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Multi-hazard Risk Configurations: A Search for Common Patterns in Three Latin American Cities During COVID-19

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Allan Lavell[1], Angel Chávez[2], Cinthya Barros[2], Gustavo Jimenez[3], Marina Martinez[4] and Celene B. Milanes[5]

Abstract

COVID-19 has seriously affected urban populations worldwide. It comprises a disaster category that accompanies more recurrent or familiar expressions associated with earthquakes, flooding, landslides, subsidence and tsunamis. Despite the differences in these hazard types, the expressions of vulnerability and exposure and their causes are often similar and many of these are based on pre-existing everyday living conditions. The present article provides preliminary evidence and analysis from the social and territorial incidence of COVID-19 to help confirm the now increasingly argued hypothesis that susceptible populations and areas are often the same, independent of the hazard type. It argues for more integral, livelihood and development-informed approaches to disaster risk management, based primarily on vulnerability and exposure reduction and control.

Keywords

COVID-19, biotic hazard, geological hazard, hydrometeorological hazard, exposure and vulnerability, everyday risk.

Introduction

The world population today is over 50 per cent urban, and this is constantly on the increase. More than 4 billion people live in towns and cities, with nearly a billion of them in slums. Latin America and the Caribbean (LAC) is by far the most urbanised southern continent, with over 80 per cent of its population living in towns and cities, that is, over 550 million people. The contribution of cities to the gross national

[1] FLACSO, San Jose, Costa Rica.
[2] GRACC Consultants, Lima, Perú.
[3] Social Sciences Research Institute, University of Costa Rica, San José, Costa Rica.
[4] Department of Social Science, Universidad de la Costa, Barranquilla, Colombia.
[5] GeMarc Research Groups, Department of Civil and Environmental Engineering, Universidad de la Costa, Barranquilla, Colombia.

Corresponding author:
Allan Lavell, FLACSO, Costa Rica, 200 metros sur 25 este, de Plaza del Sol, Curridabat, San Jose, Costa Rica.
E-mail: allanmlavell@gmail.com

product (GNP) is, on average, over 60 per cent, which is 1.5 times what is expected for European countries (Arsht, 2014).

The early urbanisation trend in LAC, between the end of the Second World War and the 1980s, which concentrated people in ever-growing cities, has given way to a more recent process of rapid growth in cities with populations under a million, and particularly under 500,000 (UN-RAR-LAC, 2021). However, among the features that larger metropolitan centres and smaller urban centres generally have in common in the developing South are the severe lack of functioning urban planning and equitable service provision, high levels of informal employment, high levels of poverty and even higher levels of income inequality, growing socio-environmental risk and conditions propitious for triggering future disasters. LAC suffers the highest levels of interpersonal, interregional and intra-urban inequality in the world and this has only intensified with the COVID-19 pandemic (UN-RAR-LAC, 2021).

The World Health Organization (WHO) estimates that 90 per cent of COVID-19 incidence worldwide has been in urban areas. The reason for COVID-19's higher spread in urban areas may be attributed to the biophysical aspects of the disease itself that are directly related to overcrowding and high density living (Kamis et al., 2021). This may have a correlation with inequality, but not necessarily in all urban areas.

The COVID-19 pandemic has been a social and economic catastrophe of enormous proportions, given its global extent and the number of persons severely affected directly, in health, economic and social terms, and indirectly, due to the spin-off effect and the affectation of others. It is also, from the authors' perspective, the most glaring example of how inequality in its different expressions—from access to basic services, income and employment to recognition, voice, and power—moulds and shapes causality, impact and response to disaster, both among countries and among population groups and cohorts that comprise them.[1] Inequality cannot be equated directly to vulnerability to hazards, but is most certainly a driving factor in its construction as it correlates with poverty, exclusion and marginalisation.

The present article is based on the notion that COVID-19 is a disaster or catastrophe[2] and the materialisation of risks that were socially constructed and then actualised with the appearance of the virus. The main objective of this article is twofold. First, to provide preliminary local-level evidence from three urban areas (Barranquilla, Colombia; Lima, Peru; and San José, Costa Rica), from which to derive preliminary conclusions as to cause–effect (virus–pandemic, and the associated social and economic malaise) and the commonality of this process across very different types of hazards. Second, it is to indicate changes needed in governance arrangements for managing risk prospectively and correctively to avoid or reduce future shocks, crises or disasters, and increase resilience at the city level.[3] The preliminary nature of the analysis must be emphasised here, which is due to the recency of the COVID-19 pandemic and the scarcity of data and information that would help pursue in greater depth aspects of the cause–effect relationship and the correlation between risk patterns associated with different types of hazards.

The central assumption of this article is that the risk associated with the propagation of the COVID-19 virus is highly impacted by the pre-existence and levels of everyday and extensive risk among the population. This ranges from limitations in access to health, employment, housing, and services, to exposure to drug addiction, alcoholism, social, personal and domestic violence, and prior experience with smaller scale and recurrent disaster events. At the same time, the risk is conditioned in scale and impact by variables such as gender, age, ethnicity and race, social class, and varying intersectional attributes and relations. One conclusion of this conceptualisation is that risk exists on a continuum and what is considered extreme or exceptional is in essence an extension of the everyday. As such, the research follows the principles and hypotheses established in the writings of Hewitt (1983), Blaikie et al. (1994), Bull-Kamanga et al. (2003), Lavell and Maskrey (2014), Lavell and Maskrey (2019), Oliver Smith et al. (2016), Lavell et al. (2020), and Maskrey et al. (2021).

A related working assumption is that, although disaster, catastrophe, crisis, pandemic, or other expressions of the severe interruption in everyday life may take different forms and relate to different types of hazards (virus, earthquakes, financial collapse, civil unrest, etc.), the attendant risk in such events tends towards convergence in the same social and population groups: those most affected previously by inequality, poverty, exclusion, and marginalisation. When seen from this perspective, the increasing uncertainty associated with new hazard events or complex hazards (most clearly represented in the notion of 'black swan' events) is counter-balanced by the increased certainty from prevailing exposure and vulnerability and from lack of resilience of certain groups in society (Maskrey et al., 2021). Resilience can be most easily understood as the existence of disposable risk-free income, where income can be defined individually or collectively and may be monetary or material, mental or physical.

Disasters, crises, catastrophes or pandemics, apart from their real-time expressions and effects, are indicative of skewed or failed development (see the UNISDR Global Assessment Reports on Disaster Risk published every two years from 2009 to 2015 [UNISDR, 2009, 2011, 2013, 2015]).

Attempts to intervene in favour of disaster risk reduction and control or respond to risk and disaster in general, independent of the triggering hazard event, must be based on the reduction and control of the growth in inequality, exclusion and poverty. Poverty, exclusion, lack of service provision, voice, vote and recognition, and socio-spatial segregation, among other expressions of disadvantage, may all be seen to be direct or indirect consequences as well as drivers and amplified conditions of risk and disasters, and at the same time offer a basis for the social construction view of disaster risk.

The present article takes the social construction argument, developed theoretically and conceptually over the last three decades in Latin America and elsewhere, and applies them in the three metropolitan cities of Barranquilla, Lima and San José. This preliminary analysis of the social conditioning and impact of COVID-19 is based on preliminary empirical evidence deriving from the framework of a research endeavour on resilience to geological, hydrometeorological and technological hazards of common occurrence in the three cities and elsewhere.

