

Review

Insights from Cuba's public health achievements: Implications for African countries

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Cuba's health system has enabled remarkable population health achievements despite resource limitations. This analysis explores Cuba's model to discern insights for healthcare reform in developing nations seeking to enhance access and equity. A scoping review was conducted to synthesize existing literature on Cuba's health system post-1959 revolution. Policy documents were analyzed to trace systemic reforms. Quantitative data was examined to assess health indicators over time. Following the revolution, Cuba constitutionally entrenched healthcare as a universal right and implemented extensive reforms to promote equity. Strategic emphasis on prevention-oriented community-based primary care, medical education expansion, and building domestic biomedical capabilities enabled major gains, as evidenced by indicators like infant mortality rate declining from 46 to 4.3/1000 live births between 1960 and 2016. However, contemporary challenges remain around demographic shifts, infrastructure, and financing sustainability. Cuba's model demonstrates that with political commitment to health equity and strategic investments in public systems, remarkable improvements are feasible even with constrained resources. Components like equitable access, robust primary care, localized innovation, and social medicine principles remain relevant for developing countries seeking pro-poor reforms. However, adaptations are required based on specific contexts.

Key words: Cuba, health system reform, universal health coverage, health equity, primary care, developing countries.

INTRODUCTION

Cuba's public health system has garnered significant international attention and praise over the decades. Despite possessing limited economic resources and infrastructure compared to more affluent nations, this small Caribbean Island has achieved remarkable health outcomes that rival even the most developed countries.

Cuba's infant mortality and life expectancy statistics in particular are on par with wealthy nations like the United States and Canada, even though its healthcare spending per capita is a fraction of theirs (Mas Bermejo et al., 2021; Macrotrends, n.d). This seeming paradox has made Cuba's model a subject of great interest and

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Table 1. Health indicators by selected years.

Indicator	Years			
	1985	1990	2000	2016
Infant mortality ^a	16.5	10.7	7.2	4.3
Mortality in children aged <5 years ^a	19.6	13.2	9.1	5.5
Low birth weight ^b	8.2	7.6	6.1	5.2
Hospital admissions ^c	16	15.2	11.9	11.4
Population per doctor	439	274	170	125
Number of family doctors	237	11 915	30 726	46 302
Population seen by family doctors	1.7	54.8	100	100

^aRate per 1000 population. ^bIn percentages. ^cRate per 100 population.
Source: González Cárdenas et al, 2018,

analysis within the global health community

Cuba as a health model for developing countries

Cuba's public health achievements have attracted global interest, especially among developing nations seeking to enhance healthcare access cost-effectively. This small Caribbean Island has managed to attain health outcomes rivaling affluent countries despite limited economic resources. Cuba's infant mortality rate of 4.1/1000 live births and life expectancy of 79 years are on par with the US and Canada, even though its per capita health expenditure is a fraction of theirs (Mas Bermejo et al., 2021; Macrotrends, n.d.). What explains this paradox? Can aspects of Cuba's model be replicated by other developing countries to maximize health outcomes amidst resource constraints? This analysis explores Cuba's health journey historically to discern key policies, strategies, and innovations that enabled its successes. By identifying best practices that align with the unique contexts of other developing nations, insights emerge on whether and how Cuba's model can inform health system strengthening globally.

CUBA'S HEALTH SUCCESSES

Since the 1959 revolution, Cuba has made remarkable health gains. It has one of the highest physician densities globally, with 8.4 doctors per 1,000 population compared to just 2.6 in the US, 3.3 in France, 0.2 in sub-Saharan Africa, and 1.2 globally (World Bank, n.d). Alongside the expansion of medical education, Cuba embedded neighborhood-based primary care teams nationwide to provide continuous preventive care and education. While infectious diseases prevailed pre-revolution, non-communicable diseases (NCDs) now cause 84% of Cuban deaths, signaling an epidemiological transition (WHO, 2018). Cuba responded by enhancing community-based NCD screening, prevention, and management.

