COVID-19: Relationships with disaster risk, its concept and management

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This document evolved in early April 2020 in response to the need to discuss common aspects between COVID-19 and more well established and known disaster contexts, and the causal processes, actions and policies used to deal with them. Writing of this document was paused for four weeks due to the author collaborating with other colleagues, to write a document on COVID-19 and risk management from the angle of political economy and government action[1]. That document includes some of the arguments and observations made in earlier and the present versions of this document. For present purposes, we have incorporated aspects of the document mentioned above, in a type of synchronized and symbiotic advance in discussions[2]. The present version is for discussion and completion of referencing and exemplifying undertaken on reception of the results of debate and comment. For those not interested in a detailed breakdown and analysis of comparative topics and themes, the reading of the executive summary and sections 1, 6 and 7 would suffice to capture the essence of the arguments put forward here.

[1] *See Lavell, A; Mansilla, E; Maskrey, A; y Ramirez, F. April,2020.* The Social Construction of the COVID-19 pandemic: disaster, risk accumulation and public policy.

[2] This document has been developed in the frame of the UCL-DPU-FLACSO resilience component of the KNOW- Knowledge for Urban Equality- project, coordinated by Allan Lavell, through the SG of FLACSO. And, it searches to contribute to ongoing discussions as to notions on systemic risk and the content of the forthcoming Regional Assessment Report-RAR-2020- (UNDRR, Panama) on risk in Latin America and the Caribbean.

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Executive Summary

COVID-19, the disease associated with the most recent coronavirus, SARS-coV-2, product of animal-society interrelations and virus transmission, has been referred to by many as a "disaster" or "catastrophe". This invites a debate and discussion as to the meaning of these terms, their significance and the relationship COVID 19 as an epidemic or pandemic has with disaster risk and Disaster Risk Management (DRM) as we have understood these to date (associated with harmful physical events of different origins and types, from natural and socio-natural, to technological and anthropogenic).

With this in mind, we seek to answer the basic question: Is the Covid-19 pandemic and its consequences a disaster and in which comparative sense? We explore several key linkages:

- How does the pandemic, its causes and impacts, compare to more traditional disaster scenarios?
- What disaster risk concepts can be leveraged in our understanding of the pandemic?
- How do government planning, intervention and response influence pandemic and physical hazard-based disasters?
- To what extent do underlying socio-economic, cultural and political conditions configure damage and loss and to what extent can common elements be found in the cases of virus and physical hazard-based disasters?
- What role can DRM organizations and institutions play in managing pandemic related disasters and what can these learn from the experience with the pandemic?

The document contrasts traditional and COVID-19 disaster scenarios, focusing on the similarities and differences in the use, application and relevance of the different conceptual components currently employed to analyze disaster risk and disaster. This is used as a basis to consider the relevance of DRM concepts, methods, and intervention modalities to support management of the pandemic.

COVID-19 is clearly different in its basic constitution and mode of existence to a disaster associated with more traditional physical hazards. However, it most obviously is a disaster if we accept the basic definition of disaster as a severe interruption of ongoing, routine daily life associated with exposure to a hazard event, under conditions of vulnerability and lack of capacity. Here it may also be accepted that “disaster” can have differing scales, from family level through to society as a whole, and also have extensive and intensive manifestations.

The option of employing different specific uses of a generic concept and reality like that of “disaster” always exist and can be justified scientifically. By examining the different specific contexts closely one can then perceive in which ways understanding one type helps in understanding another and which aspects of one must and can be taken account of in searching to manage another. Common elements that can be transferred from the study of disaster risk and the practice of DRM to the

understanding and management of the COVID-19 pandemic (or future crises associated with viral infections) and their economic impacts include:

- the application of the disaster risk formula and its components to understand the process of social construction of risk associated with the pandemic (*risk = hazard * exposure * vulnerability*);
- understanding the balance and *feedback loops between hazard, exposure and vulnerability* in constructing different risk contexts;
- the *modelling and projection* of short, medium and long term social, human and economic impacts of hazard events.
- methods for the identification of vulnerable populations and their *nutritional and health needs and the priorities in delivery of food stuffs, water and medication for the most vulnerable*.
- the role *socially constructed contexts* of informality, exclusion, poverty, marginalization, chronic, quotidian or every day risk play in *differentially affecting disadvantaged population groups in different disasters*.
- the presence of common underlying, *causal root factors in the construction of different expressions of risk*.
- the use of *corrective, prospective, reactive and compensatory risk management* categories in understanding intervention needs and in setting priorities and delimiting action;
- the use of both *structural and behavior modification interventions* in risk mitigation and risk control.
- the application of *early warning systems or their equivalent* to reduce short-term risk conditions.

Close consideration of COVID-19 related risk allows us to augment our understanding and knowledge of the complexity and systemic nature of risk. This then can prelude discussion as to the need for changes to governance systems than can account for better coordination and integration of disparate risk management contexts and systems.

The fact that COVID-19 will impact future disasters associated with hurricanes, flooding, earthquakes and other hazards must also be closely considered. The direct impact of COVID-19 and the restrictive economic and social controls implemented to reduce its spread and effects will most probably increase exposure and vulnerability amongst already disadvantaged groups, but also affect previously better off segments of the population. These contexts must be considered and attended to in short order if future disaster risk reduction and response efforts are to be effective.

The economic risk associated with physical hazards such as earthquakes and floods include direct damage and loss to constructed elements and to existing economic stocks, followed by linked future losses in employment, production, consumption and income. These impacts affect different macro and micro economic indicators over an extended period after the event. Government has little post impact influence on the direct damage associated with such physical events. However, ex-ante

planning, management and intervention can and does positively or negatively influence such levels, depending on the risk sensitivity of such actions.

In the case of the COVID-19, no physical loss and damage occurs. But economic and social impacts are high, nonetheless. This is reflected in growing unemployment, loss of incomes, loss of production, among other things. Part of this is due to individuals or companies simply reducing their activity due to health related fear of the virus and illness (this is seen in the case of decisions to open economies in many US States but with many businesses and people not willing as yet to take the risk of opening up and circulating). But the greatest part is due to the sudden social distancing demands, norms and regulations enacted by government and their impact on employment, production, income and earnings. Thus, different to traditional disaster impacts, government does have a conjunctural, immediate impact on ex post levels of loss and damage to economy and society. Health-related effects are eventually counterposed directly to economic and wider social effects and the balance between the two in decision making must be decided according to political as well as technical criteria.

The equivalent of a reconstruction and recovery plan, post-earthquake for example, are the economic reopening and recovery plans that many nations have or are developing as COVID-19 cases start to plateau or drop. However, the two contexts are different, even if they have elements in common. In particular, in the same way as post disaster reconstruction and recovery plans for events such as earthquakes and hurricanes should search to reduce and not reconstruct negative risk levels, and increase resilience, post pandemic plans must also consider changes in urban areas, housing, schools, mass transit systems, for example, which will lead to reduced exposure and vulnerability in the future.

Whether considered from the angle of risk causation and disaster impacts or from the angle of recovery and reconstruction, the analysis offered confirms a **social construction view of risk and disaster**. In the same way as earthquakes and hurricanes are not "enemies" to be confronted, neither are viruses. In all these cases, risk and its components of hazard, exposure and vulnerability, and the ensuing disaster related impacts, are essentially constructed by society. Only society and its governance structures can influence the levels of impact and post impact recovery.

The differential way in which countries have suffered and faced up to, controlled or not, the impacts of COVID 19, serves to illustrate this point. The virus is the same, whatever the country, as are earthquakes, hurricanes and floods, when taking into account their different expressions, magnitudes and intensities. However, different societies suffer and respond differently to them. This is due to the different social processes by which risk and its component parts has been constructed and society perceives and responds to it.

1 Introduction

"*It would have been bad even with the best of government.*
Here it has been an absolute chaotic disaster"

Barak Obama (2020-05-09)

The COVID-19 pandemic has been widely referred to as a disaster or even catastrophe. Negative impacts have been felt along a continuum from health and health services through to the severe social and economic consequences for the individual, family, businesses, countries, and whole regions. Dealing with the pandemic and its expressions in different countries involves understanding, contrasting, prioritizing, and managing many different realities and scenarios in the short, medium, and long terms, from health to economic and social issues.

Even with the progress in concepts, technology and science over the past decades, and the systematic elimination of "natural disaster" terminology from UN disaster risk organization (UNDRR) associated literature and actions, the notion that disasters are "natural" is still pervasive, especially among politicians, development banks, insurance companies and the public at large. There is a reason for this which is very worthy of consideration but will not be taken up on here.