The empirical base for this work has been compiled considering the cities and urban areas that formed part of the resilience component of the Knowledge in Action for Urban Equality (KNOW) project coordinated by Bartlett Development Planning Unit, University College London (UCL). Research prior to the COVID-19 pandemic had comprised both quantitative, statistical approaches for analysing, understanding and mapping risk and on-the-ground co-production methods with local communities and authorities using varied techniques, from participatory mapping processes to community conversations and SWOT analysis. The study areas included in the present analysis were selected following a mapping of the more risk-prone areas in the three cities. The ability to access and comprehend the information gleaned on COVID-19 and its spatial and social impacts relates closely to the previous work undertaken. The authors are aware of the problems associated with data, comparison, and other dimensions and provide the analysis as a preliminary step in research that must be improved over time.

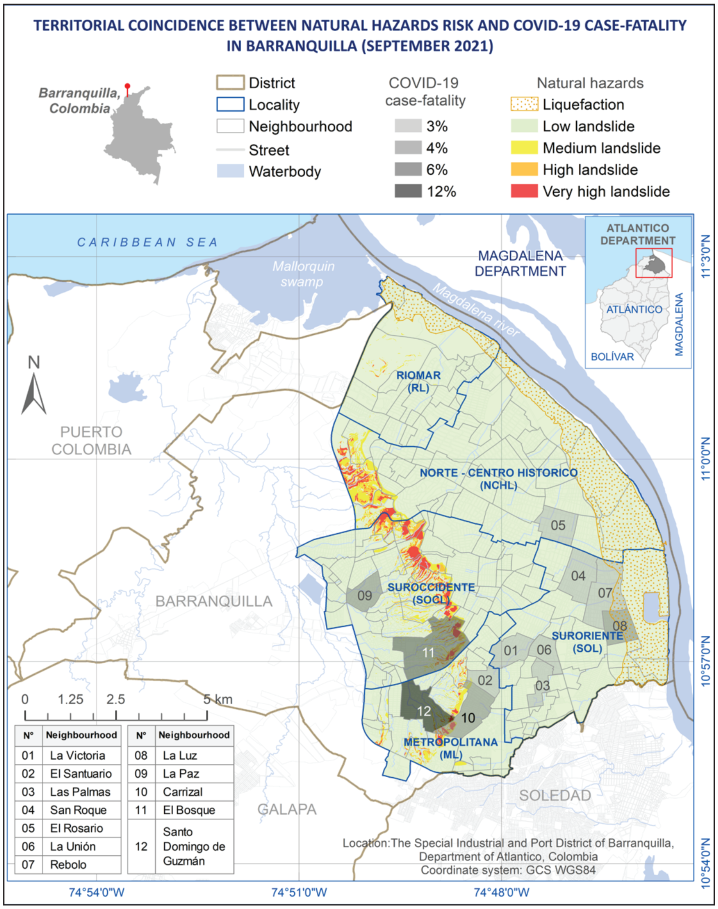
The social construction of risk postulates that risk is endogenous to development processes and not the direct result of externally generated hazard events; although, clearly these are required for disaster risk to exist (see Lavell & Maskrey, 2014). A social construction approach to understanding disaster risk has grown and become dominant in LAC over the last 30 years, and Latin American authors have contributed to this development (see Chapter 1, UN-RAR-LAC, 2021). In attempting the analysis, the authors do not pretend novelty in concept and theory but rather take the opportunity to add to the empirical evidence base that could help push disaster risk management (DRM) practice in directions not yet taken, but clearly demarcated and argued for years by tackling underlying social, economic and other risk factors and drivers as opposed to concentrating dominantly on hazards and their prevention–mitigation.

Preliminary Evidence from Three Case Studies

Barranquilla, Colombia

Barranquilla, capital of Atlántico Department of Colombia, has a population of 1,274,250 (Terridata, 2021), which makes it the fourth largest city in Colombia. The city is organised in five administrative units, Riomar (RL), Norte Centro Histórico (NCHL), Metropolitana (ML), Suroriente (SOL) and Suroccidente (SOCL). On the hillsides, particularly in the southwestern area (SOCL), most of the population lives in extreme poverty with an irregular provision of public services, scarce urban endowment, high levels of criminality and recurrent threats of landslides and floods (Milanés et al., 2021) (see Figure 1).

Over the last 20 years, Barranquilla has received large numbers of victims of armed conflict in the country, with 133,813 people or 10 per cent of its total population registered as displaced (Registro Unico de Victimas [Unique Registry of Victims], 2021). The city also faces a migratory crisis of Venezuelans and Colombian



Nº	Neighbourhood	Nº	Neighbourhood
01	La Victoria	08	La Luz
02	El Santuario	09	La Paz
03	Las Palmas	10	Carrizal
04	San Roque	11	El Bosque
05	El Rosario	12	Santo Domingo de Guzmán
06	La Unión		
07	Rebolo		

Figure 1. Territorial Coincidence Between Natural Hazards Risk and COVID-19-case Fatality in Barranquilla, September 2021

Source: Adapted from official data of the District of Barranquilla Mayor's Office (2021) and Barranquilla Territorial Organization Plan 2012–2032.

returnees from Venezuela, especially since 2018. To date, Barranquilla has received an estimated 137,000 people from Venezuela, which is 11 per cent of the city's total population (Migración Colombia, 2021). Many national and Venezuelan migrants have relocated in the more hazard-prone areas, with inter-agency difficulties in preventing illegal housing construction processes in these high disaster risk areas (Martínez-González, 2021).

From 2010 to 2020, Barranquilla had a remarkable level of economic growth. In 2018, it had the lowest unemployment rate (8.5 per cent) among the main cities in Colombia. However, the informal economy absorbed 55.8 per cent of the active work force immediately prior to the COVID-19 pandemic (Alcaldía Distrital de Barranquilla, 2019; DANE, 2021a, 2021b). Thus, most of the working population did not have formal employment that provided them with social security guarantees.

It was in the context of this pre-existing quotidian and disaster risk scenario that Barranquilla experienced and handled the COVID-19 pandemic. According to Law 1523, the highest authority for risk management at the local level are the mayors, invested with the powers and duty to provide conditions for security, peace, and health in the city. During the pandemic, many resorted to the declaration of a state of public calamity to implement the measures conducive to preventing the spread of contagion. Barranquilla made recurrent use of curfews.

Despite the measures taken, the city has faced three spikes of COVID-19, ranking seventh in the country in terms of its fatality rate at 2.7 per cent (Alcaldía Distrital de Barranquilla, 2021). Up until September 2021, 201,235 cases of COVID-19 had been registered (Alcaldía Distrital de Barranquilla, 2021), affecting 16 per cent of the population.

Table 1 and Figure 1 reflect how the lethality of COVID-19 increases with the levels of inequality and poverty, with the highest concentration of deaths evidenced in the SOL, SOCL and ML localities, where the most fragile socioeconomic conditions, informality and the highest demographic density are found. These coincide with the historically most disaster-prone areas.

Most of the neighbourhoods in the city of Barranquilla present a COVID-19 fatality rate below 3 per cent. Those upwards of 3 per cent are shown in the map in Figure 1, since they exceed the global trend and coincide with areas most exposed to frequent hazards. In the neighbourhoods with the highest number of deaths and infections, those with a fatality rate between 4 per cent and 12 per cent are predominantly located on urban slopes, exposed to landslides and pluvial torrential streams.

