 100% of the personnel who worked in direct care (Red Zone) with personal protective equipment (PPE) and preventive treatment to strengthen their immune system and protect them from the virus, including prevengovir, nasalferon or interferon, all drugs of national production with proven effectiveness.
- c) *Management of science including preventive clinical management.*
- Creation of an Innovation Committee formed by several groups of experts from the health system and BioCubaFarma, which approved the clinical management protocol. This was conceived for a preventive and a therapeutic scenario based on a staggering of the levels of complexity of the services (Fig. 3). Due to the novelty of the disease, the protocol of action was kept under continuous review and was subject to modifications according to clinical, epidemiological, and therapeutic reports. To date, there were six versions, which had incorporated new successful actions

to follow in the treatment and containment of the disease [20, 21].

- For the treatment of this disease, the Cuban Biotechnology and Pharmaceutical Industry elaborated a 30 products portfolio. Three innovations that contribute to the favorable evolution of cases were included: 1) Interferon alfa 2b (Heberon), Heberferon alfa and ganma, 2) the monoclonal antibody Anti CD6 (Itolizumab) and the peptide CIGB 258 or JUZVINZA, 3) as well as the use of plasma in convalescent patients.
- Production of means, reagents, and equipment for molecular diagnosis. Also, there were three prototype ventilators to be used in intensive care units and an impedance tomograph. This ensured that only 7.1% of the total confirmed patients reached the category of serious and only 2.9% reached the category of critical, achieving the recovery of 91.3% of the patients.
- Implementation of the protocol for the follow-up of convalescent patients: patients with satisfactory evolution were the responsibility of the family doctors and nurses, while high-level specialists must followed patients with sequelae.
- More than 800 investigations and 17 clinical trials were ongoing. In addition, 211 national and international publications were produced to date.

3.1.2. *BioCubaFarma*

This business group had been working hard in the production of medicines to confront COVID-19. Such is the case of the AICA and MEDSOL Laboratory Company, which had been completely dedicated to the production of Abdala, Soberana 02 and Soberana Plus vaccines.

An important element to point out within the entire confrontation with the disease in Cuba was the outstanding contribution of Cuban scientists who quickly began the evaluation of medicines for possible use in the creation of vaccine candidates. Such was the impact that the country currently has (with national recognition) one vaccine candidate called Mambisa and three vaccines Abdala, Soberana 02 and Soberana Plus.

Mambisa and Abdala were the result of the research carried out by the Center for Genetic Engineering and Biotechnology (CIGB), while the Finlay Institute of Vaccines (IFV) produced Soberana 02 and Soberana Plus.

The Center for the State Control of Drugs, Equipment and Medical Devices (CECMED) developed the basic functions of control of access to laboratories, registration of medicines, equipment and medical devices, clinical trials, inspections of good practices, release of batches and granting of licenses to establishments. The CECMED granted the Emergency Use Authorization (AUE) to the Cuban vaccines ABDALA 50 mg, Soberana 02 and Soberana Plus once confirmed that they complied with the requirements and parameters required in terms of quality, safety, and efficacy for this type of procedure [22–24]. The rigorous evaluation process of the files submitted to the CECMED included the performance of inspections of the plants involved in the production process, the confirmation of compliance with the established requirements and the analysis of the data obtained in the Phase I, II and III of the Clinical Trials. The inspections demonstrated effectiveness of the vaccines in the prevention of symptomatic forms of the disease of more than 91% for these vaccines, as well as an adequate safety profile, supported by the number of doses applied in the various clinical trials, the intervention study in at-risk populations and the health intervention conducted in the country.

3.2. *Ministry of transport*

This institution oversaw all air, land and maritime transportation of 1) health care workers and personnel of institutions of high priority for production, 2) PCR samples taken every day in the different laboratories, 3) necessary supplies for isolation centers (medicines, food, etc.), 4) suspected and confirmed COVID-19 patients, 5) patients with other pathologies who needed medical services in hospitals.

3.3. *Cuban Institute of Radio and Television (ICRT)*

The line of work of this institution consisted of increasing the risk awareness among the population and informing about prevention measures.

