Journal of Public Health: From Theory to Practice
https://doi.org/10.1007/s10389-020-01433-6

COMMENT

Meta-MUMS COVID-19 web server: an online daily monitoring server for comparative and cumulative epidemiological analysis

Massoud Sokouti[1] · Ramin Sadeghi[1] · Saeid Pashazadeh[2] · Saeid Eslami[3] · Mohsen Sokouti[4] · Morteza Ghojazadeh[5] · Babak Sokouti[6]

Received: 9 May 2020 / Accepted: 20 November 2020

Epidemiologically speaking, it has been more than four months since the first reported cases of the novel coronavirus 2019 (2019-nCoV) in Wuhan, China, considered as a new type of human *Betacoronavirus*, having over 96% identity with severe acute respiratorysyndrome coronavirus (SARS-CoV) according to whole-genome sequence analysis (Malik et al. 2020; Monchatre-Leroy et al. 2017). The COVID-19 outbreak subsequently began spreading around the world, threatening global public health due to the lack of any specific therapeutic agents (Sun et al. 2020). As of December 8, 2020, the global confirmed cases and deaths are 66,729,375 and 1,535,982, according to the World Health Organization (WHO) (i.e., https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports). Recent reports reveal that a clinical diagnosis of COVID-19 is possible using chest X-ray examination, similar to SARS-CoV and Middle East respiratory syndrome coronavirus (MERS-CoV) diseases (Das et al. 2015; Nicolaou et al. 2003). Also, laboratory diagnostic techniques such as real-time polymerase chain reaction (PCR) and quantitative reverse transcription PCR (RT-PCR) have demonstrated excellent performance for the detection of the disease in the early stages (Chu et al. 2020; Corman et al. 2020; Wu et al. 2020). The latest studies have investigated the epidemiological aspects of COVID-19 in terms of incidence and mortality rates by country (Ahn et al. 2020; Lai et al. 2020; Sun et al. 2020; Zhai et al. 2020). Reports have shown that SARS-CoV and MERS-CoV diseases have higher case fatality rates in comparison to SARS-CoV-2 (Park et al. 2020). Systematic reviews and meta-analysis studies are commonly designed for health-related issues based on available research evidence and provide a knowledge base outcome for health policymakers (Gopalakrishnan and Ganeshkumar 2013; Malterud et al. 2018).

The rationale behind the development of monitoring devices and tools specifically for the health care community, whether wearable, portable or online, is to provide sufficient data regarding various vital patient parameters in order to propose critical care and diagnosis, and in wider aspects to study and investigate the epidemiological effects of a disease or pandemic on a specific population. Wearable and portable health devices are used mostly for monitoring patients' health status such as blood pressure, oxygen rate, and heart rate at home or hospitals. The online monitoring health tools, on the other hand, are commonly developed based on available data to analyze and propose an epidemiological event which will be beneficial for health policymakers to enable appropriate decision-making with regard to actions to stop or mitigate the disease risk. Health-related monitoring tools will be important when periodic investigation of the recorded analyses for a disease result in a disaster situation, and the COVID-19 pandemic is no exception in this regard. In this case, various available evidence has been used for COVID-19, for instance, in terms of its transmission potential, that shows disastrous effects on the world's population (Tariq et al. 2020; Xu and Kraemer 2020). Generally, an effective health device or tool comprises three main components, including data acquisition, monitoring, and control, that are responsible for collecting data from a source, performing the tracking activities, and making decisions based on the monitoring component (Singh et al. 2020). However, some of the

✉ Ramin Sadeghi
raminsadeghi1355@yahoo.com

✉ Babak Sokouti
b.sokouti@gmail.com; sokoutib@tbzmed.ac.ir

1 Nuclear Medicine Research Center, Mashhad University of Medical Sciences, Mashhad, Iran

2 Faculty of Electrical and Computer Engineering, University of Tabriz, Tabriz, Iran

3 Department of Medical Informatics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

4 Department of Cardiothoracic Surgery, Tabriz University of Medical Sciences, Tabriz, Iran

5 Research Center of Evidence-Based Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

6 Biotechnology Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Published online: 08 January 2021

online monitoring tools may ignore the final decision-making process. A recent study also showed that policymakers and health professionals accounted for more than half of the most knowledgeable users that may play a critical role in providing awareness for a population (Al-Riyami 2010; Tricco et al. 2018). Additionally, there may be some gaps between policymakers and health researchers in terms of their points of view in interpreting the synthesized health information, and these gaps will need to be addressed in the future using decision-making systems based on artificial intelligents (Al-Riyami 2010).

