

MEDICC Review

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Vol 22, No 2

ECLAC on the
Pandemic of Inequity 8

Cuban Biotech
Tackles COVID-19 31

Primary Health Care:
Hero in the Battle against COVID-19 53

Health Care
as a Public Good 19

Human Activity
Responsible for Zoonoses 14

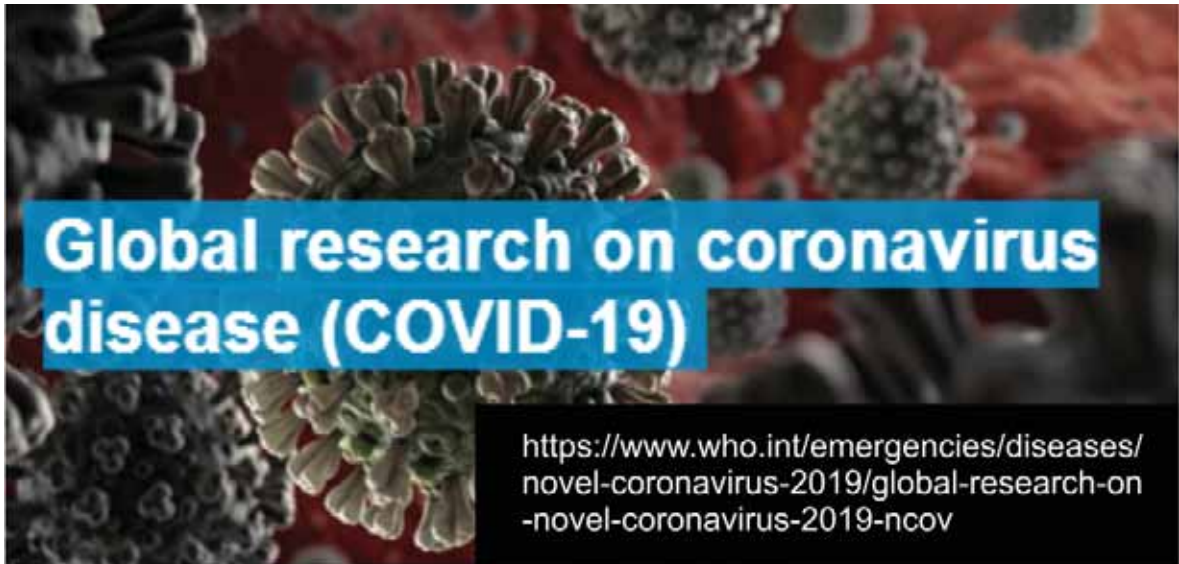
Cuba's Global Health Cooperation
Rises to the COVID-19 Challenge 64



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CUBA
DATA**

<https://covid19cubadata.github.io/>

MEDICC Review

April 2020, Vol 22, No 2

EDITORIAL

- 4 COVID-19 in the Americas: We Are in This Together

ABOUT THE CONTRIBUTORS

7

LEADING VOICES ON COVID-19

- 8 *We are calling for adoption of universal, redistributive and solidarity-based policies with a rights-oriented approach to leave no one behind.*

Alicia Bárcena MPA

Executive Secretary, UN Economic Commission for Latin America and the Caribbean (ECLAC)

Gail Reed MS

- 12 *We are living in the geologic age when human activities have dramatically affected our planet and its environment.*

Michele Barry MD FACP

Founder, WomenLift Health; Senior Associate Dean and Director, Center for Innovation in Global Health, Stanford University

Gail Reed MS

- 14 **The COVID-19 Pandemic and Paradigm Change in Global Scientific Research**
Mariana Cárdenas-González MS PhD and Elena R. Álvarez-Buylla MS PhD

Director of National and International Engagement, National Council of

Science and Technology (CONACYT)

Director General, National Council of Science and Technology (CONACYT)

- 19 *In this kind of situation, health as a public good once again becomes paramount...*

Jeanette Vega MD PhD

Member, Global Preparedness Monitoring Board; Chief Medical and Innovation Officer, Red de Salud UC-Christus, Chile

Gail Reed MS

- 21 *"Universal" doesn't just apply to health care, but to every sector's actions taken to protect the population's health.*

Pastor Castell-Florit Serrate MD PhD DSc

Director, National School of Public Health, Cuba; President, National Council of Scientific Societies in Health

Jorge Bacallao-Gallestey PhD DSc

- 24 *Are we witnessing the swan song of neoliberalism?*

José R. Acosta MD MS PhD

Member, Cuban National Bioethics Committee and UNESCO International Committee on Bioethics

Alina Alerm-González MD MS

- 28 *Much more visible now are the inequalities that have always existed in our system and much clearer the need for stronger state intervention*

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MEDICC Review is a unique open-access platform for Latin American and Caribbean praxis addressing today's critical interactions between human health, development of sustainable societies, and the health of our planet. Drawing upon the contributions of the region in social medicine, social movements, rich diversity and scientific prowess, Latin America and Caribbean authors published in the journal can help fill gaps in thinking and evidence sorely needed to build a sustainable future and a hopeful legacy for future generations. We look forward to contributing to increased visibility for their work and to its positive impact on both regional integration and worldwide solutions.

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MEDICC Review

April 2020, Vol 22, No 2

SCIENCE TAKES ON COVID-19

- 31 **Bringing Cuban Biotech Research to Bear on COVID-19:
All Hands and Minds on Deck**
Lila Castellanos-Serra PhD DSc
- 38 **Severe COVID-19 Cases: Is Respiratory Distress Partially Explained
by Central Nervous System Involvement?**
Calixto Machado-Curbelo MD PhD DSc FAAN
- 40 **Cuba's Pedro Kourí Tropical Medicine Institute:
Battling COVID-19 One Study, One Test, One Patient at a Time**
*Gisele Coutin MD MS, Jorge Bacallao-Gallestey PhD DSc,
Lila Castellanos-Serra PhD DSc*
- 45 **Curbing Misinformation and Disinformation in the COVID-19 Era:
A View from Cuba**
Patricia Alonso-Galbán MD MS and Claudia Alemañy-Castilla

FROM THE FRONT LINES

- 47 **Stemming COVID-19 in Cuba: Strengths, Strategies, Challenges**
**Francisco Durán MD, National Director of Epidemiology, Ministry of Public
Health, Cuba**
Gail Reed MS
- 50 **Cuba's COVID-19 Strategy: Main Actions through April 23, 2020**
- 53 **Mobilizing Primary Health Care:
Cuba's Powerful Weapon against COVID-19**
Tania L. Aguilar-Guerra MD MPH and Gail Reed MS
- 58 **COVID-19 Case Detection: Cuba's Active Screening Approach**
Conner Gorry MA
- 64 **Global Collaboration in Times of COVID-19:
Cuba's Emergency Medical Contingent**
Conner Gorry MA
- 69 **US Physicians Trained in Cuba Battle COVID-19 at Home:
A Personal Account from the New York City Epicenter**
Gail Reed MS

ABSTRACTS

- 🌐 Cuban Research in Current International Journals
Use of Interferon for Viral Infections: Research & Articles

Cover photo: Celeste Ramírez Cardentey, 25, is one of four women virologists at the Pedro Kourí Tropical Medicine Institute responsible for analyzing COVID-19 patient tests, using real-time polymerase chain reaction (RT-PCR).

Credit: [NaturalezaSecretaDeCuba](#), Facebook page

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COVID-19 in the Americas: We Are in This Together

COVID-19 has upended the world's healthcare infrastructures and its economies, casting a glaring light on the failings and flaws already in place, all suffered unequally. This has forced leaders and the public at large to face the stark contrast between human society as it exists and the society that is possible, with both the world's majority and the planet leaping to the top of a new agenda...an agenda as urgently needed as a new vaccine.

The pandemic has revealed the fatal results of the decades-long systematic dismantling of public institutions, including those for health care. Nowhere is this more evident than in the Americas and Latin America in particular, which remains the world's most unequal region.[1] Latin America and the Caribbean are facing an uphill battle in confronting both the virus and the economic recession following close on its heels. While the pandemic has hit the region later than some others, allowing countries to learn from other nations' efforts to flatten their curves, many will struggle due to their weakened public health structures and limited ability to scale up public health and social programs. Unemployment in the region is expected to rise sharply, especially for those in the informal economy, who are among the most vulnerable. A reduction in trade and tourism will exacerbate economic contraction, and pre-existing inequalities driven by social conflict and poverty are likely to be reinforced.[2,3]

In a *MEDICC Review* exclusive, Alicia Bárcena, Executive Secretary of the UN Economic Commission for Latin America and the Caribbean (ECLAC) outlines the extent of COVID-19's human and economic costs, and calls for "universal, redistributive and solidarity-based policies with a rights-oriented approach" that leave no one behind. She also argues that the dichotomy between revitalizing economies and protecting health is a false one, noting no economy can advance without a healthy workforce. Her interview introduces the "Leading Voices on COVID-19" section of this issue, reflecting the journal's commitment to publishing the scientists, health and other professionals of Latin America and the Caribbean. The section, offering pointed, knowledgeable perspectives on COVID-related policy, strategies, ethics, research and clinical practice, intentionally begins with those of the Americas' women leaders.

Fierce opposition to Bárcena's assertion—that only solidarity-based policies and investing in public institutions can successfully address the pandemic and enable sustainable societies—will certainly be mounted by powerful defenders of private interests over public ones. Nevertheless, as pointed out by Dr Jeanette Vega, Chilean member of the Global Preparedness Monitoring Board, health as a public good is paramount if we are to overcome this crisis and successfully meet the next.

The Global Preparedness Monitoring Board was one of the most important voices warning of an impending pandemic, issuing its report in early fall 2019.[4] And there were many others well before, all essentially unheeded by most of those in positions to make real prevention possible. Such

sustainable prevention of course means redesigning not only society but also the relation between humans and our natural environment, given the zoonotic origin of these emerging and re-emerging diseases. *MEDICC Review's* editorial team itself was unaware of the prescient nature of our expanded purview, announced in the January 2020 issue to: address "today's critical interactions between human health, development of sustainable societies, and the health of our planet."

Two of our leading voices this April delve into the need to reformulate relations between human activity and the environment: Dr Michele Barry of Stanford University, founder of WomenLift Health and Board Chair-elect of the Consortium of Universities for Global Health, notes our need to rethink this relationship beyond climate change to reorient all of human action. Drs Cárdenas-González and Álvarez-Buylla of Mexico's National Council of Science and Technology (CONACYT) address anthropogenic environmental changes resulting from current livestock and agroindustrial models, sounding the alarm on their relation to novel disease outbreaks and calling for open, collaborative science to provide the evidence needed for a "One Health" policy framework.

Sharing research and findings is a scientific and ethical imperative

Indeed, open science, interdisciplinary, intersectoral and international collaboration is a key theme running through this

entire issue. Sharing research and findings—in such areas as diagnosis, treatment and vaccine development—is a scientific and ethical imperative. Nearly a dozen Cuban specialists underscore this approach while discussing novel therapeutic products, other research and clinical protocols in two roundtables: *Bringing Cuban Biotech Research to Bear on COVID-19* and *Cuba's Pedro Kourí Tropical Medicine Institute: Battling COVID-19 One Study, One Test, One Patient at a Time*.

In the spirit of sharing new perspectives, we also recommend the contribution by Dr Machado-Curbelo, chair of the Department of Clinical Neurophysiology at Cuba's Institute of Neurology and Neurosurgery, who appeals for more research on the possible link between brainstem dysfunction and acute respiratory distress in patients with COVID-19.

If collaboration in the clinical realm is vital, perhaps even greater is this need when it comes to prevention and control strategies: discovering what are the most apparent challenges, and what is working to address them. Globally, we know the most vulnerable populations are the hardest hit, and while it's been widely publicized that case-fatality rates are the highest for the elderly and those with pre-existing comorbidities like heart disease and diabetes,[5] we are also seeing stark divisions along lines of race/ethnicity and socioeconomic status,[6] which are as predictable as they are understudied.[7] Systemic racism and implicit bias, combined with structural inequalities in access to primary care and other resources, leave marginalized populations with the triple burden of excessive risk factors, pre-existing chronic conditions and less access to health care at any

level—much less the ability to navigate health systems in these times of crisis.

A strong, universal health system incorporating intersectoral policies and specific strategies designed for the most vulnerable is the approach used in Cuba, as discussed by Dr Castell-Florit of the National School of Public Health and Dr Durán, National Director of Epidemiology at Cuba's Ministry of Public Health. Facing resource constraints, the Cuban approach has to take full advantage not only of its strong biotech and infectious disease experts, but also its formidable primary care subsystem, posting some 20,000 family doctors and nurses throughout the country. Their COVID-19 experience, contribution and protocols are detailed in two articles this issue: *Mobilizing Primary Health Care: Cuba's Powerful Weapon against COVID-19* and *COVID-19 Case Detection: Active Screening Approach*. Readers will find in *Cuba's COVID-19 Strategy: Main Actions through April 23, 2020* a complete chronology of main public health and intersectoral actions taken in Cuba to confront the pandemic.

Yet, Cuba too faces uphill battles, as burgeoning home and institutional access to Internet threatens to introduce misinformation and disinformation with the “infodemic” accompanying COVID-19, as the paper by Dr Alonso-Galbán and Alemañy-Castilla asserts; and waning risk perception as a result of relatively low case numbers (under 2000 as of April 30), is a continuing concern to health authorities and professionals across the country.

As a journal, we are party to what we believe are important international forums for broadening communication and urging greater collaboration: *MEDICC Review* is among over 300 signatories of an open letter to UN Secretary-General António Guterres calling for the formation of a WHO Global Health Equity Task Force charged with coordinating a global response for fair needs-based resource allocation to all countries facing the COVID-19 pandemic.[8] Undoubtedly, WHO deserves greater support than ever from governments worldwide. And *MEDICC Review* was a co-sponsor, with Cuba's Pedro Kourí Tropical Medicine Institute, of the first bilateral teleconference involving Cuban and US researchers and health professionals, learning from each other to more successfully stem the spread of COVID-19 and obtain better patient results.

We are also witness once again to Cuban cooperation in health, this time specifically to assist other countries' response to the pandemic: the Henry Reeve Emergency Medical Contingent now has teams in more than 20 countries, reflected in our feature *Global Collaboration in Times of COVID-19: Cuba's Emergency Medical Contingent* by senior editor Gorry, the only US journalist who has bunked with these health professionals (in Pakistan and Haiti). Interestingly, at least one team is comprised entirely of women, and another entirely of nurses.

New York City's “pandemic epicenter” is also the scene of Cuban cooperation, this time involving dozens of US physicians trained on full scholarships at the six-year Latin American School of Medicine in Havana. *MEDICC Review* offers the


experience of one: Dr Joaquín Morante, a pulmonologist and critical care specialist, who is an attending physician at Jacobi Medical Center in The Bronx, a public hospital affiliated with the Albert Einstein College of Medicine.

This journal joins UN human rights experts in calling for an immediate end to US sanctions against Cuba, and in times of COVID-19, against all other countries

At the same time that Cuban health professionals and foreign graduates of its medical schools collaborate to confront the pandemic, the US administration has not only refused to lift its sanctions, but has actually toughened them, blocking vital supplies for Cuba's health system. In fact, the US

has seized much-needed food, medical supplies and pharmaceuticals that would otherwise have been destined for Cuba. This journal joins UN human rights experts in calling for an immediate end to US sanctions against Cuba, and in times of COVID-19, against all other countries. As these experts point out: the sanctions undermine the ability of countries to respond to the COVID-19 pandemic and will cost lives.[9]

As we go forward, *MEDICC Review* will continue to publish interviews, peer-reviewed scientific manuscripts, and perspectives on COVID-19 from some of the most engaged scholars and physicians throughout Latin America and the Caribbean, and we will do so under the guiding principles of equity, evidence-based science and solidarity. We are, after all, in this together.

P.S. On a personal note, two members of our editorial team are preparing to welcome new family members in the midst of this pandemic: Executive Editor Gail Reed is expecting a grandchild this spring, and Dr Caitlin Baird, Senior Editor of our English edition, is expecting her first child at the end of May. These two children will be among the first of the cohort now referred to as “Generation C,”[10] born into a world irrevocably shaped by the coronavirus pandemic, and we can't help but wonder what kind of world that will be. In the words of Julia Belluz, Senior Health Correspondent at Vox, we're curious if this will be a world “where pandemics, climate devastation, and financial crises that seemed far-fetched only weeks ago will be the norm, or one where the intelligence and good in society—the spirit of cooperation—will prevail, and we finally start preparing long before new, catastrophic threats emerge. In the latter version, people work together on evidence-based measures to deal with these predictable risks of globalization. I'm hoping desperately for that reality.”[11] We are, too. 

The Editors

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NOTE: The remaining authors in the following pages are members of the journal's editorial team, and we are grateful for the extra effort they expended to make this issue possible. Special thanks to Dr Christina Mills for her contribution.

We are calling for adoption of universal, redistributive and solidarity-based policies with a rights-oriented approach to leave no one behind.

Alicia Bárcena MPA

Executive Secretary, UN Economic Commission for Latin America and the Caribbean (ECLAC)

Gail Reed MS

Serving in her present role since the economic crisis of 2008, Alicia Bárcena is no newcomer to regional and global emergencies, economic or otherwise. She also has extensive experience in the UN system, including as chief of staff to the UN Secretary-General and later, during Ban Ki-moon's tenure in that position, as Under-Secretary General for Management. From 2016 to 2017, she co-chaired the International Resource Panel at the UN Environment Program. A biologist trained in her home country of Mexico, she later received a master's degree in public administration from Harvard University, USA. For decades, Ms Bárcena has devoted her professional career to issues of sustainable development, financing of public policies, and the environment. She has received *Doctor Honoris Causa* degrees from the University of Oslo, Norway (2014); the University of Havana, Cuba (2016); and the Universidad Autónoma de México (2019). Today, she is a board member of the Global Partnership for Sustainable Development Data and a member of the University of Oslo/*The Lancet* Independent Panel on Global Governance for Health.



MEDICC Review: You have mentioned that the crisis unleashed by the pandemic is unprecedented in the last century and that it differs from the crisis of 2008, in that “this crisis is about people, instead of banks.” To overcome the crisis, what role should the state play?

Alicia Bárcena: Indeed, unlike 2008, this is not a financial crisis but one of people, production and well-being.

The crisis in the region in 2020, with GDP dropping by –5.3%, will be the worst in its entire history. To find a contraction of comparable magnitude, you need to go back to the Great Depression of 1930 (–5%), or even further to 1914 (–4.9%). This fall and the increase expected in unemployment will have a direct negative effect on household incomes and hence on the possibility of having sufficient resources to satisfy basic needs. In this context, the region's poverty rate would increase by 4.4 percentage points in 2020, from 30.3% to 34.7%, which translates into 29 million more people living in poverty. At the same time, extreme poverty would grow by 2.5 percentage points, from 11.0% to 13.5%, an increase of 16 million people.

A “wartime economy” is too important to be left to the market. States are assuming a central role to contain the spread of the virus, attend to the affected population and mitigate the risks that will affect the economy and social cohesion.

The COVID-19 pandemic discriminates both in terms of its impact and in the capacity to protect different population groups. The most vulnerable suffer more intensely from the social and economic impacts of the crisis, in addition to enduring deficits in coverage and quality of the region's health and social protection systems. In particular, workers in the informal sector are experiencing an abrupt drop in their already low incomes.

The COVID-19 pandemic's differentiated socioeconomic impact reflects the region's high levels of inequality, whether among people of different socioeconomic strata, or those of different gender, age, race-ethnicity, territory of residence, immigration status or condition of disability, among other factors.

It is essential that states drive social protection strategies that enable us to address the socioeconomic effects of the COVID-19

pandemic. Today, in the face of a crisis that impacts very broad strata of the population, we at the UN Economic Commission for Latin America and the Caribbean (ECLAC) are calling for adoption of universal, redistributive and solidarity-based policies with a rights-oriented approach to leave no one behind. Consolidating a universal guarantee of a basic income level should be a central element of these strategies.

We are confronting an unprecedented crisis, but one in which states and intergovernmental organizations will play a decisive role, coordinating actions that will lead us to overcome the emergency and move toward economic and social recovery as soon as possible.

The role of the state is being redefined and expanded in various dimensions. This redefinition is not something totally new. The idea of a world in which the state plays a subsidiary role (supposing markets capable of self-regulation) collapsed with the crisis of 2008. The massive intervention of governments (in terms of monetary and fiscal expansion) to prevent that crisis from deepening put an end to several myths: among these, that an increase in fiscal deficit and available liquidity during crises would generate an inflationary wave in subsequent years. The pandemic multiplies the need for this Keynesian intervention to sustain effective demand through fiscal and monetary means, both by issuing currency and by purchasing securities to inject liquidity into the economy, which also implies the need to review the role of central banks.

Another factor that amplifies the need for public-sector action is that what is at stake is more than an anti-cyclical policy. The task has changed qualitatively, not just quantitatively. Governments must create credit and income programs that reach vulnerable sectors no longer able to generate their own income, such as informal workers, those who have lost their jobs, and small and medium-sized businesses that cannot sustain themselves without financing. This could be a path towards guaranteeing a basic universal income. The probability of advancing in this direction increases as a function of the pandemic's impact on the entire productive fabric.

To the extent that the pandemic also implies a supply shock, there is a powerful need for state coordination regarding the definition of essential activities, and of how and when productive activities are to be resumed. Institutional capacities and political accords that are scarce in most countries will be required to address the demands placed on governments in the coming years.

Political legitimacy and institutional strength will be essential. Political legitimacy has been eroded by inequality, which should be tackled more effectively in order to generate the necessary consensus for state action. The central concern with equality, which has characterized ECLAC's analyses and is incorporated in the Sustainable Development Goals, is even more valid in the current crisis. Institutional capacity has been weakened as well, by what Daron Acemoglu has called "atrophy in the capacity of state institutions," which occurred during the neoliberal boom. The lack of extended health systems, powerful innovation systems and quality public services are problems that will be felt most acutely. Over the coming years, inequality and dismantling of the state, processes already under way in the region before COVID-19, will be barriers to the pandemic's control and economic recovery.

Finally, national technological capacities must be reinforced. Industrial policy, weak in the region during the last 30 years, must be taken up with renewed urgency. This is explained by the fact that new technologies can help combat the pandemic, especially those in the information and telecommunications field. Another factor that highlights the role of technological capacities is that value chains were severely affected by border closings, social isolation and the reduction of trade. Most probably, the world that will emerge from the pandemic is likely to emphasize more local and shorter value chains, as protective measures against new global shocks (or a cyclical reproduction of the pandemic.) Goods and services previously obtained via commerce should be supplied locally. Local capacities enable food and equipment production, and make for a more resilient economy at a time when trade is failing in its role as a lever of specialization (or is moving slowly and disruptively).

To influence the new global economy, the region must move toward greater regional integration in production, trade and technology. The coordination of our countries in macroeconomic and productive matters is crucial in negotiating the new normality, particularly in the current urgent crisis and also in the medium term: financing for a new style of development, with equality and environmental sustainability.

MEDICC Review: The crisis seems to point toward a greater need to ensure universal health. But the pandemic also threatens this goal's achievement. With scientific and pharmaceutical production, training of medical personnel in the region...could the health sector itself participate in revitalizing the region's economies, with health serving as both a condition and an engine for sustainable development?

Alicia Bárcena: The COVID-19 crisis, with the increase in mortality rates and sick people needing care, will have direct economic effects on health systems, as well as indirect effects that we will see on the supply-and-demand side of the economy.

Strengthening health systems requires both more and better public spending

Among the direct effects is the impact on the region's health systems, whose current infrastructure is insufficient to address the problems generated by the pandemic. Most countries

in the region have weak and fragmented health systems, which do not guarantee the universal access needed to confront the crisis posed by COVID-19. Therefore, strengthening health systems requires both more and better public spending: central government public spending on health is, on average, 2.2% of GDP in the region. Thus, the fiscal space must be found to strengthen these systems.

One aspect associated with the pandemic that reinforces the need to universalize the right to health is that it makes it more obvious, even to the most privileged groups, that you cannot leave an entire sector devoid of health services without this negatively affecting the rest of society. Although the impact is more acute among the poorest, an epidemic with high transmissibility like this one interconnects people from the most diverse social groups. Due to the matrix of demands for employment, production and services, the virus will necessarily circulate throughout, reaching towards every individual, no matter their position in society.

Leading Voices on COVID-19

To address the health emergency, it is imperative to immediately and efficiently apply the containment measures suggested by WHO, strengthen health systems, and guarantee universal access to tests, medicines and treatment. Furthermore, states must value and publicly support the tireless efforts of WHO, work of the highest technical and human capacity under the regional leadership of PAHO Director Carissa Etienne. We agree with UN Secretary-General António Guterres that it is ill-advised to reduce WHO funding in the midst of the current health crisis.

As to whether the health sector itself may serve as an engine for development: if you look at it not only as the sector capable of addressing and treating the disease, but also in its broader context as a comprehensive care system, it is definitely capable of boosting the economy with other considerable benefits. It has a smaller environmental footprint than other sectors because it depends fundamentally on services and capacity-building for Latin America and the Caribbean. And as this health crisis has shown, the health sector is preventive, socially inclusive and even goes beyond that: it can have, for example, a positive impact on the use of women's time for paid labor. Today, women shoulder a considerable part of caregiver activities, without remuneration, given there are insufficient services in the health and caregiving sectors.

The production of services, the value chains for production of medicines and equipment, as well as the creation of appropriate facilities, are all elements that stimulate the economy accompanied by environmental and social benefits. An endogenous strengthening of this sector in our region would be part of an economic recovery rooted in sustainable development.

MEDICC Review: Should we expand our thinking and action beyond human health? Does “post-pandemic” imply rethinking our relationship with the natural environment, and a regional responsibility for protecting the environment, coral reefs, coasts and forests?

Alicia Bárcena: The COVID-19 crisis strikes us at a complex moment, encountering us with a sick planet. This is one of our planet's worst moments environmentally: contaminated oceans and rivers, devastated forests, eroded soils, massive extinction of species and altered climate cycles. This should be the time to consider the unsustainability of the unequal and extractive development model.

This crisis found us with notable deficiencies when it came to caring for our health. Society had not invested enough in health security and the same can be said for the environmental crisis, for which we also exhibited a regrettable and risky lack of preparation. This diminishes our resilience. The pandemic is a global public problem and so are various environmental threats, such as global warming and the ongoing crisis of biodiversity extinction. In general, these crises develop more slowly or more focally than a global health emergency and thus, responses are sometimes weak or nonexistent. This new health crisis has exposed the fragility underlying globalization and the development models in which it was sustained.

Inequality and geopolitical rivalries were already eroding the momentum of globalization. The reaction manifested itself in a

return to unilateral policies and to the philosophy of “harm thy neighbor.” The pandemic's great political risk is that it could strengthen a discourse of isolation and rivalry. This risk cannot be ruled out.

The correct response is actually to strengthen multilateral cooperation on major global issues (such as the environment, trade and regulation of capital flows, as well as the newly introduced need for global control of the pandemic) and to recover lost space for public industrial and social welfare policies within each country. The rules governing the multilateral system cannot be the fiscal and monetary disciplines of past orthodoxy, but rather: a) the expansion of political space in each country to strengthen productive capacities, as well as universal health and welfare systems; b) the search for multilateral accords on issues such as the environment, investment and trade, to stabilize or give greater predictability to trade and investment flows in a highly uncertain context; and c) reduce the disruptive potential of speculative flows in currencies and commodities, which could recur repeatedly with pandemic cycles.

Issues related to climate change seem to have lost importance in a context of negative growth. But they will regain their relevance the moment the economy recovers. This recovery should take a less carbon-intensive path to avoid repeating past mistakes. At the same time, other environmental issues will continue to be highly important, such as desertification and the predatory exploitation of natural resources. These can aggravate the negative supply shock represented by the pandemic and the problems of inequality in its impacts.

This pandemic has the potential to transform the geopolitics of globalization, but it is also an opportunity to highlight the benefits of multilateral actions and open space for the necessary debate on a new, sustainable, and egalitarian development model capable of simultaneously addressing health concerns, economic dynamism and environmental restoration.

MEDICC Review: ECLAC has developed a formidable instrument, the COVID-19 Observatory, on the crisis in the region (<https://www.cepal.org/es/temas/covid-19>). In addition to reporting on the ongoing situation in each country and the policies each has adopted to address it, will ECLAC offer periodic analyses, with examples of effective strategies that pave the way for the future?

Alicia Bárcena: The new global scenario in times of the COVID-19 pandemic means we must take urgent measures and assess the impacts of those measures.

To support the follow-up and monitoring of progress in the medium and long term, ECLAC has launched the COVID-19 Observatory, an effort coordinated by our regional commission with support from UN resident country coordinators, which carries updated information on each country's policy announcements and other materials of interest.