Table 1. COVID-19 Fatality Rate by Locality and Neighbourhoods in Barranquilla

Locality	Neighbourhoods	Cases	Deaths	Lethality (per cent)
SOL	1. La Victoria	1,400	36	3
ML	2. El Santuario	921	25	3
SOL	3. Las Palmas	1,200	34	3
SOL	4. San Roque	1,100	33	3
NCHL	5. El Rosario	825	27	3
SOL	6. La Unión	846	28	3
SOL	7. Rebolo	1,500	52	3
SOL	8. La Luz	1,200	43	4
SOCL	9. La Paz	745	28	4
ML	10. Carrizal	1,300	50	4
SOCL	11. El Bosque	1,400	77	6
ML	12. Santo Domingo de Guzmán	364	44	12

Source: Adapted from official data of the District of Barranquilla Mayor's Office, Barranquilla.

In comparison, those with a fatality rate between 3 per cent and 4 per cent are mainly located in lower areas and exposed to pluvial torrential streams, river flooding and liquefaction but without landslides. The history of both types of settlements differs. The latter neighbourhoods, with the lowest rates, either comprise the oldest in the city (04, 05, 07 in Table 1), are linked to the dynamic and relatively prosperous growth of the city at the end of the nineteenth and the beginning of the twentieth century or were created through state housing programmes for the working population (01, 02, 03, 06 in Table 1). All of them have adequate access to transportation routes and urban services. On the other hand, the settlements with the highest mortality rates, those between 4 per cent and 12 per cent, were mainly populated in more recent decades, on the city periphery, through illegal invasions (08, 09, 10, 11, 12 in Table 1). They have higher density, much lower purchasing power, higher informal employment figures and lesser possibilities of access to basic infrastructure and services, conditions that facilitate the spread of viral infections and reveal the precarity of the access to primary healthcare services.

As of September 2021, SOCL presents the highest rate of deaths within the population aged between 20 and 59 (27.4 per cent), followed by SOL (27.3 per cent) and ML (26.9 per cent). On the other hand, the proportion of deaths in the over 60 age range was higher for NCHL (77 per cent) and RL (75.8 per cent) (analysis based on official data from the District Mayors Office of Barranquilla, 2021). This pattern may be explained by the fact that the populations of SOCL, SOL and ML tend to depend on economic activities (such as informal street trade) that expose them to a greater risk of contagion, and where handwashing and proper use of masks is difficult. Moreover, it also implies limited access to social security and health services to treat symptoms early and monitor health conditions. These areas also have a higher population density with overcrowding in homes and poor access to public services. On the other hand, the population of the NCHL and RL localities have better working conditions; many switched to teleworking options and have been able to access prepaid medicine and better medical support during the contagion period. Their homes have better access to public services, health centres, and transportation routes, among others.

Vulnerability in the city increased due to the confinement measures and difficulties in providing food to large sectors of the population. This had an immediate impact on food security, which has dire consequences on the immune response to viral diseases (Galimberti et al., 2020). In 2021, only 26.38 per cent of Barranquilla households reported consuming three meals a day, a situation that has been worsening since 2020, when the city ranked 39.7 percentage points below other cities in the country (DANE, 2021c).

The situations described above, with the coincidence of geological and hydrometeorological hazard-prone areas and impacts, and those associated with the virus indicate the need to advance with the conception of DRM as integral to sustainable development. Multiple types of physical, biotic and social hazards can be considered simultaneously and provide spaces for the population to actively participate in the process of understanding the environment, developing capacities, reducing exposure and common vulnerabilities, and acting collectively in the construction of less vulnerable and more resilient societies (Milanés et al., 2021).

Lima, Peru

Lima, the capital of Peru, is located on the Pacific coast and has a population of more than 10 million, more than 30 per cent of the country's total. It has always received significant numbers of migrants from the Amazon and Andean regions of the country. The principal centre of economic endeavour in the country, the city also has the highest absolute levels of poverty, extreme poverty, and inequality. The incidence of monetary poverty in Metropolitan Lima and the Province of Callao increased from 14.2 per cent to 27.5 per cent between 2019 and 2020 as a direct consequence of the COVID-19 pandemic (INEI, 2020a).

The increase in poverty was due to the existence of a non-poor, but highly vulnerable 27.2 per cent of the population prior to the pandemic (INEI, 2020b). The vulnerable non-poor are those who were scarcely above the poverty line, and who, with any drop in income, would quickly decline into the category of poor or even extremely poor. The government in Peru designated some economic activities as non-essential, and their economic activities came to a sudden halt while a strict quarantine was applied. This meant that jobs carried out on the street, most of them in the independent sector and in the informal economy, practically disappeared for several months, causing merchandise to be damaged and the payment chain to be broken. These people were pushed into poverty and constitute the new poor.

In the department of Lima, six out of 10 in the workforce were occupied informally in 2019, prior to the pandemic (INEI, 2020c). For the quarter December 2020 to February 2021, full employment decreased by 34.2 per cent (1,850,000 people) in Lima and the number of sub-employed increased by 17.7 per cent (323,000 people; INEI, 2021). The hypothesis is that, despite the state bailout of the economy, many jobs will not be recovered in the medium term, and many that swelled the informal economy between 2020 and 2021 will remain there in the future. The correlation of poverty and informality leads to increased social and economic vulnerability. The informal segment has been the most vulnerable to the negative shock of COVID-19 and is made up mainly of independent workers, wage earners and auxiliary family workers (INEI, 2020c). They lack the basic protection that formal jobs usually offer, and have low social security coverage, limited access to basic sanitation and health services, and face the impossibility of income replacement (OIT [ILO], 2020).

Prior to COVID-19, the city always suffered from high levels of disaster risk due to the presence of earthquakes and tsunamis, floods, and debris flows, in particular, and increasing threats of urban drought. The city is the highest disaster risk area of the country. The city has also been the hardest hit by COVID-19. In Peru, up until September 2021, COVID-19 had affected 2,175,305 people, of which Metropolitan Lima and Callao accounted for 44.9 per cent (977,582 cases). Total deaths, at the national level sum 199,314, of which Lima and Callao account for 45.7 per cent (91,167 cases) with a fatality rate of 9.58 per cent.[4] The proportion of infected and dead is far higher in Lima than the city's share of the national population.[5]

Prior to the take-up of research on COVID-19 towards the end of 2021, the KNOW project on disaster risk and resilience was based on a consideration of more common geophysical and hydrometeorological hazard conditions. In this ongoing research, the districts with the greatest risk of hazards associated with intense rains and mass movements were identified: fluvial and pluvial floods, rock falls, landslides, debris flow or 'huaicos', sand blasting, and slope erosion. Consideration was given to factors of exposure, fragility and resilience (see Table 2 on risk variables and Figure 3). Ventanilla, Carabayllo and Lurigancho-Chosica (hereinafter, Lurigancho) were the districts that obtained the highest risk values. The latter area became the focus of research for the case study on the spatial and social coincidence between vulnerability to natural and socio-natural hazards, particularly floods and debris flows, and COVID-19.

Lurigancho has 240,814 inhabitants. Research has identified areas most vulnerable when faced with debris flow and river flooding—particularly in the El Niño years—the more common hazards prior to COVID-19 (Barros & Chávez, 2021). Vulnerability was estimated using data at the block level, considering exposure, fragility and resilience, grouped according to their dimensions (see Table 3 and Figure 3).[6] In total, five areas were identified, three of them the most vulnerable: Nicolás de Piérola (also known as 'Quirio'), San Miguel and Mariscal Castilla. These areas are located on the outskirts of the historic centre or capital of the district, also called 'Monumental Zone of Chosica'. Due to their

Table 2. Factors Considered in Constructing Vulnerability Levels for Metropolitan Lima and Callao

Dimension	Factor	Variable
Physical	Exposure	Area exposed to natural hazards Count of types of natural hazards affecting the district
Social	Fragility and resilience	Expenditure inequality (Gini index) Monetary poverty Unsatisfied basic needs (UBN) Human development index (HDI) Anaemia

Source: The authors.