In the current pandemic situation, several monitoring tools are engaged to provide meaningful synthesized or raw information. A global map monitoring tool developed at Johns Hopkins University provides information for countries on cumulative cases, active cases, incidence rate, case fatality ratio, and testing rate. The Johns Hopkins interactive web-based dashboard is able to track the COVID-19 pandemic in real time to provide updated information twice a day (Dong et al. 2020). The current Meta-MUMS COVID-19 web server is different from the Johns Hopkins real-time tool. It takes advantage of the data for COVID-19 and SARS-CoV included in worldometers.info and WHO as input. It performs a meta-analysis using whole data and proposes the results for five parameters, including incidence rate, mortality rate, recovery rate, incidence vs. death, and recovery vs. death. The online Meta-MUMS COVID-19 web server is intended to provide the results of thorough comparative meta-analysis between COVID-19 and SARS-CoV and is updated once a day at 00:00 UTC. Finally, the Meta-MUMS COVID-19 will demonstrate the outcome of the subgroup meta-analysis, where health policymakers can easily use it as knowledge-based information for future decisions.

To the best of the authors' knowledge, no studies have reported the development of a web server for performing an online cumulative meta-analysis to compare two SARS-CoV-2 and SARS-CoV diseases through incidence, mortality, and recovery cases. In the current study, we introduce a web server, namely Meta-MUMS ("Meta" is a shortened form for meta-analysis and "MUMS" stands for Mashhad University of Medical Sciences) COVID-19. It performs daily online comparative meta-analysis between two diseases using the cumulative global COVID-19 and SARS-CoV data extracted from Worldometer (https://www.worldometers.info/coronavirus/) and https://www.who.int/csr/sars/country/country2003_08_15.pdf?ua=1.

