

Geospatial representations of COVID-19: Evidential relevance of medical geography for health and wellness

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Abstract

The significant role of geospatial techniques in the evaluation of COVID-19 dynamics in the last year is reviewed in this work. The application of geographical concepts, quantitative techniques and geographical methods is not a new approach but a well-established branch of geography called medical geography. This contribution presents how implementation of geospatial representation and geographical analysis has been used to understand the spread and patterns of COVID-19. It emphasises the need for the relevance of this branch of geography in our society and argues for the rejuvenation or introduction of medical geography in countries or institutions where the discipline is lacking. The principles and concepts of medical geography have served the medical field and society well during this pandemic. While there may have been limited interest among researchers and academia in geography on this area of specialisation, recent attention given to its principles in addressing the issue of COVID-19 should serve as strong motivation to revitalise this sub-field where needed. Development of medical and/or health geography has the potential to contribute to a healthy society and nation.

Keywords: COVID-19; Disease modelling; Spatio-temporal analysis; Geospatial epidemiology; Medical geography

I. Introduction

It is now more than a year since the rapid rise and spread of novel coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus, was declared a pandemic World Health Organisation (WHO). With the advent of this pandemic, the wide spread of the virus created a demand to closely monitor its movement and impact. Numerous works were consequently published that were aimed at providing global awareness about the disease. Moreover, a plethora of models that involved geospatial applications were developed or used to understand the occurrence and spread of the virus. Some examples of such spatial and or geographic models were referenced by Buolos and Geraghty (2020); Desjardins, et

al. (2020); Jia, et al. (2020); Lakhani (2020); Oyedotun and Moonsammy (2020); and Moonsammy et al. (2021). These geospatial applications were significantly used by the John Hopkins University and the World Bank to provide daily updates about disease spread and deaths (John Hopkins University Centre for Systems Science and Engineering, 2020; WHO, 2020).

The application of geographical concepts, quantitative techniques, and geographical methods to address the COVID-19 phenomenon is a well-established branch of geography called medical geography. This field specialises in using geographical and geospatial methods to address spatial (connections between locations at different scales) and place (location) issues of diseases and medicine (Meade, 2014; Mayer & Wagner, 2015). Although this specialised field may not have dominated geographical studies in many countries and universities, the wide application of the concepts, methods and techniques in the general awareness of COVID-19 has now made it a field deserving more attention.

Within the context of the current pandemic, COVID-19 from its inception was full of unknowns but one fact was made clear: it had a geographical and spatial element to it that made it possible to map and model (Franch-Pardo et al., 2020). As a result, geographical dimensions and spatial thematic concepts offered a synthetic and interdisciplinary approach where biophysical and human variables were integrated. The nexus between society and its environment, holistically present a geographical space to study the expansion of the virus (Sauer, 1925; Franch-Pardo et al., 2020). This thematic concept is a well-established approach that significantly uses an integrative approach in providing understandable and integrative awareness of COVID-19, its spread and its effects over the year.

This paper aims to comprehensively present how the implementation of spatial representation and geographical analysis have been used in understanding the spread and patterns of COVID-19; ii. to emphasise the need for its relevance in our society. The essay examines the rejuvenation or introduction of medical geography in countries or institutions where the discipline is lacking. It is hoped that this paper will inspire deep reflection among readers that would agitate necessary and needed actions where appropriate or serve to inform as an addition to the growing body of literature and thinking of the COVID-19 pandemic.

2. COVID-19 and places concepts

As COVID-19 ravaged the world in recent months, research on places and spaces expanded to study this global pandemic. Some of the studies provided simple map representations of the phenomenon while others delved into detailed conceptual spatial analyses. In the last year, several themes emerged in the literature on how COVID-19 and places are conceptualised: COVID-19 disease mapping, the geographical expansion of COVID-19, COVID-19's dynamic mobility through places and geographical landscapes, and spatiotemporal analysis of the effects of COVID-19 on populations were among the examples of themes considered by researchers in characterising this COVID-19 pandemic through the lens of places and spaces (e.g. Arab-Mazar et al., 2020; Buzai, 2020; Chen et al., 2020; Dagnino et al., 2020; Dong et al., 2020; Gross et al., 2020; Guan et al., 2020; Oyedotun & Moonsammy, 2021; Moonsammy et al., 2021; Orea & Álvarez, 2020; Rossman et al., 2020; Ruthberg et al., 2020; Sarwar et al., 2020; Zhou et al., 2020).

Given the context of the pandemic, matters relating to health were vigorously evaluated. Health control measures, health institutions, the states and conditions of medical facilities, health vulnerability and risk evaluation were explored using the concepts of spaces and places (Cuadros et al., 2020; Jella et al., 2020; Kuupiel et al., 2020; Lakhani, 2020; Padula & Davidson, 2020; Ruthberg et al., 2020). These themes were important in the management of the spread of the virus. Early detection of an outbreak in clusters continues to be crucial in the containment of a spread. To achieve containment, the use of location or place has been important for identifying clusters, monitoring local spread in both spaces and time, planning for isolation and containment in the process for decision making and possible interventions (Cromley, 2019; Keesara et al., 2020; De Ridder et al., 2020).