- Successful implementation of the National Communication Plan for health promotion and prevention actions, through different printed and audiovisual materials, with the use of the national media such as television, radio, and the written press, to inform and raise awareness in the population.

- Daily broadcasting on national radio and television of the press conferences held by Dr. Francisco Durán, Director of Epidemiology of MINSAP, reporting on the number of confirmed cases, their evolution, cases distribution by municipalities and provinces, and other epidemiological variables of interest. Also, responding to questions from the media.
- Conferences to reinforce prevention recommendations to the population, such as 1) social distancing, 2) the use of masks, 3) hand hygiene and 4) protection for people at greater risk, 5) the importance of children, elders and young people staying at home. Teleworking was recommended to limit population mobility and to reduce the risks of transmission.

3.4. Ministry of the food industry

Their role was to ensure the necessary food to isolation centers throughout the country, including hospitals, nursing homes, maternal centers, etc. To guarantee the reduction of mobility between municipalities and provinces, the direct sale of food to the sectors of the population in which incidences of the disease were detected (more than 10 people positive for COVID-19) was organized.

3.5. Universities across the country

Universities played a fundamental role in the fight against COVID-19 since they joined the COVID-19 Prevention and Control Plan by contributing to different sectors depending on the needs of the Cuban government. The following stand out among their main functions:

- Students, professors, and administrative staff working as support staff in the isolation centers.
- Calls to make blood donations and planning them in the different blood banks.
- Preparation of the isolation centers located within the universities.
- Active participation in the analysis of data to create the mathematical models to forecast the behavior of COVID-19.
- Participation in different research projects for the development of vaccines and new medicines.
- Preparation of action procedures for the improvement in the provision of services directly related to confronting COVID-19.

Professors and students at the University of Havana (UH).

At the beginning of the pandemic, between March and September 2020, the UH incorporated 17 groups of 207 volunteers to the isolation centers of Bahía and Alamar VI, and to other facilities of that kind located in Cojimar, all of them in the province of Havana.

The teams of this university also worked in the Clinical Surgical Teaching Hospitals Doctor Salvador Allende and the Julio Díaz National Rehabilitation Hospital, in the Vladimir Ilich Lenin Vocational Pre-University Institute of Exact Sciences and in the University of Computer Sciences (UCI). Subsequently, the number of volunteers increased as the confirmed cases of the virus went up.

Professors and students at the Technological University of Havana José Antonio Echeverría (CUJAE).

The CUJAE was one of the first to join the activities to confront COVID-19. Its students and professors joined social impact tasks such as [18]:

- Supporting the Family Care System (SAF), starting in the municipality of Habana del Este and extending the call to reach 12 municipalities of the capital city.
- Working in Isolation Centers directly with patients, many in the Red Zone.
- Students and faculty were involved in primary care, supporting the operation of polyclinics, command centers in municipalities and the Provincial Command Center. Coordinators were appointed in each municipality, and, over the months, the role of the students evolved to become a key element in the management of the pandemic.
- Organizing queues of consumers and scanning identity cards, through the application *cola.cu* — developed by the university — to control the number of products that arrive at each of the stores.
- Based on a call made by the Finlay Institute and the Defense Council of Havana, CUJAE assumed, with more than 200 students and several members of the faculty, the management of data in the 48 sites where the Phase III Clinical Trial of Soberana 02 was developed. CUJAE participated in the Clinical Trial in two ways: it managed all data process and advised the institutions to join the intervention.
- Developing of a link between universities and Havana hospitals, aiming the care of posi-

