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Chapter

COVID-19 Response and Vaccination in Morocco: Efforts, Challenges, and Opportunities

Mohamed Khalis, Oumnia Bouaddi and Chakib Nejjari

Abstract

The Coronavirus pandemic has disrupted global health systems and has put enormous strain on fragile health systems worldwide. Despite the challenges that the Moroccan health system faces, the country's rapid and effective response to the COVID-19 pandemic has yielded positive results in terms of virus containment. A convergence of public policies has enabled Morocco to implement multifaceted interventions aimed at achieving large-scale vaccine coverage. These efforts have contributed to the success of Morocco's national vaccination campaign. While the immunization operation was not devoid of challenges, this experience has paved the way for Morocco to expand its disease surveillance system and explore its potential as a key actor in vaccine and bio-therapeutics supply on the continent.

Keywords: COVID-19, SARS-CoV-2, immunization, vaccine, infection prevention and control, pandemics, Morocco

1. Introduction

The COVID-19 pandemic and its spillover effects have disrupted global health systems around the world. Morocco has notoriously made major strides in the management and control of long-standing infectious diseases such as tuberculosis. However, the COVID-19 pandemic has inevitably put the Moroccan health system under strain and resulted in collateral social and economic repercussions. The pandemic response in Morocco was characterized by a remarkable convergence of public policies in order to alleviate the burden on those who were most affected by the negative impact of the crisis. Morocco was involved in vaccination efforts early on through participation in clinical trials. Given the fragility of the national health system linked to low bed capacity and a shortage in the healthcare workforce, the country has rapidly and effectively mobilized immense resources and engaged in organized efforts geared toward achieving population immunity. In this chapter, we give an overview of the COVID-19 vaccination experience in Morocco and also highlight the challenges that have emerged and discuss future opportunities and prospects.

2. COVID-19 response in Morocco

Morocco issued a National Response and Surveillance plan against COVID-19 as early as January 27th 2020, and a steering committee was established by the Moroccan Ministry of Health (MoH) to oversee the health response [1]. The National Public Health Emergency Operations Center (CNOUSP), based at the Epidemiology and Disease Control Directorate (DELM), was charged with spearheading the monitoring of the epidemiological situation and the coordination of the technical aspect of the response. Additionally, the CNOUSP played a pivotal role in informing various stakeholders and partners, the media, and the public [1]. Field epidemiologists and rapid intervention teams were deployed in order to fulfill these roles. In addition to these tasks, the Regional Public Health Emergency Operations Centers (CROUSP) also organized training and information sessions for healthcare professionals both in public and private healthcare facilities [1, 2].

The first case of COVID-19 in Morocco was first recorded and confirmed on March 2nd, 2020. A 39-year-old man from Casablanca traveled to Brussels 15 days ago and then to Italy and returned to Morocco in late February. A swab was taken and the result confirmed SARS-CoV-2 as the causal agent. Contact tracing was performed, and 106 contact cases were identified and followed up [3].

Shortly after the first case was reported, decisive actions were taken by the Moroccan authorities to curtail the spread of the virus. Robust events were canceled such as the International Agricultural Exhibition (SIAM) and the international Crans Montana Forum in Dakhla. More stringent measures were put in place such as a nationwide school suspension by March 13th and the suspension of all international flights by March 15th. This was followed by more closures of mosques, restaurants, coffee shops, spas, gyms, and clubs and nationwide country lockdown. Non-pharmaceutical interventions (NPIs) such as mask wearing and disinfection were put in place and reinforced. On April 7th 2020, mask wearing was made mandatory in public places and at work [4]. Concurrently, industrial units were readjusted to increase local production capacity of masks—up to 5 million units a day—and a decree was enacted to regulate the price. A state of emergency was declared by the Ministry of Interior on March 20th, and a full-country lockdown was put in place. Citizens were allowed to move within their living space, and a special authorization was granted by local authorities to individuals working in vital sectors. Violations of the state of emergency became punishable by law per a novel decree Law 2.20.292, which was passed unanimously [5]. A nationwide survey of Moroccan households performed by the High Commission of Planning (HCP) between April and June 2020 showed an overall good compliance with some NPIs such as handwashing (87.3%) and wearing masks (78.3%). Other measures were less popular such as physical distancing (31.3%) and going out less (19.8%) [6]. These measures, namely those related to movement restrictions, proved to be effective in controlling the viral reproductive rate [7] but have naturally led to challenges experienced by Moroccans abroad awaiting repatriation and also resulted in financial hardships among Moroccan citizens, particularly those working in the informal sector. Fortunately, the economic consequences of the crises were anticipated through the creation of a COVID-19 special fund following the orders of King Mohammed VI; this fund initially contained 1 billion MAD and was later enriched thanks to contributions from banks, the National Security and Territorial Surveillance, telecommunication companies, MPs, and other senior officials. Additionally, stipends were issued to citizens working in the informal sector and who did not benefit from the state-funded insurance scheme Régime

d'Assistance Médicale (RAMed). Notwithstanding, some decisions were met with criticism by the public such as the sudden decision to confine a few cities prior to the celebration of Eid El Adha in 2020. These decisions created panic among the public and led to overcrowded roads and an increased risk of creating infection clusters [2].