Geographic Information Systems (GIS) and geospatial technologies were instrumental for effective digital monitoring and visualisation of COVID-19 cases which facilitated estimation, description and interpretation of the disease clustering (Dong et al., 2020; De Ridder et al., 2020; Iacus, et al. 2020; Minetto et al., 2020) and in evaluating the global policy (Yang et al., 2020). In addition, the incorporation of spatial mathematical models in simulating the local variations of COVID-19's infection, transmission and spread were useful in health management. These mathematical models were used to incorporate geographic connectivity in understanding the uneven distribution of healthcare capacities, hospitalisations, and/or mortality (Correa-Agudelo, et al. 2020; Cuadros et al., 2020; Jella et al., 2021).

Real-time surveillance of the pandemic depended on geospatial modelling of crowd-sourced data and geostatistical techniques that assist in informing strategic government policy formulation and decision making (Fry et al., 2021). The applications of evolutionary and artificial intelligence algorithms also made use of geospatial coordinates in identifying outbreak points, producing outbreak heat maps, the distribution of the contagion and the possible projection of its spread (Buscema et al., 2020). Beyond the effects of COVID-19 on the human or built environment, the effects of the pandemic on the natural (physical) environment also used geospatial information (e.g. Luo et al., 2020; Sajadi et al., 2020; Wang et al., 2020; Tosepu et al., 2020; Roy et al., 2021).

3. Continued relevance of medical geography

What has emerged from the sampled studies is the use of the concepts, techniques and paradigms from geography disciplines in the investigation of the spread and effects of COVID-19, and its influence on people, places, and the environment is that the discipline of medical and/or health geography was greatly honed with the COVID-19 pandemic. One of the notable definitions and purposes of geography is that it is a science that examines the relationship between humans and their environments. Medical geography, a subfield of geography, examines these relationships or “interactions that bear mainly, but not exclusively, upon human health within a variety of cultural systems and a diverse biosphere” (Earickson, 2009). It is an interdisciplinary, multidisciplinary, and integrative field. The principles and concepts of medical geography have served the medical, social and environmental sciences very well during this pandemic. While there may have been limited interest among researchers and academia in many geography departments at universities to focus on medical geography, recent attention given to its principles in addressing the issue of COVID-19 should serve as a strong motivation to revitalise this sub-field where it may be dwindling.

Beyond the focus on COVID-19, there should be sustained use of medical and/or health geography because of its scope and the kinds of issues it is likely to address – knowledge is vital about differences in the health situations, healthcare provisions, medical capabilities, health policy, epidemiology, death and diseases, health and medical inequalities, variation in health policies and health status, and geographies of health at the national, regional, local and comparative scales. Many of these cogent issues may have escaped geographic attention for research and discussion before COVID-19. However, its importance is now made bare, and should, henceforth, not be restricted to this current pandemic.

Furthermore, as the COVID-19 pandemic resulted in the output of numerous research papers, specific attention should be given to the production of key undergraduate and graduate texts for medical geography, along with continuous publishing of research papers within this field in an effort to ensure that concepts and paradigms of the field of geography are strategically deployed in addressing the health and vitality of humans and the environment. The concept of place awareness is key in health and medical geography (Moon, 2009). Undoubtedly, there are roles for geographers in medical and health research (Elliot, 2009) and ultimately for the complete physical, social, psychological, and emotional well-being among societies. The persistent presence of COVID-19 may have emotional, psychological and physical effects on the world (Teixeira da Silva, 2021), and this dimension should not escape the attention of geographers. There is a need to deploy geography techniques, tools, and concepts in addressing the long-term presence of this pandemic or other health-related issues.

COVID-19 has shown that the path to, and framework for, health, healing and wellness is not only within the sole sphere of biology and medicine. Other multiple determinants and contributors, which may be socially, environmentally, economically, psychologically, and/or infrastructurally (health-care facilities) related, are also of significance. The role of medical geography is essential in achieving the desired goal of complete health and wellness. Using various geospatial, geographical and locational-based principles, tools and concepts that facilitate the integration of knowledge in respect of COVID-19 at various scales has demonstrated the importance of medical geography in addressing a disease/pandemic. These principles, concepts and tools are also essential in achieving complete health and wellness.

4. Conclusion

This work is an addition to the growing academic outputs and research on COVID-19. It summarises and emphasises that understanding of geospatial dynamics of COVID-19 is highly critical in its mitigation, and also the necessity to embrace geographical principles and techniques as the world addresses other health and medical issues. This is not only needed in eradicating diseases but also in striving for health and wellness in all ramifications. This paper also emphasised the need for embracing geographical principles in addressing medical issues. Therefore a call for strengthening or re-introducing medical geography in geography departments across the globe is appropriate at this time, as it has the scope to tackle many health issues and complement the fields of biology and medicine. Hence, leveraging precise geographical and geospatial strategies in medical geography during COVID-19 has fortuitous implications beyond this pandemic.

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