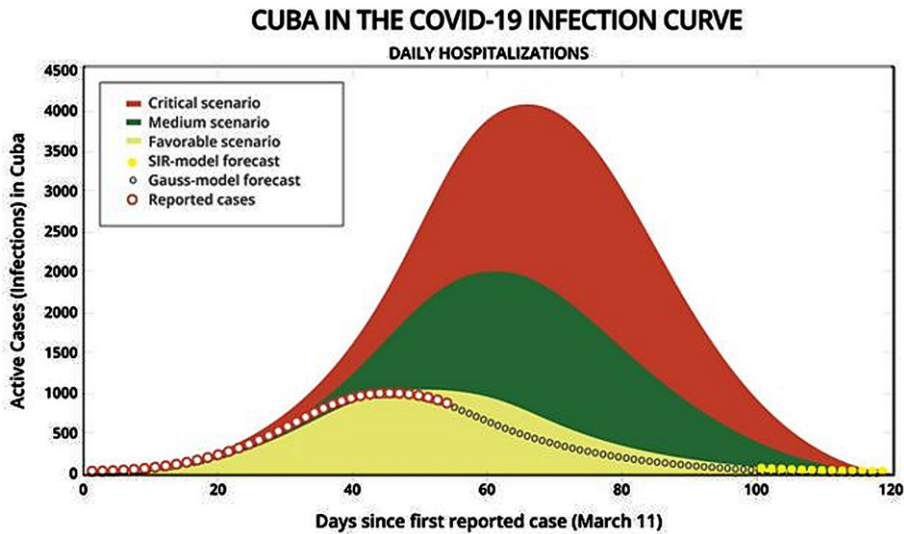


Fig. 4. Predictive mathematical models of the behavior of the pandemic in Cuba. Source: Cubadebate Official Site [28].

tive patients. Two hospital engineering projects were completed for Salvador Allende (La Covadonga) and the Pediatric Hospital of San Miguel del Padrón (La Balear). These comprehensive projects involving engineers from different fields led to a higher quality of the public health system in the capital.

- Participating in the coordination of the patient transfer from home to the isolation centers through the monitoring and evaluation of the general availability, to match it with the demands in the different municipalities. Thus, achieving the shortest possible time the patient was isolated or hospitalized according to his/her status, contact case, or confirmed case respectively.
- Updating of the Mi PCR platform, developed in conjunction with the Company for the Development of Technology and Systems Applications (Datys), entering the data obtained from those samples.
- Students and professors at this university working with the Pharmaceutical Laboratories Company (AICA) in the production of medicines, lung ventilators and related equipment.
- The Faculty of Electrical Engineering, working in partnership with the Electric Union, conducting a survey of the large electricity consuming centers to improve the services and control the power cuts due to high consumption.

3.6. Private sector

It joined the fight against COVID-19 immediately. Its contribution focused on supporting the production of ventilators for intensive care rooms in the country. It also contributed to the manufacture of oxygen forks to be able to provide assisted ventilation to more patients at the same time.

3.7. Impact of the government's strategy in confronting COVID-19

The integration between all institutions and bodies of the Central State and the private sector achieved the fulfillment of the strategies drawn up from the beginning and during the pandemic, illustrated by the favorable results obtained at the global level in confronting the pandemic.

Forecasts were made from mathematical models in which the possible behavior of the pandemic in Cuba was evidenced [25–27]. The creation of these models was the responsibility of teachers - researchers from the Faculty of Mathematics of the University of Havana.

Three scenarios were defined, one critical, one medium and one favorable. Figure 4 shows the behavior of the first wave of the pandemic in Cuba and shows that the behavior of the disease was below the favorable scenario, which demonstrated the

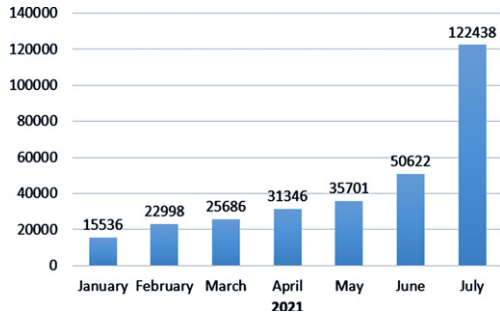


Fig. 5. Monthly behavior of COVID-19 cases in Cuba. Source: Official Website of the Cuban Science Network [29].

effectiveness of the strategic management carried out by the country to confront COVID-19.

Since the first case was identified on March 11, 2020, the weekly behavior of cases in the country initially had a favorable curve that showed negative changes due to the appearance of new variants of the virus with distinctive characteristics of high contagiousness.