By June 2020, “Wiqaytna”—Arabic for “our protection”—was created by the Moroccan Ministry of Health (MoH) and its partners and made freely available to all Morocco citizens. The aim was to facilitate contact tracing and surveillance efforts [8]. In a similar effort, the Moroccan Ministry of Interior launched a hotline “Allo 300” to receive reports on suspected cases and provide information to citizens about COVID-19. As of June 2022, there are 1,170,427 confirmed cases and 16,080 deaths due to SARS-CoV-2. The evolution of daily confirmed cases of COVID-19 up to June 2022 is shown in **Figure 1**.

Regarding infrastructure and equipment, the COVID-19 response in Morocco was marked by an increase in hospital capacity through the establishment of field hospitals and the increase in the capacity of existing structures, including bed capacity for intensive care and resuscitation units. Thermal cameras and thermometers were made available at all entry points in order to maximize early detection of the virus. As changes in the case definition occurred, Morocco adjusted its surveillance strategy at all entry levels. Concurrently, local mass production of masks and hydroalcoholic gel took place alongside efforts to regulate prices. Additionally, Morocco considerably reinforced its laboratory capacity. At the beginning of the crisis in 2020, only three laboratories had a PCR platform, this number gradually increased reaching 30 laboratories with PCR testing capacity as of September 2021, among which six are mobile laboratories [2].

In accordance with the recommendations of its National Scientific, Technical and Advisory Committee, the MoH issued a standardized treatment regimen for COVID-19 patients, which included the use of hydroxychloroquine (HCQ) or chloroquine (CQ), combined with azithromycin (AZM) as first-line treatment [2]. The Moroccan Anti-Poison and Pharmacovigilance Centre subsequently received reports of medication errors related to the administration of AZM [9]. Following these alerts, the MoH

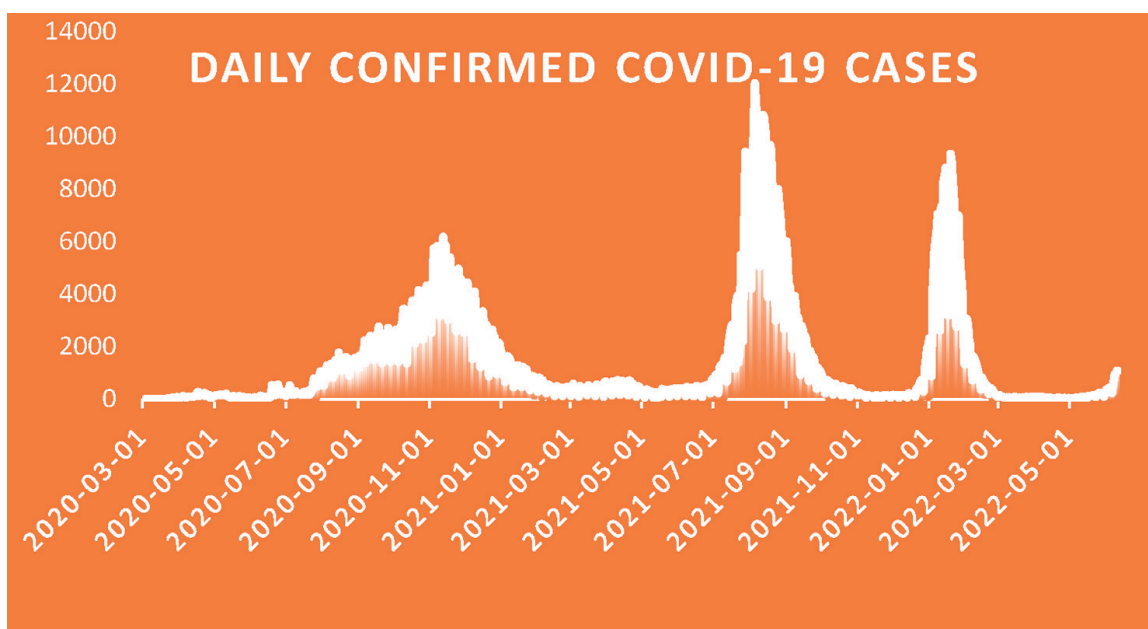


Figure 1.
Daily confirmed COVID-19 cases in Morocco.

issued recommendations directed at healthcare professionals and hospital directors in order to improve compliance with therapeutic guidelines [9]. In August 2021, the treatment regimen was updated to include Molnupiravir, an oral antiviral tablet recommended for non-severe SARS-Cov2 cases in high-risk individuals [10]. These updates were made in accordance with WHO treatment guidelines [11].

