Advances in Informatics, Management and Technology in Healthcare
J. Mantas et al. (Eds.)

doi:10.3233/SHTI220687

The Utilization of Health Informatics Interventions in the COVID-19 Pandemic: A Scoping Review

Amanda L. JOSEPH[a,1], Helen MONKMAN[a], Andre W. KUSHNIRUK[a] and Elizabeth M. BORYCKI[a,b]
[a] *School of Health Information Science, University of Victoria, Canada*
[b] *Michael Smith Foundation for Health Research, Canada*

Abstract. On March 11, 2020, the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the highly infectious virus that causes coronavirus disease (COVID-19), was characterized by the World Health Organization (WHO) as a global pandemic [1,2]. Due to its highly contagious nature, COVID-19 has catalyzed the introduction of non-pharmaceutical interventions such as social distancing and quarantine measures [6]. Thus, the pandemic has shifted society to become reliant on healthcare technologies. The objective of this scoping review is to establish what health informatics interventions have been applied, validated and tested globally during the COVID-19 pandemic. The findings demonstrated a range of 12 types of health informatics interventions with various global applications and use. As evidenced by the intervention heterogeneity, the necessity to adopt a global cohesive strategy to improve human safety through the utilization of smart, efficient, and communicable technologies is vital.

Keywords. Scoping review, COVID-19, health informatics, interventions

1. Introduction

On March 11, 2020 the World Health Organization (WHO) officially characterized the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as a global pandemic [1,2]. SARS-CoV-2 is a highly infectious virus that causes coronavirus disease (COVID-19), which can result in mild or moderate to severe respiratory illness [1-4]. The pandemic has been a widespread and catastrophic event for the healthcare sector and humanity. As COVID-19 continues to penetrate global markets, its devastation and toll on the human psyche and the global healthcare sector is not yet quantifiable. With the emergence of Variants of Interest (VOIs) and Variants of Concern (VOCs) [4], increasing concerns arise for vaccine efficacy and public health [5]. Due to its highly contagious nature, COVID-19 has catalyzed the introduction of non-pharmaceutical interventions such as social distancing and quarantine measures [6] to mitigate its transmission. Thus, the pandemic has shifted society to alter its collective activities of daily living and become more reliant on technologies. Therefore, the objective of this scoping review is to quantify the reliance on health informatics technologies and to

[1] Corresponding author, Amanda L. Joseph University of Victoria, British Columbia, Canada; E-mail: Amandalynnjoseph@uvic.ca

determine which interventions have been applied, validated and tested globally during the COVID-19 pandemic.

2. Methods

A scoping review [7] was done using the PubMed® database, to assess the current state of the literature to understand the role and utilization of health informatics interventions in the COVID-19 pandemic. The search terms used for this study were "COVID-19" AND "Health Informatics." To contextualize this review, the authors defined health informatics as the field of science and engineering that aims to develop methods and technologies for the processing, acquisition and study of patient data generated from diverse modalities and sources (e.g., medical imaging, electronic health records, diagnostic test results) [8]. Additionally, an intervention was defined as the act of interfering with the course or outcome of a process (or condition) to prevent harm (or improve a function) [9]. The article selection process was iterative (Figure 1).

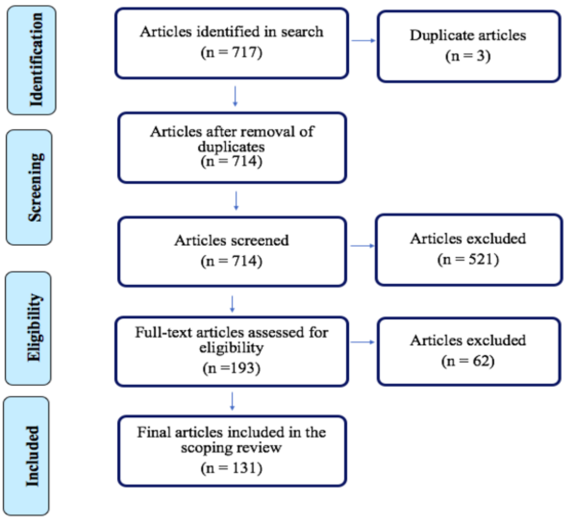

Figure 1. PRISMA Diagram [10] illustrating the flow of article screening and selection