A virus, like an earthquake, is a natural phenomenon, not a "natural disaster". Research on disaster risk points to the ensuing disaster (or lack thereof) as being largely a long-term social product, a result of inadequately managing risks associated with likely hazardous phenomena. As Obama alludes to in the quotes above, disasters are not natural, rather, social manifestations of poor development and risk governance. This observation and premise have now existed for more than 50 years (see O'Keefe, Westgate and Wisner, 1976).

The range of institutional and organizational structures and approaches involved in managing the COVID 19 crisis is large. The obvious initial primary role of health-related institutions and personnel has been complemented in many countries in the short term with the presence of emergency related organizations, including police, armed forces, fire fighters and others. The short-term economic impacts on people and their families and on businesses and sectors has required financial and economic support for these to weather the storm in its early phases. Finance, planning and economic development institutions, nationally and internationally, are now involved in managing future options for recovery and opening of closed economies. The early scientific requirement for control of exposure of individuals and hygiene methods to slow the spread of the virus is still prevalent but evolving and fine-tuned as the pressure to open economies comes to the forefront.

One major organizational and institutional framework present in some, but not all countries, in the early stages of the pandemic, has been the national disaster risk or emergency management agencies, and countries have many times used their emergency laws to support government decision and action. But institutional involvement has been rather more emergent than pre-planned as few provisions had been taken prior to the pandemic to deal with a virus-related hazard. Inter-institutional arrangements and collaboration have had to emerge along the way. In some countries obvious "turf wars" have evolved where decisions on roles and hierarchy have come into play.

2 How to define and understand a Disaster

"*This crisis reflects underlying, pre-existing conditions in our society"*

-Barak Obama (2020-05-16)

The Basics

If we consider the definition of disaster, expressed in the idea of a severe interruption in the routine, every day functioning of a society, due to the impact of an adverse physical-material or biological event, then COVID-19 and the associated pandemic qualify as a disaster (now at global, national, regional and local scales). For many countries, it is the largest sanitary crisis they have faced in generations, if ever, and in many others, it is approaching becoming, or is now a catastrophe. At the same time, the health related disaster (affecting people and the health systems that attend them) is accompanied by social and economic impacts, such as to qualify it to be understood as a concatenated or linked health and socio-economic disaster.

On a second level of analysis, the definition of disaster is also satisfied in that the impacts and effects of the virus and COVID-19 are materializations of preexisting risk conditions (that favor a potential negative future impact and discrimination in its social distribution). The existence of these conditions is explained by the presence in space and time of:

- a hazard, the probability that the virus infects individuals or that the disease itself challenges the process of economic and social development and its sustainability in the short and medium terms.
- exposure to the virus or to persons or other vectors able to transmit it; and
- the vulnerability of an individual or social group to the effects of the hazard event.

This assumes that the notion of hazard can be used both in the context of the virus and in the context of the illness itself, and the notion of disaster or catastrophe in the context of the pandemic (health or sanitary disaster) and with regard to its economic and social consequences (socio-economic disaster).

Before objections are raised as to this varied use of singular notions to depict different conditions (as is also the case when compare more traditional disaster contexts with the COVID 19 experience), it is commonly accepted that words, concepts and notions are many times developed in a particular scientific or social context, but then used by other sciences or themes to advance understanding and think management options. They have a generalized and generic use which is then specified as regards different research areas and this allows flexibility and diversity in their application. In the DRM field this has occurred with such central notions as vulnerability and now, resilience, or with adaptation in climate change study, all notions first developed in other areas of inquiry. As we know, such varied use does many times have serious epistemological problems for the research process and comparability of results and conclusions across knowledge domains. These must be recognized and resolved. The multiple use of central concepts and analytical frameworks in different areas of inquiry requires that we clearly distinguish between the contexts in which we use these terms and their veracity or usefulness in different contexts. They must be compared from a conceptual and

methodological perspective, to advance causal analysis and, subsequently, discussion of intervention and management options.

The "Sociology of Disasters", a disciplinary construction of Enrico Quarantelli, Russell Dynes and others from the 1960's onwards (see Quarantelli and Dynes, 1977) called our attention to the scientific need for precision in defining and conceptualizing "disaster" (and by association, hazard, exposure and vulnerability), given the tendency to include multiple scenarios linked by certain factors, but differentiated by others, under a singular nomenclature (Quarantelli, 1985). Similarly, this branch of inquiry proposed definitions that sought to help distinguish between an accident, an emergency, a disaster, and a catastrophe. In the context of COVID-19, it is interesting to consider the characteristics identified to denote the latter.

For Quarantelli (2000), a catastrophe exists when, among other characteristics, the specialized structures and organizations of the State and government (supported by the private sector and civil society), or those that "emerge" to attend emergencies and disasters, are themselves seriously compromised or collapsed - the fire departments, police, rescue teams, and medical services, among others. As the functional and operational pressure on health services and the number of medical personnel, including nurses, doctors, etc. is seriously affected, the notion of catastrophe is perhaps appropriate in the case of several countries, in both the North and South, suffering the effects of the COVID-19 pandemic. Obama's above cited reference to a "chaotic disaster" maybe replicates the notion of catastrophe!

As a corollary to the debate as to what is a disaster, Quarantelli remarked that much discussion exists as to definition and coverage, and though no consensus emerged, everyone knew when a disaster had occurred. This same idea is expressed in Jared Diamonds' recent book on Upheaval (2019) with regards to "crisis". There he also quotes Winston Churchill, "never let a good crisis go to waste". Hopefully, that is true of the present crisis.

Disasters have been classified in different ways, many according to their hazard trigger: hydrological or geological, biological, or economic, for example, and distinctions and relations have been highlighted between complex, compound, concatenated, nat-tech and systemic disasters. The notion of slow and rapid onset disasters has also been commonly employed.

COVID 19 as a disaster

In regard to the COVID 19 pandemic as a disaster type, amongst the categories more commonly identified it possibly most closely approximates a biological slow onset disaster. Locust infestations could possibly be seen as a case of rapid onset biological disasters.

However, in the case of COVID 19 it is perhaps worth taking up here on the notion that Piers Blaikie (1994) developed in the face of HIV-AIDS, in comparison with other disaster types associated with earthquake, storm, flood, volcanic eruption, etc.

Blaikie at the time spoke of a different type of disaster, a "long wave" disaster. With this, he refers to the characteristic of HIV, spreading slowly but constantly, with an undefined temporal extension, among vulnerable populations in different parts of the world and with diffuse and widespread impacts in time and space. As a hazard, HIV had no known time limit, no confined space in which it impacted, nor clear evidence that could help in estimating and calculating the damage and loss that would be associated with the spread of the disease worldwide. The application of such a concept to

epidemics and pandemics such as MERS, SAR, Ebola, the Spanish flu of 1918-21 or the Great Plague is suggestive.

The increasing complexity of disaster risk and disaster: hazards, exposure and vulnerability

The increasing complexity of the study and definition of disaster and disaster risk has been a constant over time. This has been reflected in changes to, and the increasing generic and specific use of the notions or concepts of hazard, exposure, and vulnerability, as well as disaster itself. The current stage in this evolution of complexity is constituted by the notion of "systemic risk" promoted by the United Nations Office for Disaster Risk Reduction- UNDRR- and the 2015 Sendai disaster risk agreement. The now widespread use of the notion of resilience, and its relations to disaster risk and DRM, is also a part of this process of increased complexity (and confusion and uncertainty many times).

With reference to physical hazards, the range of existing expressions, and the possible relations between them in a single event or occasion of disaster, has led to successive notions of multi-hazard, concatenated, complex and compound hazards and disasters. In our specific case, the virus and the disease as sequenced hazards represent a concatenation. This contemporary or sequenced occurrence of events of a natural, socio-natural, or anthropogenic nature has been recognized as increasingly common when compared to the occurrence and impact of a single event, in a delimited time and location. Multi-hazard planning frames have been common for a long time now.

Exposure is the way and degree to which a subject locates in a place, a space, a territory where it can receive the impact of a given natural, socio natural or biological event. Exposure has evolved from being considered a part or factor of vulnerability to be considered a separate though related risk factor. To be vulnerable one needs to be first exposed to a hazard. However, that exposure does not necessarily mean one is vulnerable. Hazard exposure as opposed to risk exposure, two different notions, have also been extensively employed. The latter is more typical of nomenclature in the insurance industry.

