



A geographical and crosscutting look at the COVID-19 pandemic in an international framework. Introduction

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1. Starting with an operative proposal

The spread of SARS-CoV-2, responsible for COVID-19, has highlighted in Italy – and at international level too – a strongly problematic situation that make it necessary to move jointly with a view to preparedness, so as to tackle the sanitary-epidemiological emergencies with tested and validated measures and avoid situations of crisis through well-organised and shared solutions, of support to the scientific communities and decision-making.

The current monitoring of COVID-19 at global level has after all been built on lessons previously learned from maintaining suitable systems and databases on contamination and disease, and the surveillance processes have been enhanced by the use of GIS to identify infection outbreaks, support data sharing and contact tracking, investigate social vulnerabilities and health disparities and evaluate the validity and effectiveness of specific measures (Smith and Mennis, 2020, pp. 1-2). A recent review has examined 63 scientific contributions on spatial-statistical analysis of the geographical dimension of the COVID-19 pandemic, providing useful information regarding the elaborations, functions, variables and models used for the understanding and management of this nefarious global phe-

nomenon and the definition of sanitary and political responses (Franch-Pardo et al., 2020). Another work has advanced some geotechnological proposals to tackle health emergencies, obtaining inputs from the COVID-19 pandemic for future preparedness, with specific reference to the: production, in a GIS environment, of geographical-healthcare-epidemiological models of spatial and temporal diffusion; devising of an App for data tracking and digital flow (or route) mapping and enriched with an information system for health education; realization and submission of a geolocalised online questionnaire, for promoting a smart survey for the identification of possible positives (Pesaresi et al., submitted).

In terms of advancement in the state of the art, the importance is all too clear of the need to devise and validate a *Homogenous Centralised System for Dynamic Geoprocessing and Geolocalised Diffusion Models in response to Emergencies*¹.

¹ The creation of a *Homogenous Centralised System for Dynamic Geoprocessing and Geolocalised Diffusion Models in response to Emergencies (GeoSystem2SEE)* has been the backbone idea of the planning proposal advanced by the Sapienza University of Rome (Cristiano Pesaresi for the Department of Let-

The immediate availability and setup of automatically updated data implemented on the basis of ascertained cases of positivity constitutes an essential requirement in order to carry out detailed interdisciplinary analyses and territorial screening able to support the interpretation of dynamic phenomena and to test the response capacity of the healthcare facilities, emergency departments and hospitals.

It is a question of creating a centralised system into which merge data gathered by means of homogenous collecting formats and systems in order to set up comparable and superimposable databases at a multiscale level: regional, provincial, municipal, for census sections, after having registered domicile and residence of the positives, the paucisymptomatic etc. The various health facilities, such as A&E, Local Health Units etc., should in fact make use of a standard system of data collection that flows directly into a cloud platform, aimed at guaranteeing various requirements of safety and confidentiality, for concise detailed and relational studies which make it possible to reduce time and risk of error.

A similar *Homogenous System* enhances the possibility of carrying out a series of dynamic geoprocessing activities and using specific tools and functionalities, such as geocoding that allows the scouring of the territory, highlighting details and making aspects emerge that would otherwise be unrecognisable.

In fact, the use of accurate geocoding activities has given important contributions at international level within the context of GIS applica-

ters and Modern Cultures, as Principal Investigator; Carolina Marzuillo for the Department of Public Health and Infectious Diseases) and Italian National Agency for New Technologies, Energy and Sustainable Economic Development (with Maurizio Pollino) on the basis of the “Decreto Direttoriale n. 562 – Avviso per la presentazione di proposte progettuali di ricerca a valere sul Fondo Integrativo Speciale per la Ricerca FISIR” (<https://www.miur.gov.it/web/guest/-/decreto-direttoriale-n-562-avviso-per-la-presentazione-di-proposte-progettuali-di-ricerca-a-valere-sul-fondo-integrativo-speciale-per-la-ricerca-fisir>). In the first paragraph of the present contribution, I get this aspect back and provide additional inputs.

tions to tackle emergencies and reduce risks to health (Baldovin et al., 2015; Goldberg et al., 2013; Hansen and Poulstrup, 2002). The added value of similar functionalities and an analytical-interdisciplinary approach deriving from the use of geocoding (after data cleaning for reducing/deleting address errors) has been seen both for the surveillance of infectious diseases (Myers et al., 2006; Zinszer et al., 2010), and for context analysis regarding chronic-degenerative diseases (Rushton et al., 2006; Schootman et al., 2017).

Having geolocalised and geocoded data, on the basis of domicile and residence, it is possible to produce models of spatial and temporal diffusion which allow the recognition of specific areas and propagation axes of the diseases, by means of constantly updated dynamic point maps, where each point represents the single ascertained case, reported on satellite base or digital map, by the superimposing of multiple layers. From the point maps it is possible to construe aggregate scale digital mappings or ones obtained with geospatial and geostatistical analysis functionalities, to carry out studies of density, identifying the most critical zones and those requiring an intensification of special interventions, services and devices.