The Observatory compiles and makes accessible public policies adopted by the 33 Latin American and Caribbean countries intended to limit the impact of the pandemic, and at the same time evaluates the economic and social effects that these policies will

have on the national and sectoral levels. An interactive map clearly shows the actions taken by each country. These are divided into five categories: containment measures, health, employment, economy and education.

Both for the Observatory and for ECLAC's own work, we will need to point to opportunities to achieve a more environmentally and socially sustainable economic recovery, which aims at achieving both short-term and long-term goals and allows countries to regain economic dynamism, but with more sustainable forms of development. The drop in fossil fuel prices carries long-term risks, as it presents an incentive to increase consumption. But it also renders infeasible very harmful forms of extraction such as fracking and deep-sea drilling.

Recovery can be undertaken with a narrow vision: simply attempting to return to the "environmentally destructive normality," which

The crisis allows us to think about a recovery based on more sustainable development rather than simply returning to the status quo—predatory, destructive and ever more unequal

is high risk in the long term. Or we can be guided by a long-term vision of transformation. Such a vision can be supported at this juncture by working to strengthen production and consumption of renewable energies, stimulate sustainable and lower-carbon construction, facilitate electric transportation with lower emissions, and incorporate reforestation and recovery of ecosystems into policies to produce ecosystemic services relying on nature-based solutions. In sum, the crisis allows us to think about a recovery based on more sustainable development rather than simply returning to the status quo—predatory, destructive and ever more unequal. 

We are living in the geologic age when human activities have dramatically affected our planet and its environment

Michele Barry MD FACP

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Dr Barry is incoming Board Chair of the Consortium of Universities for Global Health (CUGH) and past President of the American Society of Tropical Medicine and Hygiene. She is a member of the National Academies of Sciences, Engineering, and Medicine, and serves on the National Academy of Medicine's Board of Global Health. She has received the Elizabeth Blackwell Medal for outstanding contributions to women in the field of medicine, and is founder of WomenLift Health, a global initiative to transform global health outcomes by unleashing and elevating talented mid-career women to become global health leaders.

Michele Barry (r.) with women leaders ►



Courtesy M Barry

MEDICC Review: COVID-19, now a pandemic, is not the first disease to reach epidemic proportions in recent years. It's calculated that from 2011 to 2018, there were 1483 epidemic outbreaks in 172 countries. And in the Americas alone, we had Zika, dengue, yellow fever, drug-resistant malaria, pulmonary hantavirus syndrome, cholera and H1N1. Looking at the big picture, what should the world have learned that we didn't?

Michele Barry: We need to sit back and realize that we all live on one planet and disease knows no borders. Many of these recent epidemics such as Ebola, yellow fever and Zika started in conflict zones or in countries which have fragile health systems and more vulnerable populations. The concept of interdependent sovereignty needs to be acknowledged for pandemic disease. Early surveillance and healthcare system strengthening becomes the responsibility of all countries.

MEDICC Review: You've identified the climate crisis as one of the underlying triggers of emerging and re-emerging infections. Is it the game changer right now?

Michele Barry: Climate change is important. But what I feel is even more important is the fact that we are living in the Anthropocene

age, the geologic age when human activities have dramatically affected our planet and its environment. So yes, there is dramatic climate change, which can affect vector distribution of these diseases, but more important in my mind are other human activities which redistribute risk such as urbanization, deforestation, global travel and the human interface and relationship with animals. The majority of epidemics—Ebola, HIV, yellow fever and even now COVID-19—have to do with relationships to animals and what we call zoonotic diseases, the spillover from animal to human beings.

MEDICC Review: Yet, in Brazil, where Zika erupted, it seems government leaders are making light of the current pandemic...and continuing with the deforestation of the Amazon, the "lungs of the world."

Michele Barry: It is no surprise that Zika hit an area in Brazil that had been deforested and urbanized in the northeast. Right before the Zika outbreak, there had been a drought and people were collecting rainwater in buckets—a perfect breeding ground for *Aedes aegypti*—a ferocious daybiting mosquito whose larvae can proliferate in the water of a jar cap. I also was involved in identifying the clinical presentation of a new hemorrhagic virus called Sabia from Brazil many years ago. This virus was found in



Michele Barry (c.) in Nepal working on typhoid project.

rodent excretions around deforested areas in the Amazonian area that humans had new contact with.

MEDICC Review: What can and should governments and peoples do differently, intersectorally? How can professionals and institutions in the health sector help push them to do it?

We have seen how well governments do with a centralized coordinated approach to public health

Singapore, Taiwan and South Korea handled their outbreaks, although of course the world is waiting to see if there is a resurgence once restrictions are lifted. Intersectionality is key—good medicine cannot only be about high technology research and treatment geared to the individual. It also needs to model public population health by emphasizing disease prevention, behavioral changes for health and do this via leadership diversity. Precision medicine, a trendy name these days, should not only be about targeting the individual genome, but we need to precisely diagnose and understand the population “genome.” Lastly, health professionals need to put their weight behind strengthening WHO’s international health regulations, which set minimum standards for diagnosing and conducting surveillance for epidemic disease.

MEDICC Review: Are scientists themselves called upon to change the way they work? Have we already seen more collaboration among scientists in this pandemic?

Michele Barry: Yes. The Chinese were early to share the genome of the COVID-19 Wuhan strain. Labs around the world

Michele Barry: First, we have seen how well governments do with a centralized coordinated approach to public health. This was emphasized by how China,

are turning their sequencing machines, most about the size of a desktop printer, to the task of rapidly sequencing the genomes of virus samples taken from the sick. The information is uploaded to a website called *nextstrain.org* that shows how the virus is migrating and splitting into similar but new subtypes. Fortunately, because it is so successful at infecting people, there appears not to be much pressure for it to mutate rapidly although we have seen slow small mutations. Another way scientists are collaborating is through journals, which are rapidly sharing information online and in preprint—far faster than business as usual; most journals are waiving any costs or fees for access to these findings.

MEDICC Review: Does COVID-19 challenge the US health system to change?


Michele Barry: One hot spot of virus can quickly overwhelm the system. But in the long run, is this a wakeup call to the US to restructure their pandemic preparedness and population health capacity? I believe strongly there should be a cabinet level position for global and population health. The US needs to rethink a medical care system that may be

one of the best in the world for research and curative medicine but currently is a patchwork of decentralized public health responses that answer to no one federal branch. Even Centers for Disease Control and Prevention (CDC) needs to be invited into a state before they can help the public around an urgent issue.

MEDICC Review: Have we focused a gender lens on COVID-19, from the 70% of global health workers who are women, to the implications for health of women and families worldwide? What more can be done to bring a gender perspective into play?

Michele Barry: First, we need to get good disaggregated gender-specific data. From China we found that women did a bit better with the disease vis-a-vis survival, but we don’t have a good understanding why this is. Men tend to smoke more and may have had more comorbid disease, yet women live longer so were an older population known to be at greater risk. We need to tease these factors out.

However, we do know some things to be true: intimate domestic violence rises in pandemic situations—we saw this post-earthquake in New Zealand and we saw this with Ebola in western Africa. We also know that women bear the brunt of housekeeping, cooking and childcare in most societies when quarantine occurs. Pregnant women need to get antenatal and labor and delivery care that can be offered in a well-functioning health system. And lastly the majority of frontline caretakers are female nurses putting themselves at greatest risk.

On a small personal note, I would like to see more of my women colleague COVID-19 experts in the forefront as key deciders and presenters of policy, as well as being funded to do the science. 

The COVID-19 Pandemic and Paradigm Change in Global Scientific Research

Mariana Cárdenas-González MS PhD and Elena R. Álvarez-Buylla MS PhD

ABSTRACT

The current pandemic has rocked the lives of human beings everywhere in ways never imagined, forcing us to question where our civilization is headed. In this article, we explore and discuss scientific evidence that helps explain recent events in the context of the COVID-19 pandemic.

COVID-19 is caused by infection with a zoonotic-origin novel virus, SARS-CoV-2, that is genetically close to two coronavirus types isolated in bats. The transmission dynamics to humans from the original and intermediary hosts remain poorly understood, but it is highly likely that the SARS-CoV-2 virus infected humans after undergoing an inter-species transfer from bats to an intermediate species, and from there to human beings. Crossing the species barrier is largely fostered by industrial-scale agricultural practices that simplify original ecosystem

connections by reducing biodiversity, facilitating the emergence of new infectious diseases.

The scientific community has played an exemplary role in responding to this global emergency, working to find timely, relevant solutions for governments and society as a whole. We need to take this opportunity to promote a global and open science that delves into the interrelationships of the biological, environmental, social and economic dimensions of this and other diseases while questioning current modes of production and their impact on the environment, and thus on human health worldwide.

Keywords: Coronavirus infections; communicable diseases; zoonoses; ecosystems; technology, industry, and agriculture; pandemics; global health; Mexico

INTRODUCTION

Infectious diseases were responsible for the highest burden of disease (premature deaths and disability) in the 20th century until the development of effective, affordable interventions like vaccines and antibiotics significantly reduced infection prevalence, especially in high-income countries. Thus in 1980, smallpox, which caused 500 million deaths over the past century, was declared eradicated, thanks to a strong global immunization campaign sponsored by WHO. However, without exception, infectious diseases still pose a persistent threat to human health. Nearly 10 million annual deaths worldwide (1/5 of all deaths) are linked to infectious diseases, and the overwhelming majority of these occur in low- and middle-income countries and in children under the age of 5.[1]

Lower respiratory tract infections are the main cause of death in low-income countries, and the fourth leading cause of death worldwide.[1] It is estimated that 335 infectious diseases (emerging diseases) have arisen between 1940 and 2004, 60% of which were zoonotic in origin, and 25.4% of which were caused by viral pathogens.[2] Estimates related to major outbreaks of emerging infections in the last few decades have put costs at over US\$100 billion, not to mention the cost in human lives.[3]

This article's objective is to explore and discuss scientific evidence to explain recent events in the context of the COVID-19 pandemic. We will review what is known at this writing about this emerging infectious disease, the histories of similar pandemics and epidemics, and the importance of ecological deterioration—especially that caused by agroindustry and industrial production of animal products—in the development of zoonoses. In this context, we will also discuss the vital role the scientific community has, had and should have in understanding the pathophysiological mechanisms of emerging viral diseases, deepening knowledge of their causes and developing new therapeutic options for their treatment and prevention.

CORONAVIRUS DISEASE COVID-19

COVID-19 is the disease caused by infection with a novel virus of the *Coronaviridae* family, SARS-CoV-2. The first cases were reported in late December 2019 in Wuhan, Hubei, China. On March 11, 2020, WHO declared COVID-19 a pandemic, and by mid-April, nearly 2 million cases had been confirmed in 185 countries, and almost 140,000 people had died from the virus.[4,5]

The SARS-CoV-2 virus is transmitted from person to person through saliva droplets and direct contact, and has an incubation period of 1 to 24 days.[6] Like other viruses, SARS-CoV-2 infects pneumocytes, possibly via the angiotensin-converting enzyme-2 (ACE2) cell receptor.[6] The first clinical manifestations of COVID-19 are fever, cough, nasal congestion and fatigue.[7] In Wuhan, 14% of cases progressed to more severe symptoms, such as dyspnea and pneumonia.[7] The estimated mortality rate is 3%,[8] although as the pandemic has progressed, this value has been continuously updated. In Mexico, the first case was recorded on February 27, 2020, and by mid-April, 5399 cases and 406 deaths had been registered.[4] Considering there is high prevalence in Mexico's adult population of comorbidities associated with COVID-19 morbidity and mortality, particular attention should be paid not only to prevention of future outbreaks in general, but particularly to these frequently found risk factors. These include

IMPORTANCE

Summarizing the SARS-CoV-2 characteristics, emergence, and transmission pathways, this article examines disruptive patterns of human activity, such as agroindustrial food production and anthropization, and their contribution to fostering recent zoonoses including COVID-19; the authors call for open-science, collaborative research that integrates biological, environmental, ecological and socio-economic approaches to understand the root structural causes of these emerging and re-emerging zoonoses.

overweight/obesity, high blood pressure and diabetes mellitus (72.5%, 31.5% and 12.9%, respectively in Mexican adults).[9]

Using samples from infected patients in Wuhan, phylogenetic analyses of the viral genome were performed, showing that SARS-CoV-2 belongs to the subgenus *Sarbecovirus* of the genus *Betacoronavirus*, and is closely related (88% identity) to two bat coronaviruses, bat-SL-CoVZC45 and bat-SL-CoVZXC21. It is also related, though not as closely, to Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) ($\pm 79\%$) and Middle Eastern Respiratory Syndrome coronavirus (MERS-CoV) ($\pm 50\%$). Divergence between the SARS-CoV and SARS-CoV-2 genomes has shown SARS-CoV-2 to be a novel coronavirus whose original host was probably the bat.[5] However, it is important to note there is little likelihood that the coronaviruses bat-SL-CoVZC45 and bat-SL-CoVZXC21 are the direct ancestors of SARS-CoV-2. Rather than a bat, the likely intermediate host between bats and humans was being sold in the Huanan market in Wuhan, and was not hibernating during the season when the outbreak occurred.[5]

Humans had already recently experienced two epidemics with high pandemic potential, caused by two novel coronaviruses: the SARS-CoV virus (2002), which infected 8000 people and killed 774 people in 26 countries,[10] and the MERS-CoV virus (2012), which infected 2494 and killed 858.[11] Interspecies transmissions were identified in both cases, with the masked palm civet (*Paguma larvata*) in SARS-CoV[12] and the camel (*Camelus dromedarius*) in MERS-CoV,[11] acting as intermediate hosts between human beings and the likely natural reservoir of these coronaviruses, the bat. These diseases have now been contained (not eradicated), and no vaccine or specific treatment is available for either. No SARS virus transmission has been reported in any region of the world since 2005, while some cases of MERS are reported every year, most of which are direct transmissions (host animal to human) occurring in Saudi Arabia. SARS was contained by interrupting person-to-person transmission using syndromic surveillance measures, rapid patient isolation, strict quarantine of contacts, and in some regions, quarantine of whole populations.[13]

CORONAVIRUSES AND THEIR NATURAL RESERVOIRS

Coronaviruses are RNA viruses with large genomes (26 to 32 kb), larger than that of any other RNA virus type (≤ 10 kb). They commonly infect birds, but also mammals, such as bats and humans, causing respiratory infections in humans and enteritis in other animals. Of the seven coronavirus subtypes known to infect human beings, the betacoronaviruses are the ones that cause severe clinical symptoms and high mortality rates.[14]

The nucleotide substitution rate in coronaviruses is $\pm 10^{-4}$ /sites per year, with mutations in each replication cycle.[15] This genomic “dynamism” has promoted origin of new viral variants capable of crossing the species barrier, adapting to a new host and achieving transmission.[16]

The bat is the natural reservoir of a wide variety of viruses, and in recent years has been shown to be the natural host of coronaviruses that are closely related to highly pathogenic betacoronaviruses, such as SARS-CoV, MERS-CoV and SARS-CoV-2.[17] Metagenomic analyses of the virome of 196 different bat species

(estimates put the number of bat species worldwide at 1240) show the great variety and density of viruses, estimating that coronaviruses comprise 30% of the bat virome.[18] However, bats rarely show clinical symptoms of infection with these or other types of viruses, suggesting a history of coevolution tending toward equilibrium.

Although little studied, the immune response in bats is very similar to that in other mammals, and certain aspects are closely linked to their special relationship with the viruses. This could have a restrictive effect on certain pathogens with which they have closely evolved, preventing infection-associated immunopathology.[19] Another way of preventing immunopathological consequences of an acute immune response is through autophagy and cellular apoptosis.[19] Bats also have constitutive activation of the type I interferon system (cytosine and receptor), which regulates recruitment of macrophages and natural-killer (NK) cells to fight viral infections and tumors.[20] Lastly, some hypothesize that the increased body temperature and metabolic rate during flight may simulate a fever response that could partially explain the bats' special tolerance to viruses.[20]

The transmission dynamics of these and other viruses (intra- and interspecies) depend on conditions associated with the virus itself, the host, the newly infected organism and the environment in which these interactions occur. In general, these conditions are: 1) frequency of interactions between the natural, intermediate and final hosts; 2) population density of the infected host species; 3) overall health status of both the host and newly infected individual; 4) specific viral characteristics and adaptations (infectiousness, pathogenicity, drug resistance, etc.); and 5) behavior of the final human host (travel, migration, conflict and war, globalization, urbanization, etc.). Changes in each of these five conditions have been behind the surge in emergence and re-emergence of viral infectious diseases, especially zoonoses, that have increased infectiousness and pathogenicity.

In the past 20 years, zoonoses such as the encephalitis outbreak associated with the Nipah virus (Malaysia, 1998), the SARS epidemic (2002), MERS (2012), Ebola (West Africa, 2014–2015) and most recently, the COVID-19 pandemic, have reminded us of the inherent, inseparable connection among all forms of life and their environment.

AGROINDUSTRIAL SYSTEMS AND THE ECOLOGY OF ZOOSES

Current agroindustrial production systems have exerted strong pressure to change land use in extensive areas of the temperate and tropical regions, creating a continuum of heavily anthropized agroecosystems that increasingly encroach on less suitable land, which then undergoes considerable habitat deterioration and a major loss of ecosystem services that these spaces provide.[21] Especially the tropics, the habitat of a highly diverse population of birds and bats, have been deforested in the last few decades for the industrial exploitation of palm oil, rice, soy or sorghum for livestock feed, or for the planting of forage grasses to create pastures and farms for intensive ruminant, pig and poultry production.[22] Habitat loss in these highly biodiverse ecosystems reduces the original wild populations, creating imbalances in all trophic relationships, including changes in endosymbiosis and ectosymbiosis

Leading Voices on COVID-19

due to the physiological stress associated with the drastic change from original ecological conditions.

The surviving species are forced to explore new ecological niches, interact with species with which they had no prior contact, modify their geographic distribution beyond the optimal bounds for their physiology, and adjust their interactions with a virome also in the process of modification through contact with new vectors and potential hosts.[23]

In general terms, when an ecosystem undergoes agricultural anthropization, it remains in a perpetual state of disruption. This favors less specialized species that are highly adaptable to the dynamics of rapid growth cycles with a high input of nutrients and xenobiotics, frequent disturbances from machinery and infrastructure abuse, and overrepresentation of a few species over broad areas and time periods. In other words, the ecosystem has been artificially blocked from maintaining or reaching its natural equilibrium. It constantly recruits the individuals most resistant to the pressures exerted by agricultural management on an industrial scale, which includes the pressures exerted by pathogens favored in the continuum of degraded ecosystems. For birds and bats, the new wooded areas in plantations and paddocks, as well as islands of original vegetation, become sites of intense competition between the species most favored by constant disruption. This competition can establish new viral exchanges and recombination dynamics among the survivors and livestock.[22] Major selective pressure is also exerted by the introduction of agrochemicals and bio-inputs, especially on arthropod populations, and consequently on the bats and birds associated with them on the trophic level. These bats and birds, along with some rodents, may form part of the most overrepresented wild populations in the ecosystem, and are candidates for becoming new viral reservoirs.[24]

In this context, it is understandable that the accelerated rates of generational succession artificially imposed by agroindustry also favor the selection of new strains of microorganisms and viruses capable of crossing the species barrier, including the jump to humans, with varying degrees of pathogenicity. Migration of wild fauna, whether habitual or forced, constantly alters the distribution map of many viruses, moving these into new areas, and changes their choice of host and vector species. At the same time, worldwide movement of livestock production (live animals) with human populations guarantees redistribution of these viruses into the continuum of anthropized ecosystems, despite health controls.

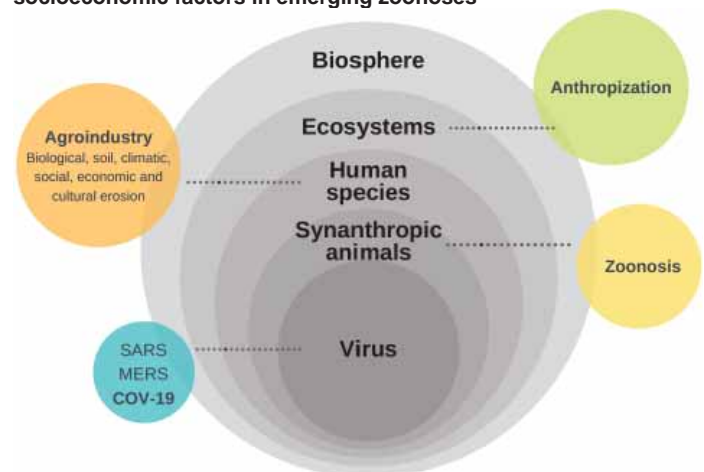
Other ecological aspects of certain bird and bat species—such as the plasticity of their reproductive rates, gregarious and itinerant habits, greater tolerance of nearby human populations, and possibly the rapid elimination of those individuals that develop acute reactions to viruses—have identified them as key participants in most emerging infectious disease outbreaks in the last few decades.[16] In some cases, the disturbed ecosystem continuum favors these species, due to an incomparable food supply and the relative absence of predators and competitors, which allow their populations to grow beyond the limits imposed by a more biodiverse ecosystem.[25] This promotes the growth of virus populations and their concomitant evolution, and favors the emergence of lineages capable of progressing in novel hosts, including humans.

It should also be noted that agroindustrial operations are financially successful because of the high genetic homogeneity of farmed species, permitting standardization of processes, supplies, machinery, facilities and products to constantly meet high market demand. Thus, large numbers of animals of the same age, sex and genetic vulnerability are confined in small spaces, with overly enriched diets and high chronic stress levels that guarantee success for infections and ample opportunities for new mutations. For example, of the 41 reconversion events in highly pathogenic avian influenza viral strains reported from 1959 to 2015, specifically subtypes H5 and H7, only two occurred on backyard farms, while the rest were identified in industrial scale commercial operations. However, even the two small-farm events took place in areas where there was industrial-scale poultry farming.[26]

Thus, it is essential to investigate the extent to which industrial modes of food production, especially those of animal origin, favors the emergence of recent zoonoses. Figure 1 illustrates the interrelation among the biological, environmental, ecological and socioeconomic factors of emerging zoonoses, pointing the need for new research approaches that integrate each of these dimensions when addressing these types of health challenges.

The high human and economic costs of these emerging diseases must no longer be ignored. It is time for us learn our lesson and stop placing the financial interests of a few corporations or states that control large-scale animal production ahead of global health, since it is clear that there is only “One Health.” We must restore ecosystems that have suffered profound destruction under current models of industrial agriculture and global commerce (including both their supplies and products). An open, global science must delve into the root structural causes of emerging viral diseases that are crossing species barriers and threatening humanity.

Figure 1: Interrelation among biologic, environmental, ecologic and socioeconomic factors in emerging zoonoses



THE NEED FOR CRITICAL, THOUGHTFUL AND SOCIALLY-COMMITTED SCIENCE

From the first alarm sounded by Chinese health authorities and WHO's declaration of COVID-19 as an international emergency, the scientific community has focused on generating useful information, mainly regarding the epidemiology of the disease, initial evidence of the natural history of the virus, clinical characteristics of the disease and measures for its control and treatment. This time, the in-

formation generated has been openly distributed. From December 1, 2019 until mid-April 2020, 2832 scientific studies on COVID-19 have been published in international journals indexed in English. [27] Some of the studies discussed in this article are examples of this intense effort of solidarity by the scientific community.

Publication of initial observations enabled exchange of knowledge and experiences, facilitating a global response to the pandemic through open access and coordinated actions. Interestingly, the first articles published on COVID-19 in *The Lancet* (in all its various formats and special editions) were quickly translated into Mandarin for dissemination, mainly among health professionals in China.[28] The scientific community has also played an essential role in releasing technical information to the general public (feature articles, infographics, interactive maps, etc.), which has aided dissemination of useful information for understanding the outbreak and its transmission, as well as the reasoning behind measures taken for its containment and their implementation to prevent contagion.

Participation by global organizations such as WHO has been vital to foster international cooperation and mobilize coordinated actions to confront the pandemic. At the beginning of February, 2020, WHO organized a virtual forum of scientists from the world over to establish research priorities for COVID-19.[29] Nine research priorities were proposed for medium- and long-term control of the pandemic; among these were topics on the virus's natural history (origin, transmission dynamic and measures to manage it) and development of vaccines and therapies to prevent and treat the disease. WHO also has developed a public registry of clinical trials being carried out worldwide; by mid-April, this platform already contained 1135 records of clinical trials evaluating COVID-19 interventions.[30]

At the start of the outbreak in China, Mexico's National Council of Science and Technology (CONACYT) created a National Project on COVID-19 Research and Social Impact (PRONAI COVID-19) as part of the National Strategic Health Program (Pronaces-Health). The latter is a high-priority initiative for organizing research efforts on important national issues that call for a decisive focus and an integrated, in-depth, broad-ranging solution. To date, CONACYT and the Mexican scientific community are working on 14 Pronaces initiatives, including Pronaces on Health, a funding opportunity for integrated multidisciplinary long-term research projects aimed at providing evidence for actions to solve strategic challenges for promoting health in Mexico.

Led by the Mexican scientific community in coordination with the Federal Health Ministry, PRONAI COVID-19 has identified urgent challenges and capacities, and projects were developed to give immediate attention to the emergency. These included projects concerning epidemiological surveillance, mathematical modeling and data science, clinical trials, vaccine development, and creation of sensitive and specific detection tools, as well as the search for means to manufacture mechanical ventilators in Mexico.

The second phase of the strategy thus far has been to publish two specific calls for proposals: one for cutting-edge research in all relevant fields, including health technology development and innovation, and the other to strengthen Mexico's ability to equip laboratories at academic institutions to provide COVID-19 diagnostic

support. Certainly, thanks to the proactive efforts of researchers at several public research centers, CONACYT was able to drive immediate actions, including manufacture of strategic medical devices such as mechanical ventilators and industrial production of hydroalcoholic gel to supply public hospitals.

These efforts clearly exemplify the relevance of intersectoral work and the fundamental role of an ever more conscious, critical and participatory scientific community to meet and overcome challenges like the COVID-19 pandemic, with a collaborative rather than competitive approach. Simply put, the scientific community's response to COVID-19 is evidence of the political, economic and scientific strengths of Mexico, when committed to clear goals aimed at improving the population's health and well-being.

PRIORITIES AND PROSPECTS FOR FUTURE RESEARCH

Effective tools for containment (improvements in health systems), treatment (new, more sophisticated drugs) and prevention (vaccines and more sensitive diagnostic devices) have been developed for most infectious diseases over the past 50 years. Yet, in just the last 20 years, the SARS, MERS, Ebola and COVID-19 outbreaks have demonstrated the need for greater, more collaborative and more diversified efforts to identify sustainable solutions to current and future challenges.

Funding for scientific research in the field of infectious diseases should consider the burden of these diseases at the regional and global level and the fact that they are the fourth leading cause of death worldwide.[1] Given that other threats such as the COVID-19 pandemic may be imminent, it is also crucial to strengthen each sector's capacity for response. For example, development of vaccines and biologics is critical and requires constant impetus. After the SARS outbreak in 2002, several studies focused on development of anti-SARS-CoV neutralizing antibodies, but none of the candidates has yet been evaluated in clinical trials,[31] and thus could not be immediately used to evaluate efficacy for the new virus (they are cross-reactive against SARS-CoV-2).


It is important to learn from this and prior experiences. In addition to constantly analyzing and keeping records of observations and research during this type of challenge, we consider it essential to encourage collaborative discussion and reflection from multidisciplinary perspectives, which will aid in understanding the root structural causes of these new viral diseases, in addition to providing solutions to the challenges they present.

Public release of technical information and scientific research dissemination are the best tools to enable both civil society and authorities to make informed, accurate decisions. Truth is both an ethical and technical imperative as humanity confronts challenges like that presented by COVID-19, which is one reason why the scientific community's participation is vital. In such cases, it is capable of anticipating, exploring and understanding in depth the ultimate and structural causes of these diseases as well as the challenges involved in their containment, mitigation, treatment and prevention, providing relevant and logical solutions for governments and society at large.

During this global health emergency, we are also challenged to seek more democratic, open ways to share scientific knowl-

edge, to avoid subordination of epistemological principles and the best solutions or prevention to the financial interests of the big pharmaceutical corporations. We must be innovative in the ways science supports decision-making and also build bridges of dialogue and collaboration among sectors and countries, between the Global North and the Global South, and more. It is also urgent to establish mechanisms to prevent the spread of misinformation and the abuse of social networks to this end.

International collaboration has been our core strength in confronting the current COVID-19 pandemic, as in past pandemics and

epidemics. The interconnectivity of the world in which we live is not only virtual, but physical; and it is not only among humans, but also with the ecosystem. The “One Health” concept, institutionalized by WHO since 2008, encompasses these ideas. Its strategy proposes using a systemic, interdisciplinary and multisector approach to design and implement programs, policies, legislation and research to improve the health of all populations in the ecosystem—and of the ecosystem itself—at local, regional and global levels. At the same time, this concept calls for a deeper questioning of modes of production and their impact on the environment, an environment also shared on a global level and inseparable from human health. 