Finally, the notions of direct and indirect exposure have been the subject of discussion. In the first instance, the impact of the event is direct on population, infrastructure and/or production as these absorb or receive the impact of the event directly in a specific place. That is, they are in the "line of fire" of the event. In the second case, indirect impacts are transmitted through the functional and dependent relationships between both contiguous and non-contiguous spaces and territories. One example of non-contiguous indirect exposure and impacts is the reduction in wheat production in the USA due to adverse climatic conditions and its impact on access to "humanitarian" or commercial wheat for populations in Africa suffering from drought, hunger, or famine. Another is when producers of electronic components in an exposed region of the world are directly impacted by a hazard, and this results in the lack of inputs for final production in another region of the world.

These two cases remind us of the importance of complexity and interrelations within globalized, trans nationalized systems.

With vulnerability and capacity, these have also been transformed over time with different interpretations of their nature and the drivers behind them. The classic typologies of levels and types of vulnerability such as that proposed by Wilches-Chaux in 1986 in Latin America are still very didactic and highly relevant and used in research and action planning, but they are now challenged in debate and complemented by other notions and definitions that attempt to restrict the use of

the notion and thus make it more accessible and precise in disaster risk studies, also allowing a distinction between cause and effect.

An example of this is the now longstanding notion (associated with authors such as Terry Cannon (Cannon, 1993)) that vulnerability should be reserved for conditions related to livelihoods and humans, and not for infrastructure, buildings, roads etc. Here the argument is that weaknesses in the latter are the result of bad or even corrupt constructive practices, not vulnerability per se; practices, however, that could and do contribute significantly to the vulnerability of humans and their livelihoods. In other words, a house or construction that collapses on a family or individual destroying their livelihood or causing death, is due to its improper construction, and this contributes to the existence of vulnerable conditions for humans and their livelihoods.

Structural engineers can legitimately refer to vulnerability of structures because that terminology is used in the practice of engineering in a context of structural weakness and is even longer standing than its use in disaster risk studies. However, when moving from engineering to the social construction of risk and its management, in the frame of disaster related concerns, the terms of reference change and thus, also, the definitions and meanings of the same words or notions. Human vulnerability would be expressed, amongst other things, in the conditions that lead people to live in hazard prone areas or occupy poorly constructed structures, not in bad construction per se.

Social construction of risk

The ontological basis of our overall understanding of disaster risk and disaster in the present document lies in the so-called **social construction paradigm**. Disaster risk and its components are constructed through human action and practice and at the same time are subject to interpretation according to different human mind sets and viewpoints. That is, society constructs both risk and its interpretation. Understanding hazard, exposure, vulnerability and finally risk and risk management options requires analysis from this risk construction perspective, whether in relation to virus or other physical drivers of risk and disaster.

3 Disaster Risk and COVID-19

In our analysis of the relevance of DRM thought and action for the analysis of the COVID-19 "disaster" and the impacts associated with it, let us first deal with the complex relationship between disaster and risk, and the hazard that triggered these, to later examine in detail, in a fourth section, the constitutive aspects of vulnerability and following that, exposure.

Disaster risk

Disaster risk has been defined in terms of the probability of future loss and damage. This is associated with the actualization or materialization of hazards in the form of specific damaging physical events, affecting population and livelihoods that exist under varied conditions of exposure and vulnerability. It is a latent condition where the option to analyze and measure risk depends on the recognition of its possible or real existence and knowledge of the characteristics of its component parts (hazard, exposure and vulnerability, offset by capabilities and capacities). The notion of uncertainty is considered fundamental in the analysis of risk and the resolution of

problems of uncertainty are of singular importance in terms of management and the direction and scope it should take in the future.

Multiple linear, complex, probabilistic, qualitative, quantitative and descriptive methods have been developed to measure and evaluate disaster risk. These consider and account for the magnitude and recurrence of the different hazard events; the different degrees of exposure and levels of vulnerability; and the economic sectors, infrastructure and different population groups that may be affected. Of course, the veracity of the measurements and calculations depends on the fidelity and compatibility of the information that feeds the models or analytical methods.

The risk associated with the virus or COVID-19 for a country, region, locality, or group of individuals can be assumed to be high under any circumstance given the potential ubiquity and the highly contagious nature of the virus itself. Normal seasonal influenza has a much lower contagion rate as do the MERS and SARS virus. This risk can be considered for different concatenated spheres of impact analysis, which have parallels as regards "traditional" disaster risk and DRM practice.

Types of impact and their modelling

Models and other techniques exist for projecting future illness, asymptomatic subjects and death where the objective is to provide information to help plan and react to the needs of the health systems and the demand for their services. Epidemiology has been a dominant concern up to now with the goal of flattening the growth curve of the disease and preventing the overwhelming of health services in the short and medium term. Regardless, many are starting to accept that some long-term projections now talk of 60-70% of the world population being infected at one time or another, prior to the so-called herd protection effect kicking in.

In the more traditional DRM theme, a similar concern is found with the development and use of models that project the number of dead, sick or disabled that may be associated with an earthquake, hurricane or other event, of determined magnitude and intensity, affecting a specific area or population group.

The difficulties encountered in such modelling are numerous due to the lack of data, and/or the level of accuracy of the base information included in the models. Furthermore, non-linearities in terms of cause and effect underlie the complexity of feedback loops in multi-hazard or concatenated events. Both epidemiology and DRM attempt to find causal variables related to possible future risk reduction measures (health and disaster) and model their impact on the behavior of the base variables.

Second, there are the potential direct impacts of the-pandemic on the economy and the daily lives of individuals, their families, businesses and public services. Direct impacts here refer to effects that are related to the existence of the virus or the disease, without considering conditions imposed by the government authorities of a country, region, city, community, etc. These impacts are difficult to determine because they exist within the framework of actions dictated by government and separating cause-effect is difficult at times.

Compared to the direct impacts associated with an earthquake or hurricane, flood or tornado, in the case of infectious diseases there is no loss or damage to constructed elements such as houses, factories, roads, schools and hospitals, beyond deterioration due to lack of maintenance. Such direct impacts can and have been modeled for traditional disaster contexts.

Direct impacts due to COVID-19 can be seen in many non-physical facets: those fearful of contracting the disease and under psychological stress; those that loose work days and income due to illness; families that loose members who are income generators; companies that lose productivity or have to close due to illness among their employees[3]; losses in agriculture due to a lack of markets or ways of harvesting and transporting; health systems that lose functionality due to illness among their employees, are among many effects that could be considered.

Finally, indirect impacts and effects, in the case of the virus and the disease, are mediated by the type of action and regulations dictated by governments or other authorities and which influence human behavior and, consequently, the functionality of the family, social group, city, regional, national or global economy. In other words, indirect impacts are those due to the control exercised in achieving a health goal, which in turn affects the economic and social functioning of society. Furthermore, actions in one country or region or city have repercussions in others, given the interconnected nature of present-day economy and society creating contiguous and non-contiguous impacts.

These impacts have been modelled at different levels and scales according to country and region. The more well-known projections refer to GDP, debt, unemployment, investment, and other macroeconomic indicators. But far finer tuned analysis has been and can be made as regards specific population groups and economic sectors, cities, areas, and regions, etc. In the case of the more well-known physical hazard-based disasters, indirect impacts typically derive directly from the original primary impacts on infrastructure and production, on individuals and their health. These are regularly modelled or projected, considering losses in future production and employment based on hazard, exposure and vulnerability indicators.

Effect of government policy and actions

A last consideration are the effects government norms, actions and policies have during the post-disaster stage of rehabilitation, reconstruction, and recovery. Here we must note that the impact of government planning interventions is not the same as the impact of controls on people under physical-social distancing and "stay at home" requirements, because with the latter controls are not for the reopening or recovery of the economy, but rather, to avoid further contagion and the collapse of health systems with higher death rates. Crossovers do occur given that, for example, preventing the death of the younger, possibly more economically productive and innovative actors in society generally contributes to a faster recovery. This was demonstrated during the influenza pandemic in 1918-21 where cities in the USA that imposed early hygiene and distancing controls compared to others had a much faster and more decisive economic recovery than others, related among other things to far lower illness and death rates among the younger population.

The criticism of many DRM schemes due to the absence of pre-elaborated generic disaster recovery plans, has been present in the case of COVID-19 and its effects. Today these plans are being

[3] For example, US meat processors companies that have had to close due to the incidence of illness and death of employees

discussed and elaborated, but in most cases without having had a previously developed method and plan in place for dealing with the recovery phase.

One result of the emergent treatment of the topic of recovery and initial reopening, and the problems this has caused, could be the future elaboration of pre-established plans to deal with such contexts. These should cover generic aspects of the problem: who does what?, what is the hierarchy of decision making and in what hierarchical structure?, what are the phases or moments to be dealt with?, how should supply chains work?, for example.

