

An Expandable and Adaptable Web Platform for Supporting Public Health Risk Response to Covid-19

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Abstract

The scale and extent of the effects of COVID-19 on our lives is unmatched by any other recent natural disaster. Effective management of the spread and consequences of this pandemic can reduce the burden on health and help in managing the different costs by relaxing restrictions. Understanding this need, our interdisciplinary team of geo and health scientists at the University of Nebraska Medical Center (UNMC) developed a multi-layered interactive dashboard in March 2020. The dashboard provides an automatically updating map of COVID case numbers and their time series in Nebraska counties. Also, Nebraska's pandemic response leaders can see each hospital and its number of beds and contact information, the location of dialysis centers, long term care facilities, and pharmacies; the name of the emergency response coordinator; and the number of electricity-dependent Medicare beneficiaries in each county. The UNMC Dashboard, has helped the emergency response and health departments of Nebraska. It has received attention from local to international level. In addition to garnering public recognition, the Dashboard established connections between our team and stakeholders in our original climate tracking projects, as well as with other groups with whom we had not previously collaborated. We have established a close connection with Nebraska Medicine, one of the top medical facilities in the region, and their demand forecasting team. Also, we have developed new connections with out of state contacts in health department, resulting into an expanded version of the dashboard. Additionally, the dashboard demonstrated our capabilities and strengthened our relationships with local health departments in Nebraska. One of our primary projects relates to public health emergency preparedness for extreme weather and climate events in Nebraska. The success of that project depends on collaboration with different health officials in the state, who are now more aware of our team and our capability to provide practical solutions and tools. We suggest that this system can adapt to different frameworks, such as the Emergency Risk Framework (ERF) by World Health Organization (WHO). Our system provides the foundation for the information sharing required by such systems -therefore helping with communication and decision making.

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Introduction
 The scale and nature of the effects of COVID-19 are not known, is exacerbated by early waves across several locations. This has affected many different areas of our lives including risk response and management systems due a rigorous test.

The solution has evolved into a complex and global world problem. A traditional condition in the long-term, it has been assumed and is affecting every other areas while and has involved different groups of scientists, professionals, and young students to evaluate and decide about the

Central Idea
 Web-based platforms with different layers of data, mapping and visualization capabilities can enhance collaboration and outreach of multidisciplinary research and policy-making projects.
 COVID-19 made this need clear through an extreme global

Benefits of Web Systems
 Using web-based cloud platforms for emergency response and planning can have the following benefits:

- Provides clear and ready-to-use data shared through the data user base. (Considering the fact that data sources are limited to specific sources 25% to 50% of the time accessing and clearing data (Fard, S. 2020))
- Facilitates collaboration, knowledge

Extension Plans

- Our Long-term objective was to develop a system capable of:
 - Early Warning System
 - Multi-level Impact Forecasting
 - Risk Assessment
- To achieve this goal we will make it world-wide, establish partnerships, share technology, and create data backbone and data structure for the multidisciplinary system.

Our Story
 The creation of **UNMC COVID-19 Dashboard** for every states in the early months of Covid-19 was well received within our teams. The success of its first version in early March 2020 to help health professionals in Nebraska they can make and early risk response, to some extent, address community, and there is a larger leader

- Starting from an initial idea of mapping the current condition in Nebraska in less than a month, it was developed into a system involving several colleagues, and

UNMC Covid-19 Dashboard
 Covid-19 Dashboard for UNMC Region 7 (L-6)

References
Acknowledgements
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References
 • Alexander, R., V. J. Center, and J. Brooks. "Web-based multidisciplinary collaboration in Covid-19."

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INTRODUCTION

The scale and extent of the effects of COVID-19 on our lives is unmatched by any other recent natural disaster. This has affected many different areas of our lives and put risk response and management systems into a rigorous test.

The situation has unfolded into a complex and global scale problem. A healthcare problem in the beginning, it has been affected and is affecting many other areas of life and has involved different groups of scientists, professionals, and policy makers to analyze and decide about the situation. Countries that could quickly establish digital technologies to manage, track, test, survey and plan showed much more success in controlling the spread of disease and its consequences (Whitelaw, S. et al, 2020)

The same complexity and interconnection exist for other hazards that threat our health and properties, in different scales from local to global. Access to web-based platforms, like the one subject of this presentation, can provided a great opportunity to effectively manage the more complex problems.

Here we present our web-based platforms for Covid-19 response, and then by applying a flexible, global conceptual framework show that it can be expanded into tools for collaboration on climate related risk situations that requires collaborations among scientists, expert matters, decision makers, and communities.

We hope that we can increase the awareness about the advantages of such systems, especially for community-science projects and risk management systems.

CENTRAL IDEA

Web-based platforms with different layers of data, mapping and visualization capabilities can enhance collaboration and outreach of multidisciplinary research and policy-making projects.