Consequently, Cuba achieved an under-5 mortality rate of 5.5 per 1,000 live births and a maternal mortality ratio of 36 per 100,000 live births by 2019, outperforming many Latin American and Caribbean nations (UNICEF, 2020). Cuba also developed its own COVID-19 vaccines and vaccinated over 86% of its population by February 2022, despite facing US trade embargoes (Taylor, 2021) (Table 1). What facilitated these accomplishments with limited resources?

Health as a right for all citizens

A key catalyst was the government's commitment to healthcare as a constitutional right for all Cubans after the revolution. The new socialist government prioritized tackling stark urban-rural and race-based health inequities that existed pre-revolution. Rural medical facilities expanded from 11% to over 30% between 1960 and 1970, enhancing rural care access (Huish and Kirk, 2007). Alongside substantial investments in medical education, Cuba achieved one doctor per 150 citizens by the 2000s, abolishing glaring provider shortages and urban biases (Keck and Reed, 2012). Universal health coverage was enabled via free care at the point of use and funded through general taxation. By entrenching health as an inalienable right and underpinning policies to uphold it, Cuba laid the foundations for its public health gains.

Emphasis on prevention and community-based primary care

Cuba recognized that reactive hospital-centric models would be untenable and inefficient given its resource constraints. Instead, the focus shifted upstream to prevent diseases before they manifested. The nationwide Family Doctor-and-Nurse Program established neighborhood-based care teams to provide continuous risk screening, health promotion, and primary care to

Table 2. Indicators of Cuba's accomplishments in public health.

First country to eliminate polio—1962
First country to eliminate measles—1996
Lowest AIDS rate in the Americas
Most effective dengue control programme in the Americas
Comprehensive health care; 1 physician per 120–160 families
Highest rates of treatment and control of hypertension in the world
Reduction in cardiovascular mortality rate by 45%
Crude infant mortality rate of 5.8 per 1000
Development and implementation of a 'comprehensive health plan for the Americas'
Free medical education for students from Africa and Latin America
Support of 34 000 health professionals in 52 poor countries
Creation of a national biomedical internet grid (INFOMED)
<u>Indigenous biotechnology sector; producing the first human polysaccharide vaccine</u>

Source: Cooper et al. (2006).

each citizen (Iatridis, 1990). By empowering communities and families to proactively monitor health alongside clinicians, hospitalizations are reduced. For instance, Family Doctors conducted over 56% of all emergency visits by 2000, showcasing reduced tertiary care burdens (HRHH, 2019). Beyond clinical services, the program also addressed social determinants of health within communities through health education, social support linkages, and outreach (Huish and Kirk, 2007). This preventive, grassroots-centric, and socially-oriented primary care model allowed optimal health service delivery despite resource limitations (Table 2).

Promoting health equity and social development

Cuba framed health as an issue of social justice and equity. Pre-revolution, Afro-Cubans and rural citizens had markedly poorer health indicators, but Cuba systematically closed these gaps through policies expanding access to education, social welfare, and health resources to deprived groups (Pineo, 2019; Keck and Reed, 2012; Cooper et al., 2006). Beyond access, Cuba trained providers in culturally-sensitive care to minority groups and implemented targeted programs to reach vulnerable groups like sex workers with HIV services (Mas Bermejo et al., 2021). Cuba thus demonstrated that promoting equity required dismantling historic barriers to healthcare and social resources while also supplying services tailored to marginalized groups' needs. This commitment to health equity was crucial for Cuba's population health gains.