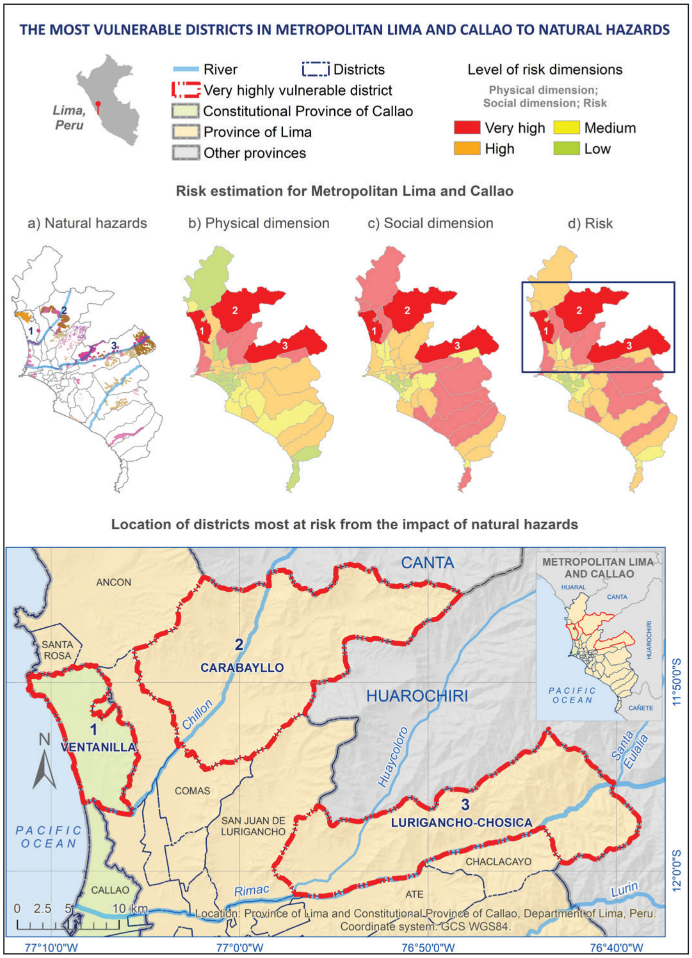


Figure 2. Location of the Three Most Vulnerable Areas of Lima

Source: SIGRID,[9] INEI,[10] MINAM.[11]

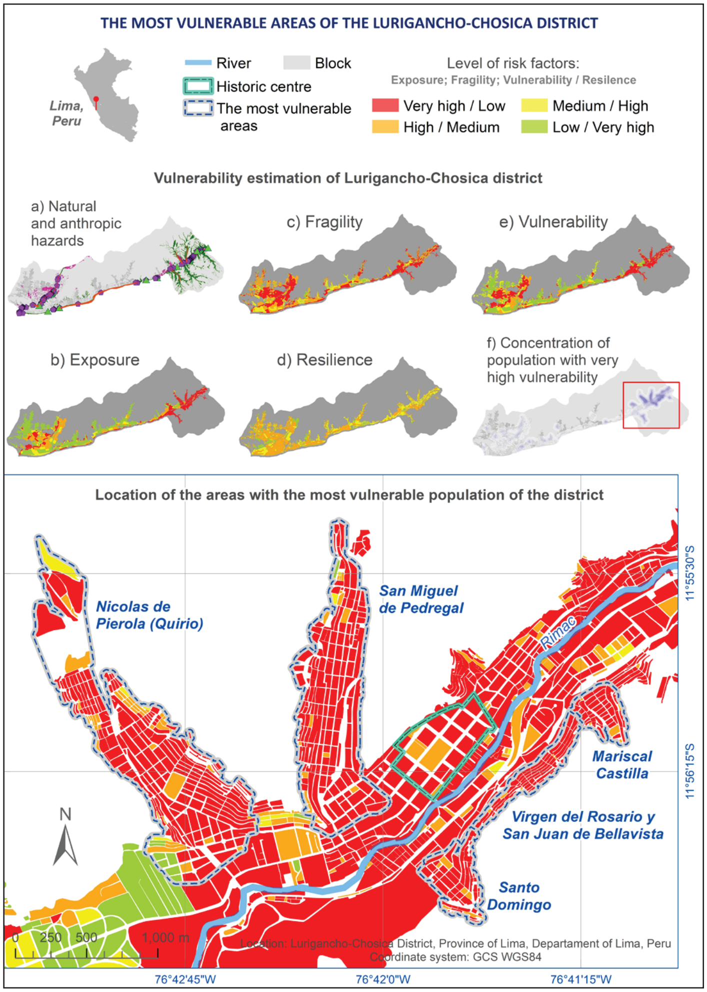


Figure 3. Location of the Most Vulnerable Areas of Lurigancho-Chosica

Source: KNOW WP2,[12] SIGRID.

designation by the government as 'unmitigable high risk' areas, these areas have rarely been able to access public water and sewage infrastructure. Any access to infrastructure has been possible only via self-investment. Although they have extremely high or high levels of fragility and exposure, these zones tend to have medium levels of compensatory resilience.

The incidence of COVID-19 in Lima has been generalised but disproportionally concentrated in the most marginalised and informal areas and populations, including the district of Lurigancho.

A comparison of the areas of high vulnerability to disaster risk identified in our research with areas of high potential vulnerability to COVID-19 shows high levels of spatial and thus social coincidence[7] (see Figure 4). The COVID-19 vulnerability mapping was carried out by the National Centre for Disaster Risk Prevention and Reduction (CENEPRED), using a methodology designed for this purpose and applied locally throughout the country. The method used is shown in Figure 5.

Table 3. Factors Considered in Constructing Vulnerability Levels for Lurigancho-Chosica

Factor	Dimension	Variable
Exposure	Environmental	Percentage of area exposed to natural and anthropogenic hazards
		Spatial proximity to natural hazards
		Exposure area to natural and anthropogenic hazards
	Social	Contaminating sources
		Unmitigable risk zone (ZRNM)
Fragility	Physical	Type of water supply source
		Type of excreta disposal
		Type of housing wall material
		Type of private dwelling
	Economic	Dwellings without drinking water service
		Population of working age looking for work
		Housing without electricity service
		Socio-economic stratification
		Weekly frequency of access to drinking water
		Hours of access to drinking water
	Social	Population without identity documents
		Population without health coverage
		Disabled population
		Vulnerable population (0–14 and over 65)
		Occupancy of the dwelling
Resilience	Physical	Type of collective housing
		Type of housing tenure
		Type of cooking fuel
	Economic	Ownership of technological telecommunication device
		Ownership of household appliances
		Ownership of transport vehicles
	Social	Educational level

Source: The authors.

Amongst the key factors that explain this coincidence, those associated with everyday risk factors are paramount. These include the lack of access to basic services: water, drainage, and electricity; occupation density along with age and employment patterns of family members; and levels of education. The inability to resolve these development gaps and the vulnerability they represent signify an inability to reduce disaster risk in general, where even medium to high levels of resilience cannot compensate the influence of fragility and exposure. As in the case of Barranquilla, only by relating everyday risk to disaster risk and understanding the similarity in patterns of social and spatial incidence between non-biotic hazards and viruses can we hope to promote more development-based approaches to DRM with an emphasis on exposure and vulnerability reduction.