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In this kind of situation, health as a public good once again becomes paramount...

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Dr Jeanette Vega is well known in global health circles for her work in the areas of health equity, social determinants of health and health systems. She has served as Chile's Vice Minister of Health, and as director of the country's National Health Fund (FONASA). For five years, she was also WHO Director of Equity and Social Determinants of Health. She currently sits on the 13-member Global Preparedness Monitoring Board (GPMB), co-chaired by H.E. Gro Harlem Brundtland, Former Prime Minister of Norway and Former WHO Director-General; and Mr Elhadj As Sy, Chair, Kofi Annan Foundation Board, and Former Secretary-General, International Federation of Red Cross and Red Crescent Societies. An independent international monitoring and advocacy body, the GPMB prepared the seminal 2019 report on the state of global preparedness, *A World at Risk*.



Courtesy J. Vega

MEDICC Review: Unfortunately, *A World at Risk* was prescient in its warnings. Now that we are well into the COVID-19 pandemic, are there lessons we have learned...in addition to those we should have learned earlier?

Jeanette Vega: There are at least two types of lessons: structural and managerial. The structural ones are quite complex: despite our warnings and those of others about the disastrous consequences of a pandemic and the urgent need to boost resources dedicated to preparing for such a global emergency, this has not happened. Quite the contrary. Generally, public health systems remain fragmented with diminishing resources, especially in areas such as epidemic surveillance and control—areas that are invisible when they work well, but catastrophically visible when they don't. So I hope this is one big lesson we learn for the future: to be prepared for the worst, because if not, the social and economic consequences are brutal.

In terms of epidemic management, I think the biggest lesson is that nobody can save themselves by themselves. In this kind of situation, health as a public good once again becomes paramount: governments, provinces, states, cities and the people in them cannot act alone. This has been an extremely painful lesson for

those places where clear governance and well-defined strategies haven't been the rule.

If you had to choose one global lesson from this pandemic, undoubtedly it would be that the neoliberal model touted around the world has failed

Another painful lesson has to do with the importance of health itself: the terrible cost in human lives, especially for the poorest, but also in terms of the financial consequences leading us to a swift and brutal

recession—and of course, once again, the countries most affected are our own, the poorer. So this points yet again to the need for organized and *predominantly public* health systems. If you had to choose one global lesson from this pandemic, undoubtedly it would be that the neoliberal model touted around the world has failed.

MEDICC Review: This brings up the implications for health systems in terms of universal coverage and access.

Jeanette Vega: Absolutely. Even in countries where the governing ideologies are quite conservative, such as France, they are suddenly rediscovering the role of what is public, the importance

Leading Voices on COVID-19

that prioritized economic resources and rights be held by all as public goods. So you see nationalizations happening in some of these countries, calling into question the privatizations that turned health care into a consumer item instead of a public good.

MEDICC Review: Does COVID-19 imply the need for changes in Chile's health system?

Jeanette Vega: Well, that's the hope, isn't it? But from what we've seen thus far, the government seems immune to what is happening, and its main priority is how to defend its economic power. At least until now, we don't see development of an economic growth model at the service of human well-being, or one that maintains health as paramount. Instead we see the emphasis on trying to minimize economic disruption...for example, the directive that people who don't go to work are liable to be fired, which goes against all principles of public health, and against all the measures of physical distancing and quarantine to stop viral spread. How can a person who is quarantined stay home when they know they will get fired?

MEDICC Review: So, is there a dichotomy between saving lives—taking care of health—and saving the national and global economies?

Jeanette Vega: No, this is a totally false dichotomy. The truth is that there is no economy without a workforce, and in order to go to work, people need to be healthy. It's as if we're returning to discussions of centuries past, which I thought had been laid to rest. Before it was capital vs. labor; now it is capital vs. health—the same thing, really. What's more, the goal of development for a planet, a country, has to do with social and personal well-being. Economic well-being is a tool for achieving that, a means but not an end in itself. The end is healthy people.

You see the divide between those who believe in democracy, in wealth distribution, in everyone having the same value, on the one hand, and those on the other hand who think that the most important thing is to maintain a healthy economy, which almost always translates into a healthy economy for the few who can reap the fruits of growth.

MEDICC Review: One of the recommendations in *A World at Risk* is related to the importance of a single, clear leadership in times of peril.

Jeanette Vega: Yes, we should make sure that we are guided by a single global leadership, and that is the World Health Organization (WHO). Yet, during the last few years, the very governments expected to give it most support have been undermining that leadership, creating instead parallel institutions. And when they do donate, these governments often earmark their funds for projects they are most interested in, which weakens WHO at a time like this. And I think this is a problem for the whole world, because we need a single voice that commands us all. Right now, we have WHO insisting on measures such as lockdown, isolation, contact tracing, testing and treatment. Yet, there are leaders of at least two major WHO contributors whose messages advocate just the opposite!

MEDICC Review: And within countries, does a single leadership play the same important role?

Jeanette Vega: Certainly. And this is a major problem. Because of social media, communication has become much more horizontal, which may be a good thing. But in these situations, it presents difficulties because there are actions needed that need a single voice, as the result of a common discourse. When there is a health emergency, we need a central command, a single voice to which everyone is responsible. It's the only way. Imagine if you have 800 voices saying what they think should be done, giving instructions!

MEDICC Review: I recalled that you were first a family physician when I read the words of a doctor in Bergamo, northern Italy, who said: "This disaster could have been avoided with the massive deployment of health services at the community level..."


Jeanette Vega: Absolutely, yes, the role of primary health care! Look, even in countries like mine, the reason we've been able to maintain decent health indicators is because when the National Health Service was created, its main pillar was primary health care. Here in Chile, small planes and boats still make rounds in remote areas. And if it hadn't been for primary health care, despite so many years attempting to dismantle it, including during the Pinochet dictatorship, we wouldn't have the relatively good health indicators we have for a country with the size of our economy.

Primary care has to evolve, reaching people at home and where they work, with new technologies

Primary health care is a fundamental strategy, and it's the main reason I'm now involved in innovation, because I think primary care itself has to evolve, reaching

people at home and where they work, with new technologies. We need social innovation technologies, to return to a more humanistic medicine capable of reaching people where they are, with health professionals accompanying people in co-creating their health.

MEDICC Review: A final word of advice?

Jeanette Vega: We'll have to take a hard look at our deficiencies to come to a new understanding of what it means to be a healthy society. We're not going to make it out of this crisis if we don't begin to view the economy as a function of people, a function of the distribution of society's wealth. The coming recession is going to be very hard. We'll need a more Keynesian approach to maintain social cohesion until our populations recover, are able to reconstruct our societies' economies, and advance towards sustainable development...with equity. 

“Universal” doesn't just apply to health care, but to every sector's actions taken to protect the population's health.

Pastor Castell-Florit Serrate MD PhD DSc

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Dr Pastor Castell-Florit's career in public health spans work at local, national and international levels. In 2016, he received PAHO's Award for Health Administration in the Americas, for “outstanding leadership and valuable contributions to the management and administration of the Cuban National Health System.” He serves as president of Cuba's National Council of Scientific Societies in Health, as director of the National School of Public Health, and is a member of the Cuban Academy of Sciences. He has published numerous books and articles on social determinants of health and intersectoral actions to address them, and holds doctorates in science and the health sciences.



E Añé

MEDICC Review: How would you describe Cuba's response to COVID-19, in terms of multisector or intersectoral actions?

Pastor Castell-Florit: For the last 61 years, Cuba has been applying an intersectoral approach to problems of health, well-being and quality of life. In fact, described as the coordinated actions of institutions across sectors, this is one of the principles of Cuban public health, along with community participation.

Nevertheless, it's undeniable that times of crisis, like the one humanity is confronting now, demand greater integration and solidarity from the social and economic sectors, in our case through coordinated action at the local, national and international levels under a central government-state leadership. This is essential if we're to eliminate or minimize the problems and their associated causes that endanger people's lives—and thus threaten social and economic development if not tackled in time—by assessing the situation and applying the resources at hand.

When the first imported COVID-19 cases appeared in Cuba, the government broadly convened social and economic sectors, social organizations and others to plan, organize, lead and monitor concrete actions aimed at safeguarding the population's health.

MEDICC Review: How is Cuba's COVID-19 response structured?

Pastor Castell-Florit: Among those convened to confront the pandemic were the Council of Ministers, provincial and municipal governments and their health system dependencies, as well as others such as the biotech sector and the Ministries of Labor and Social Security; Education; Transportation; Communications; Culture; Food Industry; Agriculture; Domestic Trade; Hydraulic Resources; Science, Technology and the Environment; and the Ministry of the Interior.

At the same time, community organizations were mobilized, including the Committees for the Defense of the Revolution, the Federation of Cuban Women, Small Farmers' Association, University Student Federation, and High School Student Federation, among others.

President Miguel Díaz-Canel Bermúdez chairs daily meetings to review specific actions taken by each sector, monitor their implementation, and decide new ones as demanded by the stage of the pandemic in Cuba. Timely information from these meetings and on the measures taken is made public via the media and official bulletins.

Leading Voices on COVID-19

MEDICC Review: What are some of the intersectoral actions being taken?

Pastor Castell-Florit: The main intersectoral activities are aimed at reinforcing health promotion (information, education and communication), so the public understands the situation and can act in ways that keep them from contracting the disease or transmitting it to others. These are also aimed at controlling risk factors by introducing more ways to sanitize and disinfect; ensuring food supplies; protecting the most vulnerable populations; social distancing and border control.

Here are some examples:

The Ministry of Public Health set up a central command post to daily update detailed information on the incidence and prevalence of the disease, cases isolated, confirmed cases, patient status, operation of the surveillance system and active case-finding in the neighborhood. The basic work teams (family doctors and nurses) are key for case finding (active screening) at the neighborhood level. They are assisted by medical school professors and students, as well as local organizations. Depending on the clinical picture in each case, and taking into account the patterns of viral circulation in the area, it's decided how to proceed: whether to confine a patient at home, send a suspected case to one of the isolation centers for observation, or send the person directly to hospital.

The entire health system is now geared to prevent and control the spread of COVID-19, including separate areas in health facilities for walk-ins who feel ill, postponement of elective surgeries, and so forth. At the same time, we continue to prioritize maternal and child health care, with specialized attention to pregnant women and newborns, for example. I should also mention that, in order to avoid crowding at doctors' offices, prescription drugs for chronic disease patients, normally refillable for up to a year, have been extended for at least six months, and may be extended further depending on how the situation develops. This of course has particular importance for older adults who tend to have more comorbidities.

The Ministry of the Economy and Planning systematically analyzes how to ensure basic resources needed to confront the epidemic, making required adjustments to the national economic plan.

The Ministries of Agriculture and the Food Industry assess current production levels of foodstuffs and project those needed to respond to the population's basic needs in this situation.

The Ministry of Domestic Trade organizes distribution throughout the country of foodstuffs as well as personal hygiene, cleaning, protection and disinfection supplies. This also means delivering these items, for example, in areas under quarantine. It also ensures that subsidized basic food staples reach local grocery stores as they do in normal times, and that persons with particular nutritional needs continue to receive their special allotments... whether due to their age (children) or health conditions (diabetics, for example).

Community Services establishes a sustainable program for collection and management of garbage and other waste, to help maintain a clean environment.

The media is responsible for systematically communicating preventive messages and providing updates on the behavior of the pandemic globally and in Cuba. Radio and television entertainment programming has also been augmented to help encourage people to stay sheltered at home.

The Ministries of Education and Higher Education have developed teleclasses for primary and secondary school students and also through information-communication technologies, to provide continuity to teaching while schools are closed.

The Ministry of Labor and Social Security approved resolutions to protect workers, orienting telecommuting where possible. These have also maintained people's salaries and provided support in cases where people cannot continue working because they are either particularly vulnerable themselves or are taking care of someone at home. The resolutions also protect workers sick with the flu or other ailments, or who are either placed in isolation or hospitalized.

The Hydraulic Resources Institute is taking on special projects and finding alternatives to address the deficit of water supplies in some areas, so that potable water continues to reach everyone at home.

The Ministry of Transportation took measures for their employees to apply special cleaning fluids in public buses and mandated their drivers, other workers and the general public to fulfill rules on board, including use of face masks. Transportation to and from health facilities is prioritized. As we move forward, public transportation is expected to be minimized.

The Ministry of the Interior, through the national police force, helps keep the public informed and insists on respect for physical distancing and use of face masks. It is also responsible for monitoring implementation of national regulations concerning such issues as physical distancing, quarantine, and so forth, and are empowered to impose fines or detain people who violate these measures, who can be charged with propagating an epidemic disease.

Members of social organizations participate in active screening (case finding) and pay particular attention to older adults who live alone and who must shelter at home, given their vulnerability.

It's important to note the role of intersectoral support activities to transport and attend to the specialized Cuban health professionals who are traveling abroad (with the Henry Reeve Emergency Medical Contingent) to assist other COVID-19 affected countries. And I should also mention those who helped transfer the passengers (some sick with COVID-19) from the MS Braemar cruise ship to charter flights to return to the UK.

MEDICC Review: What role is National Civil Defense playing?

Pastor Castell-Florit: The National Civil Defense network is responsible for protecting the population and the economy in times of disaster and exceptional situations like this one, and it also has a role in rescue operations and urgent repairs of vital systems.

So now, Civil Defense plays an important part in organizing and implementing measures related to physical distancing, assisting in food distribution, and generally in supporting organizationally the various activities being carried out to address the pandemic.

During the phase of limited local transmission—in which case clusters have been identified in specific locales with no known contact traced to a traveler from a country where COVID-19 is present—Civil Defense works with others to carry out the quarantine measures according to the Ministry of Public Health's technical guidelines and the national plan in place for COVID-19 prevention and control.


This means seeing to it that movement is restricted within and also in and out of quarantined areas, coupled with support for increased case-finding efforts, isolation of suspected cases, timely treatment of confirmed patients, disinfecting and other health and hygiene measures.

MEDICC Review: Each country has resources and strengths it can draw upon in such times of crisis, in this case, a pandemic. What are the most important ones in Cuba?

Pastor Castell-Florit: The first is establishing health as every person's right and as the responsibility of the state; accessible, free, health services oriented towards health promotion and disease prevention, community-engaged and oriented around pri-

mary health care. Then the conscious political will to make this a reality, to empower levels of government, the different sectors and the population (at the community level and individually) to work towards health, well-being and quality of life for the whole population.

We have a tradition of intersectoral actions for health with community engagement, and also of managerial programmatic planning and monitoring, from the national to the local levels. These are vital, since intersectoral actions concerning health are directly related to the population's problems. There is a sense in which "universal" doesn't just apply to health care, but to every sector's actions taken to protect the population's health. In turn, we depend upon a population that is well organized and also disciplined.

In short, unified, state leadership opens the way for all social and economic sectors to contribute from their particular vantage points, to ensure security and social welfare for everyone, so that essential resources are distributed rationally to the whole population, providing the context for health in all policies. 

Are we witnessing the swan song of neoliberalism?

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MEDICC Review: In several of your published works, you address the ethics involved in the process of formulating public policy. What ethical aspects should be considered as the world confronts the COVID-19 pandemic?

José R. Acosta: The effective exercise of human rights—including access to health care and education, as well as to the collective benefits of greater accumulated knowledge and technological advances—is only possible in the context of collective will built on ethical principles such as responsibility, solidarity, non-discrimination and protection of the most vulnerable.

In the Latin American and Caribbean region, the most unequal in the world, the neoliberal policies implemented by the military dictatorships during the 1970s and 1980s were continued by the representative democracies that followed. An ensuing more progressive decade was interrupted in several countries where the right has regained political power, restoring neoliberalism and its policies, and thus vastly deepening the gap between society's haves and have-nots.

The COVID-19 pandemic swells in the current context of weak public health systems; a clear environmental crisis; intensified circulation of travelers, migrants and goods; concentration of human settlements; and unprotected populations besieged by deficiencies and conflicts of all kinds. In an interview published March

29 in the Argentinian newspaper *La Nación*,^[1] Yale University professor and historian of epidemics, Frank Snowden, observed that “coronavirus is the first great epidemic of globalization.” This is the first communicable event of a completely global scope, produced by a hitherto unknown causal agent, both highly infectious and highly lethal, and particularly aggressive within vulnerable population groups such as the elderly, the poor and the chronically ill. This “preferential” morbidity and mortality has become even more evident as the pandemic has progressed in the most impoverished communities within industrial societies, as well as in countries euphemistically described as “emerging economies.” COVID-19's rapid spread and devastating effects have only been made possible by the favorable conditions created by neoliberal globalization.

If success is defined as corporate material gain at all costs, then it is exceedingly difficult to structure public policies to confront events with the power and magnitude of natural disasters or pandemics, which require enormous resource outlays that will not be returned in the form of profits, but rather in collective social benefit. This is why we see willful hesitation in some ruling government circles, placing the health of markets before the health of people, economic vitality before the lives of fellow human beings. This is the kind of ruthless utilitarian logic that is capable of admitting that a forecast of 100,000 deaths would be an indicator of having done “a very good job.”

The Global Health Security Index,[2] a report published by Johns Hopkins University in October 2019, analyzed 6 categories, 34 indicators, and 140 items or questions to assess health security in 195 countries. This study warned that none of the surveyed countries were prepared to face a pandemic, including the United States, which scored highest on the index with 83.5 out of 100, compared to a global average of 40.

Despite the USA's rank as the country best prepared to ensure the health of its population and the one best able to react to an epidemic, according to an April 1, 2020 Institute for Health Metrics and Evaluation projection,[3] April 15 was expected to be the day when COVID-19 would exert the greatest pressure on the country's health services. It estimated the total need for hospital beds on that day would be 262,092, projecting only 87,674 beds available; in the same vein, the demand for beds in intensive care units was estimated at 39,727 with only 19,863 beds available. Additionally, it projected that 31,782 ventilators would be required at that time, in the context of the well-publicized controversy between federal and state governments on the acquisition of this life-saving equipment. Given these dire predictions, it is not surprising that the following day, April 16, 2020, was predicted as the day with the highest COVID-19 case fatality in the United States. The dates may differ depending on the pandemic's behavior of course, but the general situation of insufficient health services' response will inevitably occur when COVID-19 reaches its zenith in the United States.

This manifest blindness and abject lack of foresight are only possible when economic values predominate over moral ones. In this context, ethical principles of solidarity, responsibility, non-discrimination and protection of the most vulnerable cannot possibly guide public policies capable of articulating a coherent national response to address, counter and defeat disasters such as the COVID-19 pandemic. Thus, we see the devastating toll it has already taken in the United States and Europe, and the tragedy that is only just beginning in Africa, Latin America and the Caribbean.

MEDICC Review: Responses to the pandemic in some countries have pitted one approach against another, to the extreme of facing off epidemiological surveillance against individual empowerment and isolation against solidarity. How do you view this dilemma from an ethical-philosophical perspective?

José R. Acosta: These dichotomies are resolved in the moral debate between individualistic egotism and shared responsibility, expressed in solidarity. It is deplorable to witness traditional allies competing for resources in the face of the pandemic to address their own needs with no regard for the needs of others. We are also seeing significant defaulting on implementation of multinational mechanisms to confront COVID-19 collectively, even when parties are signatories to regional and international treaties that legally and morally obligate them to cooperate.

COVID-19 has confirmed the close and interdependent ties between the nature of life and the fabric of society itself

COVID-19 has confirmed the close and interdependent ties between the nature of life and the fabric of society itself. This pandemic—like all health

problems, but particularly communicable diseases—highlights the underlying social determinants that decisively influence both the course and the outcome of the disease.

Protection of the most vulnerable, as well as sharing of risks and benefits in the application of knowledge and technology, are ethical principles enshrined in UNESCO's Universal Declaration on Bioethics and Human Rights (2005).[4] The isolation and surveillance measures necessitated by the pandemic in no way deny or prohibit cooperation and solidarity exercised with responsibility.

MEDICC Review: UN spokespersons maintain that all international sanctions should be lifted during the pandemic. From an ethical standpoint, how do you view the decision by the US administration to maintain its unilateral sanctions against Cuba now?

José R. Acosta: The sanctions imposed on Cuba are but an expression of what is known as "unconventional warfare," escalated by the Trump administration to previously unimagined limits.

These practices are ethically unacceptable because they disrespect the rights to life, health, dignity and personal integrity; they increase human vulnerability; hinder access to economic, social and cultural rights; and they interfere both with freedom of choice and decision-making, by the way they wield objective and subjective mechanisms of power.

The systematic worldwide demand to lift these unilateral, immoral and illegal coercive measures as a practice in international relations has intensified in the COVID-19 context, because it is inconceivable to maintain sanctions and restrictions in the face of such a global emergency affecting everyone, instead of facilitating collaboration and exercising solidarity.

MEDICC Review: From an ethical perspective, how do you view Cuba's decision to send emergency medical teams abroad in response to various government requests for help in confronting COVID-19?

José R. Acosta: As I mentioned, the accumulated health care needs are part of a systemic structural crisis of neoliberalism in many countries, associated with many other unfulfilled economic, cultural and social needs. Economic adjustment and austerity measures have greatly weakened the technical capacity and availability of human resources in these countries, although, since starting from a different baseline, poor countries have logically suffered the most. In these conditions, solidarity and international cooperation are quite necessary, and Cuba has forged a laudable tradition of providing this type of aid to those requiring it.

The practice of solidarity and global health cooperation has been an ethical principle of revolutionary medicine since the first international brigade was sent to recently liberated Algeria in 1963, a principle reconfirmed in the oath taken by the first cohort of physicians graduating after the revolution.

Collaboration in health became a vital part of the relations of friendship and cooperation Cuba established with African

Leading Voices on COVID-19

and Asian nations emerging from colonialism. US efforts to diplomatically isolate Cuba from the rest of Latin America and the Caribbean—part of the unconventional war—began to fail. As they did, friendly governments in the region began to request medical assistance in the form of long-term agreements as well as emergency aid in the case of natural disasters. Today, Cuba's global health collaboration has been extended in different modalities to dozens of countries on virtually all continents.

Cuba's solidarity in health has been reflected in sending health professionals, medicine, supplies and equipment, but also in training human resources in Cuba or in students' home countries, and in scientific research and production of medications through joint development and technology transfer. Much of this collaboration has been offered free of charge, or else by mutually advantageous agreements with those countries that are in a position to assume costs. Through this solidarity, the principle of justice has been fulfilled by improving access to quality medical services for the most disadvantaged among us, both by Cuban personnel and professionals of the receiving nations who were trained through this cooperation.

MEDICC Review: The COVID-19 pandemic poses old and new ethical dilemmas...how would you define these?

José R. Acosta: COVID-19 has catalyzed ethical debates on moral values and dilemmas at the micro- and macro-ethical levels that were already happening, but have now greatly intensified.

The fundamental macro-ethical issue is why the warnings were ignored

models about imminent catastrophic events, including epidemics, as well as warnings about the clear unpreparedness of existing health services to confront them, resulting in non-existent social services now being hastily assembled to address the challenges we knew were coming. Thus, we have the COVID-19 pandemic as the classic *guerra avisada*; a war we were warned was coming that has already claimed many lives.

MEDICC Review: There are other issues that present ethical dilemmas, from the individual to the global level: setting priorities in treatment when resources are insufficient, speeding up clinical trials for new treatment violating guidelines of established ethical standards, and taking care of one's health in circumstances where it could conflict with the health of others. And these are just a few examples.

José R. Acosta: Of course. One of the epidemiological control measures that has shown great effectiveness in COVID-19 containment is voluntary and, if necessary, mandatory isolation. It should be borne in mind that the free movement of persons is an internationally recognized human right, and for some societies it carries a highly important symbolic value. The ability to convince or impose this type of restriction depends on more than the coercive exercise of authority; it requires persuasion about individual responsibility to care for one's own health, as well as a discussion surrounding social responsibility for the health of others. In cases like this, individual autonomy is limited by its possible

effect on the common good, for which the state is the ultimate guarantor, bearing maximum responsibility for the health of its population.

Today the right to freedom of conscience and expression can be exercised in a much broader, more public way through the technological support offered by social networks. Due to the social isolation that many people are experiencing as a result of the pandemic, they now have time to spend interacting online with others where they also seek information about their concerns and questions. The information they consume and spread takes on special connotation because it can be used to clarify doubts and offer security and confidence...but also to spread unverified news and even fake news, by disseminating unfounded rumors that can cause social destabilization, intentionally or unintentionally.

Decisions on use of scarce resources such as diagnostic tests, ICU beds, positive-pressure ventilators, or even the handling of corpses, have brought to the fore conflicts common to clinical practice, but under these pandemic conditions they multiply exponentially in both quantity and drama. Each country, region, or city has particular characteristics: not only the material conditions and resources available, but also the cultural underpinnings of their respective populations. There can be no general recipes to guide humanistic behavior in these cases; each place must establish its own protocols for action based on the underlying ethical principles of justice and equity. This is the best antidote to improvisation and shock.

Another revived debate has been the ethical conflict between the duty of health professionals to care for patients at the risk of their own safety and the utilitarian rationale of self-preservation when faced with overwhelmed organizational capacities for addressing the catastrophe. In practice, it seems that altruism has predominated, and this is confirmed by the daily applause in many countries by people grateful not only for the health professionals, but for all those who are putting their health at risk for the common good, under very difficult conditions.


So far, there is no cure or specific protection against SARS-CoV-2, the causal agent of COVID-19. Until we have these, the only effective measures are those of prevention and epidemiological control. Obtaining a vaccine and effective treatment require research protocols now being developed by several prestigious institutions, including WHO, which has convened an international collaborative project. Regardless of the worldwide interest in obtaining results in the shortest time possible, this does not preclude taking all steps necessary to ensure safety and efficacy, whether the product is a vaccine candidate, a medication or a treatment scheme. The immoral attempt to buy exclusivity of one of the vaccine projects is unacceptable, as is the proposal to conduct clinical trials in Africa, given the lack of protections for its populations and the weakness of regulations concerning norms of good, ethical clinical research practice.

COVID-19 has brought with it new ways of socially relating in conditions of isolation: novel artistic and communication expressions, different forms of working, remote teaching activities at all levels of education, solidarity business practices, e-government, and community health actions such as proactive screening in primary care services, among others.

Political leaders, scientists, intellectuals, artists and social commentators insist that the world will not be the same after this pandemic. But few dare to predict just how the world will be different. Voices already call for a broad international exchange to clarify what thinking will emerge to guide us after COVID-19.

In his article *How the Pandemic Will End*, published in *The Atlantic* in March,[5] Ed Yong suggests that changes will be so profound,

so radical, that children born during and shortly after this fateful year will be called “Generation C”, because they will have to deal with the negative and positive aftermaths of the bitter global experience that was COVID-19.

Are we witnessing the swan song of neoliberalism and the transition to a more responsible and supportive world, or are we staring at a dystopian future of unrelenting plunder? 

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Much more visible now are the inequalities that have always existed in our system and much clearer the need for stronger state intervention

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Dr Armando De Negri Filho is an epidemiologist whose work has centered on development and maintenance of Brazil's universal healthcare system. Along with his training in epidemiology, Dr De Negri has a specialty in emergency medicine and a PhD involving research focused on policy, planning, economics and health systems management. In addition to his other responsibilities, he serves as an expert on the right to development for the UN Human Rights Council. He spoke with **MEDICC Review** from his hometown in Porto Alegre.



MEDICC Review: How does your current work relate to the COVID-19 pandemic?

Armando De Negri: My responsibility is mainly in a civil-society leadership team that is working on strategies to help us get through this pandemic and arrive, at the end, to a better perspective on how our system may be best served. Our activists have agreed that this is an opportunity to go beyond the limits of our national health system, which has been severely restricted during the last few years due to shortages of both financing and service development. So, we are now in a major crisis of access to health and health care—but that's not new. The pandemic is only making it much more visible.

MEDICC Review: How have your day-to-day professional responsibilities shifted since the onset of the pandemic in January?

Armando De Negri: In fact, I don't think they have shifted very much, because for many years now my place in the national health system has been in social activism and decision-making about health policies and systems. Through the coordination of various projects, I have been working to enhance our health system's capacity to meet the social needs of the population. Throughout this period, we have been very concerned with the

lack of health service infrastructure necessary to make quality health care possible—this was a problem that already existed before the coronavirus pandemic.

Currently, we are trying to not only mobilize the resources necessary to face the pandemic, but also to make this crisis an opportunity to help us shift the political agenda. And I think that might be possible: much more visible now are the inequalities that have always existed in our system and much clearer the need for stronger state intervention. We can no longer continue to ignore the fact that our universal health system has been very limited in its capacity, since it has been viewed as conflicting with economic policies. Right now, when we need to protect all of society, regardless of social class, we are in a position to propose another kind of debate. So my responsibilities in the face of this pandemic become more urgent, but their academic, professional, and social nature remain the same.

MEDICC Review: So, do you believe such increased visibility for systemic inequities offers potential for positive change going forward?