Self-Reliance in biomedical innovation

Cuban authorities have made significant advancements

in health care practice, especially in the biomedical and chemical domains, with a strong emphasis on biopharmaceuticals. With unwavering political support and technical collaborations, notably with the URSS and Russia, Cuba has been committed to producing essential medicines and vaccines tailored to meet its population's health needs (Pineo, 2019; Keck and Reed, 2012). This self-sufficient approach has not only benefited the Cuban populace but has also been a significant revenue source for the country. A testament to their achievements in this field is the development of the world's first vaccines for diseases like meningitis B and Haemophilus influenza B in Cuba (Cooper et al., 2006). This innovative biotechnology sector enabled agile COVID-19 vaccine development, rapid response vaccine production at low cost, and vaccine self-sufficiency amidst global supply constraints (Taylor, 2021). Cuba's focus on homegrown health innovation despite resource limitations and embargoes was pivotal to its resilience.

Lessons for other developing countries

Cuba's model offers insights for health reform in developing countries through its emphasis on health equity, prevention-focused community-based primary care, and locally-driven innovation under resource constraints. However, some contextual considerations remain.

Cuba's authoritarian governance enabled rapid health program implementation without typical democratic processes. Socialized medicine was feasible given wider socialist economic policies. Without similar political structures, developing nations may face challenges replicating Cuba's policies. Cuba also benefits from high health literacy rates that empowered community health worker models. Such grassroots programs may need

adaptation in settings with lower literacy (Battle, 2015).

Nonetheless, components of Cuba's model remain relevant for developing countries seeking pro-poor reforms to maximize health gains despite scarce resources. Its resolve to universalism, equity, and community empowerment are adaptable to diverse contexts. The focus on local innovation could be emulated by nurturing south-south collaborations tailored to regional health needs. Overall, Cuba provides an aspirational model of health system strengthening amidst constraints through its unwavering commitment to health equity, prevention, and self-reliance.

Cuba's health system: Structure and functioning

Cuba's health system is grounded in the country's socialist political ideology that frames health as a fundamental human right for all citizens (Iatridis, 1990). The system is structured into three key levels: 1) the community level, 2) the primary care level, and 3) the secondary/tertiary care level (Cuba Platform, n.d).

At the grassroots, neighborhood-based consultorios staffed by a family doctor and nurse provide personalized and continuous care for a defined population. Family doctors conduct home visits, health promotion, disease prevention, and primary care consultations. Polyclinics at the municipal level offer more complex outpatient and specialist services. At the apex are the secondary and tertiary hospitals providing specialized inpatient and emergency care. This tiered structure has enabled Cuba to deliver universal care despite resource constraints.

Some defining features of Cuba's health system include:

- (1) Free access at the point of use: Healthcare is free for all Cubans at consultorios, polyclinics, and hospitals funded through government spending. This eliminates financial barriers that deter access.
- (2) Focus on primary care: By emphasizing community-based prevention and care, Cuba reduced unnecessary hospital utilization, enabling wider access and cost-efficiency.
- (3) Commitment to health equity: Cuba instituted policies and programs to systematically address urban-rural, race, and gender divides in accessing quality healthcare.
- (4) Local health innovation: Cuba focused on domestic research and production capabilities to achieve pharmaceutical and biotechnology self-sufficiency, vital for its resilience.
- (5) International health cooperation: Cuba exports doctors and other health professionals globally through its 'medical internationalism' program based on global health solidarity. It also offers free medical training to students from developing countries at its Latin American School of Medicine.

While Cuba's health achievements are remarkable given

its economic constraints, the system also has critiques. Government control and limited transparency regarding health statistics has led to questions about the validity of reported outcomes. The system's sustainability is threatened by Cuba's demographic crisis of a rapidly aging population with declining births. Furthermore, while Cuba expanded access to biomedical innovations, equipment maintenance and upgrading remain a challenge.

Nonetheless, Cuba exemplifies how developing countries can optimize health system performance through a strong primary care foundation, pro-equity reforms, and self-reliance. Components of its model remain relevant for low-resource settings seeking to learn from Cuba's commitment to population health.

The following discussion delves deeper into key aspects of Cuba's health successes, challenges and lessons.