Increasing knowledge

With the passage of time and the advance of scientific knowledge many unknowns will dissipate, but others will remain. With such advance, as has been the case with earthquakes, hurricanes, floods and nuclear accidents, and other physical drivers of risk and possible disaster, science will contribute to dimensioning the hazard factor, its behavior, and its history in order to facilitate the knowledge of the long term behavior and risk associated with the virus. For the short term, uncertainty will remain high and important elements will continue to be lacking to fuel immediate and short-term decision-making. Here, for example, similar to SARS, MERS, the Spanish influenza of 1918-21, H1N1, Ebola, the notion of a period of return for the triggering event of the disease is unknown, and uncertainty always exists as to the future patterns of behavior. The intensity of subsequent waves and their spatial and social incidence can be postulated but only corroborated when they occur. The probability of, and the expression of mutation or other transformations of the virus is also unknown. All of these contexts signify that in general less is known as to the behavior of virus compared to other more recurrent physical hazards

4 Intrinsic and Social Vulnerability

The risk faced by a given population, person or other social or economic unit when faced with a hazard event is mediated by what have been called “vulnerability factors”. Analysis of such factors comprises a significant component of the analysis required to substantiate and delineate a social construction approach to understanding risk. Not only the identification of types and levels of vulnerability is required, but also an understanding of how and why such factors exist.

In the present section, we will highlight those vulnerability factors that influence the level of affectation of individuals and their families or businesses related to the COVID-19 illness and comparison will be made with the workings of vulnerability in more traditional disaster scenarios. The topic of exposure will be dealt with in our following section recognizing from the outset that risk and vulnerability can only exist if there is exposure to the effects of a hazard event.

Once the virus infects a person, due to their exposure to it, the degree of individual affectation, damage or loss can be explained by both intrinsic and socially acquired vulnerabilities. Damage and loss can be interpreted both in terms of the illness itself and the impact on the individual affected, but also in terms of the impacts on welfare, income, livelihoods and the economy as a whole.

Intrinsic vulnerability

As regards the issue of the intrinsic vulnerability of individuals, (which seems to be less critical in the case of physical-natural events than with contagions by virus or other biological agents), a few essential aspects must be considered.

Intrinsic vulnerability refers to conditions that are immutable due to them being a constitutive part of the affected individual, the result of internal conditions and processes. Intrinsic vulnerability to the virus relates to how genetics influence the level of functioning of immune systems, the level of susceptibility to coronary, liver, or cancer related illness, or in the existence of chronic digestive, hormonal and hypertension problems, amongst others. Blood type, gender and age are among other factors now discussed that could affect the incidence of the virus.

The notion of intrinsic can be extended to consider the permanent effect of past surgical operations and removal of, for example, spleens, a lung, a kidney, etc. and where there is no possible remedy or substitution for this physiologically. The previous suffering of a debilitating disease probably also has an effect in terms of the impact of the virus on a given individual. These are all intrinsic, endogenous vulnerabilities, accrued over time as part of an individual's health process.

Numerous other topics are also under investigation today relevant to intrinsic vulnerability. For example, how the application of vaccines against diseases such as tuberculosis or treatments for malaria could have mitigating effects on the incidence of COVID-19. Even nicotine consumption over time is subject to research as to beneficial or negative effects given the disproportion in the number of deaths in the USA due to COVID amongst smokers as a proportion of the number of smokers in the country (17% smokers and only 2% of deaths accounted for by smokers).

Socially acquired vulnerability

On the other hand, social risk factors associated with the existing health condition of an individual, product of their own decisions as a human being over the years, those imposed on children by their parents or those imposed by custom and practice must also be considered. These include past and present eating habits, degrees of prior or existing alcoholism and smoking, the practice of sports or physical activity, and history of mental health problems and/or depression. These factors are clearly different from the intrinsic factors associated with the birth and health process and should be classified as socially constructed throughout a person's life.

With both intrinsic and health-related acquired characteristics, in principle, many of these can be present in any person no matter what their social class, income levels, employment type, cultural origins. However, where chronic health or physical conditions are related to poor health care, poor nutrition, low quality of life, or lack of access to basic services, there is a clear relationship between social class and vulnerability, whether it be with a virus or physical hazard event.

Prior to the onset of COVID-19, but post the onset of HIV AIDS, much emphasis has been placed in disaster risk studies and practice on the notion of the social construction of risk and vulnerability in explaining risk and disaster. In other words, an emphasis on factors of human origin in explaining the development of the patterns and social and territorial incidence of risk and disaster in the world. Such approaches have evidenced, for example, that events of greater magnitude in conditions of

lower exposure and vulnerability can result in much lower impacts than where highly vulnerable populations and their assets are exposed to events of much smaller magnitudes.

With both physical hazards and COVID-19, socially acquired vulnerabilities are more prevalent and serious in general in poorer, excluded, marginalized population groups and access to social protection more discriminatory and less available. This probably brings virus associated vulnerabilities close to those existing with more well-known hazards. And this highlights the need for understanding common root causes that lead to different risk and disaster expressions under different hazard conditions. Acquired vulnerability, and its basic root causes, require us to understand that it is in the context of social class, livelihoods, income, and employment that such vulnerability is constructed and operates most (see later for a detailed discussion of this).

Vulnerability and exposure reduction measures

With natural physical events, exposure (which we will deal with in detail in the next section) under conditions of vulnerability represents a critical risk nexus. This can and has been compensated for at times with ex ante vulnerability reduction measures. This has been possible given the knowledge we have of most physical hazard patterns and return periods. But, with COVID-19, the only real current option health-wise is to reduce exposure because thereafter the risk is subject to intrinsic and already accumulated socially constructed risk factors that developed when little was known or expected as regards virus and pandemics. These were already present at the time of the initial outbreak, and beyond medical control. The same applies to the level of access to adequate health services which is also a socially constructed option and opportunity that pre-dates the health crisis. The lack of investment in, and downgrading of health services in many counties post financial crisis of 2008-9 has already had its impact on vulnerability levels during the present crisis. A recent example can also be seen in the large-scale fires in Greece some ten years ago and again in 2018 where lack of investment in fire-fighting equipment post financial crisis weighed heavily on response and control.

Finally, it is interesting to note the probable number of persons who have stopped smoking, dropped weight and started exercises under the threat of the virus, hoping to revert past customs and habits that are seen to increase a person's vulnerability. How successful these individual interventions will be is largely based on their impact over the cumulative effects of those conditions. Most interventions require longer term approaches, and these must be anticipated, as part of risk reduction and control methods promoted personally or through DRM mechanisms. Moreover, these individual health gains may in the end become just a drop in the hat compared to increased incidence of mental health issues among a much wider segment of the population, and illness and death related to downscaling or diversion of attention to other diseases and illness, including those in children and the elderly.

5. Exposure patterns

The risk and the disaster, which reflects the risk's materialization over time, can only exist if there are population and livelihoods exposed to the energy and possible effects of a physical manifestation of the hazard. In the case of COVID-19, this means exposure to the virus itself, either through those infected by it, or through the touching of surfaces on which the virus exists and the touching of the face afterwards. Here it is important to note that the virus can and will probably

exist endemically in the future and not as epidemic and under these circumstances the virus is not a hazard but rather part of the ongoing biological scenario in which persons live.

With reference to the exposure of people, what are the similarities and differences as compared to what we experience with events such as earthquakes, floods, or droughts? We deal with these below, according to type and topic, acknowledging from the outset that at any one time the seriousness of the impacts on individuals and economy of exposure will always be moderated and calibrated by vulnerability levels.

Contiguous versus "moving exposure"

With viral outbreaks there is often no contiguously delimited space or territory that is affected, in the way that can be delimited for events such as earthquakes, volcanic eruptions, floods, tsunamis, or technological explosions. Viral outbreaks have "moving exposures". Other examples of such moving noncontiguous exposure can be seen with such events as Chernobyl, cataclysmic eruptions with volcanic ash dispersion, and cases of water contamination, in which exposure is diffused due to transmission of the hazard via media that are dynamic and mobile associated with weather, atmospheric conditions, water flow, etc. Other biological hazards such as locusts also move and affect non-contiguous territories.

In cases of exposure to seismic, hurricane and flood hazard, this is the product of natural-physical contexts that determine a relatively fixed impact radius, according to the magnitude and intensity of the hazard. Whether this impacts people, livelihoods and infrastructure depends on how the population and economic production is distributed and how and where it builds protection infrastructure against the hazard. This does not however mean that an event cannot or will not occur in areas or zones where there is no historical registry of such occurrences, science has not identified their possibility, or simply they have been eroded from the collective and scientific memory. Many examples exist of each of these circumstances, from the Haiti and Limon, Costa Rica earthquakes in 2010 and 1991 respectively, through to the Paricutin volcano in Mexico in the 1940s and the severe wind storms and hurricane that affected Uruguay and Brazil in the present century.

