

A Systematic Review of Artificial Intelligence Techniques to Identify Potential COVID-19 Treatments

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Abstract

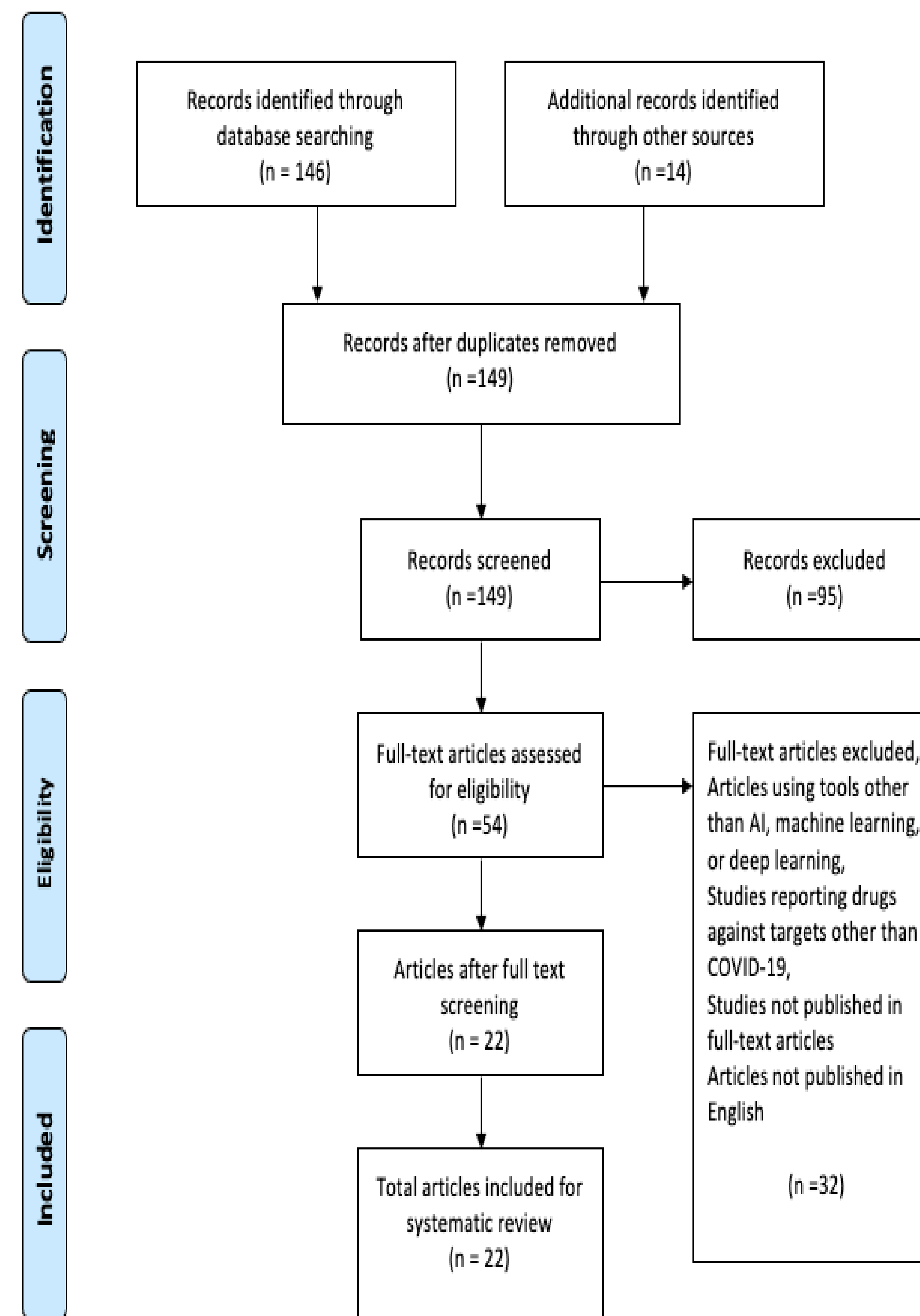
COVID-19 was declared a pandemic by the World Health Organization in March 2020. Globally, there have been over 100 million confirmed cases and more than two million deaths. An extremely limited number of medications are available as COVID treatments approved by the FDA. Artificial Intelligence (AI) and Machine Learning allow researchers to leverage existing data to make new discoveries. This review summarizes the different AI techniques, including deep learning, which have been applied to identify new treatment candidates for COVID. The medications identified by AI techniques included the FDA approved drug remdesivir and the FDA emergency use authorized baricitinib. A number of other treatment candidates were also identified.

A systematic review was conducted to identify relevant articles from PubMed, Scopus, and Google Scholar from January 2020 to February 2021. Results reviewed from 22 articles reveal various AI-based methods that have successfully identified potential drugs to be repurposed for treatment of COVID-19. Despite, promising statistically and clinical results of the mentioned drugs, further evaluation is needed for further clinical implication. Vaccines have recently been approved as preventative therapy, but the review findings remain relevant for potential virus mutations, the unvaccinated population and for methodology to approach future pandemics.

Methods

- Systematic review of journal articles from PubMed, Scopus, & Google Scholar published between March 2020-February 2021 conducted
- The search terms used were “artificial intelligence” or “machine learning” or “deep learning,” and “drug repurposing” or “drug repositioning,” and “COVID-19” or “SARS-CoV2”
- PRISMA guidelines used to report items
- English language only studies included
- Inclusion and Exclusion Criteria available in Figure 1

Figure 1. Inclusion and exclusion of journal articles



Results

Results of AI-models identified through literature review focused mainly on antivirals, immunomodulators, protease inhibitors, targets of envelope proteins, and combination therapies. Several treatment candidates were identified by various algorithms. Many of the identified therapeutics from AI models including remdesivir and baricitinib which have or are currently being evaluated in clinical trials. Other algorithms commonly used include deep neural networks, and combined machine learning and molecular docking. Multimodal learning was also noted as having strength in performing connections between multiple modalities, which shows benefit in several areas, primarily in representing features, supporting different states of fusion and growing based on modalities and data size. One study that utilized the multimodal learning approach identified hydroxychloroquine, which has also been a candidate in trials, although efficacy has been questionable. While promising, further evaluation is needed for more extensive clinical implication. No one AI algorithm was identified to be especially superior and would require further experimental evaluation.

Conclusions

The current COVID-19 pandemic is an example of the power that AI methodologies have in the drug discovery landscape and have strong implications for future discovery and aid in treating rare diseases. Despite the complications and challenges that COVID-19 has brought along, the pandemic has provided an opportunity for developing and introducing advanced AI-methods for drug repurposing for COVID-19 and the potential for future pandemics.