The researchers applied the inclusion criteria and conduct a first screen analysis by title and abstract using Covidence®. After the first screen, articles were read in entirety in a full text review and further assessed for inclusion. Upon completion of the full text review, data was extracted, and the articles were thematically categorized (Figure 2). The search strategy was not limited by geography or date restrictions and included all articles published prior to January 26, 2022. The inclusion criteria were: English articles with an abstract, articles that included tested, applied or validated health informatics interventions used in the COVID-19 pandemic. As specific criteria guided the search strategy and article selection, other relevant articles may have been excluded. The study did not warrant an ethics consultation as it utilized publicly available information.

3. Results

The PubMed® database presented a robust sample of 717[2] possible articles for analysis, with 3 duplicates. Of those, in the first screen 521 articles were excluded as they did not meet the inclusion criteria. Following this, 193 articles were read in full in the full text review and 62 articles were excluded, resulting in 131 articles in the final scoping review (Figure 1). Subsequently, these 131 articles were thematically assessed and categorized into 12 types of interventions, as detailed in Figure 2.

The thematic analysis presented diverse interventions with multiple applications, used in various settings and contexts globally. The two most prominent interventions were Predictive Modeling and Telehealth technologies. The Predictive Modeling intervention had 31 diverse articles, spanning many countries and regions. The models had ranged from statistical based models utilizing artificial intelligence (AI) to synthesize, aggregate and visually display various COVID-19 related data (e.g., infection and mortality rates, hospital capacity statistics, virus trajectory). Many of the included articles demonstrated favorable results for the predictive models. However, the findings from Kogan and colleagues found that although forecasting models can guide long term planning, their accuracy is limited by parameter updates and the timeliness of data [11]. Furthermore, the authors conclude that the most effective and reliable metric for tracing the trajectory of COVID-19 is unclear, and that all metrics have limitations [11]. The Telehealth technology category had 20 related articles and was the second most utilized intervention. For example, Becker et al. concluded in their article that a valuable way to manage COVID-19 surges is virtual rounding [12]. Along a similar line, Hannemann et al. found that digital health technologies can provide a platform to expand the offering of healthcare services [13]. Nonetheless, the authors also described that with the increasing reliance on technology, a digital divide stratified by sociodemographic and socioeconomic determinants became evident [13].

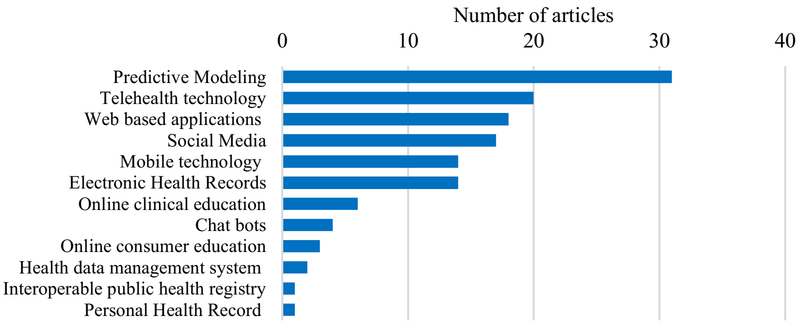

Figure 2. Frequency of health informatics interventions described in studies included in this scoping review

4. Discussion and Conclusions

This scoping review presented 12 health informatics intervention categories (Figure 2) and various barriers to their success including but not limited to: heterogeneous and

[2] For a complete reference list of articles that were included in the review, but not specifically cited in this study, please contact the corresponding author

unstructured data, inconsistent health system data reporting practices and capabilities, differences in medical terminology and nomenclature, interoperable systems, underdeveloped health system infrastructures. As evidenced by the heterogeneity of the global strategies in applying health informatics tactics to mitigate the impacts of the COVID-19 pandemic, it is paramount for global health systems to adopt a global learning health system [14,15] perspective. The pandemic unveiled the fragility of the global health ecosystem and the urgent need for a global cohesive strategy to improve human safety through the utilization of smart, efficient, and communicable technologies.