In the case of a virus, and the ensuing disease, there is no predetermined territorial limit and its territory of action is as extensive or limited as the human actions that determine its transmission. In the case of COVID-19, as in the previous SARS, MERS, H1N1 and Spanish influenza of 1918 viruses, the exposure to the hazard was extremely complex, involving aspects of human behavior in combination with the characteristics and durability over time of the virus outside of a host and its diverse means of movement and transmission.

COVID-19 does not have legs, no means to transport itself, and depends on humans, potentially animals, and such things as particles of air, in order to be able to spread to spaces beyond its point of origin. This has been facilitated by rapid international and national travel and mass urban transit systems, making these both distribution mechanisms as well as extremely high exposure structures, both by virtue of their design. The territory of exposure is in theory the whole planet, as is the risk and the magnitude of the associated health, economic and social disruption.

With this, an important point of definition of exposure to the virus can be established. A person is exposed to the extent that their behavior and that of others promotes it. There are few aspects of

exposure that derive from the characteristic of the virus itself (this includes the nano size of the virus and the limited spatial extension of different methods of contagion—coughing, sneezing, loud speaking etc. where differences and limits are in a limited number of meters not miles). This can be compared to exposure to earthquakes, hurricanes and other physical hazards where direct affectation is physically and territorially fixed within calculable limits according to the variable magnitude of the possible damaging event. And these limits can be extremely wide. With the virus it is difficult to equate the notion of magnitude with the magnitude of an earthquake or hurricane; there is no Richter or Saffir Simpson scale for virus. However, in a comparative mode the different levels of contagiousness of different virus could maybe be used as a magnitude variable.

The exposure-risk-disaster relationship

The relative effect of exposure and vulnerability on the overall level of risk is variable. In some circumstances, exposure is critical and vulnerability of lower explicatory value; in others it is the reverse.

With more traditional physical hazards, as we have concluded earlier, much is known as to the spatial limits and extent of exposure and the levels of energy discharge expected in different places under different magnitudes of event. This means that in theory exposure to an event can be compensated by land use controls and techniques for building that reduce risk even where structures and society are exposed to the energy of a future event.

In the case of earthquakes, hurricanes, storms and flooding for example, unless the expression is extreme (and even with certain extremes prevention is possible as is the case of hydroelectric power plants that are built using up to a 2500 year return period for earthquake design specifications), society has access to different construction, organizational, production and distribution mechanisms and methods that can limit the conversion of the event's energy into unacceptable loss and damage. In other words, the occupation of hazardous areas does not automatically mean severe impacts.

Given the prevalence of such types of event over large areas of the earth, human beings are almost obliged to occupy spaces subject to one degree or another of hazard. Their extent is so territorially widespread that it is almost impossible to find a territory that does not suffer some degree of hazard associated with such types of events. We are obliged to locate, build and develop taking this into account, reducing our vulnerabilities to the types of probable events. Moreover, the weight of history and the consolidation of spatial patterns of growth associated with previous cultures and civilizations, many of which revered such manifestations of nature, has guaranteed growth and development in highly hazard prone areas. Many of these are in fact rich in natural resources and therefore a constant trade off exists between the risk associated with hazards and the benefit associated with location in resource rich areas.

However, there are many extreme and even lower level expressions of physical hazard where exposure is almost a guarantee of severe damage and loss.

Firstly, when the magnitude or intensity of the hazard and the physical event that supersedes it is extreme or very high, such as shallow earthquakes above 8.5 on the Richter scale, level 5 hurricanes on the Saffir Simpson scale, cataclysmic eruptions of volcanoes or level 5 and 6 tornadoes, exposure will surely mean high levels of human and physical loss and damage whatever the building standards

and prevention options taken. In these rare, spatially concentrated, exceptional cases, with a low probability of occurrence in a particular territory, the exposure-risk-impact relationship is direct and the role of vulnerability is limited because the options for mitigating and preventing the risk of people or property located in the areas are scarce for technical, cost or other reasons. Obviously, the level of vulnerability that exists will be socially determined, but in the end whether low or high it is probable that most would suffer impacts to a large degree. Only by avoiding exposure to the hazard could severe losses and damages be avoided.

However, as we know, this type of event is the exception and a large part of the damage and loss associated with disasters are due to exposure to much lower scale events under highly vulnerable conditions and the solution lies in adapting the human occupation of fragile territories to the environment itself, using adequate hazard protection and construction techniques, together with methods to reduce human vulnerability.

Secondly, there are multiple expressions of geological and hydrometeorological hazard that even with much lower magnitudes reveal a more direct relationship between exposure and risk. A lahar or volcanic pyroclastic of moderate dimensions directly impacting a small village or urban area and land collapse or a landslide of rocks and earth affecting a rural or urban community, are almost guarantees of significant impact due to exposure and where the concept of individual or collective vulnerability does not assume the same importance as in the case of an earthquake, flood, hurricane or drought.

How, then, does the exposure-vulnerability equation work in regard to the virus, infection and risk?

Firstly, virus do not have different magnitudes and known return periods as we know these with more traditional hazards, and exposure is socially conditioned over an infinite territory, not restricted to set physical-territorial limits.

Secondly, exposure to the virus almost inevitably means contagion (we say “almost” as knowledge as to immune persons does not exist at present but can’t be ruled out). There is little that can be done to avoid contagion if one is exposed. This differs from exposure to earthquakes or hurricanes where possibilities exist that help assure that “contagion” is not suffered. Vulnerability reduction is a real possibility in exposed places.

With the COVID 19 related virus no pre event actions were possible to reduce vulnerability and, thus, the risk associated with exposure. The intrinsic factors are not modifiable and the acquired factors already present and developed in times of non-virus and non-expected virus, and not reversible in the short or medium terms. Thus, once exposed, the fate of individuals is in the hands of their differential, but already cemented, vulnerability conditions. No early warning or vulnerability reduction actions are or were possible in the short term. However, with the experience of this crisis, future changes in exposure and vulnerability reduction measures can and will be enhanced or promoted.

Although the distinction we make between types of hazard may be questioned and exceptions found it does serve in some way to illustrate that in some hazards the only compelling way to avoid risk or keep it at acceptable levels is to avoid or reduce exposure. This is the case with the

coronavirus and COVID-19. If that control over exposure fails, a less well-known terrain is chartered, dependent on the ways different persons and collectivities react to its presence.

Moreover, reduction of exposure to the virus is a relative concept, with strong controls to avoid it in the short term in function of the need to flatten the curve and thus the pressures on health services while a vaccine or other mitigating medication is found. But given the ubiquitous and, one supposes, permanent presence of the virus in different places, the working of a herd protection effect means, according to recent declarations by experts, an up to 70% overall contagion at a world level over the next two years. This means that avoiding exposure is time and priority dependent, where decisions as to the economic and sanitary health of a society come into play. The pressure existing today to reopen economies thus reducing exposure controls is in principle such a case where an unfortunate competition or dilemma has been created as regards health security and economic wellbeing and recovery. Risk levels are thus negotiated between different risk categories and expressions according to established and politically negotiated priorities.

Socially constructed conditions influencing exposure

A further key question relates to the socially constructed factors or drivers that promote or limit exposure to a virus, and that can be subject to intervention in lieu of the prevention and control of risk. Here we will not deal with those preexisting conditions related to city structure, housing, mass transit systems etc. that we touch on in other parts of this document, but rather to conjunctural and preexisting social conditioning factors that favor exposure to the virus, and which find a parallel in conditions favoring structural exposure to disaster hazard examined in more traditional terms.

This topic obliges us to consider the notions of chronic or every-day risk, of perception and awareness, and cultural influences on behavior, all so important in understanding exposure and risk in the more traditional types of disaster.

The essence of the argument is that socially constructed conditions, that could be referred to as vulnerabilities, are more important in explaining exposure than they are in explaining the different impacts of the virus on the health conditions of individuals. Given the importance of reducing exposure for controlling the spread of COVID-19 and the risk it signifies we will give close attention to the causal factors that influence exposure. In other words, we move from the notion of vulnerability to the damaging physical event to a concept of everyday vulnerability, daily life, and its impact on the type and degree of exposure. It is fundamental to understand why certain actors are more likely to promote active exposure than others and why certain sectors and strata are more likely to be exposed.