Armando De Negri: I think it could. But it's not something that we would achieve organically, because of the way our society is organized. Remember that Brazilian society has been heavily influ-

enced by its historical origins in slavery—present in our society for almost four centuries—and this history has developed a society that is, by its very nature, quite unequal. In 1988, the federal constitution established the universal right to health, but that doesn't mean that we have achieved it in every sense. Our national health system is big and everyone can access it without paying; its financing comes from taxes levied through state taxation.

However, since the adoption of our universal health system in 1988, private-sector health services have increased, accessed by about 48 million people. The universal public health system is providing services to another 170 million people, who are exclusive users of that system, with no access to private care. But the 48 million who can afford private insurance can use both private and public health services. They are doubly protected. About 45% of total health expenditures is spent on the public system, while 55% goes into private-sector health care. When you put this together, it means that some 25% of the population has access to 55% of the health resources, without being excluded from the universal health system. On the other hand, you have 170 million people that can only access services provided through the 45% of funds devoted to the public sector. The result is quite unequal in terms of the material capacities of these systems and subsystems, and of course also generates more social inequality in access to healthcare, and thus in health, within the population.

What we are observing during the pandemic is that all the resources that we have now dedicated to our health infrastructure are insufficient. Even the private sector is currently incapable of serving the needs of all 48 million people who are privately insured. So these people are putting pressure on the public system, which they can do despite the fact that they have additional, private insurance, because they are citizens. This scenario is prompting debate about the quality and strength of the public system, and is shedding light on the limitations of both healthcare systems and subsystems.

It bears repeating that what we had prior to the pandemic was insufficient. We were already observing overcrowding in emergency services, long wait times for specialized hospital care, and now we are facing a dual insufficiency—the pre-existing social debt in terms of the prevailing inequities in the health system, coupled with new needs demanded by coronavirus care. So this is a key opportunity to make the need for a stronger system much more visible.

Somebody has said “until now, the neoliberal policies were built on the idea that we could have a big boat with very few life jackets... but now that we're sinking, we're realizing that we need enough life jackets for everyone.” This epiphany on why we must center, sustain and expand our national healthcare system based on the needs of society as a whole could become a strong political point to make.

MEDICC Review: Looking at the structural inequalities you have described in the healthcare system, how do you see the pandemic playing out in Brazil?

Armando De Negri: First, we have these social class inequities that are very important, that are expressed in what you might call a planned lack of assistance. Historically, we've always struggled to have enough budget to cover social needs, and since our economic policies are very much neoliberal-oriented, we ended up with a kind of limited response to social needs—based on the “natural” assumption that the needs won't be fully addressed. This kind of behavior in

the dynamics of both state and society led to systematic reductions in our structural capacities.

For example, since 1992, we have observed a continuous reduction in the number of hospital beds. This is very much linked with an imported way of thinking: the fact that most Western countries are reducing the number of beds was consistently used as an argument to support these policies. But of course, this kind of direct translation is very misleading, because in many European countries, or even the former Soviet republics, the number of hospital beds was reduced because they had a very large number in proportion to their populations, and the decrease was linked to a transformation in outpatient care plus a drastic reduction in inpatient care. And at the same time, in the case of various Western European countries, Canada and Australia, we can see that the reduction in hospital beds was too drastic, resulting in a more recent crisis in access to hospital admission.

When we compare hospital-bed numbers in Brazil with those in other universal health systems in the world, mainly in developed Western countries, we see a huge disparity. In our universal health system, we have just 1.4 hospital beds per 1000 population. The minimum that we see in these other countries with universal state access is about 3.5, 3.6, or even 3.8 per 1000 population. And even when they are nearer to 3 per 1000 than to 4 per 1000, we observe crises in access, as is the case in Ireland, the UK, Spain, Australia and elsewhere.

My activism over the past 25 years in emergency policies and services has been directed at calling for a human rights-based policy to make the number of hospital beds sufficient to meet the population's needs. Right now, without the coronavirus, we would need 500,000 more hospital beds in our country to even begin to meet the needs of the population and solve the almost total absence of care in many regions.

What's more, this very low number of hospital beds corresponds with a low number of intensive care units and also, importantly, a lack of equitable distribution among territories. We are a very big country, with problems in inequality between regions, and services are concentrated in the state capitals or in the richest regions, with a lack of specialized hospital care even within very big territories. So the historical inability to address the needs of our population is something that becomes even more concerning now, in the face of a pandemic.

Another factor to consider is that throughout the past 30 years, we have been experiencing a fast demographic transition to an older population. This means we have many more people using the health system at a much higher rate, magnifying all the problems derived from our social and economic failings. For instance, the triple burden of disease (infectious disease, chronic disease and injury) is very high, so when we combine all those dimensions—demographic, socio-economic and epidemiologic—we have an immense social need for health care that is not addressed by existing health services and budgets. So now we need to understand health services and systems as a tool to reduce or eliminate inequalities, and this realization is coming to the forefront of public consciousness.

In other words, everything we will be debating during the next weeks and months regarding coronavirus must be understood within a broader context. The pandemic is opening people's eyes to the lack of access inherent in our health system structures. We will be obliged to go far beyond the budgetary limits we have now, to review the sources of financing, and to think about health care and our health

Leading Voices on COVID-19

systems as part of the country's vital economic life. This is a case where we should spend money expecting no financial reward, because we are talking about a very important sector of the economy. Linked to this, the question of "health sovereignty" presents another grave challenge, since the pandemic has revealed that we need national industries able to produce masks, gloves and basic life support equipment for hospitals and general healthcare use. Our level of dependency on foreign industries, especially in the case of pharmaceuticals, is unacceptable, especially in a country with 212 million people. And so this is a moment to change our health-related economy and our solutions, as well.

MEDICC Review: Foreseeing a deep global recession, possibly even a depression, do you have any suggestions for how to best balance immediate public health demands necessitated by the coronavirus with those involved in re-invigorating the economy?

Armando de Negri: I have been listening to the debates in other Latin American countries, and first of all, I think we must use this opportunity to design the real breadth of the health systems and healthcare networks that we need, emphasizing their linkages and interdependencies with social services. Within any health system, there is a mix of health conditions that demand health care and many situations where social services become very important. This is the case especially with longterm patients who require protection involving social institutions, including the possibility of housing support, the need for a regular income, and so on.

So, we have to map out the health and social systems we have right now in order to prompt a new debate on the resources we need, and to understand what we must do to achieve equilibrium between the needs of the population and our responses to those needs. In this sense, using the reference of social human rights is important because it forces us to think first about the needs of the people, and not about the limits of the budget.

The second point is this: once we have this broader picture of what we have and what we need, and once we have established the cost of what we must do, then we can examine the way forward more ambitiously and begin talking about how we can generate the resources necessary to meet the population's needs. Then we can begin to talk about tax justice and the effectiveness of the regional redistribution mechanisms we currently have in place to sustain universal policies. Additionally, we need to discuss the need to change most of the structures involved in our industrial capacities, including the education system's capacity for producing professionals qualified to sustain expanded, quality health care.

In doing all this, we can re-embed the economy in social life. This is fundamental. The idea that we work for the health of the economy must be substituted by the idea that the economy must develop to sustain the well-being of the people. Over the last 30 years, the economy was reduced entirely to its financial expression, with negative social effects. What became important was generating financial results, which means that we are all working in order to make rich people richer. We forgot the fact that money, in the end, is a kind of fictitious merchandise or commodity. We need money to mobilize our societies and to drive our economies, and so fine, let's make money, let's have a financial system. But this financial system has to submit to the real "living economy," meaning it is fundamental to re-embed the economy in society.


Of course, this is a very challenging debate; we're talking about a new global economic order. But this crisis is a global crisis. We cannot simply say, well, okay, now the plague is over, and we can revert to our old models. I think that won't be possible. And if we try to return to the way things were before the pandemic, I anticipate we will be facing a good deal of social conflict. Thus, it's a very important moment in history and an extremely important opportunity for mankind to change the way we have been doing things for the last several decades. As Brazilian civil society, we are very interested in social health and social security and quite motivated to contribute to this debate in different regions and countries in the hope of realizing the right to health.

I have been selected as an expert on the right to development by the UN Human Rights Council. We begin work in May. Precisely one of the opportunities the Council has now is to formulate a treaty proposal on the right to development. In the context of the current crisis, this right is fundamental, particularly as it expresses the concept that wealth that is collectively produced needs to be collectively used. This is an emerging debate within political economy, the idea that we all need to be much more critical in regard to how we produce, distribute and redistribute society's wealth.

Social protection systems in health are very important within this framework, as they are one of the best ways to redistribute riches, that is by creating universal education and health systems, and eliminating the commoditization of social protections. This is the hope we have—it's a political hope to change the nature of the debates over many decades now, to break the hegemony of neoliberal policies, and to institute new perspectives for humankind.

MEDICC Review: Given that the majority of MEDICC Review's readership are physicians and public health professionals, is there anything else that you would like our readers to know or to be thinking about as we move forward globally through this unique point in our collective history?

Armando De Negri: Well, I think it's often the case that health professionals are not very conscious about the complex nature of the health systems in which they work. Our medical pedagogy is usually very removed from a deeper understanding of these complexities, as well as the importance we have, as professionals, in the maintenance or the transformation of these systems. So it is essential in this context to reinforce an ethical approach based on human rights and think about what this means for health professionals. When we consider how health professionals are recognized and evaluated in society, I believe we need to stress the importance and the public value of the health professions in a way that could help to reinforce both the public systems and the dignity of work in health and health care.

Now is the time to think about that. Otherwise, especially among medical people, we can often be dominated by ideas of prestige and money, while lacking awareness about the public importance of our work. In the context of the pandemic, discussions about the ethical obligations of the health professions are very important, as well as continuing discussions of working conditions and salaries. This is a moment to build a new understanding of what health professionals are and what they should be, including our fundamental duty to enhance and develop universal systems that can take care of everyone. 

Bringing Cuban Biotech Research to Bear on COVID-19: All Hands and Minds on Deck

Lila Castellanos-Serra PhD DSc



BioCubaFarma headquarters in Havana.

This *MEDICC Review* roundtable gathers some of Cuba's top researchers in the fields of vaccines and biotechnology, all of whom work in institutions belonging to BioCubaFarma, the umbrella company of Cuban biotech and pharmaceutical R&D, production, distribution and export. Founded in 2012,

the company is comprised of 34 enterprises with 61 lines of production and some 20,000 employees. A total of 765 of its products are registered in 53 countries and exported to another 50. Its scientists' research has resulted in 2640 patents in Cuba and globally.

Introducing our readers to roundtable participants (in order of appearance):

Eduardo Martínez-Díaz PhD is a biologist with a doctorate in biological sciences and is president of BioCubaFarma since 2017. Prior to that, he served as the company's vice president as well as director of scientific policy. Earlier, he served as vice director of the Genetic Engineering and Biotechnology Center (CIGB) and director of technological development at CIGB.

Vicente Vérez-Bencomo PhD is a chemist with a doctorate in chemical sciences and directs the Finlay Vaccine Institute. He is also founding director of the Synthetic Antigen Laboratory at the University of Havana, where he led the team that discovered and developed the Cuban *Haemophilus influenzae* type b (Hib) vaccine using a synthetic antigen—the first of its kind in the world.

María del Carmen Domínguez-Horta PhD is a biochemist with a doctorate in biological sciences. She is a senior researcher at CIGB, where she is director of projects in molecular biology, immunodiagnosics and immunology, carrying out clinical trials in search of new drugs for treatment of autoimmune diseases, based on induction of peripheral tolerance.

Rolando Pérez-Rodríguez PhD is a physicist with a doctorate in biological sciences. He is a founder of the Molecular Immunology Center (CIM) and served as its director of research. He is director of science and innovation at BioCubaFarma.

Luis Herrera-Martínez MD PhD is a physician with a doctorate in biological sciences. His team is credited with developing Cuba's first recombinant biotech products, among them, recombinant interferon alfa-2b in 1986. He is a founder of the Center for Biological Research (1982) and of CIGB (1986). He served as research director at both institutions. At CIGB, he was also director of production and technological development and later director. He is currently advisor to the president of BioCubaFarma.

Gerardo Guillén-Nieto PhD is a chemist with a doctorate in biological sciences. Since 1998, he has served as director of biomedical research at CIGB, with main areas of study concerning development of new vaccines.

Science Takes on COVID-19

MEDICC Review: What do we know about the behavior of COVID-19 and the SARS-CoV-2 virus that causes it?

Eduardo Martínez: As of April 17, 2020, reported case fatality worldwide is 6.86%; in some countries it's as high as 15%. About 80% of people infected remain asymptomatic or are only mildly ill, while 20% become seriously or critically ill. In Cuba thus far, 9% have become seriously ill and 4% critically ill, with a case fatality of 3.3%. In these severely ill patients, viral load is much higher than in patients with mild disease, and once the virus establishes itself, it replicates rapidly and the immune system is unable to stop it.

Vicente Vérez: What happens to someone once they're infected depends on the viral load. The higher the viral load, the more difficult it is for the immune system to fight the disease. Many people manage to achieve equilibrium between virus and host: the virus doesn't win, but neither does the host succeed in eliminating it. These people are asymptomatic, and neither they nor the health system know that they are infected unless there is mass population screening. They are the bane of health systems and the main source of transmission.

In individual terms, however, these people are successful because their immune systems have protected them from the virus. We need to understand how some people manage to remain asymptomatic, what characterizes their immune systems that provides such protection and avoids disease development. This is a research question being tackled worldwide.

When that equilibrium between virus and host is broken, when the virus manages to overcome the immune system's defenses, infected people move on to disease states ranging from mild to critical. The virus manipulates the immune system and provokes responses that can be very harmful. Most people who die during the transition to serious or critical illness do not do so directly from the virus: strictly speaking, it's not the virus that kills them, but an intense immune response to the virus. An immune over-response, called a cytokine storm, attacks the host, finally leading to multisystem organ failure, the nightmare of all intensive care specialists.



Dr Vicente Vérez appears on Cuba's prime-time Mesa Redonda.

María del Carmen Domínguez: Reports of cytokine storm in COVID-19 patients started to emerge in mid-March this year, the first from a group of Chinese colleagues who described what happens immunologically in a group of patients in transition to critical condition. They develop this hyperinflammatory process, the cytokine storm. Inflammation is a normal physiologic process that helps the body's defenses against a pathogen, such as a virus. But when inflammation is so acute, an excess of cytokines ends up damaging the body. The patients develop respiratory problems requiring artificial ventilation, while thromboses emerge in other organs.

MEDICC Review: While we wait for a preventive vaccine, which will take some time, how can we help the immune system better fight the virus?

Vicente Vérez: There are two kinds of immunity, one specific to a particular disease (usually achieved through a preventive vaccine derived from an inactivated component of the virus) and the other nonspecific. In the case of SARS-CoV-2: when we find equilibrium between virus and host, it is the nonspecific immunity that is responsible for this, and thus for the fact that overt disease is not developing. It is *not* specific immunity, because this virus was unknown before December 2019, and more important, unknown to the body's immune defenses. There is no specific immunity to this virus simply because it's new: thus we're talking nonspecific immunity, the so-called natural or innate immunity we all have. Its protective power varies among individuals and depends on several factors.

Understanding how this innate immunity functions in COVID-19 could help us alter its clinical course, reducing the number of people who progress to serious illness. It's a major scientific challenge: to identify and then administer whatever factor that has successfully promoted innate immunity in asymptomatic people. This is a very interesting strategy that can change the outcome of the battle between virus and host, so that individual defenses triumph, boosted by medications that reinforce or enhance innate immunity to control the disease.

MEDICC Review: The biopharmaceutical industry has been playing a key role in Cuba's response to COVID-19. Could you give us an overview of projects under way to address the disease?

Eduardo Martínez: BioCubaFarma is the umbrella corporation for Cuba's pharmaceutical and biotech industry and research institutes. Its institutions are working in four areas related to COVID-19: provision of products approved by the Ministry of Public Health (MINSAP) for the disease; research and development into new knowledge and products; international cooperation to provide medications to help fight the pandemic; and internal measures in our firms to protect workers and ensure operational continuity under current circumstances. We have 25 products, including generic medications (among them chemical antiviral agents) and novel products developed by Cuban researchers.

BioCubaFarma companies have taken on production of masks and sanitizing products as well, and our factories are repairing devices needed to address the pandemic, such as ventilators, and producing personal protective equipment (mainly filter masks, face shields, goggles and gowns).



A Borrego, Gramma

Dr Eduardo Martínez: BioCubaFarma institutions are working in four areas related to COVID-19.

Rolando Pérez: BioCubaFarma is working on 15 projects for COVID-19. Six are treatments, six related to prevention in at-risk groups, two are diagnostics, and one is a medical device. Nine are undergoing clinical trials in patients and at-risk groups, while six are in R&D. There are also other projects in the design phase or early research stages.

Building on knowledge generated in other countries, we have designed clinical trials and population interventions with products that are already registered or that are in very advanced research stages. All clinical trials and population interventions have been approved by the Center for State Control of Medicines, Equipment and Medical Devices (CECMED), Cuba's regulatory authority, in accordance with ethical principles for conducting clinical trials; their results will be shared with the international scientific community.

We are using interferon alfa-2b, a foundational product of Cuban biotech, which has direct antiviral activity and is an immunostimulant. It is produced by the Genetic Engineering and Biotechnology Center (CIGB) and the National Center for Bioproducts. A nasal formulation is under development. We are also researching the combination of alpha and gamma interferons.

Two products are being evaluated for possible management of hyperinflammatory reactions (the cytokine storm). One is a monoclonal antibody from the Molecular Immunology Center (CIM), which inhibits the effector phase of immunity; the other is a CIGB product, CIGB 258, which stimulates the immune system's regulatory cells. Both are also in development for treatment of autoimmune diseases.

MEDICC Review: What preventive measures are under development?

Rolando Pérez: For prophylactic use in at-risk groups and vulnerable people, various immune system stimulants are being evaluated:

- Nasal administration of interferon alfa-2b, a CIGB project in collaboration with AICA Laboratories, a Cuban pharmaceutical company;

- Biomodulin T (produced by Cuba's National Center for Bioproducts), a natural product obtained from thyme extracts, which has been used for several years as a cellular immunostimulant in people aged 60 years and older who experience immunosenescence;
- A transfer factor produced by CIGB from natural sources, which is also a cellular immunostimulant and has been used for more than 30 years in patients with immune deficiencies;
- A new immune potentiator, CIGB 2020, now in clinical trials; and
- VME-corona, from the Finlay Vaccine Institute, a vaccine with certain components of the Cuban vaccine VA-MENGOC-BC, which has been used since the 1980s to control serogroup B meningococcal disease. In addition to its specific properties, this vaccine activates innate immunity. The regulatory authorities approved a study of people at epidemiologic risk, which should start in the next few days.

MEDICC Review: What about disease diagnostics?

Rolando Pérez: The Immunoassay Center is developing reagents for serologic diagnosis, to detect IgM and IgG antibodies in people who have been infected with the virus. It's an ELISA system, based on Cuba's ultramicroanalytic system (SUMA), and could be available in the next few weeks. Using bioinformatic methods, we've designed peptides characteristic of the SARS-CoV-2 viral structure that can be used to develop ELISA systems for detecting antibodies that recognize the virus. This would enable national coverage, since there are already 3000 SUMA equipment in Cuban health institutions. This is a strength of our national diagnostics system, which could make major contributions to COVID-19 control through expanded detection of infected individuals. Last but not least, several companies in BioCubaFarma, including Cuba's Neurosciences Center and Combiomed (which produces electromedical equipment), are repairing ventilators and designing a new ventilator model, using 3D printing of some parts.



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Dr Rolando Pérez: Various immune system stimulants are being evaluated.

Eduardo Martínez: Expanding detection is key because of course, the asymptomatic carriers represent the biggest threat in terms of disease spread. It's a challenge internationally and here in Cuba. We continue to incorporate more labs for polymerase chain reaction (PCR) diagnostics, but we need a test that we can run on 5000–6000 or more people per day, such as those based on antibodies. These enable detection of asymptomatic carriers and people who have had contact with but are clear of the virus. This is crucial information, because it enables contact tracing. Finding antibodies means that the person has been infected, even when PCR is negative because the virus has been cleared from the body. That's another advantage of an antibody test.

MEDICC Review: What role does interferon play in treating COVID-19?

Eduardo Martínez: Interferon is produced by the body and has antiviral action, activating virus-inhibiting mechanisms. The SARS-CoV-2 virus reduces interferon levels in the host organism, depriving it of natural antiviral protection. The problem is seen most strikingly in patients who are already immunocompromised and thus particularly vulnerable.

Luis Herrera: Middle East Respiratory Syndrome (MERS), a respiratory disease that appeared in 2012, was caused by a coronavirus that infects humans, bats and camels. That virus invades nonciliated epithelial cells in the bronchi, evades the innate immune system and impedes interferon production by these cells. This led us to propose use of interferon from the beginning of the COVID-19 epidemic in China. Based on those results, expert consensus recommended use of interferon in China and other countries in their treatment protocols (together with chemical antivirals). Its use in Cuba has helped us keep patients from progressing to more dangerous phases of COVID-19.

MEDICC Review: Some media have commented that interferon's effectiveness hasn't been demonstrated in this pandemic. Are there any results yet in Cuba that allow us to assess its effect?



Dr Luis Herrera: Interferon use in Cuba has helped keep patients from progressing to more dangerous phases.

Eduardo Martínez: Not definitively, nor for any antivirals, because this is a novel virus, unknown before December 2019. Thus, there hasn't been time to conduct and obtain results from clinical trials. In fact, WHO has proposed the SOLIDARITY study, running three clinical trials to assess the efficacy of various antivirals and therapeutic approaches used thus far. However, previous experience suggests interferons could be helpful. Interferon application in Cuba is showing benefits, and we plan to publish our results once they are definitive.

MEDICC Review: CIGB 258 is already in use. What is it and how was it developed?

María del Carmen Domínguez: For 20 years now, I have been leading a project to seek new pharmaceutical treatments for chronic respiratory and autoimmune diseases. In these diseases, the immune system gets out of control and produces an inflammatory response against its own molecules, leading to serious health problems.

We now have a number of therapeutic candidates we developed through bioinformatics. Among those, we selected a molecule with a role in regulation of innate immunity and so-called acquired immune memory. Starting with that molecule, we designed new molecules able to regulate the inflammatory response. This involved a broad preclinical research program including assessment of the mechanism of action, toxicology and safety studies. Among the candidates is the molecule named 258. It regulates innate immunity and also induces immune system cells to control inflammation. One of its important characteristics is that it does not induce immune suppression.

Its application in certain COVID-19 patients was approved in turn by the Scientific Councils of CIGB and BioCubaFarma, then by MINSAP's Expert Commission, which approved it for compassionate use (that is, for use in critically ill patients for whom other therapeutic options have been exhausted). Following ethical norms, the next of kin is required to give written consent for use, after receiving a thorough explanation and a document describing in detail the nature of the treatment and its possible benefits and risks. In most cases where CIGB 258 has been applied, C-reactive protein, ferritin and cytokine levels have markedly moved toward normal, and patients are recovering from leukopenia and thrombocytopenia, with substantial improvement in lung imaging.

We are in an emergency and must respond to it, but our response carries with it an important scientific ethical obligation

I also want to note: we are in an emergency and must respond to it, yes, but our response carries with it an important scientific ethical obligation. Cuban researchers don't

see the patient as a client, but as a human being affected by a complex disease and who needs our help. When we act, we do so respecting rigorous ethical standards in the midst of the eagerness we all feel to respond. We're not talking about a cure; we're talking about treatment options. It's crucial to keep patients from reaching the point where they need this molecule. That's why I emphasize the importance of taking and maintaining all the preventive, protective measures advised by health authorities.



Dr María del Carmen Domínguez, leading projects for two decades on new pharmaceutical treatments for chronic respiratory and autoimmune diseases.

MEDICC Review: What is Cuba's experience in therapeutic use of vaccines?

Vicente Vérez: In Cuba we have two vaccines that are powerful stimulants of innate immunity, one developed by the Finlay Vaccine Institute, called VME–corona, and one by CIGB, known as CIGB 2020. I'll say a bit more about the first. In 1980, Cuba suffered a meningitis B epidemic that cost many lives, mainly those of young people. Finlay Vaccine Institute researchers under the leadership of Dr Concepción Campa developed VA-MENGOC-BC, the world's first vaccine for preventing serotype B meningococcal disease. Mass administration allowed us to put an end to the epidemic.

For nearly 40 years, now, Cuban scientists have been studying the biologic mechanisms that explain VA-MENGOC-BC's efficacy. Their research has shown that certain of its components are efficient potentiators of the innate immune system. As a result, those components have also been used for years in some of our novel therapeutic vaccines against cancer developed by CIM and in vaccines against allergies. Cancer and allergies have nothing to do with the original protection target—meningococcal disease—but components of the vaccine are able to stimulate the innate immune system. Since we had so many years of research on the mechanisms for stimulating innate immunity by a product, which moreover had been shown to be safe and is in wide use in Cuba and several other countries, we considered the possibility that it might be helpful to address the current pandemic.

Gerardo Guillén: At CIGB, we're working on a vaccine called CIGB 2020. It's administered nasally or sublingually and stimulates innate immunity locally, precisely along the route of infection for a respiratory disease. We have a trial under way with volunteers, showing preliminary evidence of innate immune system activation. Specifically, the vaccine activates cell surface receptors in the nasopharyngeal mucosa that recognize repetitive patterns as in viral RNA. Systemically, you can detect stimulation of lymphocytes and macrophages in blood; these present viral antigens to the immune system and thus stimulate a specific response to

the coronavirus. In sum, these studies are showing innate immunity activation and preparation of the immune system to develop specific immunity against the virus. The study began recently; when it is complete and we assess the product in a larger group of volunteers, we'll know to what extent this response brings about effective antiviral protection.

This research doesn't involve only CIGB, but was also made possible thanks to cooperation by MINSAP, which approved the study in record time, and to participation by specialists at Havana's Luis Díaz Soto Naval Hospital, whose ethics committee also approved the trial. On March 26, 2020, the clinical trial was approved with participation of an expert group from MINSAP, the National Clinical Trials Coordinating Center (CENCEC) and CECMED. On March 27, a workshop was held to initiate the study involving medical and laboratory personnel, clinical researchers and hospital directors. Volunteer recruitment began among people with symptoms (suspected cases) or contacts of confirmed cases. Volunteers were informed in detail about the trial and provided written consent, according to ethical norms for such clinical trials.



Dr Gerardo Guillén: Limited studies of CIGB 2020 are showing innate immunity activation and preparation of the immune system to develop specific immunity against the virus.

Vicente Vérez: Turning to VME–corona, we've launched a collaborative project to evaluate it with the Pedro Kourí Tropical Medicine Institute (IPK), MINSAP authorities and hospitals assigned to manage coronavirus cases. We aim to determine what benefits we can derive from this vaccine, whose biology and immunology we know well, if we include it in treatment approaches to reduce the number of asymptomatics who become ill and reduce the number of patients who become seriously ill.

The project extends to apparently healthy people, in whom the product might have a nonspecific preventive effect. I emphasize that this is nonspecific, acting on the innate immune system; it is not a specific vaccine. In the first phase, it will be given to particular at-risk groups. We're still finalizing logistics, because administering vaccines is complicated right now with social distancing. All actions will be explained to the community; we'll inform people in detail of what we plan to do and how our approach is based on almost 40 years of research. All participants will be given detailed

Science Takes on COVID-19

information about the trial and its possible risks and benefits and will need to provide written consent. All results will be shared with the international scientific community.

MEDICC Review: Is Cuba looking for a specific vaccine against SARS-CoV-2, as others are doing?

Vicente Vérez: The Finlay Vaccine Institute has been working intensively on a vaccine against pneumococcus, a priority for protecting our children. We still haven't eliminated pneumococcal pneumonia in Cuba. Nonetheless, we've now paused that research to tackle this huge problem; when this emergency has passed, we'll continue the pneumococcal vaccine work until we have this vaccine for our national health system. Developing a vaccine against SARS-CoV-2 will need highly integrated efforts by our entire research and industrial capacity. CIGB is working on the virus's specific antigens, which will provide a platform for the projects, while CIM has considerable experience using mammalian cells for biotech production.

The Finlay Vaccine Institute has undertaken three projects to explore and understand the way the virus functions. The virus has many evasion mechanisms and designing a vaccine is impossible without understanding them. One of the most important is an expansion mechanism first observed in HIV in 2000. The virus sequesters immune system cells and puts them to work to help it multiply. In 2004, this phenomenon was also seen in the first SARS virus (SARS-CoV-1), the closest cousin to this new coronavirus. When that SARS virus enters immune system cells, it forms a double vacuole that hides many of the molecular characteristics that normally enable the immune system to identify and attack it. This viral expansion is infrequent. Might SARS-CoV-2 also be using this mechanism? How might we counter it? So we're not just looking for antigens specific to this virus; we're trying to understand the tricks it uses to its advantage. Once we understand these mechanisms, we'll be able to develop a swifter strategy to design both vaccines and treatments.