CUBA'S AGING POPULATION: A DEMOGRAPHIC CRISIS AND POTENTIAL SOLUTIONS

Situated a mere 90 miles off Florida's coast, Cuba is a unique blend of rich culture, revolutionary history, and distinctive socio-economic challenges. With an estimated population of 11,314,111, this Caribbean nation boasts an impressive life expectancy, rivaling even some developed nations (World Population Review, n.d). Yet, beneath the surface of these statistics lies a looming demographic crisis that poses significant socio-economic challenges.

Historical context

From the 1960s to 2020, Cuba underwent a considerable demographic transition. While life expectancy rose dramatically from around 62 years in the 1960s to approximately 79 years by 2020, fertility and birth rates showcased a contrasting trend. The birth rate, which stood at 31.265/1000 in the 1960s, plummeted to a meager 9.88/1000 by 2020. The fertility rate saw a similar decline from 4.6 births per woman to 1.6 over the same period (Macrotrends, n.d).

Several factors contributed to this demographic shift. The Cuban government's extensive sex education programs, universal healthcare access, including abortion facilities, and an increase in women's participation in the workforce have all played pivotal roles. Additionally, substantial emigration, especially to countries like the US, Mexico, Canada, and Jamaica, has further contributed to the changing demographic profile (Díaz-Briquets, 2015).

The implications of an aging population

Forecasts suggest that by 2028, Cuba's population growth will stagnate, initiating a gradual decline. By 2050,

projections estimate a drop to 10,823,000, a significant reduction over a short period (U.S. Census Bureau, n.d). But numbers only tell half the story. The real challenge lies in the rapidly aging population. By 2050, the dominant age group will likely range from 60 to 75 years, with over 1.5 million individuals aged above 80 (U.S. Census Bureau, n.d). This demographic profile, reminiscent of an inverted pyramid, will exert immense pressure on Cuba's social welfare and healthcare systems.

An older population invariably leads to increased healthcare costs, especially chronic disease management and geriatric care. Furthermore, as the working-age population shrinks, fewer individuals will contribute to the national pension and healthcare funds, potentially leading to their insolvency.

Governmental response and potential solutions

In anticipation of these challenges, the Cuban government has initiated various policy measures. These include the reduction or elimination of certain subsidies, especially in elderly care to reduce health care expenses. Additionally, to counter the declining birth rate, financial and social incentives are being offered to encourage larger families (Díaz-Briquets, 2015).

Cuba's approach to migration has been two-fold. On one hand, by adhering to international accords and policies, Cuba aims to manage internal discontent and bolster remittances (Duany, 2017). On the other hand, the focus has been on drawing in skilled and youthful migrants, but results have been modest due to the nation's economic constraints (Díaz-Briquets, 2002).

This is a challenge mirrored in many Western nations, and increasingly in countries like China, South Korea, and Singapore. Common strategies adopted globally to address these issues include policies to encourage larger family sizes and the introduction of immigration incentives targeted at skilled and younger migrants. However, Cuba faces unique challenges in this arena. Its economic situation, characterized by limited financial resources and families grappling with fundamental needs, combined with a centralized, state-run economy and a noticeable absence of private enterprise, makes it less appealing to potential migrants when compared with other nations (Díaz-Briquets, 2002).

In a bold move, the government increased the retirement age and reduced social subsidies. Recognizing the strain on the public healthcare system, there's a push for familial caregiving for the elderly instead of relying solely on professional services. Additionally, non-state entities are being encouraged to manage health facilities, potentially fostering competition and reducing costs (Díaz-Briquets, 2015).

Yet, these steps might only provide temporary relief. A comprehensive strategy is required. Many experts

advocate for a radical overhaul of the nation's economic governance model. By fostering an environment conducive to private investment and entrepreneurship, Cuba could potentially tap into its educated populace's potential, driving economic growth and offering a sustainable solution to its demographic challenges.

