

## Back to the “new normal”: Researching and publishing in the time of the COVID-19 pandemic

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In late December 2019, a cluster of cases due to an emerging coronavirus responsible for a pneumonia of unknown aetiology was reported. Some of the affected patients had previously visited a wet market, the ‘Huanan Seafood Wholesale Market’, located in the city of Wuhan, Hubei province, mainland China [1]. The virus was initially named as ‘2019 novel coronavirus’ (2019-nCoV) and, later, termed as ‘Severe Acute Respiratory Syndrome Coronavirus Type 2’ (SARS-CoV-2). Since its isolation on January 7th 2020, this pathogen has spread out globally, reaching 215 countries and/or territories and 2 international conveyances and infecting more than 43 million patients worldwide, causing more than 1 million deaths as of October 25th 2020.

The pandemic, called ‘coronavirus disease 2019’ (COVID-19), is overwhelming and straining healthcare systems as well as dra-

matically challenging frontline workers. Also research has been significantly impacted by the spreading of the outbreak [2–4]. Electronic scholarly databases, such as PubMed/MEDLINE, have been literally flooded by an unprecedented amount of publications. COVID-19 related literature is still increasingly growing and is practically impossible to stay abreast of all new advancements in the field.

There exist some curated open-access resources such as the LitCovid thesaurus developed and maintained by the USA National Institutes of Health (NIH), the COVID-END database curated by the McMaster University (Hamilton, Ontario, Canada), and the 2019 Novel Coronavirus Research Compendium (NCRC) designed and constantly updated by the John Hopkins University (Baltimore, Maryland, USA) [5].

However, even though selected, the body of COVID-19 related publications, remains

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massive and impressive. COVID-19, being a global pandemic, requires a holistic view and a system thinking approach, including the “One Medicine – One Health – One Science – One World” framework [6, 7]. It is, as such, of paramount importance to combine all available findings. For this purpose, the tools of the evidence-based medicine (EBM) – such as (living) systematic reviews, meta-analyses, rapid reviews, integrative reviews and scoping reviews, among others [8] – are fundamental to synthesize the existing scholarly literature on the ongoing pandemic and provide an updated synthesis in terms of i) theoretical and experimental frameworks, 2) mathematical and predictive models, 3) management strategies and 4) practices currently developed and deployed. Moreover, they can enable researchers to identify: 1) gaps in knowledge, 2) challenges, 3) barriers and obstacles to the implementation of management approaches, and 4) future perspectives in the field of COVID-19 related research.

However, performing systematic reviews and meta-analyses in the time of COVID-19 is characterized by unprecedented challenges: i) since investigations are conducted during the emergency (which is still ongoing) with the urgency to communicate results that may orientate and inform decisions of stakeholders and policy-makers and potentially save lives, most studies have a quality lower than usual, because respecting high scholarly standards during an outbreak is a non trivial task. Moreover, ii) the peer-review process, which should be aimed at correcting these shortcomings and should reveal weaknesses, enhan-

cing the quality of manuscripts, may fail its scope, due to a variety of reasons, including reviewers’ overload, commitment and engagement with the pandemic. All this is even amplified and distorted by the necessity of a fast-track peer review process.

It should also be considered that iii) the situation is constantly and rapidly evolving and data becomes outdated very quickly, with a literature that is continuously growing, making it very difficult to keep the pace. As previously mentioned, scholarly databases have been literally overwhelmed by an unprecedented amount of publications in a relatively short time span. Furthermore, it should be taken into account that iv) this is only the tip of the iceberg, with most studies being released as pre-prints. Even though PubMed/MEDLINE has started a pilot aimed at indexing pre-prints, this initiative is limited to studies supported by the NIH. Finally, v) inclusiveness, comprehensiveness and completeness over a broad scope are the major characteristics of a systematic review, which make the task of EBM even more challenging.

As such, since classical EBM techniques are not enough to capture a situation continuously under flux [9], there is the need of designing and implementing new ones, based on sophisticated methodologies such as artificial intelligence (AI) and natural language processing (NLP). Given the exponential growth of the literature, it is impossible, indeed, to manually screen all items and stay updated. Therefore, automated tools (like those based on AI and NLP) are urgently needed.

With this regard, the White House and a

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coalition of leading academic bodies and research groups including the 'Allen Institute For AI' (AI2) have launched the 'COVID-19 Open Research Dataset (CORD-19) Challenge: An AI challenge', aimed at promoting the potential applications of AI in the field of massive text mining as well as the development of new techniques. Combining EBM based search with a comprehensive literature search on past viral outbreaks and on the still ongoing COVID-19 pandemic from the 'One Medicine – One Health – One Science – One World' perspective can help develop recommendations to tackle future outbreaks and pandemics.

AI can also be employed for selecting peer-reviewers and conducting, at least partially, peer reviews, in order to assist this process, poten-

tially in an unbiased way, saving reviewers' time and identifying duplication rates and plagiarism, frauds and data manipulation/fabrication [10].

In conclusion, the COVID-19 pandemic is modifying our ways to carry out investigations, peer-review and publish them. When the COVID-19 outbreak will be over and we will be back to the 'new normal' [11], the ways of doing research and publishing are anticipated to be profoundly changed, with the pathogen acting as a catalyst for transformations. Welcome back to the 'new normal' of scholarly research!

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