3. National vaccination campaign

3.1 Vaccination timeline, strategy, and efforts

Vaccinating the Moroccan population became a major public health priority, and remarkable efforts have been undertaken by the government to achieve large-scale immunization. In fact, preparations were arranged before the arrival of the first batches of vaccine doses into the country. Moroccan citizens and residents were notified about the procedure of setting up a vaccination appointment. The procedure simply entails providing one's ID card number to register and subsequently receive a place and date for their appointment. Any citizen or resident was automatically referred to the nearest vaccination center using its digitized identity card number. Concurrently, "Liqahona"—Arabic for "our protection"—the official portal of the COVID-19 vaccination campaign, was set up by the Moroccan MoH. This platform provides information about available vaccines, mechanisms of action, the vaccine development process and clinical trials, potential side effects, and enables individuals to verify their vaccination appointment [12]. Another channel by which Moroccan citizens could get informed about their appointment is simply by sending their identity card number to the toll-free number 1717. Upon receiving a second dose of the COVID-19 vaccine, individuals are able to download and print a copy of their vaccination certificate using the same platform. Similarly, an app named Yakadaliqah/Jawaz Asseha ("vaccine vigilance"/"Health passport" in Arabic) was made freely available in Google and Apple stores as well as a website version. The aim of this app is to allow citizens to benefit from remote monitoring by reporting any adverse event observed after the first and/or second dose of vaccine and enable continuous contact with the doctors at the local vaccination center [13]. These efforts were strengthened by mass communication campaigns through diverse channels such as national TV and social media. In fact, the MoH broadcasted SPOTS on national television channels such as SNRT, 2 M, and Medi1 in order to raise awareness, prevent pandemic fatigue, and encourage vaccination [2].

Morocco has participated in multicenter Phase III clinical trials of the COVID-19 vaccine Sinopharm in early August 2020 [14]. The trial was conducted at the Ibn Sina University Hospital and Mohammed V Military Training Hospital in Rabat and Ibn Rochd University Hospital in Casablanca [14]. The national campaign against COVID-19 kicked off in late January 2021. The campaign was completely free of charge to Moroccan citizens and foreigners residing in the country and was funded through the COVID-19 special fund. On January 22nd, Morocco received the first batch of the Oxford-manufactured AstraZeneca vaccine, consisting of 2,000,000 doses [15], and on January 27th, the first batch of the Sinopharm BIBP vaccine, consisting of 500,000 doses, arrived in the country. During this month, Morocco approved Sputnik V, Sinopharm BIBP, and Oxford-Astrazeneca and later on other vaccines were approved such as Sputnik V, Sinopharm BIBP, and Oxford-Astrazeneca, and later on other vaccines were approved such as Moderna and Pfizer-BioNTech [16]. Recognizing

the critical role of cold chains in the success of immunization campaigns, the MoH worked closely with international organizations, foundations, and private sector partners, since the beginning of the national immunization campaign in January 2021, to expand and strengthen the country's cold chain capacity during the pandemic and beyond to also benefit the routine immunization program. In fact, four freezers were delivered to Morocco through the COVAX facility in 2021, which has increased storage capacity from 1.9 million to 4.1 million doses. Thanks to this facility, Morocco has received a total of 4,190,190 doses in 2021 [17]. The United States, COVAX's largest donor, has delivered 2,754,380 safe and effective COVID-19 vaccine doses including 2,449,980 Pfizer and 302,400 J&J doses [18]. The U.S. government has invested nearly \$20 million in Morocco's COVID-19 pandemic response and U.S. military has invested over \$3.8 million in field hospitals and laboratory assistance [19]. Furthermore, seven new ultralow-temperature freezers, funded by USAID and delivered through UNICEF Morocco, have allowed the country to double its storage capacity for COVID-19 messenger RNA (mRNA) vaccines, including the Pfizer vaccine, which requires specific storage conditions at minus 80 degrees [17]. It is worthy of note that Morocco took part in the Chinese Sinopharm vaccine development process by participating in clinical trials. Therefore, it was among the first nations to receive the vaccine. In fact, 1 million doses of the Sinopharm vaccine were delivered to the country, which has allowed Morocco to scale up the vaccination campaign and target other subsets of its population. The vaccine roll-out in Morocco occurred progressively, and priority was given to those at high risk of contracting the virus and developing severe symptoms. The priority groups included health professionals aged 40 and over, public officials, the military, teaching staff aged 45 and over, as well as people aged 75 and older and individuals living with chronic diseases. Areas with high levels of circulating infection were also initially targeted [20].

