Immunization strategies against COVID-19 in developing countries

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Abstract. Currently, the world is facing the pandemic, COVID-19, that started with the year 2020 and has spread rapidly. Due to the high risk of infection of the disease, and due to a lack of vaccines, the WHO proposed a set of recommendations based on social distancing and physical isolation. Many of these measures are not applicable in the context of developing countries that, due to their economic structure and culture, cannot engage with these practices. Here we present how the ideal recommendations were (and are being) implemented in many countries, and propose alternative recommendations for populations with no access to the appropriate equipment to decrease their risk of infection.

Keywords. COVID-19; developing countries; alternative strategies; social distancing.

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1. Introduction

The year 2020 began with an unexpected guest: COVID-19. The origin of the virus has been tracked down to a seafood market in Wuhan city, China. Unknowingly, many people already infected with the virus started spreading the disease in several superspreading events [1–4]. It is now known, proved by actual cases and models of the pandemic, that between 10 and 20% of the infected people cause approximately 80% of the infections [5–15].

There exist several factors that facilitate the superspreading effect. Environmental factors, such as poorly ventilated indoor areas, enhance the spreading of the virus, on occasions, more than 18 times greater than in open-air spaces [16–18]. Another important factor for the emergence of superspreading events is that they happen in crowded places. The more individuals gather in one place, the greater the chances for the coronavirus to infect many people at once, and that someone present will be infectious as well [19–21].

To this date there have been more than nine million infections with more that 400k deaths around the world. USA and Brazil lead the ranking of infections with more than 2.4 million and 1.1 million cases, respectively. On June 24, 2020, the number of new infections in both countries passed 3000 people [22]. Regardless of this situation, both countries (as well as many others) are relaxing distancing measures, reopening businesses and resuming other activities that allow (and allow contact) large gathering of people [23, 24]. This practice has led to a drastic re-surge in the infection rate, reporting high levels of increment in the number of new cases [25]. This outcome shows how the implementation of these social distancing strategies, as well as the population’s adherence to them, make a huge difference when fighting against a new disease, one for which the population has never prepared.

In general, when facing the COVID-19 pandemics, most countries have adopted most strategies recommended by the WHO [26–34]. For example, health officials in Japan have advised people to avoid situations with the three C’s: Closed spaces with poor ventilation, Crowded spaces and Close-contact settings [18]. These strategies have decreased the extent to which superspreading events occur in many cases, and it has been shown that massive infection episodes have emerged as a consequence of not complying with these.

However, there are many countries where the population cannot follow these recommendations.

In the following we will describe the most common implemented prevention measures. At the same time, we will show how other countries, due to their economic structure, were not able to successfully implement them. We will bring to the table the cases of two countries, Perú and Venezuela. Additionally, we will highlight the possible reasons why these strategies did not function
in such societies and will propose a set of plausible, yet still to be proven, strategies to ensure a reduction in the prevalence of COVID-19.

2. General prevention strategies

As COVID-19 began spreading throughout the world as a consequence of its smallworldness [35, 36], countries faced the challenge of implementing aggressive measures to contain and prevent the spreading of the disease using non-pharmaceutical approaches, due to the unprecedented interaction with COVID-19. In the following we list some of the most common measures implemented by the majority of countries/cities.

1. **Contact tracing** [37–39]. Crucial elements for the implementation of contact tracing are community engagement and public support; thoughtful planning of local contexts, communities, and cultures; trained contact tracers and supervisors; and a system to collect, compile, and analyse data in real-time.

2. **School closures** [40, 41]. More than 107 countries had implemented national school closures by March 18, 2020. It is unknown whether school measures are effective in coronavirus outbreaks. Data from the SARS outbreak in mainland China, Hong Kong, and Singapore suggest that school closures did not contribute to the control of the epidemic. Modelling studies of SARS produced conflicting results. Recent modelling studies of COVID-19 predict that school closures alone would prevent only 2%–4% of deaths, much less than other social distancing interventions.

3. **Quarantine** [42]. Introducing quarantine measures early in an outbreak may delay the introduction of the disease to a country or area. However, if not implemented properly, quarantine may also create additional sources of contamination and dissemination of the disease.