The cumulative monthly number of confirmed cases is shown in Fig. 5. Due to the rise in cases, measures to achieve control of COVID-19 were increased to achieve positive results in the following months presented in the graph (Fig. 5).

The continuous improvement of medical protocols allowed an average case fatality rate of less than 1% (Fig. 6), an incidence rate of less than 5.7 per 100,000 inhabitants. These results were supported by communication measures with the people that allowed the population to assume a new mode of action, pro-

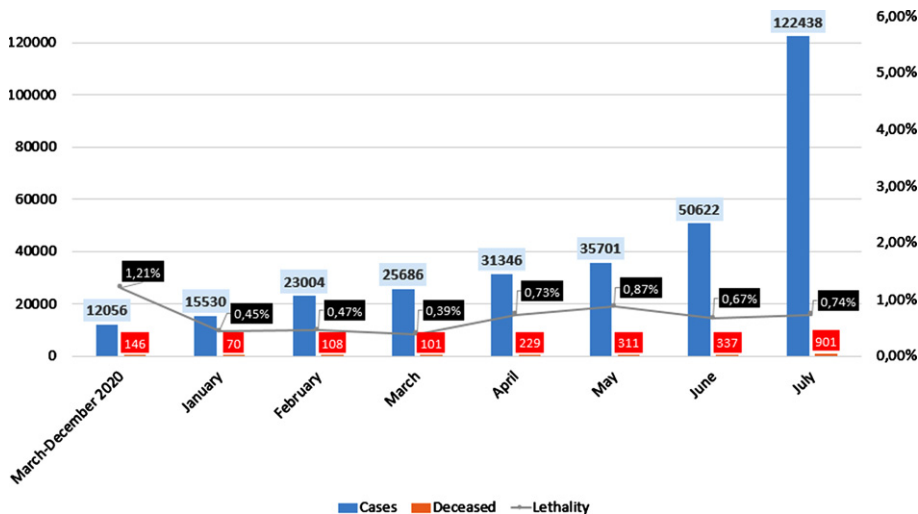


Fig. 6. Behavior of deaths and case fatality rate per month of the pandemic in Cuba. Source: Official Website of the Cuban Science Network [29].

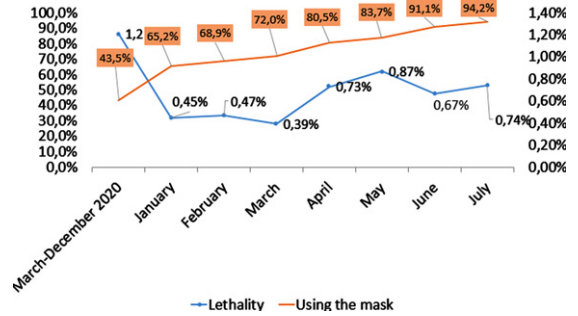


Fig. 7. Perception of the risk of COVID-19 in Cuba. From the author.

moting changes in the culture of Cubans that were reflected in an increase in the perception of the risk of COVID-19 in Cuba (Fig. 7).

Vaccination played a critical role in preventing the disease and preventing patients from developing a severe stage of the disease. As of, August 18, 2021, a total of 12,321,720 people were vaccinated in Cuba, of which 3,085,785 already have the complete vaccination schedule (Fig. 8).

The impact of vaccination was high. Below are some statistics of interest as of August 2021:

- it was estimated that the number of daily active cases would be close to 140,000. At the end of August 14, 2021, only 40,472 active cases were reported, approximately 95,000 fewer admissions than expected (Fig. 9).
- the number of daily cases was estimated to be between 10,000 and 14,000. At the close of

Dose administered according to type of intervention. Cuba until August 18, 2021.							
Type of intervention	1st Dose	%*	2nd Dose	%*	3rd Dose	%*	Total
Clinical trial	55,707	55	54,286	48.9	39,371	34.7	149,364
Intervention study	164,892		150,928		134,675		450,495
Sanitary intervention	3,288,474		3,194,546		2,911,659		9,394,679
Vaccine	1,380,008		947,094		80		2,327,182
Total	4,889,081		4,346,854		3,085,785		12,321,720

*% Calculated with respect to the population of 19 years and more of Cuba.
Population of 19 years and more 8,892,313

Percent calculated in relation to the total population of Cuba			
Total population of Cuba	43.7%	38.9%	27.6%
	1st Dose	2nd Dose	3rd Dose

Fig. 8. Vaccination behavior in Cuba. Source: Cubadebate Official Site [30].