Reduction of exposure to the virus resides in actions in two spheres: the isolation and physical distancing of individuals (which includes the closing of service outlets and businesses and control over the use of public transport, amongst other measures) and the practice of personal and environmental hygiene measures. Both are needed while there is no vaccine available or no ability to inject antibodies or use mitigating medicines. Clearly, this is, in principle, less complicated to grasp and delimit than the numerous ways available to reduce exposure to more traditional physical-natural events where exposure is the product of diverse and complicated circumstances driven by economics, social practice and mores, politics, and different forms of governance and dominance structures.

Having said this, however, we will see that in considering the drivers of exposure to the virus, these are not so distant generically from those existing in other disaster contexts. Similar, fundamental root causes influence different contexts of crisis and disaster and should be the single most important consideration in regard to overall reduction of disaster and crisis risk, and thus disasters and crises as such.

The social, economic, cultural and political conditions that propagate exposure are related to multiple factors or contexts typically used in the explanation of exposure and vulnerability to earthquakes, hurricanes etc., but also include others that are more specific to epidemics and pandemics. Among these variables, we highlight a few key factors:

i. The social class of an individual, their economic practice and livelihoods, and degrees of informality, exclusion and marginalization are highly influential with both traditional and virus-related exposures. The need many people have to be on the streets to earn a living (a characteristic of systems under crisis where the state or government on duty or others cannot or will not protect the informal population with direct payments or subsidies) is critical in increasing their exposure and that of third parties whom they come into contact with. Although the practice of social distancing and the use of personal hygiene methods, including the use of masks, can reduce the risk, the mere fact of circulating on the street and being in contact with other people increases exposure levels. Regarding hazards such as earthquakes, floods and hurricanes, class and informality are reflected in conditions of disadvantage, poverty, and social exclusion, which often forces people and their families to occupy densely populated, unsafe, hazard prone land in the city and live under conditions of very high vulnerability due to the same conditions of exclusion and inequality (see below for an extension of this central argument).

ii. The fact that the virus has a non-symptomatic expression, largely in younger people and particularly infants has been emphasized. Although data on hospitalizations place the average age around 45-50, this does not mean that young people are not infected and affected. The fact that information has been widely disseminated about the greater risk that older adults are running, may have an impact on younger and older people's behaviors. Younger people have a greater predisposition to continue meeting at gatherings and other denser social events, if allowed to or if they find opportunity to do so. This was seen in the now existing explanations of the original spread of the corona virus in the US where the carnival in New Orleans and sports events have been used to explain part of early spread. Older people, and their caretakers, in more well-off countries have been largely concentrated in assisted living settings with little recourse to limit or reduce exposure.

   An analysis by age groups crossed by aspects of social class and the ways of earning a living could indicate significant aspects needed to design methods for the reduction of exposure. In several countries, the authorities have failed or even refused to provide relevant information to the public on this and other possible causal factors. This is a major scientific limitation. It can be postulated that the non-dissemination of this type of information is due to the desire to convey that the problem of COVID-19 is for everyone and thus promote awareness of the need for distance and hygiene among all.

iii. Younger people's greater aversion to following social distancing measures has a now decades-old history but rooted in other types of dissatisfaction and dissention. One must

remember these are the same younger people that have been clamoring for action on climate-change from their (much older) decision makers but have frequently fallen on deaf ears. Now they are being asked to suffer economically and socially for an equally inadequate response to another hazard. And, we have not yet even begun to consider how the added debt load caused by coronavirus plus the cost of mitigating climate change could ever possibly be paid off by future generations, much less considering widespread inequality trends that have been consistent for decades and largely affect the youngest segments of the work force.

iv. A critical aspect in regard to the virus refers to the relationship between medical personnel and the general public, and particularly those with COVID-19. The number of doctors, nurses and medical staff in general who have become ill or died is large. Problems with access to PPE, protective equipment, putting them at risk, abound in the news. At the same time, the contagion of the public by health care workers is latent and real. In the former case there is a parallel in other accidents, emergencies or disasters where those who serve and protect us suffer more. For example, with the twin towers in New York following the 2001 terrorist attack or during earthquakes with efforts to rescue survivors.

Common, underlying disaster risk drivers

To finalize this section, we will take up on and detail what is probably the singular most important aspect to be dealt with.

On the issue of disaster risk, much emphasis has been placed on the way that poor, excluded, informal populations with tenuous living conditions and incomes have no other option than to live at daily risk and consequently in a situation of permanent disaster. Finding where to live means accepting low quality, hazard prone and exposed land, buildings built without proper engineering techniques, together with congestion and overcrowding. These and other factors increase disaster risk, a result of the impact of daily, chronic risk and impacts in causal terms.

To date increasing amounts of evidence has brought to light the relationship between those infected with the virus in different countries and their class conditions or type of occupation. Evidence does exist and will grow in time, we are sure, as to the socially stratified nature of risk where the poor and excluded, those suffering inequality in different ways, are more at risk than others from the virus and from more traditional hazards. This may go counter current to the arguments of various political demagogues such as Ortega and Bolsonaro and the quoted Governor of the Mexican State of Puebla, in the sense that COVID 19 is a disease of the rich and that the poor are not affected.

What is certain is that, for the poor, with their daily struggle for survival, their exposure to and repeated suffering with contagions, poor health, or chronic hunger, COVID-19 is possibly one of the "lesser evils" and for many it does not merit or cannot be of concern at a level necessary to prevent absolute exposure. This is not the same however as saying that the poor do not get infected or do not suffer.

The difference between the virus and an earthquake is that its affectation during the early stages of the pandemic has been more evenly distributed among social groups and can and does affect the more well off. In fact, the early contagions were more amongst such population groups. In Latin America, many early cases were associated with more well-off persons returning from virus infected countries in Europe and Asia. The case of the Uruguayan fashion designer who returned from Europe and contaminated dozens at a party was given much coverage in the international press. The fear amongst the more well-off has been a significant factor in the large-scale reaction to the crisis in terms of both health and finance. And, for this better off segment of society, short term social distancing is a real option given their ability to purchase and store large quantities of food; to use delivery services and other conveniences that limit their need to go to public spaces; have access to private vehicles eliminating risks from public transport; their access to larger, more comfortable homes that are easier to inhabit long-term; and the ability to move their household to a second or vacation home in a lower exposure area.

For the poor, and especially the urban poor, this is much less so. Personal spaces are often cramped, with little natural light or outdoor space. Public transport systems and high-traffic pedestrian areas cannot be easily avoided. Working from home is scarcely an option, and on-site work conditions are often higher density and involve more movement. Very few have the option to leave the city for the safety of a secluded vacation home, although in Peru and other countries large scale return to home areas in the countryside and small towns has been reported as the population found it impossible to subsist in the large city. Few have insurance, much less a personal doctor to contact in case of illness, necessitating the exposure of a trip to a clinic or hospital.

The fact, however, that all can in theory be infected is a major argument in favor of integrated, socially accessible, national health systems. This parallels the notion of integrated risk management systems.

What the virus and disease reveal is what other disasters have always revealed. That is, if there is no reduction in inequality, in poverty, in exclusion, little will be accomplished in disaster risk reduction for more than a small percentage of the world population.

Customs, perceptions, religiosity, culturally determined degrees of risk aversion and their basic social conditioning also play an important role in levels of exposure to the virus. The large congregations in churches in the USA and the more expressive physical forms of relationships in Latin countries compared to northern Europe, with greater levels of hugging, hand shaking, hand holding, kissing between friends and colleagues are examples of this. The pre-existing custom of handwashing that exists to a greater degree among certain age groups and in certain countries could be another factor. Such conditioning factors clearly exist as regards exposure to other types of hazard and have been extensively studied over the years by anthropologists, geographers, psychologists and economists.

There must of course be other drivers of exposure and the possibility of analyzing their impact will depend on access to relevant information and data. This is an aspect that is not entirely satisfactory in the current situation in many countries. Control over data access stands as a critical factor, risk analysis will be impossible without such access.

As opposed to traditional disaster contexts, pandemics, especially those with a large percentage of asymptomatic carriers, only manifest their exposure patterns and trends through tools that make its invisible exposure visible. First and foremost, widespread testing both in terms of contact tracing and randomized sampling are indispensable making things visible, that is, quantifying and measuring the changing exposure patterns. Yet, many governments have been slow to implement widespread testing under the fear that larger case numbers will translate to lower poll numbers: "In a way, by doing all this testing we make ourselves look bad" (Donald Trump, 2020-05-14)[4].