4. **Surgical masks** [43]. It has been shown that the use of masks and face shields (N95 and cloth masks) contribute to the reduction of the spreading of the disease when most population engage in this practice.

5. **Hand hygiene** [44]. Hand hygiene is an important part of the response to the international emergence of COVID-19. Practicing hand hygiene, which includes the use of alcohol-based hand rub (ABHR) or handwashing, is a simple yet effective way to prevent the spread of pathogens and infections in healthcare settings.

6. **Availability of mobility data** [37]. Making accurate assessments about the spread of infectious diseases relies on the availability of robust epidemiological data, a scarce commodity during growing epidemics and when resources are scarce. Official statistics are usually presented as aggregated data and tend to be shared on a limited basis, restricting access to the data by the scientific community at large. A key aspect to guarantee the utility of data is the focus on its sharing through Google Sheets and the software development platform GitHub.

7. **Travel restrictions** [35, 45]. The travel quarantine of Wuhan delayed the overall epidemic progression by only 3–5 days in mainland China but had a more marked effect on the international scale, where case importations were reduced by nearly 80% until mid-February. Modelling results also indicate that sustained 90% travel restrictions to and from mainland China only modestly affect the epidemic trajectory unless combined with a 50% or higher reduction of transmission in the community.

All the previous strategies need to be complemented with a massive testing mechanism, which would assist governments and decision-makers when deciding the benefits and/or drawbacks of a given strategy. Additionally, since individuals may transmit COVID-19 while pre-symptomatic or asymptomatic, these recommendations also emphasize the importance of quarantining contacts (infected or not) to further reduce the potential for secondary transmission.

3. Prevention strategies applied to developing countries

As a consequence of the relaxation of (or not following) prevention strategies, many countries are experiencing a new explosion in their COVID-19 cases in the last month; for instance, Sweden, the U.K. and the U.S. [25]. These countries have received fierce criticism from epidemiologists for their resistance to the tough social distancing measures necessary to stem the spread of the new coronavirus.

However, for other countries the landscape is completely different. Latin America has become the new epicenter of the pandemic in recent weeks, led by its two largest countries, Brazil and Mexico, along with Peru making the top 10 in a number of reported cases. Peru (with nearly 142,000 cases of COVID-19 and 4099 related deaths by May 28), which now has the world’s second highest per capita rate of new infections per day, declared a national state of emergency on March 15, when the country had just 71 confirmed cases of COVID-19. Peruvian president Martín Vizcarra ordered to close Peru’s borders and banned Peruvians from leaving their homes except to access essential
goods or perform essential work. It was one of the earliest quarantines in Latin America, and came in before lockdown orders in France, the U.K., and other European countries that were at the time far ahead of Peru in their contagion curves [46].

Venezuela represents another particular case in Latin America. Massive migration and its decadent social, economic and political crisis make it a dangerous scenario for the characteristics of the virus, which in appearance is isolated from the rest of the world. On March 13, the state of alarm was declared in the country, with some exceptions depending on the estimated risk. However, Venezuelan borders are hot-spots of transmission, where the virus circulates due to the great mobility of people who commute daily in the Venezuela–Colombia border, to work and/or to have access to the basic needs. In a country where medicines are scarce and basic services such as water, electricity, and gas are extremely precarious, the Venezuelan population is exposed to a catastrophic scenario, where adherence to the basic strategies to combat the virus is not plausible. According to official data, as of June 29 there are 5530 positive cases and only 48 deaths.

3.1 Alternative strategies

In this order of ideas, what alternative methods for protection from COVID-19 could be applied to these (and in general) low income countries? What strategies could be plausible under such conditions? According to the WHO, each country’s strategy must be adapted to the local context; however, there are certain recommendations that should not be overlooked and that are common in any context.

In the case of Peru, more than 70% of their economic activity is related to informal businesses [47]. People buy/sell most of their products (food, clothes and others) in open, yet crowded, markets, where the risk of infection is more. Additionally, the proportion of manual labor workers is high (construction, selling, drivers, etc.), and the interaction among people in these areas also increases the risk of infection. The last Peruvian census indicates that almost 12% of the population lives in poor and overcrowded homes.