COVID-19 made this need clear through an extreme global scenario.

BENEFITS OF WEB SYSTEMS

Using web-based shared platforms for emergency research and planning can have the following benefits:

- **Provides clean and ready to use data** filtered through the user interface. (Considering the fact that data scientists are known to spend between 45% to 60% of their time accessing and cleaning data (Press, G, 2016)
- **Facilitates** collaboration, knowledge sharing, learning, and collective decision-making. These are essential for successful management of extreme events (O'Donnell, 2018)
- **Removes potential barriers** such as geographical disparities, scattered datasets, miscommunication, etc. These are some of the potentials of web-based shared platforms (Almoradie, A., 2015)
- **Includes stakeholders** in modeling, that has been demonstrated to increase the chances of effective collaboration. (Voinov, A, 2010)

EXTENSION PLANS

- Our Long-term objective is to develop a **central platform for climate risk management and response**.
Including, but not limited to:
 - Early Warning Systems
 - Multi-hazard Impact Forecasting
 - Risk Assessment

- To achieve this goal and make it useful:
 - Establish partnerships, choose technology, and create User Interface and data structure for this multidisciplinary system
 - Create data input connections to real time data sources, and data output capabilities to provide filtered and ordered datasets
 - Distinguish the functional requirements for each of the use cases mentioned for the system

OUR STORY

The creation of UNMC Covid-19 dashboard (<http://bit.ly/covidne>), like many others in the early months of Covid-19, was self-initiated within our team. We created its first version in early March 2020 to help first responders in Nebraska the way we could, and with our expertise. It soon got attention internally, and then in a larger scale:

- Starting from an initial idea of mapping the covid condition in Nebraska in less than a month, it was developed into a system involving seven colleagues, and used by many healthcare professionals throughout NE (<https://waterforfood.nebraska.edu/news-and-events/news/2020/04/unmc-team-develops-covid-19-dashboard-for-nebraska-expanding-soon-to-include-surrounding-states>), and a request to extend it to DHHS Region 7 (including Iowa, Kansas, Missouri, and Nebraska)
- *"These maps might be a crucial tool for pandemic responders, We might want to enhance our level of testing to catch more cases [in a certain area] or put up a testing center if there's an area where people would have to take the bus or public transport when they're ill to get tested," - Prof. Kacey Ernst - EOS, May 2020*
(<https://eos.org/articles/geoscientists-help-map-the-pandemic>)

These fast reactions show a need for such tools in different scales and for different complex problems we are facing.

UNMC COVID-19 DASHBOARD

Covid-19 Dashboard for HHS Region-7 (Link
(<https://universityofne.maps.arcgis.com/apps/opsdashboard/index.html#/7c066f5a46d74bafb76127a61a0e78b>

[VIDEO] <https://www.youtube.com/embed/222qfo9ZX1A?rel=0&fs=1&modestbranding=1&rel=0&showinfo=0>

The above video is a tutorial for COVID-19 Response Dashboard for HHS region 7. The platform was developed on April 2020 after receiving a request, with added functionalities for filtering datasets compared to the NE version

Applying SREX Risk Framework as the conceptual foundation of the system

We use risk framework to guide our data categorization and model building, and specifically rely on the Risk framework proposed in the special report of the Intergovernmental Panel on Climate Change (IPCC): Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) - Summary for Policymakers. Our current COVID-19 platforms also follow the same concept. Those contain information and visualization of COVID-19 cases as a hazard layer, the related vulnerable populations as a vulnerability layer, and different health providers data as an adaptation systems layer.

