



COVID-19 infection in the developing world: the Peruvian perspective

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COVID-19 infections have spread widely in Peru, causing severe societal and health impact. We describe the evolution of the epidemics, the reasons for high transmission and the way the disease is diagnosed and managed in the Andean country

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Because of coronavirus disease 2019 (COVID-19) infection, Peru has the 6th highest COVID-19 related mortality in the world (159.53 deaths per 100 000 inhabitants) and the second highest case fatality rate (3.4% of COVID-19 cases).¹ These elevated rates probably reflect the excessive risk of intradomiciliary transmission (secondary attack rates in households in Peru are 53% compared with rates of 4.6 to 17% in China, the USA and South Korea),² as well as the overwhelming pressure on the Peruvian health system.

Peru started a lockdown on 16 March 2020, only 10 d after the first reported case of COVID-19, much earlier than many European countries. A National State of Emergency was declared and people were instructed to quarantine at home; meanwhile, all travel by flight was banned. But these well-intentioned measures collided with reality. Despite several years of solid economic growth, giving Peru one of the best performing economies in Latin America, more than 70% of jobs are part of the informal economy, that is, employment without formal contracts, worker benefits or social protection.³ One out of every five households does not have access to drinking water and has to collect or buy water. Only 34% of households own a refrigerator. Among the poor, electricity is not continuously available.⁴ In order to survive, many Peruvians had to use packed public transport, buy or sell goods in very crowded markets and queue in long lines to get cash from banks (other forms of currency are not available to the impoverished), thus fueling the epidemic.

The exaggerated intrahousehold transmission of the disease cannot be understood without reference to Peruvian family dynamics. Among the middle class, single-family homes have become multilevel buildings housing several generations to avoid the costs of buying new real estate. Among the poor, illegal land occupations, as an alternative to homelessness, are also family affairs: the occupied land is subdivided among relatives. Thus if a loved one gets sick a multitude of people become involved in their

care: predominantly relatives (because of personal feelings), but also paid helpers (out of financial need), most of the time with limited personal protective equipment.

Initially, Lima, the capital of Peru, and other larger cities were affected, but in a historical reversal, people who had fled from an internal armed conflict in the 1980s returned to their ancestral lands, seeking shelter from hunger and vulnerability, and bringing with them the disease. It is unclear what the exact number of 'retornantes' (i.e. the ones who return) was, but a governmental calculation estimated it at about 220 000 during 2020. The migration was complicated by a lack of means of transportation and itinerant logistics (lodging, food, safety). Thousands of people opted to literally walk back to their lands, causing the blockage of entire roads. Upon arrival, if carrying the disease, they encountered even more meager health systems than in the cities.⁵

Diagnosis of COVID-19 via nasopharyngeal PCR was initially promoted by the government as the test of choice. Unfortunately, demand could not be satisfied in a timely fashion. Instead, antibody detection became the preferred mode of diagnosis. As of March 2021, out of 1 500 000 positive tests, 57.95% were based on rapid serologic testing, 29.52% on PCR and 12.53% on antigen testing. The predominant use of antibody testing has been proposed as a potential source of misrepresentation of Peruvian testing capacity.⁶ In practice, many patients who do not receive specific viral testing are diagnosed based on clinical and radiological presentation. Patients presenting with hypoxemia and bilateral pulmonary infiltrates are labeled as having COVID-19.

Self-initiated treatment of COVID-19 is extremely common in Peru and has been promoted heavily via radio. Many patients have already received at least one, and more usually a combination of drugs, before they seek formal medical attention. Medications used without prescription include azithromycin, ivermectin and steroids, many times of questionable manufacturing origin.