San José, Costa Rica

In Costa Rica, the COVID-19 pandemic has considerably increased the levels of inequality and poverty, which had previously been increasing steadily UNICEF has indicated that 1 in 3 children and adolescents in the country live in poverty (UNICEF, 2021). Between 2019 and 2020, poverty increased by 4 per cent

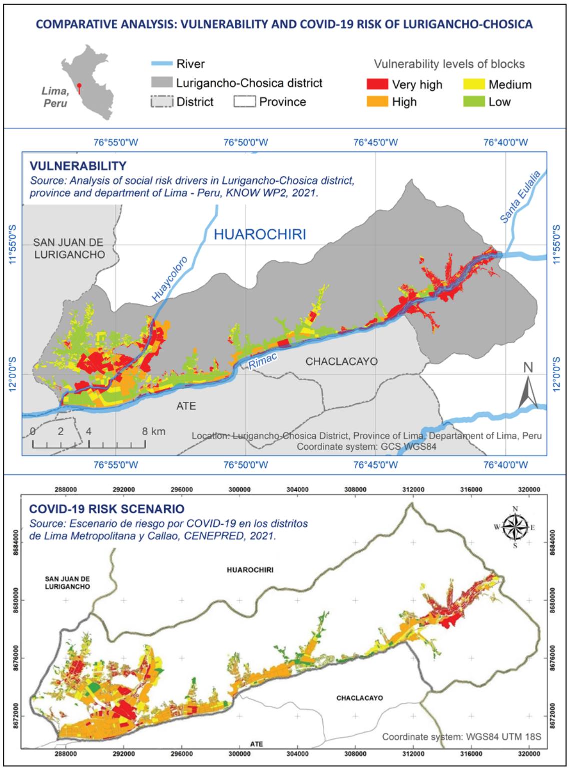


Figure 4. Comparison of High Vulnerability Areas of Lurigancho-Chosica to Hazard and to COVID-19

Source: KNOW WP2, CENEPRED.[13]

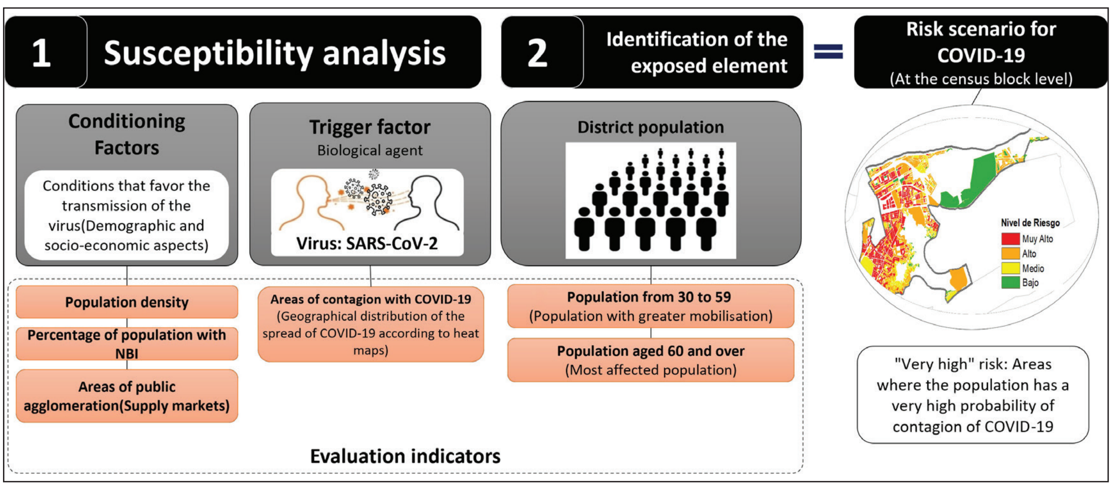


Figure 5. Modelling of the Risk Scenario for COVID-19

Source: CENEPRED[14] 2021.

and extreme poverty by 1.2 per cent (INEC-Costa Rica, 2020). The pandemic revealed historical problems of access to public services, education, and health, as well as conditions of habitability, overcrowding and unequal access to the option of staying home and earning, among others.

One of the main problems has been employment, with 26 per cent of the total working age population underemployed and 25.1 per cent working 40 hours or more a week and receiving less than the minimum wage (INEC-Costa Rica, 2021a). This high percentage of precarious formal work accompanies the 43.8 per cent of the total work force that is employed informally, mainly in urban areas (INEC-Costa Rica, 2021a). Furthermore, by the second quarter of 2021, 434,000 people were unemployed, representing 18.1 per cent of the working age population (INEC-Costa Rica, 2021a).

In the first phase of the KNOW research project in San José city, prior to the advent of COVID-19, the districts of Pavas, Los Guidos and Tirrases were identified as having the highest disaster risk (see Figure 6). In a second phase that began in mid-2021, more than a year after the beginning of the pandemic, Tirrases district in the Curridabat municipality was selected for in-depth analysis due to its risk profile, organisational capacities, and the role that the local government has had in promoting forms of inclusive, sustainable, and participatory city development. Complementary to this, the differentiated effects of COVID-19 in the districts of Curridabat were taken into account in this selection (see Figure 7). The location of Tirrases, Los Guidos, and Pavas is shown in Figure 8.

Tirrases, one of four districts in Curridabat, extends over 1.89 square kilometre, with a population of 21,730 (INEC-Costa Rica, 2021b). To date, more than 14 informal settlements have been established in

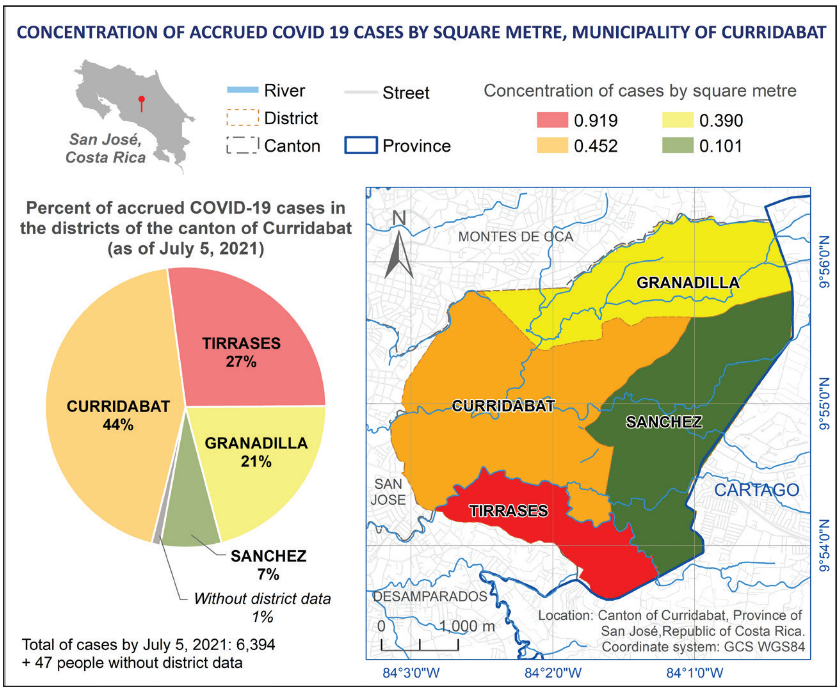


Figure 6. Concentration of Accrued COVID-19 Cases by Square Metre, Municipality of Curridabat (as of 5 July 2021)

Source: SNIT (2014), Ministerio de Salud. Prepared by Manfred Salas Castro–Maria Jose Carpio, 2021.