This approach, based on geocoding and detailed GIS modelling, with digital cartographies that work as matrix and from which can be derived elaborations functional for interpretative analysis of the components and dynamics under way, enabling the recognition of patterns, clusters and trends, has already been tested in an interdisciplinary context (Pavia et al., 2019; Pesaresi et al., 2020) in the collaborations between the Unit of Geography (Department of Letters and Modern Cultures) and the Department of Public Health and Infectious Diseases of the Sapienza University of Rome, with the support of the GeoCartographic Laboratory.

In order to tackle sanitary-epidemiological emergencies, linked to infectious diseases with a high diffusion capacity and high lethality, having an efficient response system becomes a fundamental requirement to reduce the risks connected to the pandemic and to produce simulations based on real data in continuous evolution. A homogenous collection, registration and data processing system thus becomes an instrument

of primary importance to create a common base of ready answer to the emergency.

In the case of COVID-19, numerous pieces of work have availed of the use of dashboards and digital cartographies (Dong et al., 2020; Kamel Boulos and Geraghty, 2020; Dangermond et al., 2020; Gao et al., 2020) and visual analytic tools painstakingly structured (Chishtie et al., 2020) for the detailed study of certain components and propagation dynamics, highlighting the considerable benefits to be obtained in terms of territorial analyses and support to epidemiological studies and the adoption of special intervention measures.

The one here proposed is an innovative system in such context that integrates, streamlines and strengthens the techniques and applications produced at international level for the COVID-19 emergency phase, with additional results both in the provision of a multi-scale national system, and in terms of elaborations and GIS models based on accurate data (linked to positive and paucisymptomatic cases and also to deaths).

The operative proposal is the realization of a *Homogenous Centralised System for Dynamic Geoprocessing and Geolocalised Diffusion Models* which would lay very important foundations and would create the conditions to operate harmoniously and recognise areas subject to particular levels of criticality from the very start, to envisage possible propagation directions, intervene with epidemiological investigations and stop the spread of the disease before wide-ranging propagation mechanisms are triggered. This can make it possible to counter the expansion of the pandemic, reorganise some still lacking activities and to reduce the effects of future pandemics.

Moreover, the *Homogenous Centralised System* could be implemented with ad hoc data for analysis concerning i.e.:

- correlation between data on positives and lethality with demographic and social data of official statistics (which can be loaded as different layers for overlay);
- correlation between data on positives and lethality with data on environmental aspects inferable from remote sensing and Earth observation, such as temperatures, humidity

and precipitation, pressure and speed of winds, pollution and presence of fine dust.

The importance of conducting similar correlation analysis is supported by several works which have for example:

- compared the spatial distribution of COVID-19-related mortality in Italy, at a provincial level, with different geographical, environmental and socio-economic variables, investigating them by means of ad hoc analytical procedures and techniques like the Local Indicators of Spatial Association – LISA (Murgante et al., 2020; Borruso et al., 2020);
- interpreted the evolution of the contagion, at different geographical scales, in relation to the distribution, composition and mobility of the population, the sports gatherings of the former outbreaks, the location of nursing homes and hospitals and to pollution from different substances (Casti and Adobati, 2020; Casti, 2020).

And the need of testing methodological-applicative solutions in advance becomes vital given that the possibility of further pandemics in the years to come is not excluded (Hick and Biddinger, 2020).

2. The structure and organization of this thematic issue

In addition to making dangerously overwhelmed health systems, the spread of COVID-19 has transformed the social balances, the daily lifestyle and work, the way of doing didactics and conferences, the way of relating with friends and loved ones, the way of using public and family services and transport, enjoying holidays and free time etc.; at the same time it has given rise to oppressive repercussions on the economic and productive systems, leading to the adoption of unexpected intervention measures and the use of extraordinary funds.

The entire “global system – [...] – finds itself in great difficulty in governing both in time and space the countless mechanisms damaged by the virus, with no longer aligned inner workings [...]. The Covid-19 contagion not only shows to what extent the world is global and interconnected, but also the fragilities that can derive

from these concatenations in stress of extraordinary reach; in fact, it is the very way of action of the economically more developed societies, with their capillary and efficient transport networks, which give the coronavirus the strength to spread, whereby it is the actual functionality of the system that backfires, producing particularly serious situations” (De Vecchis, 2020, p. 101).

And “the coronavirus epidemic now fills our media, our daily isolation, our lives. It is an information factory in which our desire to understand risks drowning. So much information, a turbulent and noisy swarm, so excessive: with intersecting news, at times repetitive, at times contradictory, at times only bombastic” (Turco, 2020, p. 89).

At the same time, there is “the widespread conviction that the choices that will be made during this pandemic will have long term effects and that they will nevertheless modify the present world order and humanity’s relations with the world” (Salvatori, 2020, p. 2).

It is therefore necessary to foster rigorous scientific debate at international and interdisciplinary levels and look to: reflecting on the relevance of a robust geographic literacy and culture and a widespread education and raising of awareness so as to better understand the current problems; finding new perspectives which can open up a series of opportunities in terms of scientific research, applied projects, social utility and public geography; clarifying some aspects that – after about one year from the beginning of the pandemic – continue to be vague, imprecise and contradictory.