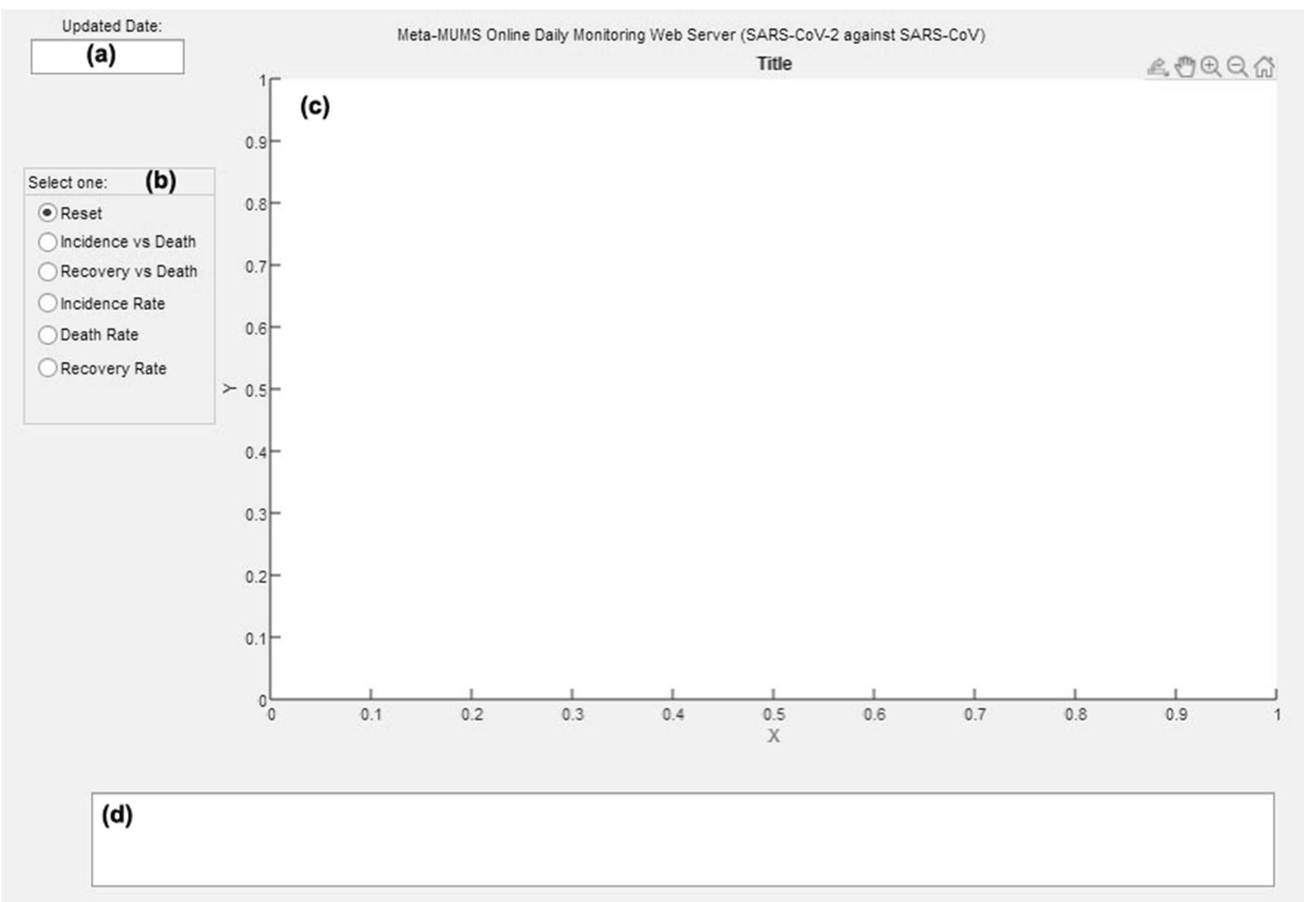

Fig. 1 The first page of the MetaMUMS COVID-19 web server. (a) The updated data for the COVID-19 database. (b) Users can select the meta-analysis type from the radio buttons, (c) the forest plot for the selected meta-analysis will be illustrated for the SARS-CoV-2 and SARS-CoV datasets, and (d) the interpretation for each forest plot will be demonstrated

The features of the Meta-MUMS COVID-19 web server include the ability to (i) compare incidence rates by event rate, (ii) analyze mortality rates by event rate, (iii) compare recovery rates by event rate, (iv) compare incidence vs. mortality rates using risk ratios, (v) compare recovery vs. mortality rates using risk ratios, (vi) provide knowledge-based descriptions for all five forest plots considering p-values less than 0.05 as significant, and (vii) provide daily updates.

The inputs for performing the meta-analysis include "country names," "cumulative number of cases," "cumulative number of deaths," "cumulative number of recovered cases," and "population of the countries." For "N/A" data, the corresponding country was excluded from the analysis. The programming environment for the meta-analysis is the MATLAB environment, in which the web app for this study is deployed. The analyzed measurements between SARS-CoV-2 and SARS-CoV diseases were event rate and risk ratio using a random-effects model. Additionally, for SARS-CoV-2, the countries with incidence cases known as critical by WHO risk assessment set as high for China's pandemic were selected to be included in the outcome.

Therefore, the Meta-MUMS COVID-19 relies on the data extracted (i.e., "country names," "cumulative number of cases," "cumulative number of deaths," "cumulative number of recovered cases," and "population of the countries") from worldometers.info, which is also updated in a real-time manner, as well as the constant SARS-CoV WHO data, and is implemented through a MATLAB web server compiled as a web service app (i.e., ctf file). The development and web server rental charge will be covered throughout the COVID-19 pandemic period; however, all of the expenses will be borne by personal accounts.

The Meta-MUMS COVID-19 web server is available at http://144.76.160.207:9988/webapps/home/session.html?app=Meta_MUMS_COVID19.

(as shown in Fig. 1).

Acknowledgments This study is part of a PhD thesis (No. 931507) and was approved and supported by the Research Council of Mashhad University of Medical Sciences, Mashhad, Iran, and carried out in the Nuclear Medicine Research Center of Mashhad University of Medical Sciences, Mashhad, Iran.

Compliance with ethical standards

Conflict of interest The authors declare that there is no conflict of interest.

