EDITORIAL

# Analyzing the health system's capacity to respond to epidemics: a key element in planning for emergencies

## *El análisis de la capacidad de respuesta sanitaria como elemento clave en la planificación ante emergencias epidémicas*

Rafael Castro Delgado[1,2], Pedro Arcos González[1]

There has been an increase in the number of epidemics of transmissible diseases, as well as in the variety of causal agents involved, since the 1980s. Around 56% of these epidemics have been due to diseases of a zoonotic nature, i.e. caused by a live agent passing from an animal to a human, while the remaining 44% were due to specifically human disease agents[1]. In addition, current epidemics are characterized as episodes of emerging diseases, i.e. diseases due to agents that have undergone a recent evolutionary change, that affect the human population for the first time or that have been discovered recently[2].

This new context of emerging and re-emerging transmissible diseases (those that after having been relatively controlled have re-emerged stronger) has led the World Health Organization to modify the International Health Regulations[3] in 2005. Among the relevant modifications is the establishment of a new epidemiological situation called a Public Health Emergency of International Concern (PHEIC) defined as an extraordinary event that constitutes a risk to the public health of states due to the international spread of a disease and that may require a coordinated international response. Most of these emergencies are due to the above-mentioned zoonoses.

Since 2005, the PHEIC situation has been declared six times: in 2009 with the H1N1 influenza virus, in 2014 with polio and the Ebola outbreak in West Africa, in 2015-16 with the Zika virus, between 2018 and 2020 with Ebola in the Kivu region and in 2019-2020 with the coronavirus COVID-19. Table 1 summarizes some of the epidemiological parameters, extent and impact of the main serious zoonoses in recent years compared to the current COVID-19 pandemic, in order of highest to lowest case fatality rate, and shows that they are very heterogeneous both in their case fatality (4-80%) and in their extent and impact.

The current COVID-19 coronavirus pandemic has placed Spain as one of the countries with the greatest number of people affected and is posing a challenge, not only in terms of the response of the health system, but also in terms of the general response of the population and its short and medium-term impact on the economy. Unlike countries in Asia, such as China, Taiwan, Singapore or South Korea, Spain has not had any previous experience in managing outbreaks of coronavirus, as was the case in the aforementioned countries, for example, with the emergency of the Severe Acute Respiratory Syndrome virus (SARS) in 2002. This may partly explain the late and certainly lukewarm response provided by the Spanish health authorities.

At present, both the epidemiological behaviour of the COVID-19 pandemic[4] and its impact on health systems[5] and clinical aspects[6] are still under study. This situation has led us to re-read an article published 10 years ago in this Journal on the 2009 H1N1 pandemic[7], in which we analyzed some key elements in these situations, such as spontaneous overtriage due to social alarm, patient flows and the vulnerability of the care chain, the collapse of health regulation centres, home management of patients, hospital intensive care units (ICUs), the reinforcement of health coordination centres as a gateway to the system, training in the use of personal protective equipment or protocols for the transfer of potentially infected patients.

All of these elements have now reemerged in Spain

**Table 1.** Epidemiological parameters, extent and impact of some severe zoonoses

| Agent | Year | Cases | Deaths | Lethality (%) | Countries afected |
|---|---|---|---|---|---|
| Marburgo | 1967 | 466 | 373 | 80 | 11 |
| Nipah | 1998 | 513 | 398 | 77,6 | 2 |
| Hendra | 1994 | 7 | 4 | 57 | 1 |
| H5N1 flu | 1997 | 861 | 455 | 52,8 | 18 |
| Ebola | 1976 | 33,577 | 13,562 | 40.4 | 9 |
| H7N9 flu | 2013 | 1,568 | 616 | 39.3 | 3 |
| MERS | 2012 | 2,494 | 858 | 34.4 | 28 |
| SARS | 2002 | 8,096 | 774 | 9.6 | 29 |
| COVID 2019* | 2019 | 510,108 | 22,993 | 4.5 | 175 |

Source: Prepared by the authors on the basis of data from the WHO, CDC, ECDC and Science alert.
*As of March 26, 2020.