Gerardo Guillén: A specific vaccine is a tremendous challenge. Some pandemics have disappeared even without a vaccine being discovered in time. There's no evidence yet to suggest that risk of viral contagion will disappear within a few months, so many groups worldwide are working on a preventive vaccine. Because of containment measures to protect the population and prevent deaths, much of the world's population will not have had contact with the virus, won't have developed immunity and will continue to be susceptible as long as the virus continues to circulate. That's why specific vaccines are needed. A specific preventive vaccine could take years to develop. The most optimistic scientists speak in terms of a year to 18 months of intense development.

Cuban institutions working toward such a vaccine are designing various strategies, beginning with selection of viral antigen fragments and their expression in mammalian cells, bacteria and yeast. Such cell systems are used in biotech to produce proteins for use in both treatments and vaccines. After this first step, we'll have to develop purification processes, analytic systems, and in vitro and in vivo studies. These projects require participation from several areas of our institutions, including research, product development, animal research, toxicology and pharmacology. Finally, only candidates that successfully pass through this entire trajectory proceed to clinical trials to assess their safety and efficacy in humans.

MEDICC Review: How important is international collaboration in this research?

Eduardo Martínez: Cuba is willing to collaborate on research and other areas as well, sharing experiences. A number of countries have also requested Cuban cooperation, not just with health personnel, but also with medications. For example, 72 countries have asked for interferon. We have a production plant in China and one here. We also have factories that make other medications, which we could convert to interferon production if needed at some point. Finally, of course, Cuban institutions are collaborating in every way possible with WHO and PAHO, indispensable for any effective global response to COVID-19.

Gerardo Guillén: International collaboration is essential to move ahead with development of specific vaccines. It's highly unlikely that any single institution would have all the methodology, equipment, animal models and financial resources to carry out a project of this magnitude quickly and successfully. For example, animal studies require exposing animals to the virus. There are reports of this kind of research on coronavirus using transgenic mice, ferrets and monkeys. This has to be done in highly secure Level-3 laboratories. We have links with Chinese colleagues who have such conditions for experimental research. Only joint efforts through these collaborations will carry us through all the essential stages of this complex research program.

MEDICC Review: Cuba has collaborated with China on biotech production for years such as the joint ventures Biotech Pharmaceuticals, to produce monoclonal antibodies against cancer, and ChangHeber for interferon alfa-2b production, the first with CIM technology, the second with CIGB technology. Can you describe Cuba's collaboration with China concerning COVID-19?

Eduardo Martínez: We have a group of scientists working in China. Last year, we created a Chinese–Cuban R&D center. Information from our representatives in China has been systematically compiled over the course of the pandemic and has been very important. Much of it we received before it appeared in the mass media and helped us form an idea of what was going on and what our contribution could be.

Luis Herrera: The Chinese–Cuban joint venture, ChangHeber, was created in 2003, with headquarters in the city of Changchun, to produce interferon alfa-2b. As we mentioned, this product is being used to treat COVID-19 in China, selected by the country's State Health Commission. ChangHeber, together with Biotech Pharmaceuticals and Changchun Heber Biological Technology, are the results of Chinese–Cuban collaboration in biotech, a sector with ample prospects for joint projects.

MEDICC Review: Antibacterial chemotherapy has had great success, despite the phenomenon of resistance. In the field of antivirals, with few exceptions (such as acyclovir), it was only with the onset of the AIDS epidemic that concerted research was directed at antiviral chemotherapy. In fact, what stopped AIDS from spreading was not discovery of a vaccine (still pending), but the success of antivirals. How is research on antivirals proceeding globally, and what can we expect in the next few years?



Prensa Latina

Cuban biotech's interferon alfa-2b is being used in China and other countries as an antiviral and immune booster during the COVID-19 pandemic.

Luis Herrera: Drug repurposing or drug reprofiling is an established practice in the pharmaceutical industry. Accumulated knowledge of how a drug acts provides a precedent for trying it for other diseases; based on that knowledge, we form hypotheses about its possible action against a new disease. This increases the chances of finding a successful drug. The previously designed drug has already passed all the required steps to obtain regulatory approval, especially in regard to safety, production requirements and molecular structure. So there's no need to repeat all those expensive and time-consuming steps. Several drugs already approved for other viral diseases are going into clinical trials to see whether they are effective against this new coronavirus.

MEDICC Review: What can we learn from other recent epidemics to help us deal with the COVID-19 pandemic?

Vicente Vérez: We can't wait to develop a pharmaceutical product from zero, which takes a long time, because the pandemic won't let us. We all dream of a preventive vaccine that can resolve the problem, but unfortunately that solution isn't within

our grasp this year, no matter how hard the international scientific community works. Because, additionally, most of the technologies needed are new themselves. Until we have such a preventive vaccine, we have to put up barriers against the virus. Today the best "vaccine" is prevention via physical distancing. We have to learn from history: the SARS epidemic ended before a vaccine could be developed. The same thing happened with Ebola. The world is facing a critical juncture: What will happen epidemiologically when countries emerge from the current epidemic phase and reduce social isolation restrictions, returning to "normal" life? We don't know whether the epidemic will end, as others have, or if the virus has come to stay.

We are working passionately. It's a very complex problem that scientists the world over are tackling.

Here in Cuba, we hope to apply what we've learned about the innate immune system and administer products that are the fruit of years of research and massive use, taking advantage of this considerable experience and accumulated knowledge, particularly about their immunological mechanisms of action. Such products can help address urgent needs, before finding a preventive vaccine. This is the path we have to pursue with all our intelligence, a battle we have to win.

Eduardo Martínez: One important lesson is that most countries lacking a solid pharmaceutical industry have a serious problem: scarcity of drugs used for treatment and inability to meet demands to tackle the pandemic. Cuba can count on domestic production of antiviral medications, particularly interferon alfa-2b, and that gives us an advantage going forward.

Editorial note: This roundtable is the result of original MEDICC Review telephone and email interviews with participants complemented by published comments from them as necessary for clarification.

Severe COVID-19 Cases: Is Respiratory Distress Partially Explained by Central Nervous System Involvement?

Calixto Machado-Curbelo MD PhD DSc FAAN

The main characteristics and challenging symptoms of COVID-19, caused by the novel coronavirus SARS-CoV-2, are related to respiratory distress. Although most patients have mild symptoms such as fever, headache, cough, myalgia and anosmia, some develop acute respiratory distress syndrome, leading to death in many cases.

Human coronavirus (CoVs) were responsible for two previous worldwide outbreaks: Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV). Several reports of these outbreaks demonstrated that these diseases affected the central nervous system (CNS).[1] Thus, for the current COVID-19 pandemic, a crucial question arises: does CNS affection at least partially explain the respiratory distress commonly found in these patients?

SARS-CoV-2 is a beta-coronavirus sharing similarities with SARS-CoV. Thus far, it has been postulated that the virus uses glycoproteins expressed on its surface to bind the receptor of the angiotensin-converting enzyme 2 (ACE2), which is distributed in respiratory tract epithelial cells, lung parenchyma and other areas such as the gastrointestinal tract and endothelial cells. The brain expresses ACE2 receptors as well. Those receptors have been detected over glial cells and neurons, both in the cortex and brainstem; therefore, these cells are targets of SARS-CoV-2.[1,2]

Extra-pulmonary symptoms have been described in these viruses, highlighting their capacity to cause neurological complications: febrile seizures, loss of consciousness, convulsions, ataxia, status epilepticus, encephalitis, myelitis, neuritis and Guillain-Barré syndrome, both in humans and experimental models. Preliminary data suggest that sudden olfactory deprivation happens in about 30% to 50% of SARS-CoV-2 infected patients. I have read that anosmia and ageusia (loss of smell and taste) can be initial warning signs or unique symptoms of COVID-19 and have reviewed the most common mechanisms of these signs in this disease.[2]

Several routes used by neurotropic viruses to reach the CNS have been described, including transneural and hematogenous pathways. CoVs have been found to reach the brain via the olfactory bulb, and from there, spread into the CNS and periphery. This pathway is an excellent mechanism to access the CNS for viruses that enter the body intranasally. The olfactory nerve has the peculiarity that it communicates with the nasal epithelium and also with the olfactory bulb, a CNS entryway. Experimental models have demonstrated that olfactory nerve ablation limits viral neurotropic capacities in mice. In humans, as soon as the infection is established, the virus can spread to the whole brain and cerebrospinal fluid in less than seven days. Consequently, it has been reported that these viruses can induce demyelination in studies of neuron and glial cultures.[1]

Some research has found that SARS-CoV-2 affects the brain. A recent study describes neurological manifestations in 36.4% of

214 COVID-19 patients from Wuhan city, China. These include acute cerebrovascular diseases, consciousness impairment and skeletal muscle symptoms, suggesting a neurotropic potential for SARS-CoV-2.[3]

China's National Health Commission's Diagnosis and Treatment Guidelines for COVID-19 published human histopathological studies finding edema and partial neuronal degeneration in brain tissues. Another study reported presence of SARS-CoV-2 in the cerebrospinal fluid of a COVID-19 patient.[1,2]

Firsthand reports in Wuhan hospitals indicate COVID-19's common symptoms were fever (83%–99%) and dry cough (59%–82%) at the onset of disease. However, the most characteristic and deadly symptom was respiratory distress. Among patients with dyspnea, more than half needed mechanical respiratory support. Some 46%–65% of patients in intensive care units quickly worsened and died due to respiratory failure.[3] Wang reported that 11.1% received high-flow oxygen therapy, 41.7% received noninvasive ventilation and 47.2% received invasive ventilation.[4] These data indicate that most (about 89%) COVID-19 patients in intensive care units required mechanical ventilation.

CoV infections have been reported in the brain of patients and experimental animals, finding the brainstem to be heavily infected.[1,2] Furthermore, some coronaviruses have demonstrated their capacity to spread via a synapse-connected route to medullary cardiorespiratory centers.


It has been widely supported that such medullary lesions can cause respiratory dysfunction—as in the case of congenital central hypoventilation syndrome—or severe brain injury, which results in damage to medullary respiratory control function. Viral antigens have been detected in the brainstem, where the infected regions included the nucleus of the solitary tract and nucleus ambiguus. Afferent axons from the carotid and aortic bodies in the glossopharyngeal nerve contain chemoreceptor cells, and vagal afferent nerves from receptors in the lung communicate with the medulla and respiratory control centers to coordinate and regulate inspiration and expiration, while the efferent fibers from the nucleus ambiguus and the nucleus of the solitary tract provide innervation to airway smooth muscle, glands and blood vessels. Such afferent and efferent neuroanatomic interconnections indicate that the death of infected animals or patients due to respiratory distress may be caused by dysfunction of the brainstem's respiratory center.[1]

In conclusion: as the COVID-19 pandemic expands, I believe there is an urgent need to understand the neurotropic potential of SARS-CoV-2 in order to prioritize and individualize treatment protocols, and to prompt physician attentiveness to neurological symptoms as soon as they appear. This would assist in making possible earlier diagnosis, and hence earlier actions, such as brain edema treatment. It is also important to note that

SARS-CoV-2 can invade the brainstem, leading to respiratory center dysfunction.

Hence, serial neurological examinations are recommended, with exhaustive exploration of brainstem reflexes, as soon as the first symptoms appear in COVID-19's clinical course. As neuroimaging techniques (CT-Scan and MRI) are not always easy to use in ventilated patients, ancillary tests (such as brainstem auditory and

somatosensory evoked potentials, quantitative EEG and transcranial Doppler) can be used to monitor brain function in severely ill COVID-19 patients.

Acute respiratory distress in such patients may be partially explained by brainstem dysfunction. This suggests the need for more specific and aggressive treatments with direct participation by intensivists and neurologists. 

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Cuba's Pedro Kourí Tropical Medicine Institute: Battling COVID-19 One Study, One Test, One Patient at a Time

Gisele Coutin MD MS, Jorge Bacallao-Gallestey PhD DSc, Lila Castellanos-Serra PhD DSc

This *MEDICC Review* roundtable brings you specialists from Havana's Pedro Kourí Tropical Medicine Institute (IPK), who are working directly with testing, research and patient care during the COVID-19 pandemic. Founded in 1937 by its namesake, the Institute has gained considerable worldwide prestige. Today, it is a PAHO–WHO Collaborating Center for the Study of Dengue and Its Vector, and for the Elimination of Tuberculosis. Its main role within Cuba's health system is as the national reference center for prevention, control, management and elimination of infectious diseases, including epidemics. Its 479 workers staff

32 departments, including laboratories, research and teaching facilities, a hospital and isolation center. The IPK's hospital treats later-stage AIDS patients, while the Institute is the national reference center for attention to all HIV-positive patients and maintains the national HIV/AIDS registry, as well as registries for other infectious diseases. The institution was responsible for training the Cuban doctors who served in West Africa during the 2014–2016 Ebola outbreaks and for those going abroad to assist in the COVID-19 response today, and its professionals offer an internationally-recognized biennial course on dengue.

Introducing our readers to roundtable participants (in order of appearance):

Manuel Romero-Placeres MD MPH PhD is a physician with dual specialties in family medicine and epidemiology, as well as a degree in public administration and a doctorate in medical sciences. He also holds a master's degree in public health, concentrating on environmental health. He is full professor and senior researcher at the Medical University of Havana, and is a member of the Cuban Academy of Sciences. Dr Romero is director of the Pedro Kourí Tropical Medicine Institute (IPK).

Daniel González-Rubio MD MS PhD is an internist with a master's degree in infectology and tropical diseases, and a doctorate in medical sciences. He is full professor and associate researcher at the Medical University of Havana and chief of the Tropical Medicine Unit at IPK.

Sonia Resik-Aguirre MD MS PhD is a physician specializing in microbiology with a master's degree in virology and a doctorate in medical sciences. She is full professor and senior researcher at the Medical University of Havana. Dr Resik heads the Virology Department and directs the National Polio Reference Laboratory at IPK. She has participated in numerous international collaborations, including 12 with WHO on inactivated polio vaccine. She is a member of WHO's SAGE Polio Working Group.

***MEDICC Review:* How has the Institute organized its work to address the challenges presented by COVID-19?**

Manuel Romero: In research, we're beginning studies related to the clinical evolution, epidemiology and virology of COVID-19 in Cuba. The main research is devoted to characterizing the clinical manifestations of the disease, treatment protocols and clinical diagnosis. The virology studies are related to diagnosis, disease pathogenesis, as well as kinetics of the virus and its excretion in different samples; plus of course immunity and genetics research.

In epidemiology, we are analyzing the disease's characteristics in Cuba, its symptomatic and asymptomatic expressions, progno-

sis, and the influence of climatic variables. Simultaneously we are studying costs. Multidisciplinary teams of epidemiologists, sociologists, mathematicians, geographers, biostatisticians, economists and information technology (IT) specialists have been set up to carry out epidemiological surveillance and research in this arena.

To ensure 24-hour surveillance at the Institute, we have established a temporary decision-making task force, headed by an expert epidemiologist, including a resident in hygiene and epidemiology stationed at hospital admissions, plus a computer specialist for data processing. This group supports the Ministry of Public Health's own 24/7 epidemiological surveillance and participates in its working groups of epidemiologists and geographers. Thus, we send daily reports to the Ministry of Public Health (MINSAP) on admissions, discharges, suspected COVID-19 cases seen, and the epidemiological histories of the hospitalized cases. This is fundamental for contact tracing and timely control of potential transmission clusters at the primary health care level. We also publish a weekly epidemiologic bulletin on the disease to update medical personnel nationally.

In the academic area, IPK has developed a training program for our own personnel as well as those in the national health system and other government agencies involved in addressing the disease. We taught a national course on prevention and control of the new coronavirus for a group of health professionals who then served as facilitators to share the knowledge in each province; and we developed an online course as well. We are involved in three specific aspects of teaching now: care for suspected or positive cases, confirmatory diagnosis, and preparation of all personnel going abroad in the Cuban medical teams serving in other countries to help confront the pandemic.

IPK's hospital is in quarantine, devoted to care for suspected or positive COVID-19 patients. There, we have a triage admissions unit, where adults and children are seen separately. There are 7 hospitalization wards with 70 two-bed rooms, distributed as follows: one for pediatric and obstetric patients (suspected positive); two for confirmed cases (red zone); and four for other suspected-positive patients. We have an ICU for serious-to-critical patients

or those who require closer monitoring. Outside our facilities, we also supervise the Antonio José de Sucre Isolation Center in Jagüey Grande, Matanzas Province, which is also used as a quarantine center for COVID-19.

We have the human and material resources we need to care for these patients, including molecular diagnosis (real-time polymerase chain reaction; RT-PCR), and personal protective equipment (PPE) for our workers. IPK and Cuba as a whole have received donations from PAHO; the governments of China, Russia and Venezuela; national and international scientific institutions; joint enterprises here in Cuba; Cuban farmers and other individuals; and Cuban non-governmental organizations, among others.



Manuel Romero: We send daily reports to the Ministry of Public Health on admissions, discharges, suspected COVID-19 cases seen, and the epidemiological histories of the hospitalized cases.

Daniel González: On the clinical front, we have a group of internists, who have either master's degrees or doctorates in infectious diseases, as well as critical care specialists, all selected from among IPK's main clinical experts. This group guides all COVID-19 case management, whether confirmed or suspected, based on the attending physicians' reports. The attendings are primarily internists (with master's degrees in infectious diseases and/or tropical diseases), plus family doctors and other physicians in these master's programs. For serious and critical cases, we also consult with a national group of critical care specialists who play an advisory role throughout the country.

Our IPK clinical team interconsults with the central group headquartered here comprising epidemiologists, virologists, biosafety experts, managers and MINSAP representatives. They discuss the clinical-epidemiologic aspects case-by-case, as well as the situation of serious and critical patients, results of complementary analyses, candidates for discharge, and follow-up strategies for those who have been released.

Here in Cuba under MINSAP guidance, each death is exhaustively discussed at the national level, reviewing the therapeutic decisions made at each stage of treatment and the patient's response to them.

MEDICC Review: How has COVID-19 most frequently presented in the patients in your care?

Daniel González: COVID-19 is an emerging disease, with only a few months on the global radar. Despite this, it has been well characterized clinically. One quarter of confirmed patients arriving at IPK were asymptomatic, resulting from tracing contacts of suspected or confirmed cases. With few exceptions, they have come to us in the disease's initial stages, and any complications have started between the fifth and the eleventh day after symptoms first appeared. Among those who had symptoms, most are mild and their cases uncomplicated: most frequent symptoms are dry cough (85%) and fever (65%). Most symptoms last for three to five days. Nevertheless, 15% of patients present with serious pneumonia.

I want to note the special attention being paid to risk groups—such as older adults, pregnant women, patients who have cancer or are immunocompromised—which begins in primary health care. Two related elements of the Cuban approach are important here: active case detection and quarantine in isolation centers of all contacts of positive patients. I believe few countries could do something similar.

MEDICC Review: What are the essential elements for your diagnosis of COVID-19? And what role has IPK played in establishing diagnostic criteria nationally?

Manuel Romero: When SARS-CoV-2 appeared, one of our experts from IPK's National Virology Reference Laboratory received PAHO-sponsored training for diagnosis by RT-PCR, and we immediately introduced this at IPK.

Actually, once Zika hit our radar a few years ago, and with support from a research project in collaboration with WHO and MediCuba-Europa, MINSAP established labs for molecular diagnosis in the Provincial Hygiene and Epidemiology Centers in Havana and Santiago de Cuba, later adding Villa Clara Province, equipped with advanced technology. IPK trained all these labs' personnel, and later we incorporated the Molecular Biology Laboratory of the Civil Defense's Scientific Research Center, as well as those of the Genetic Engineering and Biotechnology Center and the Hermanos Ameijeiras Clinical-Surgical Teaching Hospital in Havana.

Moreover, the National Virology Reference Laboratory (NVRL) at IPK is responsible for quality control of diagnoses made in all these centers, so there is constant exchange with these laboratories and our own.

Sonia Resik: With this kind of disease that can hit anyone, virology diagnosis is essential, so very early we started special training of our laboratory staff under PAHO auspices. We also participated in conceiving the national plan to confront the disease and in designing guides for taking samples for virology diagnosis, in biosafety training, and in the molecular diagnosis techniques we would be using across the country. Two of our virologists are also abroad, assisting other countries in the region.

Manuel Romero: The NVRL is working around the clock to provide results within 24 hours of receiving samples. Its staff is working in shifts: 24 hours on, 72 hours off. In addition to quality control, the NVRL is responsible for molecular diagnosis of our

Science Takes on COVID-19

own patients and all those of suspected cases in the western provinces of Pinar del Río, Matanzas, Mayabeque, Artemisa and the Isle of Youth Special Municipality.

MEDICC Review: Globally we have seen very rapid disease progression in some patients, particularly those advancing to serious or critical stages. What criteria do you use for evaluating patients, and have you developed tools to anticipate which ones may have a worse prognosis?

Daniel González: Yes, the disease's course varies widely and many times unpredictably. We know of cases where a person has progressed from a practically asymptomatic status to respiratory distress within hours. For any physician, this is disconcerting and very troubling; we've commented that we have never seen such a thing before.

Luckily, such evolution is infrequent. In our own experience and in the international literature, we have found certain clinical, radiological and laboratory elements precede severity and can alert us to potential decline. So this is one of the pillars of our protocols: early identification of these factors, to get ahead of severe evolution.

On the clinical side, a key sign is dyspnea: that is, before full manifestation, patients describe feeling tired or "different" while carrying out normal daily functions like bathing or brushing their teeth. Physicians can detect a slight increase in respiration rate, while digital oximetry will show slight oxygen desaturation. Auscultation may reveal presence of some moist, crackling rales, still without fully established pneumonia. A chest x-ray can corroborate such physical exam findings, revealing initial stages of pneumonia. Also related to severity are increased blood levels of lactate dehydrogenase (LDH), transferrin, reactive C protein and globular sedimentation velocity. Other factors are leukopenia accompanied by lymphopenia and thrombocytopenia.

Such findings enable timely intervention to minimize risk of patients progressing to severity, and we have applied this approach



Daniel González: We know of cases where a person has progressed from a practically asymptomatic status to respiratory distress within hours. For any physician, this is disconcerting and very troubling.

with good results. Another important aspect is applying treatment protocols as early as possible. In fact, we recommend initiating treatment before COVID-19 confirmation in patients highly suspected of infection or with risk factors.

MEDICC Review: What treatment protocols are you following?

Daniel González: We follow protocols guided by international experience, adjusted to our own. Protocols vary, depending on whether the patient is an asymptomatic contact, a suspected case or a confirmed case. For confirmed cases, we combine antiviral medications with immunomodulators and broad-spectrum antibiotics (if they develop bacterial infections), carefully monitoring for other complications that might arise. There are protocols for managing respiratory distress and other events such as sepsis, shock and organ damage. The medications we use in Cuba coincide with those included in other countries' protocols, and we apply them nationally in all institutions.

Another characteristic of Cuban protocols is inclusion of novel medications developed by our biotech industry, such as Biomodulina T and the pulmonary surfactant Surfácén, manufactured by the National Center for Bioproducts, and the Itolizumab monoclonal antibody from the Molecular Immunology Center. We are also using nationally-produced interferon alfa-2b, of course.

MEDICC Review: In some countries, plasma from recovered COVID-19 patients is being used for seriously ill patients who have not responded to other treatments. What is your experience, your perspective on this?

Daniel González: Cuban experts are working under the principle that no hypothesis should be rejected out of hand concerning the disease's pathogenesis or therapeutic options. We analyze all the information we receive. Plasma transfusion from convalescing patients is an alternative with some unanswered questions. It's true that it has been used quite successfully for other infectious diseases. To use it, two essential components must be considered: the donor and the recipient.

For COVID-19, there are still doubts about when a donor is completely "cleared" of infection, because we know of some cases of disease recurrence. On the receiving end, these patients usually develop a serious case in the second week of evolution, that is when they have already developed their own antibodies to the virus. We don't know to what extent those patients might benefit from introducing other antibodies.

Nevertheless, I reiterate that this is an alternative for treating a disease that daily is taking thousands of human lives, and thus, all therapeutic alternatives should receive consideration.

MEDICC Review: What criteria do you use to discharge a COVID-19 patient? And what about immunity conferred, re-infection or possibilities of remaining contagious?

Daniel González: Discharge criteria are well defined and include clinical, epidemiological and microbiological elements. The main clinical criterion is that the patient must be free of major symptoms that could be life-threatening; and epidemiologically, must be symptom-free for at least 14 days. Additionally, absence of SARS-CoV-2 must be confirmed by RT-PCR. All three criteria

must be met for a patient to be discharged. Then they must spend another 14 days in home quarantine, under supervision by physicians in primary health care.

Some aspects of COVID-19 remain unclear: possible re-infection or relapse, immunity, the potential time the disease is contagious or its capacity to infect other hosts and additional transmission routes besides respiratory. Nevertheless, we think the criteria we're applying for medical discharge and post-hospitalization surveillance minimize risks for the patient, their family and their community.

MEDICC Review: How are you dealing with the understandable fear and anguish in these patients, especially those who are seriously ill?

Daniel González: This is a very tough challenge. The pandemic is rightfully receiving broad media coverage, but this can also create more anguish in patients suffering from the disease. A good, harmonic doctor-patient relationship is essential for psychological management. But this relationship is seriously compromised by various factors inherent in COVID-19's case. Patients think they may die, and that in itself generates anguish and can even lead to panic. What's more, they are hospitalized in total isolation, with no visitors, not even able to leave their rooms.

At the same time, doctors have to see their patients while fulfilling biosafety requirements, which creates a physical barrier between them and their patients. In this adverse scenario, doctors must make their maximum effort not only to provide the best treatment possible, but also to provide the equally important psychological support. In this, nursing staff is fundamental, especially because they have frequent contact with patients. Their selflessness and dedication, their humanistic values, are constantly being tested, in a role where their technical-professional expertise must go hand-in-hand with compassion, while taking strict care of themselves as well.

When a patient dies, informing their relatives is a terribly difficult moment, both for the families and for the doctors who have to give them the news. We always hold out hope, even for critical patients, but it is painful to the extreme when the virus wins, even after applying all the therapies at our command and making all possible efforts to save them.

MEDICC Review: We know that IPK has well-established protocols for protecting its personnel when addressing infectious diseases. Have you taken additional measures with COVID-19?

Manuel Romero: As mentioned, IPK's hospital is in quarantine. We have established three staff groups, each comprising doctors, nurses, lab technicians, radiologists and support staff. They rotate 14 days in the hospital, 14 days in one of the isolation centers, and 14 days at home. During the 14 days here, we abide by standard labor codes in place in terms of hours and breaks, and they have adequate conditions to rest. To protect our personnel, we follow strict biosafety regulations, with PPE determined by the degree of risk in each zone where people work, and we constantly monitor fulfillment of biosafety measures.

A special protocol was established at IPK for management of suspected and confirmed COVID-19 cases, and we trained nurses, doctors and service staff, including housekeeping, kitchen staff and those who distribute food trays. Each work area is monitored daily by the biosafety department. For example, we have established: biosafety measures in areas of admissions and patient care, with access determined by the type of area; instructions for personal hygiene and cleaning of each area; measures for manipulating samples, food, waste, hospital linens and protection equipment; norms for disinfecting and sterilizing intensive care units; indications for quarantine; and organization of regular health and safety inspections.

MEDICC Review: As a virologist with more than 30 years' experience, what new challenges has this pandemic posed?

Sonia Resik: Many! First, how to lead a group of scientists and young researchers, motivating them to give their all under conditions completely different than those they are used to. Confronting the newness of this disease, an infectious disease not seen before, demands the best in terms of human and professional values.

This isn't the first epidemic we have addressed or have prepared for. There have been many: dengue, Zika, epidemic neuropathy, H1N1 influenza, SARS, hemorrhagic conjunctivitis, HIV/AIDS, Ebola. In some cases, these diseases haven't reached Cuban shores, but in others they have had a serious impact on our people's health.

But this pandemic is different from all the others because COVID-19 is highly contagious, the SARS-CoV-2 virus highly transmissible. It spreads very rapidly, and in less than two months was in almost every country in the world. Emerging and re-emerging diseases have a very important social component as well, given the economic and social factors that facilitate their advance. Globalization is also to blame for this phenomenon: we travel from one part of the world to another in mere hours, and viruses and other microorganisms accompany us. And since this is an emerging vi-



Courtesy S Resik

Sonia Resik: Another characteristic of this pandemic is the large number of asymptomatic patients. They are infected, transmit the virus, but don't have symptoms to permit clinical diagnosis.

Science Takes on COVID-19

rus, it finds a “virgin” population to colonize. There is no previous immunity, and so we are all susceptible to contracting the disease. The high levels of environmental contamination, megacities with overcrowded neighborhoods, poverty and inequality are all factors that make for greater risk of pandemics.