THE LANDSCAPE OF NON-COMMUNICABLE DISEASES (NCDs) IN CUBA

Since its second epidemiological transition, Cuba's health challenges began to reflect a global trend: a significant shift from infectious diseases to non-communicable diseases (NCDs). In the 20th century, infectious diseases were the primary health concern, but by 2016, NCDs represented 84% of all deaths in Cuba [World Health Organization (WHO), 2018]. This pattern signifies a substantial evolution in the nation's health landscape, where earlier concerns were replaced by diseases often related to lifestyle and aging.

In Cuba, chronic illnesses are a significant concern, accounting for 60% of all deaths. The leading causes include cardiac conditions, followed by cancers and diseases affecting the brain's blood vessels (Dieci et al., 2021). This prevalence aligns with a broader trend observed across many nations in Latin America and the Caribbean. Globally, cardiovascular diseases have become predominant due to a mix of genetic, environmental, and lifestyle influences. In the context of Cuba, the high death rate from these diseases is further aggravated by an aging population, widespread tobacco use, and notable alcohol consumption. Addressing cardiovascular diseases is in line with global health priorities, underlining the importance of targeted interventions (Dieci et al., 2021).

Addressing health needs with limited resources

Cuba's constitutional mandate to provide care for all its citizens is commendable. However, it is a promise that comes with challenges, particularly when the resources, both in terms of technology and finances, are limited (Keck and Reed, 2012). Yet, Cuba's approach to this challenge is notable.

The Cuban health policy, grounded in the philosophy that prevention is better than cure, emphasizes primary and secondary care. This policy mirrors the belief that "It makes sense to go upstream, to catch the problem before it begins or very soon afterward" (Iatridis, 1990). Such an approach is cost-effective and reduces the strain on the tertiary healthcare system.

Cost-effectiveness is crucial, especially for nations with limited resources. Data on the Disability Adjusted Life Years (DALY) cost-effectiveness of various Cuban prevention programs highlight the nation's pragmatic

approach. For instance, a program controlling rheumatic fever and heart disease in Pinar del Rio was found to avert death at an approximate cost of \$1500 US (Watkins et al., 2015). When juxtaposed with similar studies from other low- and middle-income countries, these numbers underline the effectiveness of Cuban health interventions (Horton et al., 2017).

Strategies in response to chronic diseases

Cuba's multi-pronged approach towards NCDs, and especially cardiovascular diseases, starts at the community level. The focus is on decreasing exposure to risk factors and preventing severe diseases. Risk factors identified between 1995 and 2010 include tobacco consumption, alcohol dependence, obesity, lack of physical activity, and hypertension (Landrove-Rodríguez et al., 2018). Addressing these required a multi-sectoral effort, involving not just the health sector but also education, community organizations, and local governance.

To prevent the impact of these risk factors, specialized personnel received training across the provinces in order to integrate newer technologies, foster community engagements, promote multidisciplinary approaches, and ensure surveillance of chronic disease risk factors (Landrove-Rodríguez et al., 2018). This reorientation towards primary care was accompanied by infrastructure developments, such as the construction of physical rehabilitation rooms in polyclinics across the country, further highlighting the importance of community-based preventive measures (Landrove-Rodríguez et al., 2018).

Another pillar of the response strategy is the Family Physician and Nurse program, initiated in 1985 subsequently discussed. This program, developed in response to an aging population and a surge in chronic diseases, embedded medical teams within communities, ensuring immediate and holistic care. By 2000, these teams handled a vast majority of outpatient and emergency visits, underscoring their critical role in the healthcare framework (Keck and Reed, 2012).

Beyond primary care, Cuba also emphasizes specialized care. The establishment of intensive care rooms across the country, focusing on chronic diseases, is a testament to this. Moreover, Cuba's biotechnology institutions play a pivotal role in producing diagnostic tools, medicines, and other essential medical supplies, ensuring high levels of therapeutic coverage at subsidized costs (Landrove-Rodríguez et al., 2018).