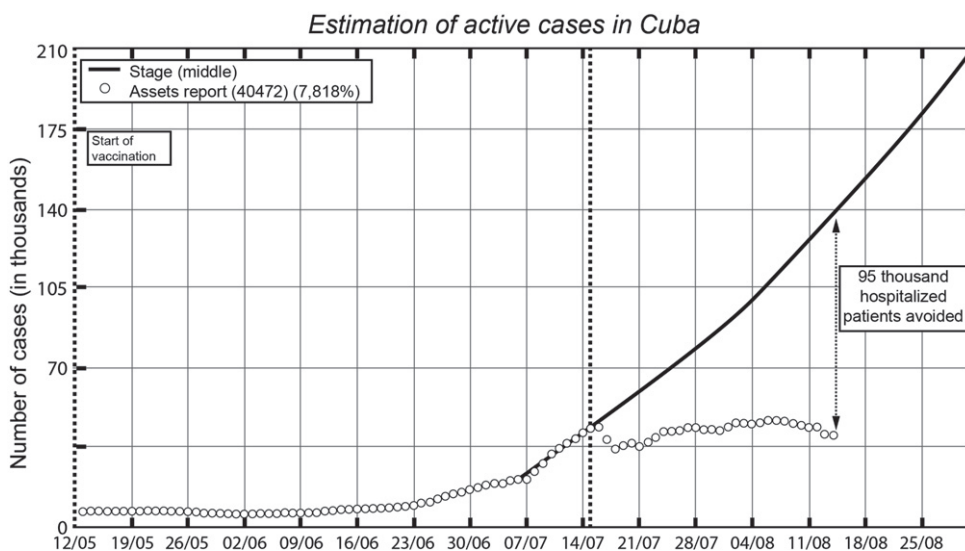


Fig. 9. Estimation of active and accumulated real cases.

August 14, 2021, around 8,500 new cases were reported as daily averages (Fig. 10).

- according to the forecast made, it was estimated that the accumulated number of deaths would be around 4,800. At the end of August 14, 2021, 4,023 deaths were reported in Cuba, 780 less than predicted (Fig. 11).

The positive impact of the government strategies implemented by the country for the control of the disease in Cuba was evident. The people and the institutions worked together to achieve control of the pandemic.

The results demonstrate the need and usefulness of achieving synergy between all stakeholders (government, ministries, public institutions, universities, state and private companies, and of course the population, among others) to achieve a common goal that was the control and reduction of the pandemic in Cuba. Through government strategies and their deployment at all levels of the different instances, satisfactory results were obtained in each outbreak that the country had to face, experience that served to modify and improve existing work protocols and the inclusion of new ones based on the scientific and technical knowledge acquired in each crisis.