Ethical approval Not applicable.

References

Ahn D-G et al (2020) Current status of epidemiology, diagnosis, therapeutics, and vaccines for novel coronavirus disease 2019 (COVID-19). J Microbiol Biotechnol 30:313–324

Al-Riyami A (2010) Health researchers and policy makers: a need to strengthen relationship. Oman Med J 25:251–252. https://doi.org/10.5001/omj.2010.75

Chu DK et al (2020) Molecular diagnosis of a novel coronavirus (2019-nCoV) causing an outbreak of pneumonia. Clin Chem 66:549–555

Corman VM et al (2020) Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. Eurosurveillance 25:2000045

Das KM et al (2015) Acute Middle East respiratory syndrome coronavirus: temporal lung changes observed on the chest radiographs of 55 patients. Am J Roentgenol 205:W267–S274

Dong E, Du H, Gardner L (2020) An interactive web-based dashboard to track COVID-19 in real time. Lancet Infect Dis 20:533–534. https://doi.org/10.1016/s1473-3099(20)30120-1

Gopalakrishnan S, Ganeshkumar P (2013) Systematic reviews and meta-analysis: understanding the best evidence in primary healthcare. J Fam Med Prim Care 2:9–14. https://doi.org/10.4103/2249-4863.109934

Lai C-C, Wang C-Y, Wang Y-H, Hsueh S-C, Ko W-C, Hsueh P-R (2020) Global epidemiology of coronavirus disease 2019: disease incidence, daily cumulative index, mortality, and their association with country healthcare resources and economic status. Int J Antimicrob Agents 55:105946

Malik YS et al (2020) Emerging novel coronavirus (2019-nCoV)—current scenario, evolutionary perspective based on genome analysis and recent developments. Vet Q 40:68–76. https://doi.org/10.1080/01652176.2020.1727993

Malterud K, Bjelland AK, Elvbakken KT (2018) Systematic reviews for policy-making – critical reflections are needed. Health Res Policy Syst 16:112. https://doi.org/10.1186/s12961-018-0387-9

Monchatre-Leroy E, Boué F, Boucher J-M, Renault C, Moutou F, Ar Gouilh M, Umhang G (2017) Identification of alpha and Beta coronavirus in wildlife species in France: bats, rodents, rabbits, and hedgehogs. Viruses 9:364. https://doi.org/10.3390/v9120364

Nicolaou S, Al-Nakshabandi NA, Müller NL (2003) SARS: imaging of severe acute respiratory syndrome. Am J Roentgenol 180:1247–1249

Park M, Thwaites RS, Openshaw PJ (2020) COVID-19: lessons from SARS and MERS. Eur J Immunol 50:308–311

Singh P, Dwivedi YK, Kahlon KS, Sawhney RS, Alalwan AA, Rana NP (2020) Smart monitoring and controlling of government policies using social media and cloud computing. Inf Syst Front 22:315–337. https://doi.org/10.1007/s10796-019-09916-y

Sun J et al (2020) COVID-19: epidemiology, evolution. In: And cross-disciplinary perspectives trends in molecular medicine

Tariq A, Lee Y, Roosa K, Blumberg S, Yan P, Ma S, Chowell G (2020) Real-time monitoring the transmission potential of COVID-19 in Singapore, march 2020. BMC Med 18:166. https://doi.org/10.1186/s12916-020-01615-9

Tricco AC et al (2018) Engaging policy-makers, health system managers, and policy analysts in the knowledge synthesis process: a scoping review. Implement Sci 13:31. https://doi.org/10.1186/s13012-018-0717-x

Wu D, Wu T, Liu Q, Yang Z (2020) The SARS-CoV-2 outbreak: what we know. Int J Infect Dis 94:44–48. https://doi.org/10.1016/j.ijid.2020.03.004

Xu B, Kraemer MUG (2020) Open access epidemiological data from the COVID-19 outbreak. Lancet Infect Dis 20:534. https://doi.org/10.1016/s1473-3099(20)30119-5

Zhai P, Ding Y, Wu X, Long J, Zhong Y, Li Y (2020) The epidemiology, diagnosis and treatment of COVID-19. Int J Antimicrob Agents 55(5):105955