Another characteristic of this pandemic is the large number of asymptomatic patients. They are infected, transmit the virus, but don't have symptoms to permit clinical diagnosis. As we say, “this virus has no face.” This is why strict measures of physical distancing and personal responsibility are so important, as well as increasing people's risk perception. And we have to focus particularly on young adults, who most often are responsible both for children and the elderly.

Another challenge right now in this global context is availability of resources, in our case aggravated by the constant US blockade. Although we don't have an abundance of material resources, we do have the most important thing for confronting the pandemic: our human resources, their sense of service, solidarity and sacrifice for the good of others. As scientists, we have another challenge: to be altruistic by sharing information. All scientific information that we can collect concerning this disease must be for the world, for the collective good of everyone, because COVID-19 is a global problem that affects all of us.

MEDICC Review: What lessons—from IPK's experience and your own personal experiences—would you like to share with our readers?

Manuel Romero: At IPK, specialists are keeping records of our daily activities, anything that might be of interest, to document the experience we're accumulating. Since March 11, 2020, when we diagnosed the first cases, we've been keeping complete statistical data as well. This recordkeeping is supervised nationally by MINSAP, which has also created a system for documenting and preserving the country's experience confronting the COVID-19 pandemic.


Sonia Resik: We have to overcome the fear of the unknown, something new. We've all felt it. But continuous learning and our

experience help us confront it. This kind of fear also helps us to adapt our behavior to the situation, for our own benefit, in this case to protect ourselves and the people around us.

And I certainly haven't escaped that fear, especially when my son and daughter-in-law, both young internists, told me they were coming to IPK to work with COVID-19 patients in the “red zone.” As a mother, I was afraid, but as a physician, I had to overcome that fear, because I'm also working in virologic diagnosis of these patients. And ever since he was born, my son has seen me working, studying, studying some more, facing epidemics. So right now, I can't let that mother's fear restrict him. And all three of us are dedicated to helping our population survive this pandemic, to maintaining the free and universal health care we have had for the last 60 years.

You also have to face distancing from other family members, taking special care if they're older. That's the case of my own parents. They understand I have to be at work, that their grandson—who they adore—has to be here, too. I talk with them by phone every day. Meanwhile, my sister and brother-in-law pick up the rear-guard to attend to my parents, since everyone understands the urgency of the situation.

I say medicine is a vocation, a calling, and it's for life. Because the point is to guarantee everyone from birth the right to health care, and the best care possible. That's why we're here.

Daniel González: We've all lived through many days and many experiences we could talk about. A few days ago, one shift of workers who were finishing up their 14 days on duty asked me: “Professor, why substitute us? We're not tired yet!” That kind of willingness on the part of such a young staff fills you with pride, especially because most of them were trained at IPK. Another time I went to console a critical care doctor who had just lost a patient and was crying bitterly as if she had lost a member of her own family. Standing outside to send off a recovered patient who is being released is really something, a feeling I'll never forget. Personally, one of my most gratifying times is looking over the daily emails I get from my regular patients, full of encouragement, and asking me to take care of myself. What a treasure! 

Curbing Misinformation and Disinformation in the COVID-19 Era: A View from Cuba

Patricia Alonso-Galbán MD MS and Claudia Alemañy-Castilla

As the COVID-19 health crisis engulfs the planet, we are submerged in a parallel pandemic: the glut of misinformation and disinformation. The data associated with this phenomenon are creating a disaster within a disaster. In early April 2020, the Spanish news agency EFE[1] reported that over one million internet accounts were dedicated to rumor-mongering, spreading unverified information about the coronavirus. From January through April 13, fact-checkers at Maldita.es[2] had tracked over 400 lies and false alerts circulated about COVID-19 in Spain alone.

Misinformation and disinformation—the latter with intent to misinform—describe ideas and information disseminated by individuals, organizations and media that are not supported by facts.[3–5] They have been used to deliberately influence the evolution of political, economic and social events or trends.[3] And their appearance is not new in the health arena.

Since the start of the COVID-19 pandemic, WHO has consistently challenged these rumor mills, sifting through the avalanche of news and purported science to point professionals and the public-at-large to trustworthy sources. Various strategies include technical collaboration networks established for experts,[6] designed to share innovative solutions to “confront pandemics and ‘infodemics’.” The latter term was introduced into the medical lexicon in 2006 by Gunther Eysenbach,[7] referring to the proliferation of news and misleading information. In fact, WHO Director-General Dr Tedros Adhanom Ghebreyesus and the entire UN system has mounted a “mythbusting” campaign against the infodemic’s plethora of rumors and misinformation about COVID-19,[8] mainly through the WHO Information Network for Epidemics (EPI-WIN).[9]

Identifying the myths isn’t easy though,[3–5] less so in the midst of the SARS-CoV-2 infodemic. Fact-checking has proven tough, given the sheer volume of information zipping around the world at record speed. In fact, even media and professionals specializing in health have joined major news organizations and internet users-at-large to disseminate their share of apocalyptic, unsubstantiated information.

But a number of broad strategies taken together can help internet users and media confirm the veracity of information and of images as well: looking up primary sources of information; reading full texts, not just the headlines; comparing data offered by different sources; checking where photos have been published before; searching for other posts or work by the same writer; and checking the publication date to provide more context.

As COVID-19 was diagnosed in Cuba and began to spread, a number of initiatives have been launched to minimize the impact of rumors and misinformation on public opinion and support WHO’s call for faster access to reliable sources. Various specialized platforms—such as those of the Ministry of Public Health (MINSAP) and Cuba’s health network, Infomed

(<http://www.sld.cu/>)—offer opportunities to compare incoming information with reliable sources.

An example is the website *Infecciones por coronavirus* (coronavirus infections) (<https://temas.sld.cu/coronavirus/>), created on Infomed in 2003, but now continually updated with information on COVID-19 (<https://temas.sld.cu/coronavirus/covid-19/>), obtained from official, credible sources, intended specifically for health professionals involved in epidemiological surveillance, control, attention to vulnerable groups, diagnosis and care of patients infected. There, users can access reports and latest news from WHO and PAHO, MINSAP’s daily press briefing, plus current information selected and curated by specialists. This last covers aspects such as: COVID-19’s viral agent, surveillance, symptoms and case definition, laboratory tests, management of patients and contacts, treatment, guidance for travelers, different countries’ actions to stem the pandemic’s tide, and frequently asked questions about the disease. The site also includes suggestions of more in-depth materials for health professionals such as books, medical databases, articles, journals and other scientific publications, multimedia, podcasts, technical guides and options for advanced learning.

Infecciones por coronavirus offers information to guide active public participation in curbing the spread of COVID-19, including orientation on how people can help cut the transmission chain by adhering to measures implemented by health and government authorities. Finally, it permits users to submit—either by phone or email—their doubts, concerns and questions about the disease, which are answered by experts.

As a complement, Infomed has developed a mobile application for Android that provides current, reliable information on COVID-19: *COVID-19-InfoCU* (https://www.apklis.cu/aplicacion/cu.sld.COVID_19_InfoCU). The app has been available free for download since late February 2020 and, using sources from the *Infecciones por coronavirus* site, offers basic information on the nature of coronaviruses, the infections they cause and the latest on the COVID-19 pandemic: cases, deaths, countries affected, and so on. The app takes advantage of other resources on Infomed and MINSAP’s own online materials, including strategies, normative documents and specialized information resources from WHO.

Other media have joined efforts to combat misinformation in Cuba, notably *Juventud Técnica (JT)* (<http://www.juventudtecnica.cu/>) the country’s only mass-circulation magazine devoted entirely to science, technology and the environment, with an emphasis on investigative journalism. Late in 2019, digital *JT* launched its *#VerificaJT* project, aimed at debunking misinformation in various scientific fields. This new initiative was informed by earlier fact checking experiences, notably one involving both Cuban and foreign media publications about a pre-exposure pill to prevent HIV infection in a single-city pilot program that implied its use was to be extended across Cuba.[10–13]

There was a clear gap in Cuba: an urgent need to help internet users grapple with misinformation


particularly critical now that 7.1 million Cubans (63%) have internet access and 6.27 million (55%) are active on social media, according to the latest data.[14]

Thus, *JT* began to fact-check COVID-19 information and sources almost as soon as the pandemic was declared. Weeks before the SARS-CoV-2 virus was first diagnosed in Cuba, *JT* rebuffed several rumors, contrasting the misleading information with that from sources such as Cuba's Pedro Kourí Tropical Medicine Institute and MINSAP itself.

As the number of cases increased in Cuba, the magazine developed other projects to facilitate public access to facts. It increased

What's more, there was a clear gap in Cuba: an urgent need to help internet users grapple with misinformation. This has become

production of infographics synthesizing information related to the pandemic and national measures to confront it. Later, it created a bulletin sent daily to subscribers via email, and finally it launched *Covid19CubaData* (<https://covid19cubadata.github.io/>). This tool pulls together in graphic form all the data from MINSAP, and now is available as a mobile app (<https://www.apklist.com/application/club.postdata.covid19cuba>) and a bot on the Telegram social network (@covid19cubadata_bot).

There is more to be done, and certainly it is no exaggeration to say that lives are at stake: trustworthy information that carries the day over rumors, misinformation and dangerous speculation is critically important to confront global and local health emergencies. There is no place for false claims, apocalyptic predictions or unfounded optimism, for xenophobic and racist assertions, or for promoting political agendas over the lives of people and our planet.[15] It is time for science to be in everyone's hands and be everyone's guide. 

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Stemming COVID-19 in Cuba: Strengths, Strategies, Challenges

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Dr Durán is a native of eastern Santiago de Cuba and his early medical career began in this mountainous region, where he also headed provincial prevention and treatment of HIV/AIDS. He went on to become rector of the Medical University of Santiago de Cuba and provincial health director. Later in Havana, Dr Durán was director of medical education and vice minister at the Ministry of Public Health (MINSAP). Abroad, he served as advisor to Angola's Minister of Health, and on his return, as deputy director of Cuba's Pedro Kourí Tropical Medicine Institute (IPK). Dr Durán has been "battle-tested" over the years by his involvement in stemming dengue epidemics and other infectious disease outbreaks, good preparation for his current position as National Director of Epidemiology. Today, his is the voice and the face on the 11:00 AM briefing carried daily by Cuban television, reporting the latest data on the unfolding COVID-19 pandemic globally, in the Americas and



in Cuba. This *MEDICC Review* interview took place on April 10, 2020, a month after the first three COVID-19 cases were diagnosed in Cuba (March 11, 2020).

***MEDICC Review:* Can you walk us through the most important strategies adopted by Cuba to head off COVID-19 over the last few weeks and months?**

Francisco Durán: Of course. Remember that Cuba is an island, so well before closing our borders altogether, we stepped up surveillance at the port, airports and marinas. In that period, any traveler arriving with symptoms from countries experiencing transmission of the disease was hospitalized in isolation for 14 days, where they were studied; travelers from other countries were followed in primary health care at home or where they were staying. When flights were essentially stopped (except for returning Cubans and for humanitarian reasons), everyone arriving was isolated during 14 days for observation and study. As you know, 14 days is assumed to be the maximum incubation period for this coronavirus to develop. These measures reaped good results.

The other main strategy has been active case detection in large population groups, using both rapid tests and real-time polymerase chain reaction (RT-PCR) tests in some cases. By large population groups, I mean identifying the most vulnerable, the suspected cases (people who have had contact, for example with people coming from high-risk countries, or who have symptoms) and contacts of confirmed cases. These are

the kinds of people who are placed in isolation centers for diagnosis and testing by RT-PCR, as well as any person hospitalized for an acute respiratory infection, or who becomes seriously ill with one while hospitalized. And we are now also testing post-mortem any persons who died with respiratory or diarrheal symptoms. This has helped us identify a good number of cases.

And we also use rapid tests in larger population groups, tests which of course are not only quicker but also less expensive. This broad testing is important for finding possible cases because COVID-19 is contagious during the incubation period when people are asymptomatic. Nobody carries a sign identifying themselves as a carrier. You have to go out and find them.

Then there is the door-to-door active screening, with participation by our medical students, to discover people with respiratory symptoms. If physicians determine there is any epidemiological risk, these cases are remitted immediately to isolation centers for study as well. Every time a case is confirmed, contact tracing is initiated to isolate contacts, too. All this has resulted in identification of another good share of cases.

I should mention that we are also carrying out epidemiological surveillance and various other measures for people in prison where

From the Front Lines

until now, we have no cases identified. But we are continuing to watch this carefully.

MEDICC Review: How broad is the active screening?

Francisco Durán: We have screened about 2.5 million people a day with medical students, coordinated by and reporting to family doctors, going house-to-house. Anyone found with respiratory symptoms is given a rapid test by the coordinating physician. The students are trained and protect themselves with masks and gloves; they don't enter into homes, but stay outside a few feet away. Their work is critically important.

MEDICC Review: I see that South Korea started testing early, at least with rapid tests. But we're seeing Cuba rely more heavily on this massive door-to-door screening that continues at the primary health care level.

Francisco Durán: The fact that we have primary health care everywhere—even in the remote mountains of Santiago de Cuba, there's a family doctor and nurse, a community polyclinic—has permitted us to do the screening and also rapid testing, which is quite easy, on whole groups of at-risk people. It has also allowed us to screen other groups, such as the health professionals leaving to assist other countries. They receive both a rapid test and a RT-PCR.

MEDICC Review: I want to have the protocol clear on the rapid tests...

Francisco Durán: We began using them to test travelers coming from countries with transmission; then for anyone arriving in the 14 days prior to March 24, when most travel to Cuba was suspended, as part of primary care follow up. Beginning on March 24, all people who, for one reason or another, are still returning to Cuba are tested in isolation centers where they remain for 14 days of observation; all contacts of suspected (not confirmed) cases; those with acute respiratory infections, even a common cold; symptomatic people who may have been indirectly exposed in areas where transmission clusters have been identified (or areas quarantined); all those in nursing homes, psychiatric hospitals and psychopedagogical centers; once again, to all health professionals going abroad; and to anyone hospitalized with a respiratory infection.

You know that the rapid test isn't conclusive, but gives you an idea of possible infection. So of course, when a person is identified with a serious acute respiratory condition, then we use RT-PCR in addition to rapid testing.

MEDICC Review: Today is April 10. The first cases in Cuba were identified 30 days ago, on March 11. What is the situation today?

Francisco Durán: The measures taken thus far have meant that for most of this time, we were seeing only imported cases, or those infected by travelers, or very small clusters (such as families). Now this has extended and we are talking about limited local transmission. That means that whole neighborhoods or communities are affected, and as a result are put into quarantine, where movement in and out is further restricted and epidemiological surveillance and testing stepped up. This has happened in specific places in various provinces up until now.

MEDICC Review: It seems that prevention is more important now than ever. How has the media been involved?

Francisco Durán: To the strategies adopted by the national health system, you have to add the intense media campaign. On television, you see a barrage of information and messages. People all across the island tune in to our daily briefing. It offers a panorama of the global COVID-19 situation and the situation in Cuba. We report how many total and new cases have been confirmed in the country, where the new cases have been found (province or town), how many are in serious or critical condition, how many deaths. And this information is accompanied by messaging: for example, if I say that many of the critical or serious cases are people who are hypertensive or diabetic, or that they are in a given age range, then this helps us explain why people of a certain age or with these risk factors should take extra care, should stay home, and so on.

MEDICC Review: Of course this response doesn't just involve the health system and the media. Who else is involved at this point?

One group, including scientists from various institutions and universities, and in particular BioCubaFarma, is working on developing medications to treat COVID-19. Another group is working on digital applications. One is already available that allows people with symptoms to communicate with a health facility's professionals, so they can be identified and receive instructions this way. Another application by Infomed, the country's health information network, publishes updated reports on the situation in Cuba and the world.

Further afield, intersectoral participation is fundamental—not only by neighborhood or mass organizations and local communities, but also the measures taken by Immigration and Customs, Ministries of Education, Higher Education, Culture, Tourism and the Sports and Recreation Institute. Another key action was taken by the Ministry of Labor and Social Security to protect people's salaries when they have to stay home, particularly people over 60 or who have chronic conditions, who have been asked to shelter at home...unless of course they're folks like me, who are older and still working!

MEDICC Review: In many places worldwide, health facilities have been overwhelmed by patients. What is Cuba doing to prepare for the possibility of high rates of hospitalization and critical care?

Francisco Durán: First, we have set aside more facilities as isolation centers, to be able to handle more people who are at risk, but are asymptomatic, where they stay for 14 days under observation. As you know, travelers arriving since late March, and even the few arriving after that date, have been shuttled directly from the airport to isolation centers.

We have increased the numbers of hospital beds dedicated to COVID-19 patients, including ICU beds, readying these for when we hit the peak of cases, now expected in mid-May. In general, we believe we have enough, and we are using all the capacities we can. In terms of critical care, we are looking fundamentally for more ventilators, so important for these patients. The US sanc-

tions have made it more difficult to acquire ventilators, but we're doing what we can to find more.

We have also ramped up our diagnostic lab facilities: early on, we had three with molecular biology capabilities testing for this virus (one at the Pedro Kourí Tropical Medicine Institute, one in Santiago de Cuba Province and one in Villa Clara Province), but now we have included other labs in Havana, such as the lab at the National Civil Defense's Scientific Research Center. And in each of the first three laboratories, we've increased testing capacities. So now, we are processing well over 1000 RT-PCR tests daily. Because we have to keep searching, searching, searching...and once found, isolate and hospitalize infected patients.

MEDICC Review: In terms of both RT-PCR and rapid tests, does Cuba have enough? And do you have enough suppliers?

Francisco Durán: We're in a very tight situation. The first RT-PCR kits came through the Pan American Health Organization (PAHO), but very few; later, we were able to acquire more from China, and we had a donation from Marseilles, France. But as you know, the US sanctions (actually a blockade), shut many doors on us when it comes to these kinds of purchases as well. In any case, and through various countries, principally China, we have quite a few tests now.

The same has been true with the rapid tests. We acquired a good number from China, and UN organizations such as PAHO and UNICEF, as well as the Global Fund, have also made successful efforts. Through them, we've also acquired some personal protective equipment (PPE). But all this is further limited by the fact that everyone is after these supplies and the prices are going up every day. Thus we received the donations I mentioned, and with government funds, we continued to look for more, and so have a sufficient number for now. But we want to prepare for the time when we may see an increased case load. So, in addition, we are producing domestically such items as specialized gowns, aprons, masks, goggles and face shields, which greatly facilitates protection for people working in our health services.

We have limitations, even in the amount of cloth we've been able to import, but with what we produce and the arrangements made through international agencies, including WHO-PAHO, we have these items to protect our health workers.

In addition, the general public is getting quite used to wearing their own masks, and the police are requiring it.

MEDICC Review: Do you have the N95/P2 masks, and enough of them, for workers most at risk?

Francisco Durán: We've acquired the N95/P2 masks through the same routes I've described. These of course aren't used as massively, but rather for those people working directly with COVID-19 patients, in the laboratories as well. But yes, we have them. And we are always looking for more.

MEDICC Review: I know that Cuba is using its own interferon alfa-2b, as well as various other antivirals in its treatment protocol. And thus far, the country has a low case fatality rate.

Francisco Durán: Yes, today's case fatality was 2.7%, below that in the Americas. And we are working very hard with these treatments and with the broader preventive measures to keep it low.

MEDICC Review: What about those who have recovered? What is your protocol?


Francisco Durán: Patients are hospitalized for at least 15 days, and if by the end of that time, they are symptom-free, recovering, then they are tested by RT-PCR. If the results are negative, they receive a clinical discharge to return home, but with a restricted movement regimen for an extra 15 days. That is, they can't go out and can't receive visitors at home. How do we check up on them? Their families do, as well as the local health professionals in primary health care. After those 15 days at home—that is, one month after admission—a RT-PCR is repeated. If it is negative, then they receive an "epidemiological discharge" and can return to their normal activities, of course also limited for the general population right now.

Now, if the second RT-PCR is positive, it's repeated again in 5 days, while the patient remains confined to home, and if it's positive once again, they are readmitted to hospital until the test proves negative.

MEDICC Review: Mathematicians have developed predictive models forecasting coronavirus cases in Cuba will peak in mid-May. And the goal of course is to flatten the curve from the higher to the lower estimates. How can that be done?

Francisco Durán: Exactly. What happens depends on the results of our actions. If we're able to sustain all the actions I mentioned, plus receive real cooperation from the public—in terms of self-protection, taking care to further limit social activity, only leave home when absolutely necessary, and then respect perimeters of physical distancing—then undoubtedly the peak will be lower, the curve flatter. The increase in cases will happen, but you'll be able to modify how it looks. The curve won't look the same if you delay actions, delay necessary quarantine or delay restricting people's movements. Then the peak will hit higher.

And that's what we're struggling against. We're fighting. And with what? With all the actions I've described, and by accelerating their pace. You've seen the daily meetings the Cuban president has with ministers and vice ministers, with other leaders, to analyze the situation and take new decisions. From those meetings come new measures. For me, like so many others, there's no rest. It's an unprecedented situation and we need even more public participation, greater awareness so that the panorama ahead can be more positive.

The mathematicians are working, you know that! And they've made their forecasts, which are useful to us: if they say we're going to reach a peak of nearly 5,000 cases, then our job is to fight to keep from reaching that number. We need to prepare for it, for the peak, by reinforcing ICUs, increasing beds, ventilators, everything, so that we're not taken by surprise. But struggle we will, fight like hell, to keep the case numbers lower, to keep more people from becoming infected. 

CUBA'S COVID-19 STRATEGY: MAIN ACTIONS THROUGH APRIL 23, 2020

Following identification of the coronavirus disease COVID-19, Cuba activated its National Action Plan for Epidemics and convened a National Intersectoral Commission to design measures to protect population health. Following approval of the COVID-19 Prevention and Control Plan, scores of measures were implemented to fight the pandemic. Internationally and in Cuba, these are organized according to three epidemiological phases: stage 1, pre-epidemic; stage 2, limited local transmission; and stage 3, epidemic. As of this writing, Cuba is in Stage 2. Actions and measures have been rolled out gradually and systematically.

The Ministries of Tourism, Culture, Education, Higher Education, Labor and Social Security, Domestic Trade, and Agriculture; the Sports and Recreation Institute; Civil Defense; Immigration and Customs; national media; and mass/social organizations have participated in design, organization and implementation of actions taken. The Ministry of Public Health (MINSAP) and the Council of Ministers decide guidelines, then coordinate and monitor activities and their results, which are reported daily by national television and radio, print media and carried on digital platforms and social networks.

Timeline of COVID-19 Measures in Cuba through April 23, 2020

Date	Actions
January	
	Ministry of Public Health, Civil Defense (CD) and others establish National Intersectoral Commission for COVID-19.
	National Action Plan for Epidemics (last updated during Ebola, 2015) is updated and activated.
	Surveillance at all ports, airports and marinas is increased, including use of digital thermometers and infrared scanners for incoming passengers from the USA, France, Spain, Germany, Italy, China, Japan and South Korea.
	COVID-19 response training begins for border and immigration officials.
	Protective protocols are implemented for Cubans posted abroad (including health professionals).
	COVID-19 Prevention & Control Plan is drafted.
February	
1	Council of Ministers approves COVID-19 Prevention & Control Plan.
26	The Cuban health network Infomed launches <i>COVID-19-InfoCU</i> , a free mobile application for Android to provide current, reliable information on COVID-19 using sources from the <i>Infecciones por coronavirus</i> site. This is later complemented by <i>Juventud Técnica</i> infographics dashboard on COVID-19 in Cuba.
All month	Health services in community polyclinics and hospitals are reorganized to reinforce and isolate areas for attending infectious disease patients, particularly those with respiratory symptoms.
	Health professionals, cleaning, cooking and administrative staff, ambulance drivers and others working directly with patients in isolation centers and hospitals are trained according to COVID-19 prevention and treatment protocols.
March	
5	Council of Ministers updates COVID-19 Prevention & Control Plan.
	National Intersectoral Commission for COVID-19 begins meeting daily.
6–7	Regional meetings (west, central, east) with national authorities are held to analyze and implement measures according to COVID-19 Prevention & Control Plan.
9	First prime-time television “Roundtable” broadcast on COVID-19 announces series of measures; frequent hand washing, physical distancing recommended.
	Military hospitals around the country are added to those previously designated for remission of suspected cases.
	Molecular biology laboratories in Villa Clara Province (central region) and Santiago de Cuba Province are activated for COVID-19 testing, supplementing lab at Havana’s Pedro Kourí Tropical Medicine Institute (western region, national reference center).
	More than 3100 hospital beds are designated for COVID-19 patients, in addition to 100 ICU beds.
	Science and biotechnology group comprised of experts from various research institutes is created to develop COVID-19 treatments, including antivirals and rapid tests, as well as vaccine candidates, diagnostics and other innovations.
	Ministry of Labor & Social Security applies Law #116 as established in the National Labor Code regulating worker protection, salaries and social security.
	Production of digital and print health messaging materials begins.
10	All in-bound travelers are tested for COVID-19 using rapid tests, expanding previous testing, which was limited to travelers coming from countries with transmission.
11	First cases of COVID-19 are confirmed in Cuba: three Italian tourists. Stage 1, “pre-epidemic” phase declared.

	Public health information meetings begin in communities across the country to inform population about COVID-19 transmission, prevention and measures implemented to date.
12	1322 additional beds in 11 hospitals and 824 beds in 10 isolation centers around the country are set aside for COVID-19 cases, contacts and suspected cases. More to be added as needed.
17	National broadcasts of daily Ministry of Public Health press briefings begin, including domestic, regional and global updates on COVID-19, implementation of new measures, detailed epidemiological data, and press Q&A. Active screening (case detection) commences in neighborhoods across the country involving 28,000 medical students.
18	Cuba allows the MS Braemar cruise ship, with 1063 passengers and crew (5 confirmed COVID-19 cases), to moor off Havana coastline. Cuban specialists facilitate safe transfer of all personnel to charter flights for repatriation to UK. After a 14-day quarantine, all Cubans involved in the transfer are tested and receive clean bill of health. Cuba begins COVID-19 testing post-mortem on all who died with critical and severe respiratory complications, or diarrhea. All patients presenting in hospitals with acute respiratory infections receive a real-time polymerase chain reaction (RT-PCR) test.
19	Validity of travel-related documents for Cuban residents working, studying and traveling abroad is extended past expiration dates until further notice.
20	President Miguel Díaz-Canel announces new national measures on prime-time "Roundtable" television broadcast. Large meetings, gatherings and social/cultural events are prohibited. Hotels (except those used for quarantine), campgrounds, discos, cinemas, theaters, etc. are closed. Restaurants are required to reduce capacity, maintaining at least six feet between tables. Physical distancing of at least 1–1/2 yards is mandated; citizenry advised to wash hands often and properly; avoid touching eyes, nose and mouth. At-risk groups are advised to shelter at home, limiting contact with others as much as possible. Telecommuting is indicated for those offices and workers where feasible. Tax payments are suspended for small business owners. Hospitalized patients are guaranteed 50% of their average salary. Households with insufficient earnings due to economic measures qualify for Social Assistance; Family Assistance System, providing food, medicine and other goods to extremely low income households activates home delivery. Central Bank announces debt suspension and restructuring for businesses and individuals until situation improves. All facilities are required to have a 0.1% sodium hypochlorite solution at the door for hand disinfection. Sales of sodium hypochlorite are increased to the public nationally.
23	155 workshops begin manufacturing face masks; President encourages citizens to make their own, sparking a national, grassroots production movement of face masks. Education is suspended at all levels, schools closed until further notice. Health measures are instituted at orphanages and those day care centers still open (for children of essential workers: health, transport, food supply); 444 day care centers remain functioning. Outbound travel by Cuban citizens is limited to humanitarian reasons. Interprovincial transportation is suspended; 100% of passage on public transportation reimbursed.
24	International arrivals are limited to Cuban residents; asymptomatic travelers are transferred directly from airport to isolation centers in their home province for 14-day quarantine and receive rapid tests. Travelers with symptoms are transferred to a hospital and receive RT-PCR tests. Shelter-at-home order is issued for all remaining foreign visitors in the country, required to stay either in their hotel or rental home. Discos, gyms and pools are closed at all hotels. Privately-owned bars, pools and gyms are closed. Churches, synagogues, mosques and other religious institutions are asked to avoid large gatherings. Police presence is reinforced on streets. Elective surgeries and non-emergency, regularly-scheduled appointments with specialists are postponed; non-urgent dental appointments suspended. Until further notice, prescription medicine refills and government-subsidized special food allotments for health conditions are extended six months beyond original renewal deadlines. Provincial and Municipal Defense Councils are activated.
26	Cuban Society of Psychology launches Psico Grupos, online consultations via WhatsApp, grouped by theme: older adults; families with children; teens; essential workers; and families with members abroad.
30	Camilo Cienfuegos, Pinar del Río Province, is first community put under quarantine. Teleclasses begin for elementary, middle and high school students.
31	All crew on recreational boats must leave Cuban territorial waters within 48 hours or submit to 14-day quarantine in an on-shore isolation center.