**Author affiliation:** [1]University of Oviedo. Department of Medicine. Emergency and Disaster Research Unit. [2]SAMU-Asturias. Spain.
**Contribution of the author:** The authors have confirmed their authorship in the document of responsibilities of the author, agreement of publication and cession of rights to EMERGENCIAS.
**Corresponding author:** Rafael Castro Delgado. Area of Preventive Medicine and Public Health. Faculty of Medicine and Health Sciences. Julián Clavería Avenue, 6. 33006 Oviedo, Spain.
**E-mail:** rafacastrosamu@yahoo.es
**Article information:** Received: 17-3-2020. Accepted: 23-3-2020. Online: 27-3-2020.
**Editor in charge:** Òscar Miró.

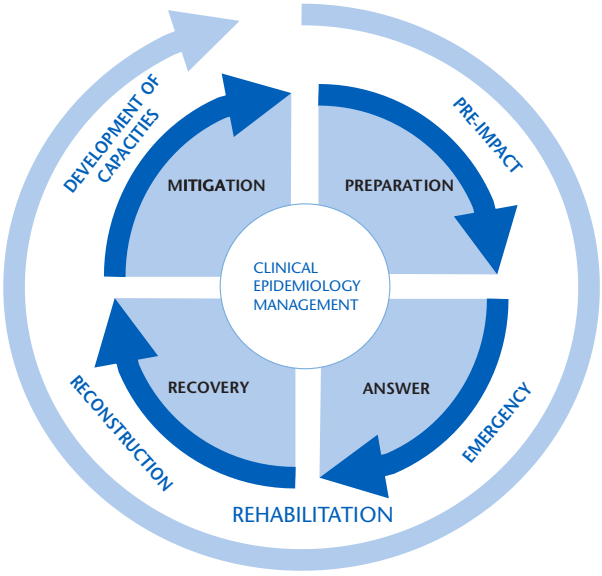


**Figure 1.** Interrelationship between the disaster cycle and the development of health system capacities.

with the COVID-19 pandemic[4] without seemingly, judging by the serious impact that the current episode is having on healthcare capacity, having been addressed from a perspective of prior planning and preparation (Figure 1). In fact, most of the contingency plans for our health services have been made on an ongoing basis, as problems have arisen. In contrast, planning the health response to an epidemic emergency requires, as a precondition, a thorough analysis of the system's own response capacity, known as surge capacity[8,9]. In the case of terrorist attacks, for example, this problem has already been well studied[10,11].

Mathematical models capable of predicting the care burden of a given health system have been available for years, some of them specifically designed for respiratory[12] virus emergencies[13]. These models for predicting the demand for care in emergencies use variables whose data are generally available: hospital and ICU capacity, number of ventilators, average stays per process, estimated duration of the epidemic and rate of attack, among others. The predictions generated by the model are basic to be able to resize essential services in the response such as the emergency department and ICU: the former because it is an important element in the management of patient flows and their initial handling[14], and the latter because it is one of the determining elements of mortality associated with the emergency[15].

The change in the care process at the pre-hospital level and the calculation of necessary health transport resources are also important aspects in the planning. This pre-planning and its staggered application should contemplate organizational measures in the emergency services to protect the emergency coordination centres (ECCs) from suffering cases in their personnel and affecting their operation as a key element of coordination. Currently, in many emergency systems, care personnel are also working in the ECCs, which increases the risk of cases.

Only an early analysis and planning of the response to an emergency allows decisions to be made in scenarios that are rapidly changing by their very nature. It is essential that this planning be shared and, as far as possible, agreed with the different actors involved in its execution. It is also essential to avoid the use of material or human resources which, although having a high value in terms of media visibility or high political profitability, detract from the coherence and technical professionalism of the overall response and imply an added cost. In this sense, the use of the sometimes misnamed "field hospitals" (often only tents) has not proven to be an efficient measure in the response to emergencies without prior planning and without a clear definition of their roles[17]; or devoting personal protection equipment to disinfecting floors in public places of high transit[18], such as sidewalks or stations, when there is a deficit in the hospitals of this equipment.