Government norms, laws and guidelines affecting exposure

Prior to the enactment of government controls and norms to reduce exposure to the virus, exposure was basically determined by common traits and custom as regards movement, gatherings, workplace characteristics, city transport systems, among other things. For example, the carnival in New Orleans, a large funeral and sports events led to massive transmission of the virus prior to its existence having been recognized in the USA. In Italy, a professional soccer match provided the catalyst for an early super-spreader event.

With viruses we do not need to concern ourselves directly with exposure of infrastructure and housing or other built structures and production. However, past decisions as to urban and housing design, mass transit systems, population densities and distribution clearly influenced the rate and type of exposure of present-day populations to the virus under pre government control conditions.

As regards social controls to reduce exposure to virus, the options are much easier to recognize and, in theory, to put into practice, as compared to hazard exposure under more traditional types. However, they depend on the general collaboration of the population, a collaboration that cannot necessarily be offered due to survival, income and livelihoods needs, as has been discussed earlier. The difficulties and contradictions can be seen with the application of ongoing physical-social distancing and quarantine calls, recommended hygiene conditions and norms for the reduction of road transit. The Indian and Peruvian lockdowns quickly laid bare many of the shortcomings, and even in developed countries food access and nutritional problems arose as a consequence of lockdowns almost overnight

Low compliance of guidelines can be seen with government recommended, but not always directly enforceable, social distancing in the stay at home mode and quarantine demands for arriving new nationals and residents from abroad. Personal hygiene measures are voluntary, and the disinfecting of public spaces and surfaces has been undertaken at different levels of intensity and frequency. Even with obligatory measures such as prohibition of large gatherings, closing of businesses or limited openings, prohibition of circulation at certain times, disregard of norms has occurred in many places. Furthermore, at the present time large protests are seen with the call to open up and go back to work. The reasons for non-compliance are varied and are a fertile area for conceptual and empirical enquiry.

In the case of society's exposure to the energy of earthquakes, hurricanes, floods, etc. although the analysis and delimitation of territories that may be impacted is a well advanced science (even micro-

[4] https://www.nytimes.com/2020/05/06 /us/politics/trump-coronavirus-recovery.html

zoning of hazards is undertaken), the degree of society's compliance with the rules, laws, regulations, issued by government (if they exist) to control the location of population and production, infrastructure and services and decrease their exposure, is mediated by multiple contexts and social and economic rationales and non-compliance follows virus related performance in many places in increasing exposure. These include the potential gains from land speculation in hazard prone areas, due to urban rent processes, the need for the proximity to sources of work and income for the informal population and the absence of land options in safe places, illicit sales of urban land in hazardous areas, among others. Many cases of municipal authorities providing water and energy infrastructure to marginal hazard prone communities exist, even where the occupation of such land is prohibited by urban ordinances. The kick back is in terms of elections and votes.

Such factors play out to either limit rules and norms all together, or for norms to be simply disobeyed. One way or another, regulations and norms are ex ante measures, prospective in their application, as opposed to emergent and conjunctural as is the case with the virus. How cities and public spaces, houses and parks take into consideration future possible virus outbreaks and exposure to them will have to be seen in the future planning schemes of public and private actors.

As well-designed homes in exposed areas have safe places for tornado impacts, maybe homes will also have social distancing, disinfecting, and contact-reduction features built into them. The same will apply in previously unforeseen measures that significantly reduce exposure to society at large: early examples include 2m spacing in public spaces and the increased use of face masks; longer term measures may include structural measures such as improved ventilation systems and social measures such as increased use of delivery services. All these variables will work together to reduce exposure, and thus minimize future outbreaks. But they will probably benefit the more well off more than the vulnerable and excluded as has always happened with risk and disaster.

6. Summing up on cause and effect

This document has examined how risk is constructed at different levels, how exposure plays out and the comparability between virus and disease as hazards versus more traditional physical hazards. From this analysis we venture to propose some conclusions vis a vis the question: Does COVID-19, seen as a disaster, have enough common causal elements to be considered a similar disaster or provide a context that could derive lessons and experience from DRM for the purpose of guiding intervention and vice versa?

Common and differing risk elements: COVID 19 and physical hazard-based disasters

a. With COVID-19 there are two sequenced contexts that can be considered independently or in concatenated form under the notion of "hazard" and “disaster”. The first is the virus as such that incites illness and death and a health and personal or family disaster due to the direct impact on individuals and families or communities as regards livelihoods, employment and income. The second is the COVID-19 disease, epidemic and then pandemic, which once established and expansive, constitutes a hazard for the sustainable economic and social future of a country, region, or city, that is to say, a community beyond the individual and the family. Much of this impact is related to government close down

measures called for by the spread of the illness itself. In the case of physical hazard-based disaster concatenation has been referred to when talking of the “first” and “second” disasters. That is to say, the first impacts directly related to the occurrence of the hazard event and then the consequences of these, mediated by the types, efficacy and efficiency of government and wider social intervention.

b. In the case of the threat of primary infection and of the disease being transmitted between individuals, the possibility that this will occur is determined by the direct contact of individuals with the virus. The only way to avoid such contact is to eliminate exposure between individuals or to other vectors, or through acts of personal and environmental hygiene, such as the use of face masks. In other words, the threat of the virus becoming a disease can be controlled by avoiding exposure and through the onset of herd protection processes or/and by using vaccines or appropriate mitigating medicines. The former constitute behavior modifying methods impacting the individual and the latter structural measures impacting the hazard.

   This has parallels with the traditional division of disaster risk prevention and mitigation measures between those that control or modify human behavior and on the other hand, "structural-engineering" controls that prevent the hazard from materializing in a real damaging event. The latter can be seen with lahar deviation schemes in Japan, river dikes and means for shoring up unstable slopes. These are a type of DRM equivalent of vaccines. These measures prevent the hazard developing or getting to and affecting people.

c. Exposure to the virus is influenced by different political, social, and economic conditions. In other words, the possibility of contagion through human contact or contaminated surfaces has motives and drivers associated with differentiated behaviors and roles of individuals and authorities, many a product of structural conditions of existence, others due to lack of personal discipline and obeyance of controls imposed by government.

   These are not conditions of vulnerability per se, but rather factors that influence the degree of potential exposure to which an individual is subjected and thus the possible kick in of vulnerability factors in contagion and illness. There is a parallel here to the issue of disaster as we know it in that exposure to the "energy" or the damaging natural effect of an adverse physical event is also seriously affected or conditioned by multiple social, economic, and political conditions and circumstances.

d. Vulnerability has both intrinsic and socially constructed elements. In the case of the virus intrinsic, genetic and health process related factors are probably more important than in the case of physical hazard-based disasters. Socially constructed vulnerability, based on many common structural and conjunctural causes, seriously affects those impacted both by virus and such hazard events as flooding and hurricanes. This highlights the need for attention to underlying root causes if the reduction of disaster risk and risk in general is to be achieved.

The relations and management needs

Three aspects seem important and must be in the mind set and future action plans of the competent authorities. They deal with common causes regarding exposure, vulnerability and resilience, irrespective of the disaster, together with options in the use of analysis, monitoring and emergency prioritization methods.

a. A first consideration can be seen in the similarity between the underlying, root causes of exposure and associated socially constructed vulnerability conditions in both types of disaster, particularly as these relate to the everyday, chronic risk suffered by large segments of the population, particularly in developing and low income economies. These are associated, particularly, but not exclusively, with conditions of poverty, inequality, exclusion, and marginalization. This reaffirms that the way to structurally face up to and reduce one type of risk, is similar to the method to reduce another. The systemic nature of risk requiring comprehensive management is a needed option and way forward. The fundamental need for a development based, socially constructed understanding of risk and disaster and its management cannot be postponed indefinitely.

b. A second consideration is the complex context that will exist if a conventional physical disaster should occur in communities, areas, cities or whole countries seriously affected by COVID-19, and where local disease care and control systems are already saturated or under pressure and the population subject to controls over movement. This relates to the preconditions and context in which any new disaster event occurs, and which influence the severity of impact and security options associated with a new disaster. In the case of COVID-19 it is a particularly serious disease due to its widespread spatial incidence and high level of contagion, but in generic terms it constitutes the same situation as an area affected by adverse health conditions related to malnutrition, malaria or dengue, or affected by financial crises, social unrest and war. The overall context is part of the disaster and conditions its evolution and impact, requiring a comprehensive risk management approach and prospective planning actions.

c. The social and economic conditions related to COVID-19 with the closure of the economies of many countries, constitute a cause of increasing vulnerability of population to future hazards, both physical-natural events and subsequent waves of the disease itself. This goes beyond the exacerbation of vulnerabilities accentuated in excluded and poor populations, also affecting those of better economic status seriously affected by the disease and its effects. These are the new poor. This constitutes a new driver of disaster risk in that they increase the population's potential vulnerability and exposure to physical threats. The excluded/poor/extreme poor, forced migrants, single mothers and their children, among others, are of singular importance here.