On the basis of similar considerations, this thematic issue begins with the contribution of Joop van der Schee who focuses the attention on the possible role of geography to help to understand local and global problems, and the distribution of COVID-19, also reflecting on the relevance of the health geography approaches and geography education in order to be aware and prepared for possible future tough challenges. The Author hopes that this pandemic helps us to adopt a sustainable lifestyle and teaches us that more attention to systems thinking and responsible and respectful behaviours are needed.

Chew-Hung Chang then expresses his work in terms of teaching and learning geography in

pandemic and post-pandemic realities, and provides inputs for geographical education across the individual, local and global scales, also suggesting ways and directions to rapidly respond to the present crisis as a community. In fact, the Author reflects on various tools and possibilities to suitably get us started on advancing the activities in geographical didactics for the post-pandemic scenario.

Gradually, Gino De Vecchis – after providing five cornerstone introductory annotations and recalling the concept of Anthropocene – shifts the focus onto the need of promoting an intensification of the scientific collaborations between geographers and researchers of the medical area, also enhancing the possibilities connected to digital cartography able to investigate the spatial and temporal spread of the virus, for the purposes of surveillance and prevention.

In their contribution, Estella Geraghty and Joseph Kerski analyse, from an intersectoral viewpoint, the impact of COVID-19 on geography, GIS, and education, underlining the perspectives opened by web applications, dashboards and interactive mapping tools for creating knowledge and opening new instruction opportunities, and they conclude by affirming that expanded teaching about GIS and with GIS will help to tackle the future challenges with ductility and greater skills.

Antonio Angeloni, Antonella Farina, Cristiano Ialongo, Patrizia Mancini and Emanuela Anastasi, after a framework on territorial disparities in different periods of the pandemic, from the viewpoint of experimental and molecular medicine, focus the attention on the various tests currently available and their usefulness in the present situation and their possible use once the mass vaccination is available. Moreover, they provide a synthetic look at the good practices suggested for the diagnosis and monitoring of the SARS-CoV-2 infection in the perspective of providing details on aspects which create misunderstanding.

The “low tide” of tourist flows in the COVID-19 era is the main subject of the contribution written by Stefania Cerutti and Stefano de Falco, who analyse the dynamics relating to the sectors of air and cruise tourism, and the situation concerning the coastal and inland areas,

with a focus on Italy. In fact, the outbreak of COVID-19 constitutes a thorny and evolving challenge for tourism, and suitable strategies must be progressively identified and launched.

Antonella Primi and Cristina Marchioro's contribution investigates the perception of different kinds of constraints during the lockdown, at a national level, and the spatial-temporal organization of a group of university students, at a local level, in a general context where digital technologies have acquired a central role in staying continuously involved in social, sanitary, cultural and economic processes and in planning the time of our greatly modified daily life.

Many special actions, where geography can provide support in the context of an interdisciplinary environment of applied research, have been launched by international institutions, and for example many projects supported by the European Commission concern "epidemiology, preparedness and response to outbreaks, the development of diagnostics, treatments and vaccines, as well as the infrastructures and resources that enable this research"². Other possibilities have been launched by the European Space Agency (ESA), also through the collaboration agreement with the Italian Minister for Technological Innovation and Digitalization (MID), and a specific example can be the Announcement of an Opportunity entitled "BASS AO: Space in Response to COVID-19 Outbreak"³ (AO10314)³.

In many research and educational contexts, the geographical approach, supported by GIS applications and Earth observation, can closely collaborate with other scientific and disciplinary sectors in terms of concrete proposals and detailed analysis aimed at tackling this and future health emergencies.

And it can i.e. happen:

- providing theoretical and methodological contributions founded on solid contents and thoughtful critical thinking;

² https://ec.europa.eu/info/research-and-innovation/research-area/health-research-and-innovation/coronavirus-research-and-innovation_en.

³ http://emits.sso.esa.int/emits/owa/emits_online.showao?typ1=8470&user=Anonymous;
[https://business.esa.int/funding/invitation-to-tender/space-response-to-covid-19-outbreak-italy.](https://business.esa.int/funding/invitation-to-tender/space-response-to-covid-19-outbreak-italy)

- stimulating renewed didactics and third mission, also taking advantage of the possibilities offered by the remote teaching systems and on line platforms, and an active participation of the population and companies;
- promoting a deep culture and knowledge of the events and phenomena, social and sanitary guidelines, behaviours to adopt, territorial disparities, main contagion areas etc.;
- encouraging joint discussions, international conferences and interdisciplinary researches, also to think about measures, decrees and specific actions promulgated by the government of different countries, and draft summaries of good practices;
- rigorously elaborating and interpreting quantitative and qualitative data at different geographical scale, enhancing GIS tools and functionalities for the geospatial, multitemporal and geostatistical analysis and an effective visualization;
- participating in the development of robust and high-performance geotechnological solutions, ad hoc models and harmonised platforms to help citizens, communities, hospitals, Local Health Units and organisms in charge etc.

New challenges, new opportunities to make science advance, new possibilities to underline the crucial role of geography in didactics, third mission, applied research and interdisciplinary project!

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