CUBA'S HEALTH TRANSFORMATION: EQUITY, QUALITY, AND UNIVERSAL ACCESS

The World Health Organization (WHO) recognized during its Thirteenth Global Program of Work (GPW13) that

identifying health inequalities and their drivers is fundamental to achieving health equity. The socio-determinants of health (SDOH) are central to these inequalities, which can dictate health outcomes within populations (American Medical Association, 2021).

Before 1959, Cuba exhibited pronounced disparities in health and other societal aspects. Many faced barriers to education, and illiteracy was rampant, with nearly half the population unable to read or write. Living conditions were dismal for many, especially in rural districts and Afro-descendant areas. The nation's health infrastructure was overwhelmingly urban-centric. Havana, with less than 20% of Cuba's population, was home to about 70% of its doctors, underscoring the vast inequities in healthcare access (Cooper et al., 2006).

Following the revolution, Cuba underwent a significant transformation. The post-revolutionary Cuban constitution emphasized core principles of equity, social justice, and human and social development. Consequently, decent healthcare was established as a non-negotiable right for all Cubans (Pineo, 2019). The commitment to free, quality healthcare was not mere rhetoric. Over the years, efforts were made to eliminate the gap between urban and rural healthcare access. The expansion of medical education became a priority. From having a single medical school, Cuba built 13 medical schools with 25 faculties, producing thousands of national and international graduates every year (Gorry, n.d.).

The statistics provide a testament to Cuba's health metamorphosis. The nation boasts a remarkable physician-patient ratio, with 1 doctor for every 150 people, making it one of the most medicalized countries globally (World Atlas, n.d). Furthermore, infant mortality, a reliable metric of a health system's performance, stands at an impressive 4.1 per 1,000 births, surpassing even some developed countries (Macrotrends).

In the realm of pharmaceuticals and biomedicine, Cuba has exhibited exceptional prowess. The consistent political will, coupled with strategic collaborations with the USSR, enabled Cuba to produce medicines and vaccines that not only catered to domestic needs but also created a new export avenue (Keck and Reed, 2012). The development of vaccines, like the first meningitis B and *Haemophilus influenzae* B, underscores Cuba's contributions to global health (Reed, 2016).

These enhancements significantly transformed the Cuban health landscape, as outlined in Table 2. However, two programs deserved to be special attention.

Family Physician and Nurse Program

The Family Physician and Nurse Program, pioneered in the 1980s, was Cuba's ambitious response to an evolving set of public health challenges. The country was not just grappling with the natural process of its populace aging but was also witnessing an alarming rise in chronic

Table 3. Distribution of outpatient and emergency room visits by level of care.

Level of care	2015		2016	
	N	%	N	%
Outpatient visits	68 744 699	100.0	71 594 464	100.0
Hospital	5 293 342	7.7	5 154 801	7.2
Primary care	63 451 357	92.3	66 439 663	92.8
Family doctor	51 421 035	74.8	54 125 415	75.6
Emergency room visits	20 412 903	100.0	18 286 319	100.0
Hospital	7 879 381	38.6	7 277 955	39.8
Primary care	12 533 522	61.4	11 008 364	60.2
Other				
Community outreach visits	15 001 781		16 376 473	
Home visits	438 473		425 530	

Source: González Cárdenas et al., 2018,

ailments such as ischemic heart diseases, cancers, and other infectious diseases (Pattison, 2017).

Understanding that merely reacting to these diseases once they had manifested would not be a sustainable approach, especially in a resource-constrained environment, Cuba took a proactive stance. The government envisioned a system where individual citizens and their families were not just treated for their ailments but were continuously educated, monitored, and given preventive care (AMA, 2021). To implement this vision on the ground, teams consisting of 15 healthcare professionals were created. These teams were not just confined to traditional healthcare settings; they were embedded in the very fabric of Cuban society. From neighborhoods and schools to factories and childcare centers, these healthcare teams became an omnipresent force. Their integrated approach meant that healthcare was not an abstract concept people sought in hospitals, but was an everyday reality, present at every corner (Pattison, 2017; Kengadaran et al., 2020; AMA 2021). By the year 2016, data suggests that the program's deep integration was bearing fruit, with a staggering 76% of outpatient visits and only 40% of emergency care was taken to the hospitals, the rest managed at the primary care levels, showcasing their pivotal role in the Cuban healthcare paradigm (Cardenas et al., 2018) (Table 3).