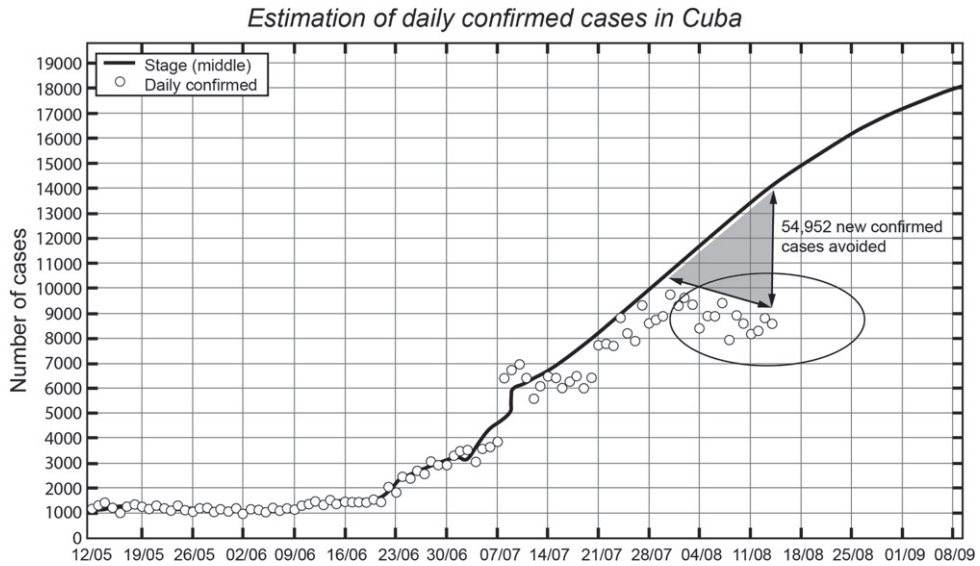


Fig. 10. Estimate of confirmed cases and cumulative real. Source: Cubadebate Official Site [30].

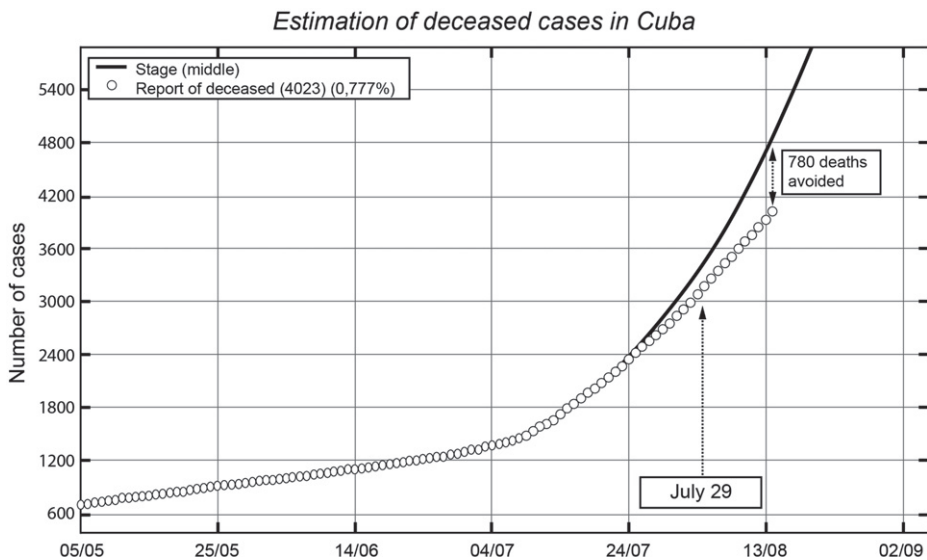


Fig. 11. Estimation of deceased cases in Cuba. Source: Cubadebate Official Site [30].

4. Discussion

This experience brought a tremendous lesson that enriched the strategy of confronting extreme situations in Cuba. Its key elements were the preparation of a unified national plan; the use of specific strategies for the investigation; the diagnosis and tracing of cases; the implementation of a therapeutic protocol and management of patients according to the different stages of the disease and finally, the creation of four national vaccines and their application.

The main limitation of this research was the lack of information on the centralized government strategies adopted by other countries in the region to confront COVID-19. Although we knew the figures of contagions, deaths, and recoveries for other countries in America, there is no way to establish the relationship between those figures and the strategies adopted by the government. This lack of information had not allowed establishing comparisons between the effectiveness of the strategies of other countries and the strategies adopted in Cuba.