It is known that in some cultures the concept of crisis is naturally associated with that of opportunity. Perhaps this is an excellent time to do the same in Spain and combine both aspects of the situation. We should not miss this new opportunity offered by the COVID-19 to work together with clinicians, epidemiologists and health managers in the study and clear knowledge of the response capacity of our care devices as an inexcusable precondition for adequate planning of the response to the next crisis. The ability to be creative and improvise can be a great virtue, even in emergency situations, but it can never replace prior analysis, planning and preparation.

**Conflicting interests:** The author declares no conflict of interest in relation to this article.

**Financing:** The author declares the non-existence of funding in relation to this article.

**Contribution of the authors:** The author has confirmed his authorship in the document of responsibilities of the author, agreement of publication and cession of rights to EMERGENCIAS.

**Article commissioned and reviewed internally by the Editorial Committee.**

## References

1 Smith KF, Goldberg M, Rosenthal S, Carlson L, Chen J, Chen C, Ramachandran S. 2014 Global rise in human infectious disease outbreaks. J. R. Soc. Interface 11: 20140950.
2 Smith KF, Guégan F. Changing Geographic Distributions of Human Pathogens Katherine F. Annual Review of Ecology, Evolution, and Systematics 2010;41:231-50.
3 International Health Regulations, 2nd edn. Ginebra: World Health Organization; 2005.
4 The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020. CCDC Weekly; 2 (8): 113-22.
5 Remuzzi A, Remuzzi G. COVID-19 and Italy: what next?. The Lancet (Health policy). (Consultado 12 de Marzo de 2020). Disponible en: https://doi.org/10.1016/S0140-6736(20)30627-9
6 Guan W et al. China Medical Treatment Expert Group for Covid-19. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020. (En prensa)
7 Castro Delgado R, Arcos González P, Rodríguez Soler A. Sistema sanitario y triaje ante una pandemia de gripe: un enfoque desde la salud pública. Emergencias. 2009;21:376-81.
8 Hick JL, Hanfling D, Burstein JL, DeAtley C, Barbusch D, Bogdan GM,

et al. Health care facility and community strategies for patient care surge capacity. Ann Emerg Med. 2004;44:253-61.
9 World Health Organization. Hospital preparedness checklist for pandemic influenza. Focus on pandemic (H1N1) 2009. Ginebra: World Health Organization; 2009.
10 National Center for Injury Prevention and Control: Updated In A Moment's Notice: Surge Capacity for Terrorist Bombings. Atlanta, GA: Centers for Disease Control and Prevention; 2010.
11 Arcos González P, Castro Delgado R. (Dirs.). Terrorismo y Salud Pública. Gestión sanitaria de atentados terroristas con múltiples víctimas por bomba. Madrid: Ministerio de Sanidad y Consumo - FCSAI; 2007.
12 Centers for Disease Control and Prevention. FluSurge 2.0. Reviewed August 22, 2016. (Consultado 19 Marzo 2020). Disponible en: https://www.cdc.gov/flu/pandemic-resources/tools/flusurge.htm
13 Pineault R, Daveluy C. La planificación sanitaria. Conceptos, métodos, estrategias. Barcelona: Ed. Masson; 1987.
14 Robinson SM, Sutherland HR, Spooner DJW, Bennett TJH, Lit CHA, Graham CA. Ten things your emergency department should consider to prepare for pandemic influenza. Emerg Med J. 2009;26:469.
15 Kain T, Fowler R. Preparing intensive care for the next pandemic influenza. Critical Care. 2019;23:337.
16 Bayram JD, Zuabi S, El Sayed MJ. Disaster metrics: quantitative estimation of the number of ambulances required in trauma-related multiple casualty events. Prehosp Disaster Med. 2012;27:445-51.
17 Department of Emergency and Humanitarian Action. WHO-PAHO Guidelines for the Use of Foreign Field Hospitals in the Aftermath of Sudden-Impact Disasters. Washington DC: World Health Organization. 2003.
18 Service RF. Does disinfecting surfaces really prevent the spread of coronavirus? Science, Mar 12, 2020. (Consultado 12 Marzo 2020). Disponible en: https://www.sciencemag.org/news/2020/03/does-disinfecting-surfaces-really-prevent-spread-coronavirus)