From the Front Lines

April	
1	Use of face masks is made obligatory in public.
7	Stage 2, “limited local transmission” phase declared with six local transmission events in Pinar de Río, Havana, Matanzas, Ciego de Ávila, Camagüey and Holguín Provinces.
8	Number of hospital and ICU beds for COVID-19 patients is increased. Five more molecular biology laboratories are activated for COVID-19 testing. Every police station is staffed with a district attorney representative to permit violators of COVID-19 regulations to be charged. Alcohol sales are limited; drinking prohibited in public. Restaurants are limited to takeout or home delivery; stores and restaurants must close business by 8:00 PM. Payment of utility bills is temporarily suspended without penalty (electricity, phone, water, gas).
9	University entrance exams are postponed.
10	Large supermarkets are closed to help reduce overcrowding; online sales rolled out; stores limited to selling food and personal hygiene products.
11	All urban and intermunicipal public transportation is suspended; government transportation and private cars (except in quarantine zones) may still circulate. Hospital taxi service is reinforced and guaranteed, including transport for dialysis patients, cancer treatments and patients discharged from hospitals. Transport is guaranteed for medical staff and other essential workers.
13	Prime-time television “Roundtable” airs on Cuban biotechnology products for COVID-19. Includes details on new antiviral CIGB 210, inhibitory peptide CIGB 300 and CIGB 258, a regulatory treatment for hyper-inflammation in critical patients; new diagnostic tests; and a vaccine for activating innate immunity (in clinical trials). National treatment protocols use 25 domestically-produced medicines and products.
13–19	Use of interferon alfa-2b, administered nasally, to protect medical personnel begins.
13–19	Disinfection of main streets in Havana and other cities begins using a soap, water and bleach solution.
14	Government leaders and expert group convene to analyze organizational plan moving forward as epidemiological picture gets more complicated following 20 instances of local transmission. National hotline goes live to answer population’s questions and concerns about COVID-19.
15	20 communities in six provinces (Havana; Pinar del Río; Matanzas; Ciego de Ávila; Holguín; Camagüey) and the Isle of Youth are under total or partial quarantine. Molecular biology lab at the Genetic Engineering and Biotechnology Center (CIGB) is added to those processing RT-PCR tests for COVID-19.
16	Prime-time “Roundtable” airs explaining COVID-19-related offenses (price gouging, hoarding, public disobedience of health measures) and legal rights/mechanisms including Article 87 of the Penal Code (crimes against health); over 100 cases tried to date.
17	26 cases of local transmission are reported; 92 health workers confirmed infected with COVID-19. Cuban-designed mobile phone application “Virtual Screening” goes live to complement the 28,000 medical students conducting active screening. A free, opt-in application allowing users to submit epidemiological survey for statistical inclusion and analysis by the Ministry of Public Health.
19	Provincial Defense Council, Havana, urges citizenry to conserve water and electricity as situation becomes more complex.
23	Prison protocols, first implemented in mid-March, are reinforced: newly-charged prisoners go into 14-day quarantine; workers or visitors presenting with respiratory symptoms cannot enter; number of visitors is reduced; workers and visitors must disinfect hands upon entering; active screening is increased to twice daily; and dedicated wards for possible COVID-19 cases are established. To date, there are no confirmed cases in any prison but quarantine is not ruled out as epidemiological situation evolves.

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Mobilizing Primary Health Care: Cuba's Powerful Weapon against COVID-19

Tania L. Aguilar-Guerra MD MS and Gail Reed MS

A strong foundation of primary care is critical to the health system and is particularly important during pandemics like COVID-19. Primary care practices should be a natural fit for triaging, testing, treating, and educating patients.

—Corinne Lewis, Shanoor Seervai, Tanya Shah,
Melinda K. Abrams, and Laurie Zephyrin MD
The Commonwealth Fund, April 22, 2020[1]

This thoughtful observation by The Commonwealth Fund writers seems to describe what we were finding in Cuban neighborhood after neighborhood, as we interviewed for this story: the backbone of Cuba's universal public health system is also the backbone of its response to the coronavirus pandemic. Primary health care. And the results are beginning to emerge: as of April 30, 2020, through primary-care case detection and contact tracing, sources for 85.7% of the 1537 COVID-19 cases to date had been identified, essential for flattening the curve.[2] On May 1, the New York Times reported Cuba at 13 cases per 100,000 population and less than 1 death per 100,000; well below rates in the USA, Italy, Spain, France, the UK, Canada and Brazil, among others.[3]

In the Cuban case, primary health care (PHC) takes the form of 449 multispecialty community polyclinics, each serving as a hub for 15 to 40 neighborhood family doctor-and-nurse offices. Catchment populations are defined by geographic area, meaning that each doctor-nurse team is responsible for prevention, health promotion, patient care and rehabilitation of up to 1200 people (300 families); and the polyclinic's total population usually varies from 20,000 to over 40,000, depending on density. Cuba is 75% urban, but in rural areas, longer distances mean responsibility for fewer patients.

Since the late 1980s, 100% of Cubans have had free access to family doctors and nurses, with more than 10,000 offices dotting the island today. These health professionals are embedded in the neighborhood, the doctor living above a modest office, exam room and waiting area. Family nurses often come from the neighborhoods they serve.[4]

Nearly all polyclinics have earned national accreditation to teach medical, nursing and allied health students, and provide a setting for curricula that include large doses of direct patient engagement and community-based learning. Polyclinic professionals are also responsible for local maternity homes, pharmacies, seniors' clubs and other community institutions...and in the case of COVID-19, for just about any local business, church, hotel, school, factory or even national ministry in their health area.

COVID-19: Building on the Strengths of Primary Health Care

The first three cases of COVID-19 diagnosed in Cuba on March 11, 2020, caught no one in the health system by surprise. In fact,

since January, health authorities and government had mapped out an intersectoral approach to prepare for the potential onslaught.[5] Working at the time with few real-time polymerase chain reaction (RT-PCR) tests—made available by PAHO to the Pedro Kourí Tropical Medicine Institute, IPK—and without early access to rapid tests, massive testing was clearly not in the cards as a first strategic option. However, primary health care was: the universal subsystem already at work in neighborhoods across the country was destined to become the health system's front line barrier and first line of attack against the novel coronavirus.

What has made it so? Insights we gleaned from dozens of interviews and reports are summed up as follows:

- 1) **Cuba's is a single, universal, public health system with the ability to mobilize and adapt its considerable human and logistical resources to confront new situations, despite material resource constraints.** The largest labor force in the system is working in primary health care, where it is highly structured and experienced for both training and care.
- 2) **The primary health care subsystem was already operating under protocols for continuous community health assessments (public health–epidemiology), as well as individual and family health evaluations (*dispensarización*, or Continuous Assessment and Risk Evaluation, CARE).** In addition, even medical students have experience in door-to-door case finding for infectious patients, given their participation in quelling dengue outbreaks in Cuba over the years.
- 3) **Communication is well organized both horizontally within primary health care and vertically with other levels of the health system,** permitting data sharing and quick implementation of new measures and activities as necessary.
- 4) **Family doctors and nurses are committed teams,** used to being available 24 hours a day (although their time is usually respected), and to making regular house calls as well as receiving patients for office visits.
- 5) **Family doctors and nurses are literally next door, and have gained a reputation over 40 years as trustworthy healthcare providers: when they talk, people listen and are apt to follow their lead.** People feel safer knowing they are around the corner or up the hill. These health care providers **know their communities, and in turn count on their communities' cooperation and support.**

How these factors play out in a primary care strategy for COVID-19

Single, universal, adaptable health system, capable of COVID-19 training and mobilization of primary-care personnel:

Dr Mayra García is director of the 19 de Abril University Polyclinic in the heart of Havana, which is responsible for 25 family doctor-and-nurse offices and for 25,304 residents in its health area. It



Courtesy M. García

Dr Mayra García: Training included “anyone who might come in contact with a patient, including all support staff.”

also has one of the country’s oldest populations, with more than 30% over 60 years of age. She says **special COVID-19 training of the health workforce was key to mobilization** well before March’s first cases were identified.

“Training was three tiered,” she explains. “Everyone in the health system was trained on this coronavirus, how it was transmitted, and what was happening globally with its spread. First, we had a course at IPK involving professionals selected from each province, and then they returned home to share this new knowledge locally, the second tier. Here in Havana, this resulted in the provincial health department creating a group to train personnel. They trained directors of hospitals, polyclinics and the like, area by area, because Havana has 82 polyclinics, each with a fair number of family doctor-and-nurse offices. Then they went on to the third tier: training for family doctors and nurses themselves, lab and radiology technicians, administrative personnel, and also housekeeping staff, ambulance drivers and orderlies. Anyone who might come in contact with a patient, including all support staff. This last is key, I think, because people are always thinking about doctors and nurses, but what about other health personnel? They need to be just as aware and just as protected.”

But Dr García says the training didn’t stop with the health sector: the polyclinic was responsible for more. “Each polyclinic’s staff went out to **train people in the workplaces in their geographic health area**, including small business owners, such as people renting their homes or managing private child care facilities. Family doctors, for example, mapped the houses that were being rented (especially those to foreigners) and wherever children were being cared for, to explain COVID-19 health measures and protocols so they could better protect themselves and those in their homes and businesses, learning what to do, how to recognize symptoms, and so on.”

Dr Rubén García, who has spent the last 22 years as a family physician in various primary-care responsibilities, is now vice director for medical care in Havana’s Plaza Municipality, where the 19 de Abril polyclinic is located. He notes that **reorganization of**

primary care activities started early, beginning at the top: “All of the supervisors—whether nurses, doctors or program directors, who had been trained as family doctors and nurses—went to family doctor-and-nurse offices to reinforce them. We left very few at the top of the primary care subsystem in the municipality. We also involved dentists and physical therapists, whose workload was beginning to diminish as a result of stay-at-home guidelines. And in the case of polyclinics like 19 de Abril, we transferred some personnel from other areas to theirs, to even out our capabilities across the network.”

He notes that more family medicine specialists, dentists and nurses were posted in local hotels, to provide 24-hour case detection and medical care to foreigners still residing there. At one point, some 320 guests were lodged in one hotel, the responsibility of a single polyclinic.

The **polyclinics also reorganized services**, in order to isolate from the rest of patient care the areas for people with respiratory symptoms, mainly those referred by family physicians but also some walk-ins to emergency services. Explains Dr Mayra García: “One of the first orders we received was to create different areas for evaluating people with symptoms of acute respiratory infections (ARIs), including both doctor office areas and urgent care. So we restructured to keep those patients separate from others. The new areas are staffed 24/7 to assess all ARI patients who come in, as is the polyclinic ‘command center,’ where doctors finally determine the course of care or remittance of patients with respiratory or other symptoms of COVID-19.”

Regularly scheduled appointments at polyclinics or with family doctors were postponed whenever possible, and prioritized patients such as older adults with chronic conditions or pregnant women were most often visited at home, rather than seen in offices. This **reorganization of family doctor-and-nurse time** then enabled these duos to head up newly organized efforts, including daily active case detection and contact tracing in their neighborhoods.



Courtesy R. García

Dr Rubén García: “All of the supervisors...trained as family doctors and nurses...went to family doctor-and-nurse offices to reinforce them.”

Primary care already operating under protocols for continuous community, family and individual health assessments:

Two essential tools of Cuban primary care are the community health assessment and the individualized CARE model. The first makes use of a medical training that melds clinical medicine with public health, by assessing the general health—including environmental issues and social conditions—of a neighborhood annually by family doctors and then by the polyclinic. The CARE model goes more deeply into family and individual medical histories, categorizing each person into one of four groups: apparently healthy, with risk factors for disease, ill, and finally in recovery or rehabilitation. Risks include such key factors as smoking and overweight or obesity. Ill includes acute as well as chronic conditions, such as hypertension and diabetes. This information is collected by family doctors and nurses from the people they serve in their neighborhood, for whom they keep paper medical records that also include items such as well-baby visits, vaccinations, pregnancies and so forth.

Dr Marta Gálvez, family physician with a master’s degree in geriatrics, has been in her neighborhood family doctor-and-nurse office #9 of the Plaza University Polyclinic for the past 29 years... except for those times when she volunteered abroad in places as far away as Namibia. She says the CARE model is fundamental: “The first thing any self-respecting doctor must know is the health situation of the population she serves. You need to know what to look out for, what you need to prevent, what you need to promote. The main goal of a primary care physician is health promotion and prevention of diseases, so you have to know your community to design a strategy that suits their needs. CARE is a vital tool: it’s why I know that I have 658 older adults in a total population of 1093 people, and 42 of the elderly live alone. That’s one of my biggest challenges, the aging of the people in my neighborhood.”

Dr Alejandro Fdragas, family physician with master’s degrees in infectious diseases and sexology, has served in office #8 in his Plaza University Polyclinic neighborhood for 18 years. “The CARE model also automatically alerts us to people who are more susceptible to respiratory infections, the people whose chronic diseases are the risk factors most commonly associated with complications in COVID-19 patients. This way, we already know who they are,” he says.

With the experience of applying such protocols, primary health care teams were prepared to incorporate new actions into their daily routines. Since they already made house calls most afternoons, it was not a stretch to turn these visits into the **single most important tool since the early days of surveillance: active case detection**.^[6] The protocols in place for COVID-19 call for daily active case detection in every Cuban neighborhood, with some 28,000 medical students joining the effort led by family doctors and nurses.

Dr Gálvez explains how this works: “Mainly we’re actively looking for respiratory symptoms, active case detection, and if these appear, then, depending on how the symptoms are classified, we follow one or another protocol. For example, when we find someone with symptoms, we take an epidemiological survey, based on a very detailed questionnaire; we also make a thorough physical exam and a comprehensive evaluation. We use all this to decide what conduct to follow.



Courtesy M Gálvez

Dr Marta Gálvez: “The first thing any self-respecting doctor must know is the health situation of the population she serves.”

It also enables us to survey 100% of our population on a daily basis, starting with the medical students every morning, household by household.”

If a person is suspected as having COVID-19, they are remitted to their polyclinic for evaluation, and if physicians there determine that indeed they have a suspected case, then the patient is first isolated in the polyclinic itself and **then sent to one of the isolation centers** now set up in every municipality in the country, for a period of at least 14 days (where they receive rapid tests). If the case appears to be another respiratory illness, the person returns home, but must stay there for at least 14 days, followed in primary care.

Dr Gálvez emphasizes: “The importance of this whole process of active detection at the primary care level is so that **hospitals are reserved for those patients who really need them**: thus, those patients with COVID-19 have the ICU bed they need, the attention for any complication that might present. But the rest of the acute respiratory patients can be cared for at our level. That way, even as patient numbers may increase, we have a better chance of giving everyone the care they need.”

But active case detection, evaluation, temporary isolation and referrals aren’t the only responsibilities of primary care professionals during the COVID-19 pandemic: they are also entrusted with the equally important job of **contact tracing for all suspected or confirmed cases**. Personnel at hospitals specially selected for COVID-19 patients carry out an epidemiological survey of their own, to identify contacts the patient may have had.

Dr Gálvez says this part can be stressful: “Imagine! You have to decide among competing priorities. Just now, for example, I got a call from the polyclinic director, who says there are three people in my neighborhood who had contact with a confirmed case. So I need to visit them immediately. Then there is another patient who is not feeling well. The nurse and I have to juggle things on an hourly basis.”

Josefa Nietos has spent 34 of her 45 years as a nurse in primary care, and she was a founder of the family doctor-and-nurse pro-

From the Front Lines

gram in the Plaza Polyclinic health area, where she works in family doctor-and-nurse office #11. “Yesterday, we saw the first family in our neighborhood that had contact with a confirmed COVID-19 case. The family was asymptomatic, and we remitted them to the polyclinic so they could be sent on to an isolation center for the required 14 days. And then their home was disinfected.”

Home disinfection of contacts and suspected cases is a lesser-known aspect of primary care tasks, and is carried out by a “rapid response” team, usually made up of the polyclinic director and two vice directors, who disinfect households with family members. This is carried out with various disinfecting solutions, for surfaces and even for staircase railings in apartment buildings. If need be, family doctors and nurses pitch in.

Protection of health workers, and the apparently healthy people they come in contact with, is another concern in primary health care. Dr García notes that the workers at a hotel in her polyclinic area are checked daily by nursing and medical staff assigned there, “because the foreigners have been lodged there for over 21 days without becoming ill, so if they’re infected now, it’s our responsibility.” Disinfectants, gloves, masks and other protective gear are provided by the polyclinics; Dr Gálvez says they change masks every four hours, wash them, boil and then iron them for re-use; and they disinfect family doctor-and-nurse offices and their homes daily.

Dr Fadragas notes that once at home, he leaves his shoes outside, removes all his clothes, separates them for washing, and jumps in the shower. “I don’t deny that I’m worried about me or my family becoming infected,” he says. “So I wish we had even more protection.”

A vital communications network involving primary care:

As was alluded to by Dr Gálvez, polyclinic “command centers” are in touch throughout the municipality, province and even country, to alert for contact tracing and possible cases. In the early phase, when travelers were still flying into Cuban airports, this also involved rapid communication from airport and port medical personnel, who received the health questionnaires filled out by each passenger. These included the address where each was headed in the country, and local family doctors were charged with follow up for all.

Essential communications lines with hospitals have also been set up: when COVID-19 patients are discharged, they require follow-up in primary care for the next 14 days, and then must be cleared by a RT-PCR in order to receive an “epidemiological discharge.” All this falls on local polyclinics, family doctors and nurses.

Primary health care providers committed, used to 24/7 responsibilities:

There is no doubt that the heavy lifting required in primary care during COVID-19 is testing not only professional prowess, experience and organization, but also commitment. These health workers must be on the ball, ready to move and to make decisions that can change the course of the spread of the disease.

Dr Gálvez notes: “I have lost track of time; I don’t know when I’m not at work. **Right now, you have to dedicate yourself entirely to the job.** Because depending on what you do now, later you’ll

have less work to do, because fewer people will be getting sick. It’s prevention and health promotion that ensures our communities’ health, after all.”

“There are days we finish at 10 o’clock at night, but we can’t rest now. You feel a tremendous sense of responsibility,” says Dr Fadragas, “We’re right here, every day, in touch with the population, where they live, where we need to make sure things are done right to protect everyone. We know we’re on the front lines, and we’re the most effective ones there. We’re the ones who have the main job of educating people, especially during our ‘rounds’ of active case finding, to increase awareness of risk perception. It’s not an easy task, but we know we have to do it and do it well.”



TL Aguilar

Dr Fadragas: “You feel a tremendous sense of responsibility.”

Family doctors and nurses are literally next door, their communities listen to them, and they count on their communities:

This two-way street may be the most critical, long-lasting effect of this Cuban strategy relying so much on primary care: since these health professionals are embedded in their communities, they have gained a solid reputation over time, are respected and listened to. This **makes them better at influencing local residents than just about anybody else**, and they are also there to see when people aren’t abiding by physical distancing, sheltering at home, or when an older resident living alone needs a helping hand from a neighbor.

And certainly not all is well concerning risk perception and individual responsibility, especially in densely populated, high-risk municipalities like Plaza. Comments Dr Rubén García: “I think at one point, people started becoming too confident, when they saw the number of cases wasn’t rising very fast. When there were fewer travelers coming from abroad, too. Right now, I think the main problem we have is respect for physical distancing, people on the street without face masks. People who don’t have to be

there, unnecessary congestion, even though we realize people have to shop for basic needs. As a member of the local Civil Defense Council, I've brought that up, and we're working on it. This is where contributions from other sectors become so important."

Dr Fadrugas notes: "When we see people in the street not correctly using their face masks, or not using them at all, then family doctors and nurses have the capacity to influence them, to convince them how important it is to follow these guidelines, to be more responsible. And when we find an elderly person outside, we not only speak with them, but also with their family, to make them understand how risky that is."

Not all family doctors stay as long in one neighborhood as Drs Fadrugas and Gálvez, and turnover in some areas of Havana is high. Dr Fadrugas says "when you have spent 18 years in a place like I have, people respect you and trust you, not just because you're always there, but because they assess your work with them and their families over time. So we, along with the nurses in our teams, have an opportunity like no others to modify people's behavior for their own health...critical at this juncture with COVID-19."


Local organizations, such as the Federation of Cuban Women and seniors' clubs are active in helping family doctors and nurses, especially when it comes to additional attention to older adults living alone, until the system kicks in that involves social workers taking them meals and other necessities. Small business owners have also come together in a network called *Covidvoluntarios* to shop for elderly who live alone, as well as for disabled residents in their neighborhoods.

Nurses are the linchpins in many neighborhoods, especially where doctors may frequently change. "A nurse's role is fundamental," says Josefa Nietos. "We are the communicators, the educators, and we're there so that people feel accompanied and more secure. In these times of COVID-19, people are afraid they may be exposed to this virus, and we're there to calm their fears, and constantly remind them what they can do to protect themselves and their families."

"We talk a lot," she says, "because we need to talk a lot. Even before the first cases were diagnosed, we held neighborhood meetings here to explain to people what this pandemic means, what the symptoms are, and what they needed to do. Then we started going door-to-door with the medical students, repeating the same messages. Going to people's homes also meant fewer patients coming into our office, thus better physical distancing. Luckily, Cubans are educated, and they can understand the reasons why we're calling on them to be more responsible."



Nurse Josefa Nietos: "The children were given a homework assignment to represent who was their 'superhero' in the fight against COVID-19, and this young girl decided it was me, her nurse!"

Community cooperation is also one way of expressing community appreciation for these primary care professionals. Another, of course, is the evening rounds of applause heard now in almost every country. But in Cuba, there is no doubt that the doctors and nurses are right there in the community to hear it for themselves. 

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COVID-19 Case Detection: Cuba's Active Screening Approach

Conner Gorry MA

Meningitis, neuropathy, HIV, dengue—since the 1960s, Cuba has faced its share of epidemics. More recently, Cuban health professionals tackled domestic outbreaks of H1N1 (2009) and Zika (2016), and worked alongside colleagues from around the world to stem Ebola in West Africa; all three were categorized by WHO as public health emergencies of international concern.

In December 2019, China reported its first cluster of pneumonia cases, later identified as the novel coronavirus disease COVID-19. In January 2020, Cuban authorities convened a multi-sector working group coordinated by the Ministry of Public Health (MINSAP) and Civil Defense to tailor its national epidemic control plan to confront the rapidly-spreading disease. The plan features a national reporting system and database, with standard protocols including early case detection, contact tracing and regularly-scheduled public health messaging. In late January, no fewer than six ministries, plus the National Sports and Recreation Institute, Customs, Immigration and national media outlets, came together to adapt domestic protocols and design multi-phase control and response mechanisms to combat the SARS-CoV-2 virus.

Cuba's previous experience with epidemics, tackled in the context of a universal health system, was an advantage. A national diagnostic and surveillance network was already in place, supported by provincial Hygiene, Epidemiology and Microbiology Centers, a national network of WHO-compliant diagnostic laboratories, and the national reference center lab for infectious diseases in Havana's Pedro Kourí Tropical Medicine Institute (IPK).

Trained human resources also proved advantageous in mounting a rapid COVID-19 response. From infectious disease specialists, microbiologists and trained lab technicians, to epidemiologists and more than 13,000 family doctors[1] and nurses who serve people in neighborhoods and hillsides across the island, health authorities had the necessary personnel in place to detect, isolate and monitor cases—key elements in epidemic control and prevention.

Following a nine-day, international fact-finding mission in February, a joint WHO–China report found that among the most important elements allowing China to control its outbreak were “high quality non-pharmaceutical public health measures” including extremely proactive surveillance, rapid case detection and isolation, rigorous contact tracing and community involvement.[2] Infectious disease and public health experts agreed: interrupting the transmission chain of COVID-19 through prevention, surveillance and rapid case detection are proven, pro-active strategies for mitigating this threat. To do this, Cuba turned to another deep store of human resources on the island: medical students.

Preparing for National Active Screening

Before Cuba confirmed its first case of COVID-19 on March 11, deans of medical schools across the country[3] issued a call for student volunteers to participate in early case detection through active screening. Over 28,000 responded—not only Cubans,



Medical student volunteers are the backbone of Cuba's active screening campaign.

but also students from the USA, Canada, Chad, South Africa, El Salvador, Colombia and elsewhere, studying for their degrees at the Latin American School of Medicine (ELAM) and at other Cuban medical schools. Since the Cuban curriculum incorporates community as well as classroom learning, and public health is melded with clinical medicine, the prospective volunteers were accustomed to working with local populations. And other infectious disease outbreaks had also given them active screening experience. “I’ve been doing one to two weeks active screening since my first year,” says Olive Albanese, a fifth-year US ELAM student. As part of our training, “we go door-to-door screening for dengue, Zika and other vector-borne illnesses.”

Nevertheless, to arm each participant with knowledge specific to the SARS-CoV-2 virus that causes COVID-19, a two-stage orientation was held before students first headed into the field on March 17. The initial stage detailed characteristics of the virus, including the most common symptoms and modes of transmission, supplemented by experiences from other countries and current scientific findings. The second stage updated students on new evidence regarding COVID-19, detailed how the active screening would be organized, in which health area they would work and instructions on carrying out that work in the community. “These students are a tremendous resource,” says Dr Eduardo Alemañy, dean of the Medical University of Havana's Salvador Allende Faculty of Medicine. “Incorporating them into active



Fifth-year US ELAM student Alexander Ruiz began active screening in mid-March.



Fifth-year US ELAM student Sol Henrik Bockelie screening door-to-door in the Altahabana neighborhood of the Cuban capital.

screening makes a concrete contribution to their professional development, but also means we haven't had to train community workers. The students have previous screening knowledge, training and field experience. This has helped us gain ground and save time in early case detection."

The pragmatism of a medical school curriculum that combines classroom work with community-based practice becomes applicable and actionable during infectious disease outbreaks. Sol Henrik Bockelie, a fifth-year ELAM student from Bremerton, Washington, USA, was completing the public health segment of the curriculum before COVID-19 reached Cuban shores. Classwork included infectious disease control and the importance of "preventive measures and the need for a strong, centrally-organized public health response using a multi-sector approach." From the classroom, Bockelie joined his colleagues in the field: "each student was responsible for conducting a transversal study on the health situation in 30 homes." Known as Continuous Assessment and Risk Evaluation (CARE; *dispensarización* in Spanish, Eds.), this is usually conducted annually (by family doctors) and evaluates all aspects of health—disease prevalence and incidence, prevention, treatment, diet, addiction—in each household across Cuba. "We discuss family planning and inter-family relations, assess building infrastructure and test local water supplies." In the new situation, he says, this hands-on experience is paying off: "we just submitted our CARE results and the project definitely helped us when it came time to begin community screening for COVID-19."

Given the transmission dynamics of the virus, volunteers received special instruction provided by epidemiologists, medi-

cal professors and municipal health directors on how to protect themselves and the health of others while in the community. This included the proper use of masks, gloves, antibacterial gel and bleach solutions; discussions on how to properly conduct door-to-door screening in ways that reflect the bioethics of respect for interviewees; what questions to ask; what to report and how; and the all-important element of physical distancing. This last has required adaptations to the usual approach. Cuba's is an extremely sociable culture, where community-based public health campaigns are a fact of life and health workers—whether doctors, nurses, students, inspectors or epidemiologists—are often neighbors, received affectionately and even invited into people's homes. But the importance of social distancing during COVID-19 changed that: student screeners maintain at least one and a half to two yards between them and residents at all times; they don't enter homes, touch doors or pass through entry gates.

The original active screening strategy called for student volunteers from the third, fourth and fifth years (Cuba's is a six-year curriculum). But in the first week of April, when Cuba entered the disease's second epidemiological phase of limited local transmission, the call was expanded. Now all medical students willing to volunteer, regardless of their year of study, participate in active screening. As of this writing, over 9 million of the island's total 11.4 million population, have been visited in their homes and places of work. Says Gabriela Reguera, a fourth-year Cuban student from the Victoria de Girón Institute (Medical University of Havana), volunteering in Havana's Vedado neighborhood: "many people in my health area are elderly and more vulnerable; we owe it to them to help keep them healthy. It's my commitment and calling and the least I can do for my community."

From the Front Lines

Organization, Work Flow & Information Retrieved

Cuba's integrated primary health care system, with family doctor-and-nurse teams in every neighborhood, each one reporting to a community polyclinic, allowed for a quick rollout of the active screening strategy. First, a work flow between the family doctors offices, polyclinics and medical school deans was designed, whereby the latter were responsible for recruiting and placing volunteers in their medical school's municipality.[4] Polyclinics, most already accredited as teaching sites, then designated a coordinating professor to organize the teams, who were assigned to family doctors' offices.

Working in pairs, students are responsible for daily visits to their assigned homes and workplaces; up to ten pairs may be supervised by a single family doctor and nurse, depending on the size of the office's catchment area. Every morning, screeners report to their family doctor's office and head out on foot to visit each home, business or entity—for instance, day care centers still open for essential workers with small children—within their universe.