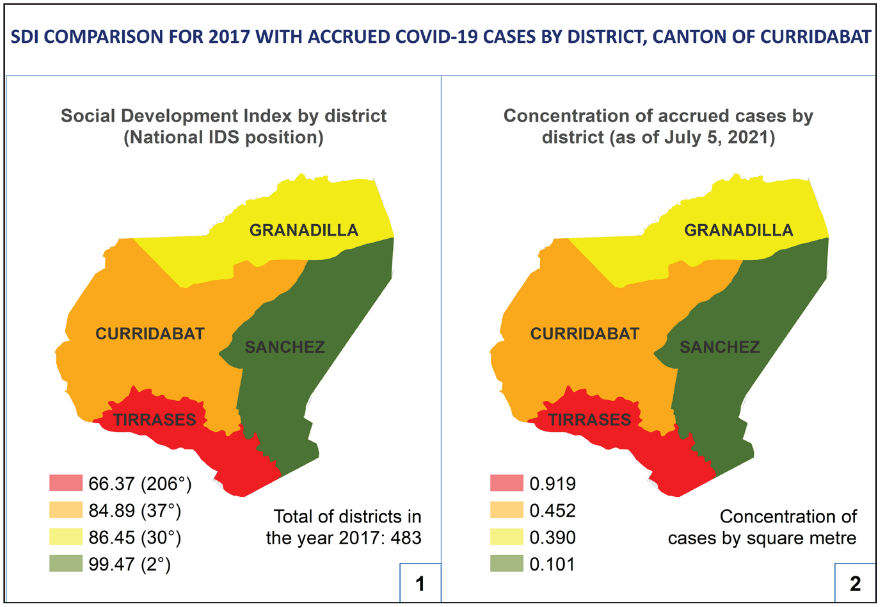


Figure 7. Curridabat: Comparison of SDIs and COVID-19 Incidence per Square Metre for the Districts of Curridabat

Source: SNIT (2014), Ministerio de Planificación Nacional y Politica Economica (2018), Indice de Desarrollo Social 2017. MIDEPLAN: San José, CR. Ministerio de Salud (2011). Prepared by Manfred Salas Castro—Maria Jose Carpio, 2021.

the district (Ministerio de Vivienda y Asentamientos Humanos [Ministry of Housing and Human Settlements], 2013). Many of these are built on steep slopes with high levels of landslide hazard. Hydrometeorological events between 1988 and 2018 have caused over one million dollars in losses; a considerable amount given the poverty of the zone and the low population size (MIDEPLAN, 2019).

Two of the most vulnerable communities in the Tirrases district are Miravalles 1 and Miravalles 2. Historically, they have faced severe problems in gaining access to services such as water and electricity. Only Miravalles 1 has obtained access to potable water and sewers. Miravalles 2 has 700 people, mostly of Nicaraguan descent and from female-led households, who have no access and are under an eviction order from the National Commission for Risk Prevention and Emergency Attention (CNE) due to the risk of landslides (Technical Report No. DPM-INF-0446-2007, cited in Sala Constitution of Costa Rica [Constitutional Chamber], 2019).

Although Tirrases has not been the most affected in absolute terms by the pandemic (1,722 infected people and 24 deaths as of July 2021; Ministry of Health, 2021), it is the district with the highest number of accumulated cases per square metre, considering its higher population density compared to the other districts of the municipality (see Figure 7).

At the social level, the data on accumulated cases of COVID-19 per square metre corresponds to the contrasting socio-historical conditions that exist in Curridabat, where three of the districts (Sánchez, Curridabat and Granadilla) have high social development indexes (SDI) in relation to the rest of the country. On the contrary, Tirrases has an intermediate to low ranking (206th of the 483 districts in Costa Rica). As can be seen in Figure 8, there is a correlation between COVID-19 cases per square metre and

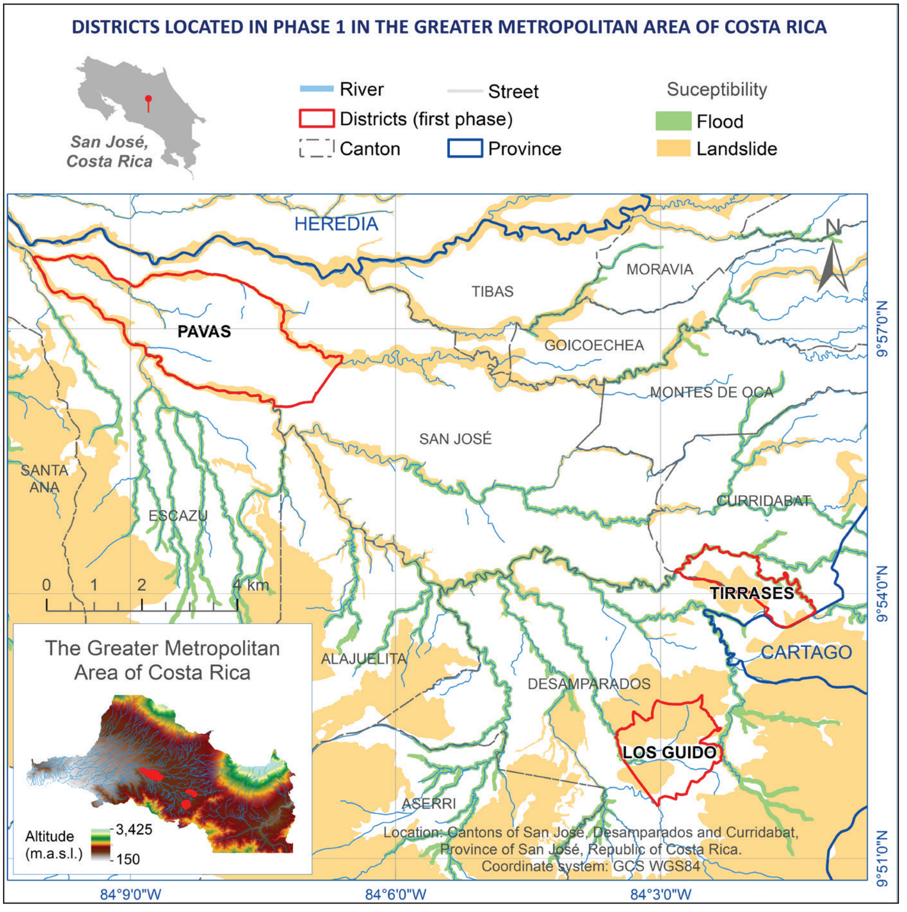


Figure 8. Location of Tirrases, Los Guidos and Pavas

Source: Sistema Nacional de Información Territorial (SNIT) (2014). Prepared by Maria Jose Carpio–Manfred Salas Castro, 2021.

the level of SDI, which reflects the patterns of socio-territorial inequality present and the greater susceptibility in the Tirrases district.

The issue of hazard and recurrent disaster conditions is not something new for the Tirrases district and, prior to the pandemic, more than 93 disaster events had been recorded due to different types of hazards between 2000 and 2018. As can be appreciated in Figure 9, in the communities of Miravalles 1 and Miravalles 2, the most frequent events were those related to landslides, a situation that has led to destroyed homes and evacuation of inhabitants of the area (UNDRR-DesInventar Sendai, 2021).