In Venezuela, the shortage of food, gas, and other basic needs, force people to engage in high-risk activities. In order to buy most food, the population has to make huge and crowded lines in supermarkets. At the same time, the shortage of gas has converted the lines of cars into places of high interaction of the population, elevating the risk of infection. In addition, the lack of masks and hand sanitizers, combined with unscheduled cuts in the water supply, increases the chances of getting infected and infecting others, especially those demographic groups at higher risk. These and many other factors put Venezuelans facing a catastrophic future in the battle against COVID-19 [48].

Due to these and many other difficulties faced by the two countries in consideration (and many others), below we list some strategies that countries facing political and/or economical distress could perform. These are by no means all the possible strategies and should not be replaced by the officially recommended ones. However, following them may assure a decrease in the risk of infection.

1. Develop a sense of local risk. It has been demonstrated that one way of roughly estimating one’s infection risk would be to count the number of infected (symptomatic) people in our neighborhood [49]. Once infected individuals start appearing among the neighbors, it is a good moment to take measures to prevent infection, if not done earlier.

2. Make a protocol when arriving at home if superspreading events cannot be avoided. Due to the many high-risk activities the population of low income countries has to engage in (buying food, making lines, commuting, etc.), when arriving home, make sure to have a change of clothes at the entrance. Wash your hands with abundant water and soap. If the interaction with other individuals has been intense, when possible take showers. Handle your clothes with care, and wash them immediately. Remember that the virus that produces COVID-19 remains active in aerosols for hours and on many surfaces up to 4 days [50].

3. Avoid contact with higher risk demographic groups, when arriving at a household. It is well known that the most vulnerable people to COVID-19 are people who are 50 (or more) years of age. However, it has also been highlighted that in spite of not being at death risk, the population between 15 to 35 years old are the ones who transmit the virus at a higher rate [51].

4. Whenever possible, engage in the practice of social solidarity. Make a plan in the community to assist those at higher risk and those who might be suspected of being infected. Do not panic, talk to each other, consult with the local physician about appropriate measures of isolation and quarantine.

5. Avoid touching your face when in doubt if a potential source of infection has been contacted. The community could engage in the manufacturing of homemade masks and other equipment that may reduce the contagion risk.

6. Be informed. Now more than ever, through social networks, we can get in touch with experts around the world who are willing to assist those in need. If you and your close relatives do not know anyone...
who could provide reliable information, there most certainly are willing people not farther than ‘six hand shakes’ (small-world effect [52]).

4. Conclusion

Currently, the whole world is facing challenging times, the year 2020 began with the spreading of the virus that produces COVID-19, which rapidly became a pandemic. When governments and health institutions became aware of the severity of the disease, and due to the lack of knowledge of how to fight the virus, the WHO made public a list of non-pharmaceutical strategies to prevent propagation. Most of these strategies involve social distancing measures, which were rapidly adopted by affected nations. Other measures involved cancellations of local and international traveling (buses, flights, cruises, among others). These measures showed immediate results, and when people are engaged in complying with the recommendations (masks, hand hygiene, gloves, social distancing, etc.), the burden of the disease can be diminished.

However, there are societies where, because of the economic structure they are in, most of these recommendations cannot be followed, leading to massive contagions. In countries, like Peru, strict quarantine and curfew measures have proven to fail due to the necessity of the people to work in crowded places. Venezuela is another example of a country where these strategies cannot be implemented where, due to the food, medicine and water supply shortage, the population is forced to go to frequently populated environments. The critical conditions in which Venezuelans live has transformed this country into a local epidemiological risk.

In the absence of the necessary equipment to follow successfully the WHO recommendations, low income populations have to adapt in order to endure and survive a pandemic. Here we highlighted a by-no-means complete first list of strategies that could be implemented locally in populations with scarce resources.

We want to highlight that the best time to start complying with safety is now. External aid could arrive in countries in need, but if the population does not do its part, this help could arrive too late. These alternative recommendations are not proven yet; however, any strategy which could help to decrease the risk of infection, and potential death should be adapted as soon as possible.

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