Thanks to these joint efforts, as of June 8th, 2022, 24,839,199 of Moroccans have received their first dose of the COVID-19 vaccine, 23,321,341 have received a second shot, and 6,470,755 have received a third shot [21], thereby achieving the highest COVID-19 vaccination rate in Africa—63% of the total population are fully vaccinated [22]. This success has been attributed to the deployment of a smart vaccination campaign and technology, which has sped up the vaccine roll-out.

3.2 Challenges and opportunities

In discussing vaccination, the socio-behavioral aspect must not be omitted. The COVID-19 pandemic and the accompanied misinformation campaign led to the emergence of vaccine hesitancy among the world's population. Vaccine hesitancy presents a worldwide challenge that threatens to reverse years of progress made in infectious disease prevention and control. An initial survey conducted by the HCP after the first case was reported in the country, indicated that the acceptance rate was 68.6% among Moroccans [6]. However, the same report noted that nearly one household in 10 (11%) would refuse to get vaccinated [6]. More recent studies in Morocco reported low vaccine acceptance rates among health science students (26.9%) [23] and non-health-sciences students (35.3%) [24]. A similar study conducted among healthcare workers found a relatively high vaccination acceptance rate (62.0%). The main reasons of refusal or hesitation were concern about potential side effects (74.8%) and doubts about its effectiveness (47.8%) [25]. Similarly, one study was conducted among 3800 Moroccan citizens to evaluate the factors associated with COVID-19 vaccine acceptance using the Health Belief Model. The findings of this

study were that perceived susceptibility and benefits were the strongest predictors of acceptance of the COVID-19 vaccine. Being female and having a chronic illness were also factors associated with a higher COVID-19 acceptance rate [26]. Throughout the pandemic response, the MoH deployed mass media campaigns to educate the public and promote vaccine uptake. Ultimately, legal action was taken against individuals who spread fake news about COVID-19 in order to prevent the undermining of public trust and prevent panic among the general public [27]. Examples of these legal actions were the arrests issued. Additionally, since the beginning of the pandemic, the MoH and the Ministry of Education urged citizens to fact-check pandemic-related information before sharing it. Furthermore, decision-makers in the country were the first to get the vaccine, which helped bolster public trust and dispel doubts surrounding the safety and efficacy of the vaccines. While vaccination is undeniably one of the most cost-effective interventions in the management of infectious diseases and to reduce the levels of circulating infection, compliance with NPIs and increased public awareness are of paramount importance in light of the emerging variants of concern (VoCs) and the waning efficacy of vaccines in the face of emerging variants.

The success achieved during the mass immunization operation compared with other countries in the region reveals the potential that Morocco holds in pioneering vaccine development and supply to the rest of the continent. In fact, efforts are already underway to accomplish this goal. In January 2022, Morocco has launched the construction of a vaccine manufacturing plant in the region of Benslimane, near Casablanca. This “fill and finish” site was launched in partnership with the Swedish firm Recipharm and was inaugurated during a ceremony attended by King Mohamed VI. This factory is expected to need an investment of almost \$600 million and its objective is to achieve vaccine “self-sufficiency” for Morocco as well as to ensure coverage of 60% of the needs on the continent. This structure will allow for the transfer of aseptic filling and the manufacture of active substances of more than 20 vaccines among which are three COVID-19 vaccines [28]. It is worthy of note that Morocco is currently producing more than 3 million doses of the Sinopharm vaccine every month. This production is expected to reach 20 million doses by the end of the year. This was achieved thanks to the transfer of aseptic filling locally. While these prospects may be promising, the current crisis has not yet receded. In fact, the case count has been on the rise since the beginning of June 2022 as the country recorded a total of 1067 new confirmed COVID-19 cases as of June 12th [29]. This recent trend may force planners and decision-makers to reinstate movement restrictions, which may halt touristic activity—usually at its height during the summer season—and further delay the recovery of the Moroccan economy.

4. Conclusions

Morocco’s strict and effective response to the COVID-19 pandemic has resulted in positive results in terms of preventing severe disease and limiting the spread of the virus. This experience has highlighted the country’s potential in pioneering vaccine supply and promoting vaccine self-sufficiency on the continent. However, the harsh economic consequences, along with the emergence of other VoCs, may hinder these prospects. Therefore, careful planning needs to be undertaken to simultaneously address the collateral damage of the COVID-19 crisis, anticipate potential future threats, and explore current opportunities.

Conflict of interest

The authors declare no conflict of interest.

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