Acknowledgement

Amanda L. Joseph received funding from the Natural Science and Engineering Research Council of Canada Visual and Automated Disease Analytics Program.

References

[1] WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 [Internet]. WHO.[Cited 2022 Feb 27]. Available from: https://www.who.int/director general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march 2020 #:%7E:text=WHO%20has%20been%20assessing%20this,to%20use%20lightly%20or%20carelessly.

[2] Coronaviridae Study Group of the International Committee on Taxonomy of Viruses. The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol. 2020 Apr;5(4):536-544.

[3] Coronavirus. [Internet]. World Health Organization. [Cited 2022 Feb27].Available from: https://www.who.int/health-topics/coronavirus#tab=tab_1.

[4] Tracking SARS-CoV-2 variants. [Internet]. World Health Organization. [Cited 2022 Feb27]. Available from: https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/.

[5] Ciotti M, Ciccozzi M, Pieri M, Bernardini S. The COVID-19 pandemic: viral variants and vaccine efficacy. Crit Rev Clin Lab Sci. 2022 Jan;59(1):66-75.

[6] Askitas N, Tatsiramos K, Verheyden B. Estimating worldwide effects of non-pharmaceutical interventions on COVID-19 incidence and population mobility patterns using a multiple-event study. Scientific reports. 2021;11(1):1972.

[7] Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol.2005;8(1):19-32.

[8] Imhoff. Health Informatics. In: Sibbald W.J., Bion J.F. (eds) Evaluating Critical Care. Update in Intensive Care Medicine, vol 35. Springer, Berlin, Heidelberg; c2002.p.255-256.

[9] Intervention. [Internet]. Merriam Webster Inc.[Cited 2022 Feb 27]. Available from: https://www.merriam-webster.com/dictionary/intervention.

[10] PRISMA flow diagram. [Internet]. PRISMA.[Cited 2022 Feb 27]. Available from: http://prisma-statement.org/prismastatement/flowdiagram.aspx.

[11] Kogan NE, Clemente L, Liautaud P, Kaashoek J, Link NB, Nguyen AT, Lu FS, Huybers P, Resch B, Havas C, Petutschnig A, Davis J, Chinazzi M, Mustafa B, Hanage WP, Vespignani A, Santillana M. An early warning approach to monitor COVID-19 activity with multiple digital traces in near real time. Sci Adv. 2021 Mar 5;7(10):eabd6989.

[12] Becker NV, Bakshi S, Martin KL, Bougrine A, Andrade J, Massey PR, Hirner JP, Eccleston J, Choudhry NK, Britton KA, Landman AB, Licurse AM, Carlile N, Mendu ML. Virtual Team Rounding: A Cross-Specialty Inpatient Care Staffing Program to Manage COVID-19 Surges. Acad Med. 2021 Dec 1;96(12):1717-1721.

[13] Hannemann N, Götz NA, Schmidt L, Hübner U, Babitsch B. Patient connectivity with healthcare professionals and health insurer using digital health technologies during the COVID-19 pandemic: a German cross-sectional study. BMC Med Inform Decis Mak. 2021 Aug 25;21(1):250.

[14] Friedman C, Rigby M. Conceptualising and creating a global learning health system. International journal of medical informatics (Shannon, Ireland). 2012;2013;82(4):e63-71.

[15] Roundtable on Evidence-Based Medicine, Institute of Medicine. Appendix D IOM Roundtable on Evidence-Based Medicine. In: J. Michael McGinnis, Dara Aisner, LeighAnne Olsen, editors. The Learning Healthcare System. National Academies Press; 2007. p. 353-4.