The pandemic has revealed and enhanced many negative conditions already present in our cities. Timely work on these problems with the actors who suffer them is necessary to avoid or reduce future risk. The greater exposure to COVID-19 in Tirrases can be explained by the historical hazards and vulnerabilities faced by the communities, revealed in the processes of socio-spatial segregation at the municipal level. A multicausal and multisectoral comprehensive approach to risk management and urban inequalities is required (Oliver-Smith et al., 2016).

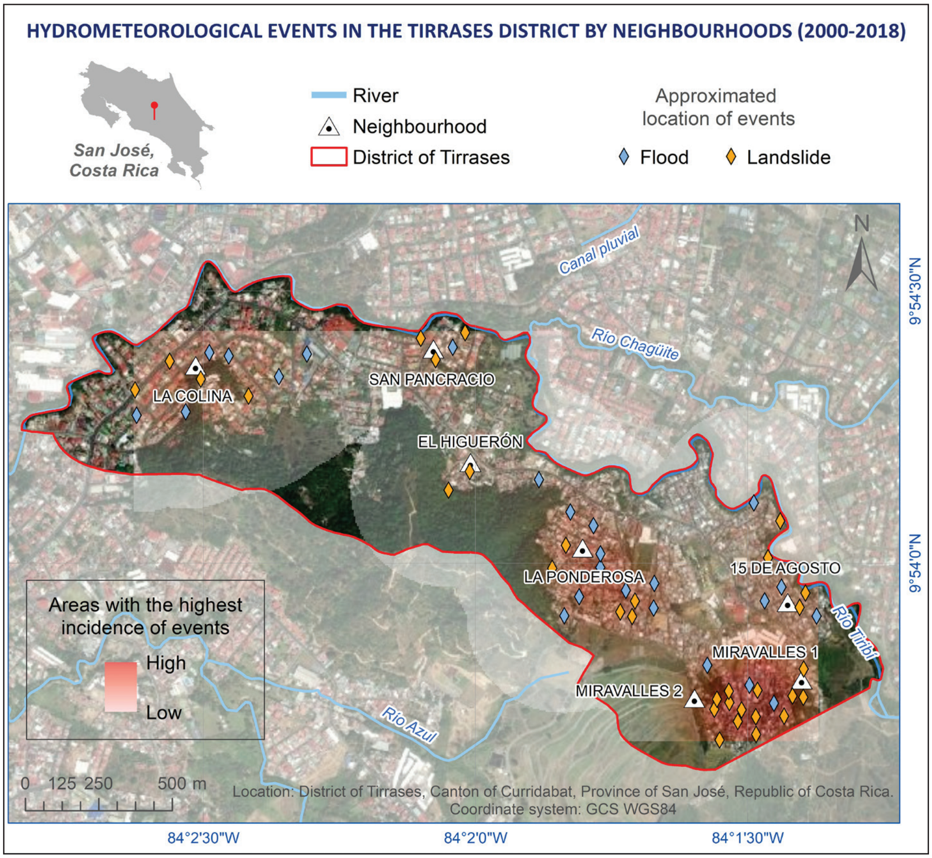


Figure 9. Hydrometeorological Events in the Tirrases District, by Neighbourhoods (2000–2018)

Source: SNIT (2014), own work based on data for the districts of Tirrases (2000–2018) in the database of the DesInventar platform. Prepared by Maria Jose Carpio–Manfred Salas Castro, 2021.

From Analysis of Interrelated Cause–Effect to New Governance of Risk for Sustainability

Viruses, along with other non-commonly considered hazard types, were given close attention in the most recent UN framework for disaster risk reduction, signed at the Third UN World Conference in Sendai, Japan in 2015. With this, the range of hazard and risk scenarios and the challenge for DRM increased and existing DRM organisations were called upon to be more closely involved in risk reduction, control and response, and recovery from virus-related disasters and scenarios in which hazards interact in more complex ways.

Although not homogeneous, it is known that the participation of legally constituted, normatively established DRM organisations in the response to COVID-19 has been in general marginal, poor, or non-existent, with some notable contrary cases and contributions in determined circumstances. This includes national, regional and local DRM Systems, Emergency and Contingency Offices and Commissions, and

Civil Protection or Defence Offices. Methods for vulnerability analysis (see Belén Desmaison et al in this special issue) and initiatives for the response to the COVID-19 emergency have emerged at the local level. This means that the response to COVID-19 has been developed jointly by GRD organisations, health sectors, planning, local government and initiatives at the local level. The question is whether this is something that should be improved in the future or if the current complexity and origins of risk and its drivers (including considerations of systemic risk, extensive and intensive risk, and moral hazard) do in fact present a problem that current governance arrangements are not accustomed to deal with, particularly when considering managing disaster risk from a risk prevention and mitigation angle and not that of response and recovery.[8] The discussion and evidence we provide tends towards the conclusion, or rather the confirmation, that a new approach is required.

If governance arrangements emerge from the development and internalisation of new concepts that better reflect reality, then the principal argument here must relate back to the starting assumptions in this article. Disaster risk and disaster, and the causal factors these involve, are a continuity of pre-existing everyday conditions of existence, in which inequality, poverty and exclusion are predominant, if not unique. Much of the disaster risk that exists in LAC and other regions is concentrated in cities. This is clearly an expression of skewed development, with underlying causes and drivers deriving from failings in the concept and practice of development. Hazard factors may change—from floods to technological failings, from earthquakes to viruses—and the ability to predict and monitor some of these, particularly what have been called emergent hazards, is increasingly uncertain. However, what is more certain is the recognition that vulnerability and exposure factors are critical in any attempt to govern risk in the future and these have similar origins and expressions whatever the hazard event. Moreover, they are based on everyday risk contexts that help define social exclusion and poverty in general.

Unfortunately, it seems today that DRM is still conceived primarily as an instance for dealing with exogenously generated threats. The somewhat ‘exotic’ expression of governance that has evolved from an exogenous view of risk must be rejected and, re-elaborated and re-located institutionally as a concern and process in order to take account of the endogenous construction of risk and the processes and actors behind this (Lavell & Maskrey, 2014; Maskrey et al., 2021). Assuming the guise of a development sector as such, even though they are not, many DRM institutional frames portray the idea that disaster risk and disaster are caused by external exogenous factors impinging on an innocent society and its development process, and that risk is constructed by hazards, many of which are emergent, black swan, unpredictable and uncertain (see Hewitt, 1983, for an early analysis of such contexts). This as opposed to what is clearly the case: disaster risk and disaster are endogenous to the very systems that suffer them. The conditions for crisis are in the system itself. Without an overall change in the social, economic, political and cultural conditions that lead to and drive risk, little advance will be made in risk prevention and control in the future and response will become increasingly costly, while the basic problems remain unresolved.

The correlation we have found—between areas suffering more commonly experienced disaster hazard and risk conditions and those suffering the health and economic consequences of the pandemic the most—leads to only one conclusion if we think prospectively and not reactively: disaster risk governance is not a sector owned by an institution or system of institutions. Risk signifies the failure to achieve development sustainability goals; it is a reflection and symbol of malaise and the breakdown in societal–environmental relations. This signifies that when talking of disaster risk prevention methods, we are basically talking of the achievement of sustainable development goals in sector, social and territorial terms, in which reducing inequality, poverty and exclusion in their varied forms is critical. By doing so, no matter what the hazard, society gains, as vulnerability in general is reduced and sustainability and resilience increases. The essence of risk prevention as opposed to reduction or mitigation of existing risk is in recognising its roots in societal practice informed by failed development tenets and drivers. If these are not transformed, the current tendency for increased risk will continue and response and mitigation will become necessary and increasingly expensive.