4.1. Summary of the actions undertaken for the control and management of the COVID-19 pandemic in Cuba

- ✓ Preparation of the COVID-19 Prevention and Control Plan.
- ✓ Creation of the Temporary Intersectoral Working Group to Confront COVID-19 under the principle of intersectorality of actions.
- ✓ Development of communication policies, which included the use of mass media and social networks for communication to the population.
- ✓ Adjustments in the allocation of existing material resources.
- ✓ Deployment of the Epidemiological Surveillance System with key points for the identification of risk.
- ✓ Promotion of community participation, social mobilization and behavior change for disease prevention and control.
- ✓ Mobilization of the primary health care system and its strengthening with medical students.
- ✓ Early detection and isolation of confirmed cases and their contacts.
- ✓ Active control and monitoring of confirmed cases and suspects.
- ✓ Identification of severe forms of the disease and vulnerable groups with pre-existing diseases.
- ✓ Implementation of a network of molecular biology laboratories to apply molecular diagnosis (PCR) in real time.
- ✓ Establishment of protocols and provision of biosecurity means for health personnel Therapeutic interventions.
- ✓ Establishment of rules of conduct and therapy, according to a protocol that indicated what to do at each moment of the evolution of the disease.
- ✓ Participation of the Cuban biomedical and biotechnology industry in the development and application of specific innovative drugs, equipment, and vaccines against the disease.
- ✓ Maintenance of all services, from prevention and diagnosis to isolation, hospitalization, and care in free and universal intensive care.

Among the strengths to face the health crisis and achieve advanced management, the following stand out: the consecration of highly qualified and committed professionals, many of them with international experience; the existence of a universal, free and inclusive Public Health system, supported by a con-

solidated primary care system; the availability of health infrastructure and universities; the allocation of the State budget to finance health and social assistance expenses; the national medical-pharmaceutical industry which provided innovative products, and scientific potential with the capacity to respond to dissimilar contingencies; and last but not least, the achievement of three vaccines obtained by Cuban researchers allowed 89.4 % of the population to be vaccinated [31].

The philosophy adopted by Cuba to manage the crisis, which was successfully overcome, was to systematically prepare, raise awareness, align management/administration bodies and all workers with the action plans designed, and cultivate social and organizational commitment.

4.2. Barriers to be overcome

When analyzing the management process of the pandemic in Cuba (as in other countries), tensions arose due to mistakes made by some of the actors. Two examples are the existence of overconfidence, or simply, the breach of the approved protocols. In the Cuban case, the increase in the number of cases after the relaxation of measures demonstrated the need to maintain control and awareness regarding the perception of risk. The lack of responsibility of some people was the main cause of the recent increase in the number of cases, by neglecting social isolation and failing to observe hygienic-sanitary measures.

It was also necessary to develop theoretical and methodological proposals [24] enriched with the current experience in order to be scientifically tested and contribute to future preparation. Above all, it was necessary to delve into the capacity of organizations to continue operating; to analyze the costs of managing the crisis and the profitability of budgets; to identify new mechanisms for adapting organizations to work and its new forms, technologies and the supply chain; to determine the resilience of companies according to size, structure, strategic focus and financial projection and test, their ability to adapt to new conditions and the strategies to create value from the Superior Organizations of Business Management (OSDE).

The keys to the success achieved by Cuba in keeping the cases of infections and deaths at the lowest possible level were directly related to the correct evaluation of the scenario and its strengths and weaknesses.

Also, important were the immediate adoption of the containment protocol, the maintenance of an

open dialogue, inter-institutional and intersectoral collaboration, interdisciplinary participation, and the deployment of intense work to accelerate responses. On the other hand, the active public communication and significant citizen commitment -evidenced in the active participation of the people and of young students and workers in the actions designed by the institutions- as well as the practice of international solidarity and cooperation were fundamental.

5. Conclusions

The Cuban model for confronting the pandemic, implemented through the COVID-19 Prevention and Control Plan, was based on the interrelationships between the different institutions and key organizations in the country. As a distinctive aspect, it included the permanent evaluation of the epidemiological situation, the immediate adoption of the containment protocol and its constant updating according to the evolution of the pandemic. The data analyzed in the literature review placed all the figures on the favorable prognostic curve, the lowest of the three possible scenarios defined in the mathematical models. To summarize, the coordinated work of all the actors involved -Primary Health Care as a comprehensive care strategy with the individual, the family, and the community at the center of its actions, the development achieved by the country in science, and the mass vaccination of the population- allowed, since the first moments of the pandemic, achievement of positive results in confronting COVID-19 in Cuba. This showed the effectiveness of the government strategies adopted in the country.

Ethical approval

This study was approved by the Technological University of Havana José Antonio Echeverría.

Informed consent

Not applicable.

Conflict of interest

There are no conflicts of interest.

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