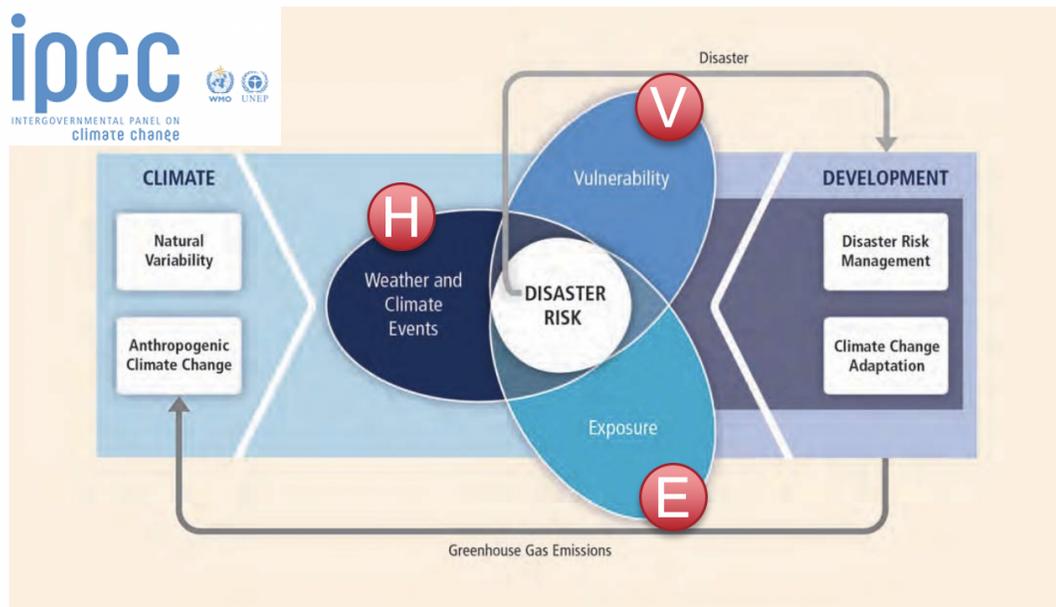
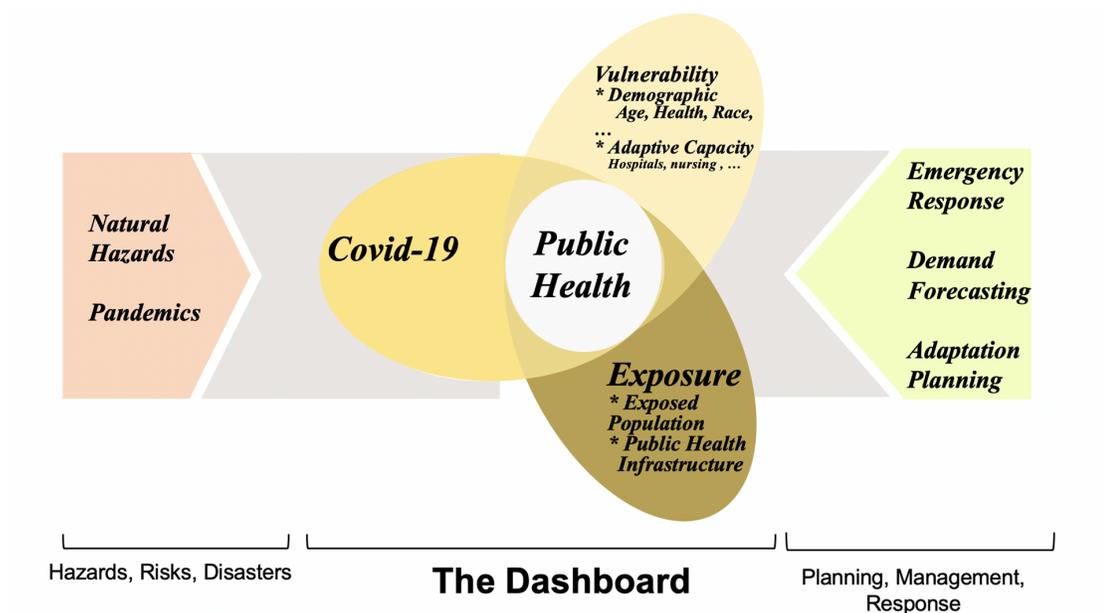


Figure SPM.1 | Illustration of the core concepts of SREX. The report assesses how exposure and vulnerability to weather and climate events determine impacts and the likelihood of disasters (disaster risk). It evaluates the influence of natural climate variability and anthropogenic climate change on climate extremes and other weather and climate events that can contribute to disasters, as well as the exposure and vulnerability of human society and natural ecosystems. It also considers the role of development in trends in exposure and vulnerability, implications for disaster risk, and interactions between disasters and development. The report examines how disaster risk management and adaptation to climate change can reduce exposure and vulnerability to weather and climate events and thus reduce disaster risk, as well as increase resilience to the risks that cannot be eliminated. Other important processes are largely outside the scope of this report, including the influence of development on greenhouse gas emissions and anthropogenic climate change, and the potential for mitigation of anthropogenic climate change. [1.1.2, Figure 1-1]

The figure below shows our adaptation of SREX Risk framework for this specific case, and our proposed potential expansion of the system to cover other cases of natural hazards and epidemics as hazards, and different use cases facing these situations.



Adaptation of SREX risk framework into Covid dashboard.

REFERENCES

Acknowledgement

This project was funded by the Region VII Disaster Healthcare Response Ecosystem grant and the Nebraska Research Initiative; at the University of Nebraska Medical Center College of Public Health.