Antiviral packages or prepacked combinations of these products are not difficult to obtain. The case for the use of ivermectin merits a special mention. On 8 May 2020, the Ministry of Health approved the use of ivermectin in mild, moderate and severe cases of COVID-19 infection based on *in vitro* results of an investigation in Australia, and a significant grass-root movement was ignited by the unpublished report of a physician treating '1200 jailed inmates and first line responders with excellent results'. As the drug supply was insufficient, an illegal market for the veterinary version of ivermectin exploded.⁷

Many non-pharmacological unproven substances are promoted via social media as a potential cure for COVID-19. One of the most highly publicized and dangerous is chlorine dioxide, a bleach-like disinfectant, which is expected to be ingested in a diluted form. The Peruvian Congress invited a promoter of chlorine dioxide to discuss 'the benefits' of such therapy, but the meeting was cancelled after significant uproar among journalists.⁸

The Peruvian health system is very fragmented and includes several institutions: the Ministry of Health (the equivalent of public or charity hospitals), Social Security (government-funded medical services for salaried workers), Police and Armed Forces, as well as a vast array of private practices, clinics and hospitals. The quality of practitioners and services varies widely. All systems, however, have been overwhelmed by patients' demands and are beyond capacity.

The hospital infrastructure in Peru is old and dilapidated. Although smaller hospitals have been opened in recent decades, the last large hospital with reasonable critical care capacity was built 62 y ago in Lima, when the population was only 25% of its current total. Even before the pandemic, hospitals were overwhelmed. The number of ICU beds in the country has quadrupled since March 2020 according to governmental estimates; unfortunately, the number of critical care physicians has not increased, hence ventilators have had to be managed by non-ICU specialists.

When patients are hospitalized, most of them receive empirical antibiotic therapy upon admission. Ceftriaxone is the drug of choice, but resource-rich institutions may use broad spectrum antibiotics initially. The Peruvian Society of Infectious Diseases has recommended daily *i.v.* treatment with 6 mg of dexamethasone for up to 10 d.⁹ Hydroxychloroquine, ivermectin and tocilizumab are not commonly used, except by a few physicians. Convalescent plasma is used only on an experimental basis. Unproven therapies are used by some physicians who believe 'it is better to offer the patients something, rather than tell them there is no treatment'.¹⁰

For severely ill patients, oxygen supply can be daunting. Some institutions will have enough supplies. Others will admit patients only if they 'bring their own oxygen supply'.¹¹ Private businesses selling oxygen tanks have flourished and the prices charged may vary according to patients' anguish. More perturbing is the need for sedating and paralyzing agents. These are in short supply and poorly resourced institutions frequently rely on patients' relatives to purchase them.

Vaccination against COVID-19 started in Peru amid political instability. President Martin Vizcarra was impeached and removed from office over bribery charges in November 2020. In February 2021, it was discovered that he and 470 other high-profile individuals had been inoculated with a vaccine produced

by Sinopharm (a Chinese manufacturer); this was a dubious incident that shed suspicion over the results of a clinical trial run in Peru with the same product.¹² Both the Pfizer and Sinopharm vaccines are being used in Peru. The government chose to immunize healthcare workers and members of the armed forces as a priority. As of March 2021, only individuals aged >85 y have been vaccinated among the general population.

On a personal level, the authors are constantly burdened by the poor availability of hospital beds, as well as the shortage of ventilators and other technical assets. Impotence in being unable to help those who remain at home is a common feeling. Anguish when deciding who receives priority treatment is constant. RHL and RMS have intubated and provided critical care to 12 classmates and witnessed the demise of 2 of them. This article is too short to discuss the heavy burden of the pandemic on Peruvian physicians and healthcare workers' physical and mental health; but the toll is severe.

When we reflected on the consequences of COVID-19 in Peru, we found many similarities with the situation in the USA: general misinformation, the toxicity of social media, the absence of scientific support to back the governmental response (during the Trump administration), a lack of uniformity in patient management and a burdensome tax on healthcare workers, were all common findings. But the extreme poverty, absence of adequate infrastructure and lack of resources compound the disastrous consequences and explain why Peru has one of the world's highest mortality rates for COVID-19.

The solutions for the Peruvian crisis are complex. In the healthcare setting, appropriate testing, resolving logistical constraints and innovating ways to increase healthcare infrastructure are needed, but these will probably not be achieved in the short term. The emphasis may need to be on prevention: improved hand-washing and sanitation, universal use of cheap masks, massive information campaigns, targeted social isolation (as opposed to universal isolation, which may be detrimental) and widespread vaccination campaigns.

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