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ORCID iDs

Allan Lavell https://orcid.org/0000-0001-5653-0287
Celene B. Milanes https://orcid.org/0000-0003-2560-8859

Notes

1. 'It has become clear that vulnerability to COVID-19 depends on several conditions: where in a city a person lives and works, gender, age, pre-existing health conditions, income level, type of home, and access to public services, such as health facilities, transportation, and clean water. Poverty and marginalisation intersect in slums and poor neighbourhoods, perpetuating other forms of socio-economic, political or cultural inequality, further increasing the risks facing residents in these areas…. Reducing urban inequalities is a cornerstone to ensure we are all better prepared for future shocks and crises and are able to thrive' (UN, 2021, p. 9, 29).
2. These terms, as used in this article, have been defined by paraphrasing different attempts to define the terms and employing our own accepted usages. Disaster is used to refer to a severe interruption of the routine functioning of a society due to the impact of a hazard event or events on an exposed and vulnerable society and is expressed as direct and indirect economic, human, cultural and other types of loss and damage. Catastrophe is used to depict the most extreme form of disaster where even the institutions and organizations established to deal with disaster and stress are overwhelmed and even destroyed. Social construction of risk refers to the social, economic, and political processes, made real through human actions and activities, by which a physical, biotic, technological, or anthropogenic hazard event is transformed into conditions that propagate and potentiate loss and damage. Such processes include environmental mismanagement and encroachment, absence of urban and land use planning, poverty and exclusion, lack of consideration of risk in public investment decisions, amongst others.
3. The present article employs diverse concepts or definitions common today in disaster risk studies but not always homogeneously interpreted: disaster risk is understood as the potential for, and probability of determined levels of loss and damage associated with the occurrence of a hazard event; hazards are defined as the physical, biotic, technological and anthropogenic threats that ensue from living and existing in a particular environment or space and which can materialise at some time in the form of a damaging event; exposure comprises a context where people, communities, goods, infrastructure and other tangible components of livelihoods, production and consumption are in the potential spatial range and the territories of hazard impacts; vulnerability is an endogenously constructed condition which signifies a proneness to suffer loss and damage and face difficulties in recovery in areas which are socially and territorially diverse and conditioned by numerous social, economic, political and cultural factors; resilience is understood as the capacity of a population, community, country, livelihood, and so on, to bounce back and recover from stress post impact and is related to existing human, mental and financial resources, levels of social cohesion and capital. Disaster Risk Management comprises a complex practice in which society plans, organises and acts integrally in order to reduce existing risk (corrective management), prevent new risk (prospective), respond and prepare for emergency

and disaster situations (reactive) and to increase resilience and recovery opportunities (compensatory) (see Lavell, 1998, for a first development of this typology and idea; and Lavell, 2004, for further development). Everyday or quotidian risk comprises the lack of opportunity for a healthy, secure, prosperous and fulfilling life that is associated with deficiencies in access to health, employment, income and personal or collective security, among other conditions (see Bull Kamanga et al, 2003). Extensive risk and disaster are expressed in cases of recurrent smaller-scale losses and damage to the same communities and areas as opposed to intensive risk, where low frequency high impact events occur.

4. See, Sala Situational COVID-19 Perú: https://covid19.minsa.gob.pe/sala_situacional.asp (data from 29 September 2021; accessed on 1 October 2021).
5. The department of Lima has more than 30 per cent of the total population of the country and in area it represents 2.71 per cent of the total. Comparing the density of Peru and Lima, Peru has 25.79 inhabitants/km^2, while Lima has 272.35 inhabitants/km^2. Deaths are not registered by the place of death but by the place of origin registered in the national identity document. These are official figures, which have been audited on several occasions, the figures of the Ministry of Health (MINSA) were verified with those of the National Information System of Deaths (SINADEF) precisely to ensure the statistics correspond to reality and not lead to wrong interpretations. Another element to consider is that when the pandemic began, migrants who worked in Lima temporarily (and who did not permanently reside in Lima) returned to their places of origin to quarantine. Also, people in Peru usually do not die in the health establishments that comprise the health system, there was no such capacity before the pandemic. The health system collapsed in the days that the pandemic began, health establishments were closed for months, and many people died at home.
6. The discussion on vulnerability is diverse and contested, but this does not mean that it cannot be measured. The vulnerability model used in this study is one of the many approaches to vulnerability analysis and has taken into account the fact that field work could not be undertaken due to the pandemic. Due to this, secondary information was used to inform the proposed model. Variables selected from the official population census were used to build a vulnerability model based on the analysis of deficiencies in daily living conditions such as lack of water, electricity, health status, and education. These are weaknesses that expose families to the impacts of adverse events in a very particular way. The method used was developed in the 1980s by the mathematician Thomas L. Saaty (1990) and designed to solve complex multi-criteria problems by building a hierarchical model, which allows the actors (decision-makers) to structure the problem visually. It combines the objectivity, tangibleness and rationality of classical science with the subjective, intangible and emotional aspects of human behaviour. The model has mathematical support, allowing the incorporation of quantitative (field measurements) and qualitative information (level of incorporation of risk management instruments, levels of social organisation, etc.), for which the participation of a multidisciplinary team is required (CENEPRED, 2014, p. 15, 206). To estimate the relative importance of each of the indicators, a pairwise comparison methodology is used (Saaty, 1990).
7. It is impossible to know how contagions and deaths are distributed among the lots and blocks of the city due to Law 29733 on personal data protection, which prohibits the publication of personal data. The purpose of Law 29733 is to guarantee the fundamental right to the protection of personal data, both in the public and private sectors.
8. DRM today in Latin America identifies four types of intervention: prospective, which looks to avoid future risk; corrective, which deals with existing risk attempting to mitigate it; reactive, which deals with preparedness for and response to disaster; and compensatory, which deals with resilience enhancement. These are all essentially different in terms of objectives, methods, and actors, although linked through the idea of risk and disaster.
9. Based on information from the Disaster Risk Management Information System (SIGRID), an open access geospatial platform with information on hazards, vulnerabilities and risks caused by natural phenomena, as well as territorial information at the national level in Peru. http://sigrid.cenepred.gob.pe/sigridv3/
10. Based on information on the socioeconomic status of Lurigancho-Chosica from the document ‘Planos Estratificados de Lima Metropolitana a Nivel de Manzanas 2020’, National Institute of Statistics and Information (INEI). https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1744/libro.pdf
11. The hillshade map was created with the Digital Elevation Model (DEM) from the Ministry of Environment (MINAM). http://geoservidorperu.minam.gob.pe/geoservidor/download_raster.aspx

12. Based on the results of the research in 'Análisis de los impulsores sociales del riesgo en el distrito de Lurigancho-Chosica, provincia y departamento de Lima – Perú' from Work Package 2 of the Knowledge in Action for Urban Equality Project (KNOW WP2).
13 The map was adapted from the document 'Escenario de riesgo por COVID-19 en los distritos de Lima Metropolitana y Callao' (page 46), National Center for Estimation, Prevention and Reduction of Disaster Risk (CENEPRED). https://sigrid.cenepred.gob.pe/sigridv3/documento/10384
14. Translated by the authors from the document 'Escenario de riesgo por COVID-19 en los distritos de Lima Metropolitana y Callao' (page 19). https://sigrid.cenepred.gob.pe/sigridv3/documento/10384

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