References

- Almoradie, A., V. J. Cortes, and A. Jonoski. "Web-based stakeholder collaboration in flood risk management." *Journal of Flood Risk Management* 8, no. 1 (2015): 19-38.
- O'Donnell, Emily C., Jessica E. Lamond, and Colin R. Thorne. "Learning and action alliance framework to facilitate stakeholder collaboration and social learning in urban flood risk management." *Environmental Science & Policy* 80 (2018): 1-8.
- Press, Gil. "Cleaning big data: Most time-consuming, least enjoyable data science task, survey says." *Forbes*, March 23 (2016): 15.
- Voinov, Alexey, and Francois Bousquet. "Modelling with stakeholders." *Environmental Modelling & Software* 25, no. 11 (2010): 1268-1281.
- Whitelaw, Sera, Mamas A. Mamas, Eric Topol, and Harriette GC Van Spall. "Applications of digital technology in COVID-19 pandemic planning and response." *The Lancet Digital Health* (2020).

AUTHOR INFORMATION

I am a Postdoctoral Research Associate in the College of Public Health, University of Nebraska Medical Center. As an environmental data scientist with a background in civil and environmental engineering, I try to understand the effect of climate extremes on communities and built environment through different data analyses methods and tools. This is a multidisciplinary work that needs feedback from different stakeholders and scientists, to be effective. Therefore, I use data visualization and mapping to communicate with different groups and receive feedbacks. My current study focus is to better understand the pathways that link climate-related events to human

health in Nebraska, map and identify the communities and populations that are “at-risk” or vulnerable to extreme weather and other climate-related events in Nebraska, and the surrounding region , and help in establishing web platforms that can facilitate collaboration for emergency preparedness and response.

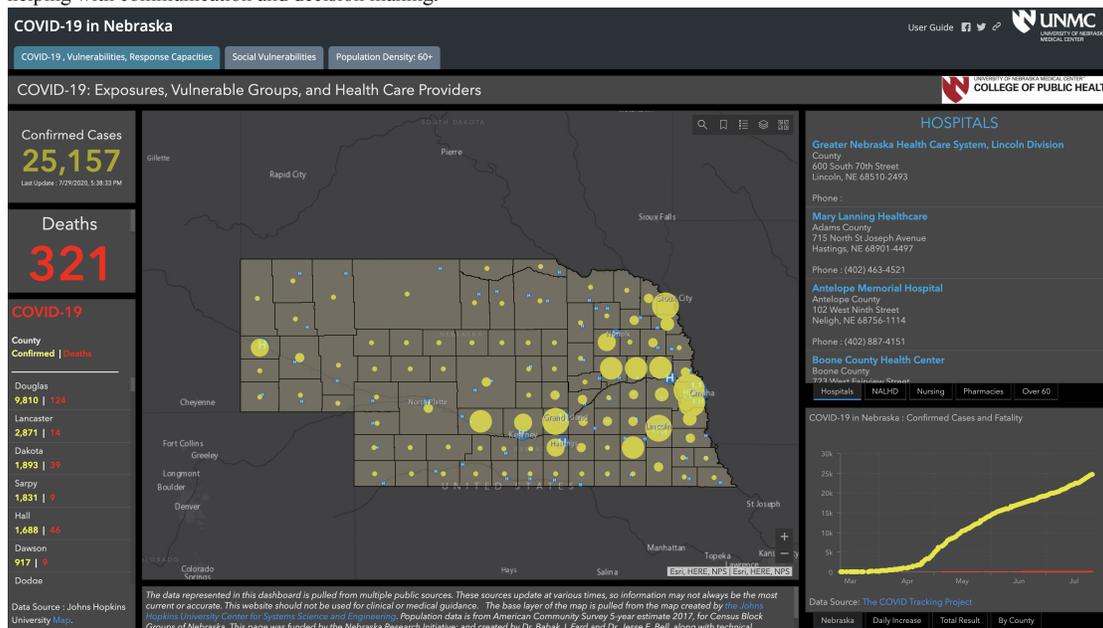
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(https://agu.confex.com/data/abstract/agu/fm20/4/7/Paper_756674_abstract_724473_0.png)

REFERENCES

- Almoradie, A., V. J. Cortes, and A. Jonoski. "Web-based stakeholder collaboration in flood risk management." *Journal of Flood Risk Management* 8, no. 1 (2015): 19-38.
- O'Donnell, Emily C., Jessica E. Lamond, and Colin R. Thorne. "Learning and action alliance framework to facilitate stakeholder collaboration and social learning in urban flood risk management." *Environmental Science & Policy* 80 (2018): 1-8.
- Press, Gil. "Cleaning big data: Most time-consuming, least enjoyable data science task, survey says." *Forbes*, March 23 (2016): 15.
- Voinov, Alexey, and Francois Bousquet. "Modelling with stakeholders." *Environmental Modelling & Software* 25, no. 11 (2010): 1268-1281.
- Whitelaw, Sera, Mamas A. Mamas, Eric Topol, and Harriette GC Van Spall. "Applications of digital technology in COVID-19 pandemic planning and response." *The Lancet Digital Health* (2020).