Program intended for the most vulnerable

While the Family Physician and Nurse Program was revolutionary, the Cuban government recognized that certain sub-sections of the population had unique needs that demanded specialized attention. With this understanding, the 'Program Intended for the Most Vulnerable' was introduced in 1983, placing a strong

emphasis on women's health (AMA, 2021).

Recognizing that women, especially those from marginalized sections, were often at the receiving end of health disparities, this program was tailored to address the myriad challenges they faced. The gamut of services offered was vast. It ranged from basic healthcare interventions like contraception to more intricate services such as regular prenatal care, postnatal baby check-ups, and vaccinations. Furthermore, acknowledging the potential complications associated with high-risk pregnancies, the program instituted provisions for immediate medical care (AMA, 2021).

CUBA'S RESPONSE TO THE COVID-19 PANDEMIC

The COVID-19 pandemic posed an unprecedented challenge to health systems globally. Cuba's response has been notable for its emphasis on proactive containment, leveraging of domestic biomedical capabilities, and maintaining health equity principles.

Early in the pandemic, Cuba implemented strict containment measures including border closures, quarantines, localized lockdowns, and active surveillance (Salas, 2020). These proved largely successful in delaying widespread transmission during the initial wave in 2020 (Aljazeera, 2020). Cuba's established primary care infrastructure, with consultorios embedded within communities, facilitated case identification and contact tracing. During lockdowns, family doctors conducted door-to-door monitoring of vulnerable groups to mitigate health risk (Burki, 2021).

However, with gradual reopening and the arrival of more contagious variants, Cuba witnessed escalating case counts in 2021 (Our World in Data, n.d). This overwhelmed contact tracing capacities and strained

hospital capacities (Reuters, 2020). Cuba responded by rapidly mobilizing medical students and converting other facilities into COVID-19 wards. Nonetheless, these reactive measures proved insufficient to contain the Delta wave.

A pivotal aspect of Cuba's pandemic response was leveraging its biotechnology sector to develop five COVID-19 vaccine candidates domestically. Mass vaccination began in May 2021 using the Abdala and Soberana 02 vaccines. By harnessing its existing research and production infrastructure nurtured due to past resource scarcities, Cuba rapidly developed and manufactured cost-effective vaccines despite embargoes (Taylor, 2021). This exemplified the dividends of Cuba's long-term investments in health self-reliance.

However, vaccine uptake was initially hampered by citizen distrust and complacency. Cuba countered this through nationwide mobilization efforts emphasizing social solidarity. By March, over 95% of the population was fully vaccinated (New York Times, 2023). Cuba also exported vaccines overseas, upholding its commitments to global health cooperation.

While Cuba's pandemic response has not been flawless, its early successes highlight the value of preparedness and agile leveraging of domestic capabilities. However, reactive restrictions to contain renewed surges proved socially and economically unsustainable. More sustainable measures aligned with "new normal" living are required to look ahead. Nonetheless, Cuba's pandemic response exemplifies adaptable governance, biomedical innovation, and health solidarity amidst constraints.