Systemic and complex risk scenarios and a new governance

COVID-19 has led to great economic loss and human suffering and this will undoubtedly increase in the future. Its incidence has revealed existing deficiencies and strengths of different health, emergency management, and economic and social support systems and mechanisms within and between countries. Surely a modified or new governance of health risk and associated disaster must be considered in the future. The complexity of the interrelationships between different risk issues

(health, financial, public order, disaster, etc.) has become more obvious and the need for visible governance reforms to address these gaps is increasing. In this context, the discussion about systemic risk becomes more relevant, and the association with the already existing multi-hazard, compound, complex and concatenation issues must be brought to center stage.

The existence of COVID-19 adds elements for a discussion of the notion of resilience and its promotion, considering the multiple conditions in common between different types of crisis and stress. Phases, analytical tools, models, and types and sequences of intervention promoted through disaster risk management practice have parallels with virus-based risk and disasters and exchange and symbiosis between them is possible and needed. Experience in one field can and should be transferred to the other to bring the current, and future crises under better control and to allow risk prevention and mitigation in the meanwhile. Thus, although COVID-19 is not a disaster in the sense we have handled this in more traditional DRM practice, the relations are clear and even obvious and this must be recognized and its importance considered in risk analysis, reduction, response and recovery plans.

7. From analysis to management of risk and disaster

Knowing (measuring and evaluating) and understanding (fundamental causes) of risk, and the impacts or effects that it presages in the future, are fundamental in order to design concrete ex ante and ex post risk and disaster intervention policies, strategies and actions. Management depends on scientific knowledge and understanding of the different risk factors, their behavior and origins and the ways in which damage and loss or disasters are expressed and materialized in society. The relevance of this during the current pandemic has become obvious even if many times limited in its impact by politically motivated decisions both with regard to exposure and decisions on the opening up of economies.

Disaster Risk Management has been developed as a concept and practice mainly with reference to physical-natural, geological, geomorphological and hydrometeorological, socio-natural and technological hazards and events. The notions and concepts of exposure, vulnerability/capacity and resilience have closely considered these hazard drivers individually and in consonance and concatenation, as well as their outcome, in terms of both direct and indirect impacts and effects. Increasing complexity has been introduced in terms of risk factors as we have described in previous sections and today increasing emphasis is placed on the notion of systemic risk.

The Basics of DRM and its relevance to the COVID-19 issue

In its most modern expression, DRM constitutes a strategy, an action approach, a set of methods and processes related to the issue of disaster risk and disaster. Faced with the possibility or probability of the occurrence of a disaster it searches for and enacts options, opportunities and lines of action to understand, measure, mitigate, foresee and prevent future risk. It also helps prepare society to face and react in the event of an announced disaster, respond to its impacts and immediate consequences and implement mechanisms, processes, and actions that allow for the rehabilitation, reconstruction, and recovery of the affected society, strengthening and fostering its resilience. The concept and practice of DRM are conceived increasingly as searching to contribute

to a development strategy for sustainability, under conditions of increasing equality, participation, and poverty reduction. DRM must be mainstreamed, must be an integral part of the DNA of organizations, institutions, families and companies, and a fundamental guiding principle for their development and growth.

The series of processes, methods and actions enacted through DRM may be classified according to different types of management perspective: corrective (with reference to existing risk), prospective (anticipating future risk), reactive (preparing and immediately responding to a disaster) and a compensatory process (recovery and strengthening of resilience from the moment of crisis forward). These types of management bring together the different activities and approaches traditionally referred to as prevention, mitigation, preparedness, response, rehabilitation, reconstruction, recovery and resilience. They are clearly relevant for a consideration of management around COVID-19 and its consequences in society. In other words, the generic types of management method and the tools used in DRM offer a potential or real opportunity and guidelines for health and economic planning authorities dealing with the pandemic (and future pandemics), and their consequences for society and the economy. What varies are the specific methods, processes, actions, and authorities required to deal with and reduce risks.

Analyzing and searching to categorize actions according to the abovementioned typology is, however, not easy when considering the virus and COVID-19. This is mainly due to the fact that the lessons learned from previous virus episodes (HIV-AIDS, MERS, HINI, the Spanish flu, for example) did not lead to any really well developed planning frame or plans of action to face up to increased risk of viral pandemic proportion risk and disaster in the future. This is not to say that the notion of future pandemics and epidemics was not on the books but clearly, with the exception of countries like Hong Kong, South Korea, Costa Rica, Taiwan, Denmark and New Zealand, this does not seems to have been internalized in many countries. This can be seen in the responses of the vast majority of counties where planning schemes and intervention processes have been rather more emergent than planned and schemes used in one country copied in others where it may not be the most appropriate.

Reactive risk management has been most evident with COVID-19 with certain and uncertain outputs and results. This has included social distancing and personal hygiene aspects, as well as the shutdown of economies and reduction of internal and international movement of persons. It also includes economic protection measures and nutritional surveillance and access to food stuffs for the more vulnerable. Basically, the “surprise” associated with COVID-19 has led to emergent reactive policy guides and actions with few real preconceived plans of action.

Corrective and prospective risk management, both of which take place prior to disaster or during processes that could lead to new risk, have not been much present in the case of COVID 19 management, but, hopefully, will exist in the future.

Corrective management could be applied to understand actions that are now ongoing under the stress of current circumstances, for example to improve and expand existing health services and resources and the access to them. Prospective management requires thinking the future and the new ways of dealing with building, cities, towns, transport infrastructure, health services, supply chains, to avoid or reduce the spread and impact of future outbreaks of COVID-19 or other diseases. Clearly this means coordination and collaboration in urban design and must interface with many other relevant physical, economic and social planning setups.

It also means rethinking the governance arrangements and roles in more complex, systemic risk scenarios. Among these are the complex and concatenated scenarios that can and will exist where multi hazard, risk and disaster scenarios exist. At present, the risk of the concatenation of the COVID-19 pandemic along with hurricane, seismic, flooding and landslide damage is very high. It is hard to estimate how these complex disasters will unfold until the data starts coming in. It is likely complexity will go far beyond such short-term scenarios by the time this all plays out.

In view of the ways COVID-19 can influence the management of disaster and disaster risk in the future, there is a clear need for the authorities responsible for DRM and its collaborators in sectors and territories to recognize these potential influences and confront them with concrete actions for the future, that is, prospective risk management. Of course, an impact of the existing condition of COVID-19 on the risk of disaster and disaster conversely implies that a "traditional" disaster can seriously affect the development and spread of the disease and its territorial and social incidence.

Consequences in terms of Risk Management as a whole

We have not seen the need to elaborate further on the differences between virus and physical event related types of management and those responsible for these. To the extent that there is clarity on the process, causal factors and expressions of risk, the needs can be identified secondarily.

However, due to the contexts, contradictions and competition that have been observed with regard to management through different sectoral and territorial government health, emergency and economic development agencies in different countries, it is necessary to rethink management in the subject area of risk. This is essential in order to establish what transitions should be considered in the future. Lessons from the contradictory and inefficient way in which Climate Change Adaptation and DRM relations developed should be enough to recognize the need for seriously rethinking and reworking governance schemes, based on a clear conceptual framing of the issues and understanding of management needs and coincidences.

The essence of the argument here is that the risk of disaster in any of the ways that disaster is triggered and materializes (health, economic and social impacts, financial, everyday risk etc.) has elements and relations in common. In other words, in causal and sequence terms, everything is related to everything in the end, to a greater or lesser extent, and under different causal modalities. Consequently, management must take account of the links, interrelationships, concatenations, complexities, and systemic elements that exist.

The debate on which is the most appropriate governance structure to deal with the risk nexus and its consequences is open. Ideas of risk ombudsmen have been considered. Unique integrated risk management systems with a clear specification of needs and functions in terms of types of risk and disaster and their relationships must be looked into. Likewise, principles of differentiation between countries and regions must be established in recognition of cultural, historical, and social and economic status.

It is clear that insofar as any of the expressions of the specific risk are low, this in general contributes to the possibility and probability that the risk in another sphere is also lower. This cannot be affirmed, however, without considering that when taking into account sectors and social groups, types of economy and livelihood, some win and others lose. In this sense, considerations of equality and equity, distribution of resources, access to services, among others, must all be considered

closely and are of fundamental importance for any long-term reduction or control of risk. The challenge is daunting, but the need imperative.

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