Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

American Journal of Emergency Medicine 45 (2021) 671–672

Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

The COVID-19 pandemic: How predictive analysis, artificial intelligence and GIS can be integrated into a clinical command system to improve disaster response and preparedness

Europe's second wave of coronavirus infections has struck well before flu season even started, with intensive care units filling up again. Making matters worse, authorities say, is a widespread case of "COVID-fatigue." Record high daily infections in several eastern European countries and sharp rebounds in the hard-hit west suggest Europe never really flattened the COVID-19 curve as hoped after springtime lockdowns [1].

There is social pressure to provide timely and effective responses to COVID-19 along with the potential for unknown crisis that can seemingly lurk around the corner, such as flooding, earthquakes, and other climate induced disasters. Technology has enabled businesses, governments and society to function in a transformative capacity with unprecedented expediency due to the COVID-19 pandemic. Data driven decision making is increasingly regarded as an important characteristic of a successful response to any crisis [2]. When disaster strikes, governments are responsible for the safety and well-being of the citizens they are sworn to protect. Readily available and credible information that is easy to access and interpret is crucial for a timely and effective response [3-5]. Geographic Information Systems (GIS) is a framework used for gathering, managing and analyzing data. In a disaster and crisis management context GIS is used to highlight the relationships, patterns and associations that can be difficult to extrapolate due to the complexity of data. Geospatial analysis tools can be used to improve planning, response times, collaboration and communication in an overwhelming complex and turbulent environment [6,7].

European governments should to evaluate investment in GIS frameworks that are standardized so that information can be readily shared across the European Union. Over 500 hospitals globally have partnered with GE Healthcare to implement clinical command centers that are high tech solutions to improve patient care coordination using artificial intelligence and predictive analysis [8].

An integrated command center provides decision support for staff that monitors patient flow, tracks delays and provides this information in real time using both strategically located large LCD screens throughout the hospital and mobile applications that are available to hospital staff. GE's Command Center ecosystem was used during the COVID-19 pandemic at more than 150 hospitals and in Oregon's statewide system for managing real time bed and ventilator inventory [9].

Integrating GIS into the software ecosystem of a clinical command system would generate a much more precise response and improve operational capability and collaboration throughout the healthcare system during a disaster or crisis event. For example, crowd-sourced geographic data could be used to improve situational awareness and improve data reliability in cases where standard mapping is either unavailable, or outdated [10,11]. GIS data can also be utilized in emergency departments with their response to pandemics and concurrent disasters by reporting real time data concerning staffing and resource allocation including ventilators status. Coordination across hospitals and healthcare systems regionally through visual dashboards would help to manage a surge of patients requiring admission in an effort to achieve load-balancing and prevent overwhelming local resources [12]. European governments are urged to invest further in applying geospatial thinking to improve the speed, scalability and insights provided by GIS technology. This should be integrated into clinical command centers to help achieve a collectively more secure and prosperous European continent.

References

[1] Cacciapaglia G, Cot C, Sannino F. Second wave COVID-19 pandemics in Europe: a temporal playbook. Sci Rep. 2020;10(1):1–8. https://doi.org/10.1038/s41598-020-72611-5.

[2] Aye ZC, et al. A collaborative (web-GIS) framework based on empirical data collected from three case studies in Europe for risk management of hydro-meteorological hazards. Int J Disaster risk Reduction. 2016;15:10–23. https://doi.org/10.1016/j.ijdrr.2015.12.001.

[3] Goniewicz K, Burkle FM. Analysis of the potential of IT system support in early warning systems: mitigating flood risk in Poland. Prehosp Disaster Med. 2019;34(5):563–5. https://doi.org/10.1017/S1049023X19004801.

[4] Sofina N, Ehlers M. Building change detection using high resolution remotely sensed data and GIS. IEEE J Sel Topics Appl Earth Ob0 Remote Sens. 2016;9(8):3430–8. https://doi.org/10.1109/JSTARS.2016.2542074.

[5] Reichardt M. Open geospatial consortium standards. Int Encycl Geogr. 2016:1–8.

[6] Goniewicz K, Burkle FM. Disaster early warning systems: the potential role and limitations of emerging text and data messaging mitigation capabilities. Disaster Med Public Health Prep. 2019;13(4):709–12. https://doi.org/10.1017/dmp.2018.171.

[7] Kuipers S, Boin A, Bossong R, Hegemann H. Building joint crisis management capacity? Comparing civil security systems in 22 European countries. Risk Hazards Crisis Public Policy. 2015;6(1):1–21. https://doi.org/10.1002/rhc3.12070.

[8] GE Healthcare Command Centers. Available online http://Gehccommandcenter.com/covid19. (accessed on 13 October 2019).

[9] Tampa General's New Command Center Cuts Delays Saving Millions. Available online https://www.tampabay.com/news/health/2019/08/20/tampa-generals-new-command-center-cuts-delays-saving-millions/; 2020.

[10] Freeman JD, et al. Use of big data and information and communications technology in disasters: an integrative review. Disaster Med Public Health Prep. 2019;13(2):353–67. https://doi.org/10.1017/dmp.2018.73.

[11] Goniewicz K, et al. Geographic information system technology: review of the challenges for its establishment as a major asset for disaster and emergency management in Poland. Disaster Med Public Health Prep. 2020. https://doi.org/10.1017/dmp.2020.74.

[12] Goniewicz K, Goniewicz M, Burkle FM, Khorram-Manesh A. The impact of experience, length of service, and workplace preparedness in physicians' readiness in the response to disasters. J Clin Med. 2020;9:3328. https://doi.org/10.3390/jcm9103328.

Attila J. Hertelendy

[a]Department of Information Systems and Business Analytics, College of Business, Florida International University, Miami, FL 33174, USA

[b]Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Disaster Medicine Fellowship, Boston, MA, USA

https://doi.org/10.1016/j.ajem.2020.10.049

Krzysztof Goniewicz
[c]Department of Aviation Security, Military University of Aviation, 08521 Dęblin, Poland
*Corresponding author.
E-mail address: k.goniewicz@law.mil.pl

Amir Khorram-Manesh
[d]Institute of Clinical Sciences, Department of Surgery, Sahlgrenska Academy, Gothenburg University, 413 45 Gothenburg, Sweden
[e]Department of Development and Research, Armed Forces Center for Defense Medicine, Gothenburg, 426 76, Västra Frölunda, Sweden

18 September 2020