STRENGTHENING CUBA'S HEALTH SYSTEM FOR THE FUTURE

Looking toward the future, Cuba must adapt its health system to evolving demographic, epidemiological, and economic realities. Four priority reforms are recommended based on an analysis of existing challenges:

1. Restructuring elderly care: The needs of the expanding aged population will strain Cuba's health infrastructure. Scaling up non-institutional long-term care through community and home-based care integrated with primary care services could optimize elderly care capacity.
2. Modernizing equipment and digital health: With outdated medical equipment and limited adoption of digital health tools, Cuba's health system modernization is imperative. A balanced approach is needed between domestic production and strategic import procurement to upgrade health technology access.
3. Sustainable chronic disease management: The growing NCD burden warrants optimizing preventive services and better integrating specialized care into

community-based care pathways for holistic chronic disease management.

4. Economic reforms to support health: Broader economic liberalization reforms to spur growth, foreign investment, and private enterprise are required to financially sustain Cuba's expansive health system. However, equity must be safeguarded when optimizing financing and efficiency.

Targeted capacity building, carefully sequenced reforms, and global learning exchanges focusing on these priority areas could help Cuba's health system successfully adapt to emerging realities. Political will is integral to instituting bold reforms aligned with the country's values of equity and solidarity. If accompanied by wider economic reforms, Cuba can pioneer dynamic health systems strengthening for the 21st century.

CONCLUSION

In retrospect, Cuba's healthcare framework serves as a beacon for nations navigating the challenging terrains of public health amidst economic constraints. By constitutionalizing health as an inalienable right, Cuba has bridged healthcare disparities and set a precedent in pro-active, community-based care. This holistic approach, augmented by an unwavering focus on preventive strategies and indigenous medical and biotechnological advancements, has imbued the Cuban health landscape with resilience and self-reliance. However, for the Cuban health model to remain relevant and efficacious, addressing impending challenges, from sustainability to infrastructural upgrades, becomes imperative.

While lauding Cuba's strides since 1959, the extant literature often presents fragmented insights or veers towards a predominantly descriptive narrative. The literature's proclivity to spotlight specific programs or timeframes, without encompassing the entire post-1959 health journey of Cuba, leaves much to be desired. Moreover, the dearth of global comparative studies renders the literature somewhat parochial, especially given the universal applicability of many of Cuba's strategies. Surprisingly, the commendable and agile pandemic response of Cuba, a testament to the system's robustness, remains under-discussed.

This research endeavors to plug these literary gaps, offering an exhaustive, balanced, and forward-thinking purview of Cuba's health journey. Rooted in the nation's current health landscape, our work suggests actionable reforms and extrapolates vital insights for nations aspiring for equitable healthcare. By emphasizing Cuba's pandemic management and vaccine developments, we underscore the system's malleability and robustness. The aim is to present a holistic, globally-relevant, and insightful discourse on Cuba's healthcare journey, catalyzing informed health policy dialogues and actions across the globe.

DISCLOSURE

This manuscript explores the Cuban healthcare model's adaptability, with particular emphasis on its applicability for resource-constrained developing nations, a thematic overlap with Ronn Pineo's "Cuban Public Healthcare: A Model of Success for Developing Nations" (Journal of Developing Societies, 2019). However, the nuances in the approach used provide a fresh perspective. While Pineo delves into a broad economic, political, and historical examination of Cuban healthcare, the analysis zeroes in on the specific, replicable elements of this model. The study aims to discern how its strategies might be tailored to the unique challenges and contexts of diverse geopolitical landscapes.

A distinct facet that the manuscript introduces is Cuba's agile response to the COVID-19 pandemic and its leveraging of the biotechnology sector for domestic vaccine development. This serves as a testament to Cuba's long-standing investments in health self-reliance and its embodiment of social medicine principles, especially in the face of global crises. The study spotlights how, amid resource constraints and external embargoes, Cuba implemented strategic containment measures and harnessed its medical innovation ecosystem to vaccinate a substantial portion of its populace with locally-produced vaccines. Given its publication timeline, Pineo's work understandably lacks this contemporary analysis. Thus, the contribution of this study not only echoes certain themes of previous discourse but also introduces a timely and pivotal evaluation of Cuba's adaptability and resilience during unprecedented global health challenges.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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