"Together my screening partner and I will visit between 80 and 100 homes a day," says Alexander Ruiz, a fifth-year, Cuban-born ELAM student from Jacksonville, Florida, USA, who joined the active screening in mid-March. "We visit residences, as well as private and government-run businesses, making sure to re-visit those places which were closed during previous screening attempts. My work has taken me to different areas: affluent, suburban neighborhoods, apartment complexes, and shelters and transitional housing for people whose homes were destroyed in hurricanes." Given both rising temperatures as Cuba

approaches summer, and also the need to continue students' studies, screening is carried out in mornings only, from 8:00 AM to noon.

Information screened for includes the number and ages of those living in the home or working in the business; if anyone has traveled outside Cuba or had contact with someone who has recently traveled abroad; if so, when and to which countries; and if anyone has a fever, respiratory difficulties or other symptoms. All results are reported back to the family doctor at the end of each screening shift. The information is then transferred to the coordinating professor at the polyclinic, consolidated and passed on to polyclinic administrators for database entry and statistical reporting.

The family doctor provides follow up with those individuals who describe symptoms, as well as with those who have had contact with a foreigner or someone who has traveled abroad. Vulnerable groups—including people with disabilities, those over 60, individuals who live alone and pregnant women—also receive follow-up by the family doctor. Anyone who has had contact with a confirmed case is remitted to one of 36 isolation centers dotting the country for an obligatory 14-day quarantine, screened for 26 other viral respiratory diseases, and tested for COVID-19.

Screening at the Secondary Care Level

As the epidemiological situation evolves, so do the health measures to limit the spread of COVID-19. New actions, along with the number of confirmed cases, patients' health status, geographic location, number of tests conducted, as



A Cuban medical student performs active screening in health area served by family doctor-nurse office #9, Playa municipality, Havana.



Cuban student Gabriela Reguera checks her grandmother (with whom she lives) for respiratory symptoms.



A Skeeter

US ELAM students Sol Henrik Bockelie and Alexander Ruiz meet each morning at family doctor-nurse office #250, Boyeros municipality to begin their screening day.

well as recovered and death totals, are made public in daily press conferences held by President Miguel Díaz-Canel, Health Minister Dr José Ángel Portal and National Director of Epidemiology Dr Francisco Durán. As the virus continued to spread into April, for example, separate intake wards were established in general and specialized hospitals for patients presenting with respiratory problems.

Dr Yatson Jesús Sánchez, chief of Emergency Services at the Pepe Portillo Pediatric Hospital in Pinar del Río Province, put out the call for screening volunteers declaring, “I need 16 crazy Quixotes, possessing the soul and calling of a doctor, to accompany me in the fight for our dearest treasure, our children.”[5] A few hours later, he had his Quixotes—14 Cuban and two foreign pediatric residents—who signed up to help staff the pediatric respiratory screening center in Cuba’s westernmost province. The provisional COVID-19 center includes an emergency room, separate wards for confirmed cases, possible cases and patients under observation, as well as an intensive care unit.

Working 24-hour shifts, followed by three days’ rest, residents receive children with respiratory problems in the emergency room and immediately perform comprehensive clinical exams and screen for a variety of respiratory infections. Those suspected as possible carriers of the SARS-CoV-2 virus are separated into the appropriate wards for observation, treatment and follow-up, while the rest are remitted to a specialized consult for acute respiratory infections. Babies 18 months or younger who have had contact with someone who has trav-

eled internationally are immediately remitted for observation after a comprehensive epidemiological survey and detailed conversation with the parents involving contact-tracing; residents are accompanied by a specialist throughout their shift, never seeing patients alone.

The screening center enforces international protocols for safeguarding the health of both patients and staff. This means that before each consult, residents don sterilized surgical caps, masks, goggles and gloves; changing these after each patient; and taking care to properly remove and dispose of these in separate, sterile receptacles for each item. Standard surgical hand-washing techniques are used and exams are performed at a distance of three feet, with the patient’s back to the resident or specialist. After each screening, all equipment and the exam room are disinfected. Says resident Dr David Gómez: “It’s vitally important that every surface is disinfected and to maintain proper distance so we’re separated from patients who might accidentally sneeze or cough near us—which can happen when you’re examining for respiratory infections. I’ve become an obsessive-compulsive hand washer!”[5]

Context-Specific Challenges

While Cuba’s national epidemic prevention and control plan, together with applied infectious disease experience and robust human resources are proving advantageous during this global crisis, certain difficulties in the country’s health system predate—and are compounded by—the onset of COVID-19. One is resource scarcity, exacerbated by the decades-long US embargo, which continues to block medical and other aid



I Muhammad

US ELAM student Ivan Smiley conducting active screening in Boyeros Municipality, Havana.

From the Front Lines

to Cuba from third countries.[6] Thus, domestic production of face masks, bleach and personal protective equipment has been accelerated, with some factories completely retooling their production lines. Nevertheless, other imported supplies integral to population health including food, raw materials for biotech products, replacement parts for medical equipment, gasoline for ambulances and other items necessary for stemming the pandemic, are directly affected by the US policy and by Cuba's limited economy.

Another challenge is low risk perception. As with HIV and other communicable diseases, confidence in the universal health system to protect and treat the population against COVID-19 is a double-edged sword, looming large during active screening. "Cuba had very few cases when we began our work in the community and our active screening wasn't taken as seriously by some local residents," says fourth-year ELAM student Ivan Smiley from Houston, Texas, USA, who began active screening on March 19. Nevertheless, in the later weeks, says Smiley, he has noticed that "the community has been more than cooperative, is grateful for what we're doing and that has only intensified." He attributes the change to the daily press conferences by the President, Health Minister and National Director of Epidemiology, news specials devoted to all aspects of prevention, control and treatment of COVID-19, as well as the efforts of private businesses, local law enforcement and other sectors.

"There is also a psychological element to the screenings," says Sol Henrik Bockelie. "When people see us with face masks and checking on each household, they're reminded of the seriousness of the situation." This provides an educational opportunity, he says: "We remind them to maintain physical distancing of 6 feet, to leave home only if essential, wash their hands with soap for more than 20 seconds, wear a face mask in public, and to clean or remove footwear before re-entering their house. People are always very kind."

Whole-population screening, however, has revealed another challenge, now a regular topic in the public briefings: hiding symptoms. Speaking specifically to the effectiveness of active screening during his April 7 briefing, Health Minister Portal said: "The population mustn't hide symptoms. You must alert screeners and family doctors to any symptoms. One of the latest fatalities was a patient who had not reported respiratory symptoms; nor did their family report those symptoms." [7] He went on to say that early detection is key and that lamentably, some patients are arriving at emergency rooms too late. To address this, screeners have adjusted their questioning both in length and depth.

Finally, Cuba's population demographics and general health picture have required an emphasis on vulnerable groups, including those with chronic diseases such as diabetes, hypertension and asthma, and those over the age of 60—since both pre-existing chronic conditions and advanced age have been identified as COVID-19 risk factors. Due to the fact that some 20% of Cubans are already older than 60, with the associated increase in co-morbidities, screeners are emphasizing early detection among the country's senior citizens, prioritizing them for longer, in-depth interviews and follow-up by their family doctors. Initial screening for everyone "over



Six days a week, third-year US ELAM student Kaylaa Banks is actively screening at homes and businesses.


60 was probably the most daunting task," says Smiley. "In a 12-story apartment building, you can find a lot of people who are over 60."

Despite the public's general cooperation, daily screening in record-breaking heat during a global pandemic can be stressful. But Ruiz, the fifth-year ELAM student from Jacksonville, says he channels the stress into energy: "Some people are afraid for themselves and their families and even burst into tears over what may happen in the future. Although screening can be taxing, being able to validate their concerns and give them hope provides me all the energy I need." Smiley says "Cuba is one of the calmest places to be on this planet right now...I've been handling the stress by studying for the USMLEs (US medical licensing exams), listening to music and communicating with friends and family back home." Yet, he admits he is often drained at the end of his screening shift, citing the relentless sun and general global uncertainty around COVID-19. Kaylaa Banks, a third-year ELAM student from Riverside County, California, USA, has implemented a well-body and mind routine to keep her stress at bay. "I move my body at least 15 minutes every day—doing yoga, a short workout or even simple stretches." Meditation and eating lots of fresh fruits and vegetables are also part of her daily regimen. And she keeps a journal. "I find joy in writing, knowing

that one day I'll be able to look back on COVID-19 as something we all conquered together.”

Conclusions

As the world continues to struggle against the pandemic caused by SARS-CoV-2 evidence from a variety of contexts shows that certain factors are fundamental in the fight against this common enemy, including: the political will to prioritize public health, community participation and cooperation in prevention measures, and the early case detection that leads to timely treatment. With an accessible universal system

rooted in community-based, primary health care and deep reserves of trained and experienced health professionals, Cuba was better prepared than many developing countries when COVID-19 struck—despite material scarcity, sometimes acute. From the beginning of the outbreak, time-saving efforts to seek out every suspected case were made possible by the willingness of thousands of trained medical students, with previous experience, to conduct total-population active screening. Honing their skills in the field, based on humanistic principles and ethical commitment to population and individual health, bodes well for their futures and that of their patients. 

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Global Collaboration in Times of COVID-19: Cuba's Emergency Medical Contingent

Conner Gorry MA

The days are long and arduous, with endless patients to attend, often in a foreign language, always on foreign shores. Far from family and the familiar.

Sleep is fitful at best for health professionals serving in emergency situations—when sickness obeys no clock and patients' pain haunts even the quiet moments. The crisis scenario varies: post-earthquake, hurricane or tsunami; amid a cholera or Ebola epidemic. The countries vary: Haiti, Pakistan, Guatemala, Mozambique, Sierra Leone. What does not vary is the answer to the calls for help and Cuban professionals' commitment to care for the most vulnerable. These aren't armchair musings or a political pat on the back: they are my own conclusions after living for weeks in close-quarter tents with Cuban doctors, nurses and biomedical engineers in post-earthquake Pakistan and Haiti, and witnessing their work.



Henry Reeve Contingent field hospital, Lombardy, Italy.

Since its founding in 2005, Cuba's Henry Reeve Emergency Medical Contingent has provided free medical services in nearly 30 post-disaster and epidemic situations. Recognized for its relevant, on-the-ground experience and humanistic approach—particularly during cholera outbreaks in Haiti following the 2010 earthquake and during the 2014 Ebola epidemic in West Africa—dozens of governments have requested Henry Reeve teams to help their health systems confront the COVID-19 pandemic. On March 26, 2020, the first team to go abroad began treating COVID-19 patients in a field hospital in Lombardy, Italy, established for this purpose.[1] Today, more than a thousand of these specially-trained and equipped health professionals (including family doctors, nurses, laboratory technicians, biomedical engineers and epidemiologists) are collaborating around the world to help prevent, contain and treat COVID-19; nearly all of them have previous experience serving overseas. This report was filed on April 24, 2020, with the latest available data.

In many cases, the Henry Reeve Contingent supplements Cuban health professionals already staffing public health systems abroad under bilateral agreements pre-dating COVID-19.[2] But the magnitude of this global crisis, combined with health system fragilities, inequities and the urgent need for global cooperation revealed by the pandemic, means new countries, contexts and components for the Contingent.

Two separate teams are now working in northern Italy, a focal point of the European outbreak, and on April 12, 2020, a team of 11 Henry Reeve specialists departed for Togo in sub-Saharan Africa[3]—both are contexts where Cuban health professionals have never before served. A Henry Reeve Contingent comprised

entirely of nurses—another first—arrived in Barbados on April 5. Of the 101 licensed nurses now serving in Barbados, 95 are women.[4] Indeed, of the nearly 1200 health professionals in the Contingent involved in fighting COVID-19, more than half are women.[5]

Safeguarding Human Resources at Home & Abroad

Cuba is no newcomer to international medical cooperation, launching its first disaster relief initiative in post-quake Chile (1960) and the first staffing of a foreign public health system in Algeria (1963). Nevertheless, guaranteeing effective, acces-



All-nurse brigade, a first for the Henry Reeve Medical Contingent.

sible care at home while collaborating abroad has prompted continual review of this strategy. The results have been neither linear nor seamless. Despite 13 medical universities and 25 medical faculties across the country conferring 6-year medical degrees at no cost to students, Cuba's international commitments periodically stress human resources at home—particularly during the 1970s with a rapid expansion of overseas agreements in health and more recently in 2008, which required a re-distribution of primary care services.[6] One response to these challenges has been to ramp up medical education: today, Cuba has 9 doctors for every 1000 inhabitants, or over 95,000 total.[7] Another was to formalize selection and participation protocols for volunteer overseas postings, including the Henry Reeve Medical Contingent.

The importance of these protocols becomes paramount during global public health crises such as Ebola and COVID-19, since everyone is at risk—patients in Cuba, as well as Cuban health professionals serving overseas. In order to assure quality care at home, volunteers for the Henry Reeve Contingent are only considered from those services, locales and institutions with available staff. Dr José Ángel Portal, Minister of Public Health, spoke to Cubans' concerns on this point on March 29 when he emphasized that “we use a fine-toothed comb to evaluate which professionals are eligible to work overseas,” so as not to affect health services for the population.[8] To properly prepare and protect professionals serving with the Henry Reeve Contingent, each must successfully complete pre-departure training, including modules on transmission dynamics, prevention measures, the use of personal protective equipment and biosafety protocols to be followed while attending patients. Each Contingent member also receives a real-time polymerase chain reaction (RT-PCR) test before travel. Specialists at the Pedro Kourí Tropical Medicine Institute (Cuba's



Henry Reeve Medical Contingent doctors attending patients in Suriname.

national reference center for infectious diseases and a PAHO-WHO Collaborating Center) hold teleconferences with doctors already abroad, supporting them with updated information and case discussions.

With a virulent pathogen like SARS CoV-2, the health and well-being of Cuban professionals working abroad—who are also mothers and fathers, sons and daughters, siblings, friends, neighbors and colleagues—can be a stressor for those back home. Regular



Henry Reeve Emergency Medical Contingent, Togo—one of the more than two dozen teams in 23 countries helping to contain and treat COVID-19.

From the Front Lines

contact with family and loved ones in Cuba is another protocol followed by the Henry Reeve Contingent, an issue addressed in televised press conferences by National Director of Epidemiology Dr Francisco Durán. “Thanks to today’s technology, all our health professionals, no matter where they’re serving overseas, have contact with their families here in Cuba. This is supplemented by coverage of our teams carried on nightly news.”[9] Additionally, every team serving in each country files a daily report that includes the health status of team members, according to Dr Jorge Delgado, director of Cuba’s Central Medical Cooperation Unit (UCCM).[4] In case of emergency, all efforts are made to swiftly unite families. Henry Reeve Contingent veteran Dr Eduardo Ojeda, who has served in Guatemala and El Salvador, reflects: “the homesickness and distance from your family can be heart-wrenching when you’re working abroad. But the Contingent becomes your family. We keep each other strong and ready to move forward.”[10]

Looking Ahead


As of this writing, Cuba’s Henry Reeve Medical Contingent has 24 teams working in 23 countries; this international commitment is likely to grow as the worldwide strain intensifies on health systems and the professionals staffing them. Indeed, local and national governments continue to solicit Cuban collaboration with their COVID-19 response. For their part, island authorities say they will review pending and future requests for Henry Reeve Medical Contingent participation in the fight against the virus, as long as the domestic situation and global context allow.[11]

Unfortunately, the politicization of population health—from defunding international health organizations to playing the “blame game”—has fatal consequences during a pandemic of this nature. Among the unacceptable: maintaining US sanctions on Cuba itself, keeping vital equipment and supplies from reaching the island’s health system, and increasing costs of medications.[12] coopera-



A nurse on the tarmac at Havana’s airport, heading for COVID-19 service in Cape Verde.

tion losing precious time to bureaucratic roadblocks (Manitoba’s First Nations request for Henry Reeve Contingent help, still pending as Canada debates visa logistics);[13] disinformation campaigns, whether about dangerous “miracle cures” or unreasonable questioning of Cuban physicians’ qualifications to practice abroad (such as the formal complaint registered by Argentinian medical associations to halt Henry Reeve assistance).[14]

Infectious disease knows no borders, pledges no national or political allegiance. If there is one thing COVID-19 is making clear, it is that global cooperation is a necessity, not a choice. 

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As the conceptualization of health broadens from strictly biological bases in medicine to encompass population and public health, social determinants, “One Health”, “Planetary Health” and the Agenda 2030, ***MEDICC Review*** aims to build upon this continuum, including its inevitable expression in the demand for health systems to reach universal access and coverage.

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We look forward to contributing, however modestly, to increased visibility for their work and to its positive impact on both regional integration and worldwide solutions.

US Physicians Trained in Cuba Battle COVID-19 at Home: A Personal Account from the New York City Epicenter

Gail Reed MS

Speaking remotely with US graduates of Havana's Latin American School of Medicine (ELAM), I found them at work on hospital floors, in ICUs and health centers across the United States, putting their professional and personal commitment to the test against COVID-19. Nowhere was that more evident than in New York City, the disease's epicenter, where one grad told me virtually every hospital has at least one MD from the Cuban school, which has provided free 6-year medical training for some 30,000 doctors since the school's founding in 1999. The student body comes primarily from low- and middle-income countries worldwide, but Cuba also provided 200 US students with scholarships.

One of them is Dr Joaquín Morante (ELAM Class of 2012), who did his medical residency in internal medicine, followed by fellowships in pulmonary disease and critical care medicine. Triple-licensed in internal medicine, pulmonary and critical care medicine, he is now an attending physician on staff at Jacobi Medical Center in The Bronx, one of New York City's public hospitals, and considered a 'hot spot' due to its COVID-19 caseload. I spoke with him during a break at home in mid-April.

Dr Joaquín Morante, ELAM Class of 2012: Pulmonologist, critical care attending physician at Jacobi Medical Center, New York City.



Courtesy J Morante

MEDICC Review: I think the first question I have to ask is how are you doing?

Joaquín Morante: A bit tired. I worked a 16-hour shift last night, which is how it's been since COVID-19 started its course through The Bronx and the rest of New York City. In normal times, I wear two hats: I do both inpatient and outpatient medicine as a pulmonologist, and inpatient medicine as an intensivist. So in the intensive care unit (ICU), I usually see patients admitted for a lung issue, such as chronic obstructive pulmonary disease (COPD), asthma and so on.

MEDICC Review: What kinds of patients do you see most at Jacobi Medical Center?

Joaquín Morante: Jacobi, a public hospital affiliated with the Albert Einstein College of Medicine, is one of the 11 hospitals under the umbrella of the city's Health and Hospitals Corporation: we are the public hospitals, a safety-net system. We're here for the uninsured and there's no other place for them to go. So we see a disproportionate number of uninsured compared to other hospitals. If you call the city's health hotline, you're automatically connected to the public hospital network.

We see people from all walks of life, a wide range of ages, and mainly Black and Latino patients because of where we're located, and who accesses the public system. Usually, we see the uninsured in an outpatient setting; if you're uninsured, you're unable to see an outpatient doctor in one of the private or

not-for-profit hospitals since there's no type of reimbursement for such places, so patients have to pay out of pocket.

But right now, we're dealing with an inpatient crisis, because people are being told to stay home unless they have shortness of breath. This means that the people we're seeing are already in respiratory distress, already need supplemental oxygen or some kind of medical support, such as rehydration or antibiotics for community-acquired pneumonia.

MEDICC Review: How did your hospital prepare for the influx of COVID-19 patients?

Joaquín Morante: In the beginning of the crisis, in terms of the public hospital network, we started to see the bulk of COVID-19 patients at Elmhurst Hospital in Queens and Lincoln Hospital in the South Bronx. Those hospitals quickly reached capacity and had to send their patients to others in the network. Here at Jacobi, our experience was that cases grew exponentially within a week: the first day we had one case, then twice that the next day, then twice that again. We doubled our ICUs from two to four, with the necessary ventilators, nursing staff and places to put these patients who would be admitted to the hospital with respiratory distress syndrome. Because hospital intensive care settings are where the health systems have been stretched to the limit. Normally, most hospitals have one intensive care unit that can handle 12 to 16 patients, and they usually run to capacity. But right now, we have 70 to 100 intubated patients at Jacobi Medical Center. That's quadruple the number we would normally be handling on ventilators.

From the Front Lines

MEDICC Review: What are the main challenges you're facing now?

Joaquín Morante: For us, it's the volume. We're seeing a non-stop, steady stream of patients with respiratory distress on the medical floors (who are not ventilated) and in the ICUs, where we manage mostly ventilated patients. We're filled to capacity. Last night, for example, I personally oversaw 36 ventilations and on top of those, cared for any emergencies for patients admitted to the general medical wards.

MEDICC Review: What does this mean for hospital organization, especially the ICUs?

Joaquín Morante: ICU patients require constant care, so as critical care doctors, our responsibility is to staff the ICU around the clock. There's always a critical-care attending in-house. During the day, we divide up the ICUs, so that one doctor is directly responsible for one ICU's patients. We usually work seven days straight, but because we're so overworked with COVID-19, we switched to a schedule where we work the day shift for five days, followed by two weeks when we work multiple night shifts. So it ends up looking like this: one attending covers days and a rotating staff of ICU doctors cover nights, to make sure that all the patients are safe and their treatment and care plans are executed 24 hours a day.

Of the four ICUs, three are our responsibility, but because we're spread so thin, trauma surgeons, who are also trained in critical care, are seeing COVID-19 patients admitted in what would normally be a surgical ICU. Since our hospital is a burn center and Level I Trauma Center, the surgeons aren't accustomed to seeing medical patients, so we end up co-managing those patients to help with the ventilators and medial issues. COVID-19 patients are extraordinarily complicated the world over. We're seeing a large proportion of these patients going into renal failure and requiring dialysis, going into heart failure—extremely coagulopathic, clotting more than normal. And also developing an inflammatory response, the cytokine storm, that has been deadly for a lot of these patients.

The result is that our ICUs are filled right now, with much sicker patients than usual landing on the general medical floors. We just don't have the capacity.

MEDICC Review: Do you have enough ventilators and other equipment you need?

Joaquín Morante: I will say—to the credit of New York City—that thus far, we have been able to obtain the ventilators we need; we've redistributed. Our 11 hospitals have looked at their capacities and moved ventilators from some of the smaller hospitals that have ventilators that they haven't needed to the hot spots. To Elmhurst, to Lincoln, to Bellevue, to Jacobi. As of two days ago, in terms of patients admitted to ICU, Lincoln was number one, then Elmhurst, then Bellevue, then Jacobi. Then the rest of the hospitals. So they moved the ventilators to hospitals where there was the surge, seeing a disproportionate number of these critically ill patients.

At Jacobi, we've come close to reaching our limit. I've had nights where we've only had one vent left. But we have not reached the

critical point where I've been out of ventilators. It's very scary if you have somebody who needs to be intubated and you don't have a ventilator to put them on.

MEDICC Review: What about supplies of personal protective equipment (PPE)? And has Jacobi staff been infected with the virus?

Joaquín Morante: The situation in New York City remains dire when it comes to PPE. And we have seen a lot of health care professionals getting sick. Last night, they asked me to come to help with another doctor, an emergency room physician who was symptomatic, with shortness of breath and tachycardia. We're seeing a lot of our colleagues, including nurses, medical technicians, people who come to clean patients' rooms, doctors, residents, attendings...we're all getting sick in very high numbers.

At Jacobi, we definitely don't have enough of the N95 masks that are so necessary. At this point at my hospital, if you're in the ICU, you get one N95 mask per day; before COVID-19, you would get an N95 mask anytime you entered a patient's room. And when you left, you would discard that mask. If you're on the general medical floors, you get one mask every three days. That's not enough PPE.

We have always had gloves, but we've had issues with getting gowns, face shields and goggles, too. Because of the media coverage about the lack of PPE, we've received many donations. So while we still don't have enough single-use PPE, as it should be, there has been more PPE available, so it doesn't have to be re-used by health workers over multiple shifts.

MEDICC Review: I know your partner, Aida Alston is also an ELAM graduate, right now volunteering at Montefiore Hospital here in The Bronx, but also spending most of her time with your two small children. How are you protecting your family?

Joaquín Morante: When it became evident that we were in the middle of a public health crisis here in New York City, I started wearing a mask in the house, to protect Aida and the kids, and started sleeping in a separate bedroom. And I distance myself. In no way do we touch, do we hug or can we be as close as we were four weeks ago. I haven't seen my father or my mother in weeks, except through video chatting. When they have needed anything, Aida is taking care of it, but we've also tried to isolate my parents from the kids, who might be vectors of transmission.

I wear a mask because I could be asymptomatic. As an intensivist, I'm doing procedures with these patients that are considered the highest risk: I'm intubating, which is where you aerosolize their respiratory secretions. That can get into your mucous membranes, into your eyes...you can inhale it. And get infected.

MEDICC Review: Handling such a load of critical COVID-19 patients...are there some who have really gotten to you personally?

Joaquín Morante: I think the whole process has been tough. We're seeing eight or ten patients dying in one shift. That's almost a patient an hour on some nights. If you were in a wartime situation and you had a soldier die every hour, you would consider

that to be pretty heavy combat, enormous casualties. To have these patients dying like this takes a tremendous emotional and psychological toll on you. These are people's grandmothers and grandfathers, mothers and fathers, brothers and sisters. Here in New York, many weeks ago we stopped allowing visitors into the hospital to limit exposure. So these are people who are also dying alone, with no family members next to them to say goodbye. You're the last person they're seeing.

Mortality in patients with severe respiratory distress syndrome and who are connected to the ventilators is quite high right now. So from a critical care perspective, although we continue to learn about the disease, we're not having a tremendous amount of success in extubating these people and getting them better, being able to liberate them from the mechanical ventilators. We're not seeing constant success with extubation; it has been a very unpredictable disease for the critically ill.

Seeing so many patients requiring oxygen and respiratory support, and at the same time, losing so many...it takes an enormous psychological toll. And while in some ways we were prepared for high mortality with our older patients, anecdotally, I've seen 29-year-olds die and 35-, 38-year-olds die from this disease. So it's not just octogenarians, it's also your young cousin who has suffered from this disease...and that's been quite humbling.

MEDICC Review: New York City has been an epicenter of COVID-19 in the United States, and even in the world. What lessons can we draw?

Joaquín Morante: Here in New York City, they've just come out with COVID-19 mortality reports by race. They are saying deaths among African Americans and Latinos are the highest and second-highest respectively and African Americans are twice as likely to die from COVID-19 as Whites. The lessons? We already knew the lessons, that Blacks and Latinos are especially vulnerable when it comes to health care. We have the highest rates of chronic disease, not because it's our fault, but because we don't have access to health care, we live in food deserts, live on top of each other and in urban environments where disease is easily transmittable. We are less educated, because we have fewer educational opportunities. So these rates are a reminder, a product of this situation, as Malcolm X said, "of the chickens coming home to roost." Of a health care system that is not set up to take care of people, that's not set up to take care of poor people, that doesn't have its values established in taking care of people of color, of taking care of immigrants and taking care of the undocumented. This COVID-19 result is what you get.


Also from an acute public health standpoint, what can we learn? You have to take preventive measures early. This is definitely a

disease with high transmissibility, and your health system can be easily overrun in a matter of hours. I remember feeling helpless during the early surge. I think physical distancing and getting people to wear masks, teaching people proper hygiene, about washing their hands, has been very important, crucial. Moves to isolate, quarantine, track contacts of positive cases, and early testing to identify COVID-19-positive patients are all important. We dropped the ball on every single early intervention we could possibly have made. We didn't have enough tests. We didn't self-isolate and self-quarantine quickly enough. We didn't track close contacts of positive cases. We sent positive cases home, without properly tracking those patients.

I think that getting ahead of this and trying to flatten the curve from the very outset is vital. There's no doubt that this virus is going to circulate once it gets into a community. But flattening the curve from the outset, so that the resources of your health care system are not overtaxed, is so important. And that leads to another point: you have to have a plan in case your system becomes overwhelmed. How are you going to triage these patients; where will you put them; do you have the necessary number of ventilators; do you have the necessary staff to take care of acute patients? And all of that has to be done before you have the possibility of being overrun by the disease.

MEDICC Review: You were trained as a physician in Cuba. Are there experiences or approaches you learned in Cuba that you find useful now?

Joaquín Morante: Cubans are very disciplined and very quick to implement preventive measures and to use all the resources of their health care system to do a number of key things. Number one is education, which was something we lacked here early on. We didn't do education for the population, telling the public how this disease was transmitted, what were the proper preventive measures to take. We did all of that late, after the horse was out of the barn.

Cubans have always been very good at prevention. Look at dengue, when they had health professionals and medical students knocking on doors, house-to-house, looking for possible sources of vector transmission. We were looking to see if there was standing water in people's homes; we were giving people the proper insecticide. They've always done a good job of saying 'where can we limit the opportunities for transmission of infections?' And here, we don't have that discipline. We have this disjointed system that wants the private sector to do that education. And when it came down to PPE, we left it to the private sector, too. But the private sector is reactionary, not proactive, and so its response is very slow. When you react, it's already too late. That's what we've seen here in New York. 

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