The Use of GIS to Monitor Global Supply Chain Security

In a previous blog post, I highlighted why healthcare organizations should utilize geospatial intelligence (GEOINT) as a strategic planning tool to prepare for the next pandemic. Some of the advantages for using geospatial tools and technology in healthcare include the following:

- Data from multiple sources can be obtained for free or low-cost
- Data can be visualized and statistically analyzed to increase confidence it its validity
- Data gathering and analyzing can be out-sourced to minimize disruptions to current operations
- World-wide geospatial data can be gathered, analyzed and reported to key decision makers in a timely manner

In this post, I'll discuss how geospatial analysis can be used to assess the resilience and security of the healthcare supply chain. Here, I'll focus on recent headlines regarding the pharmaceutical supply chain and the increasing shortage of important cancer chemotherapy drugs and antibiotics as a use case for GEOINT.

Drug Shortages

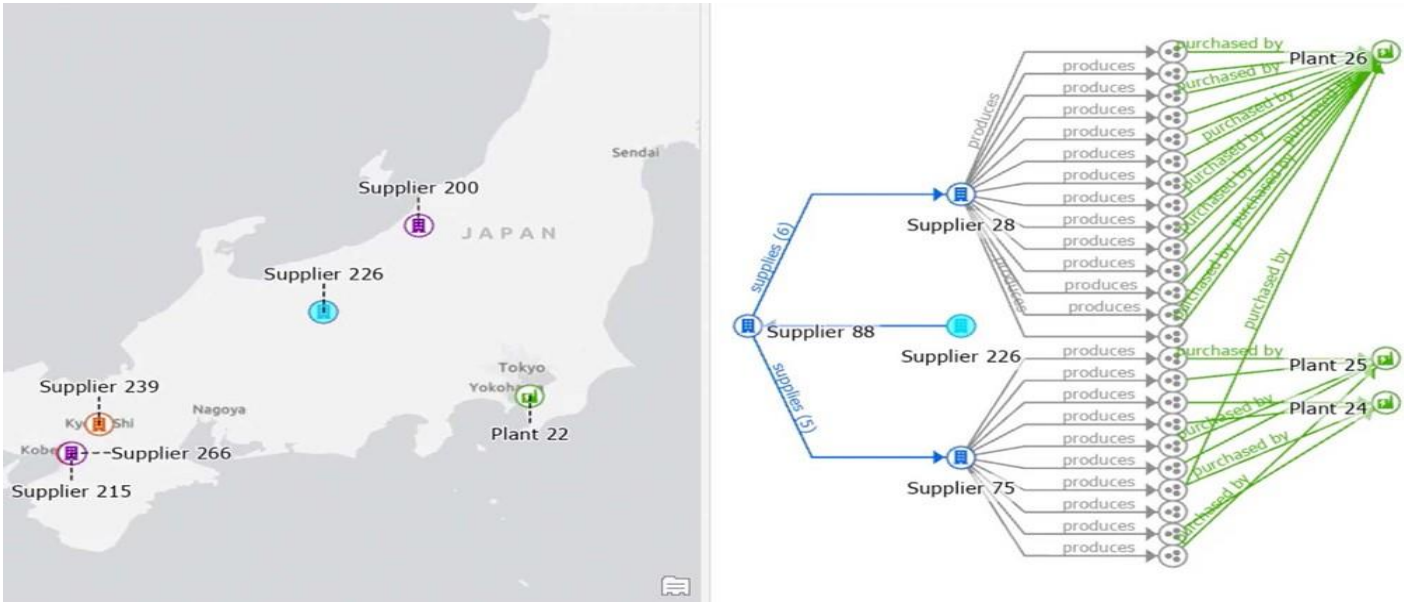
On May 12, 2023, the American Cancer Society's Cancer Action Network released a statement[1] outlining the reasons for the current shortages of drug therapies used for cancer treatment. The reasons given include "expanded demand, supply shortages, limited manufacturing capacity, and low profit margins."[1] The Food and Drug Administration (FDA) has a role in preventing drug shortages but according to Richard Pazdur, MD, the director of the FDA's Oncology Center of Excellence, the main cause of shortages of important chemotherapy drugs cisplatin and carboplatin is the "failure of the industry to invest in building capacity."[2] The FDA maintains a website that has a list[3] of drug shortages for various therapeutic categories. Included on this list are anti-infectives used to treat bacterial infections. A sample of the drugs

listed include amoxicillin oral powder for suspension, clindamycin phosphate injection, gentamicin sulfate, and rifampin capsules.[4] In general, the anti-infective drug shortages can be categorized as supply and/or demand issues and regulatory issues.[5] For a more complete discussion, see https://www.frontiersin.org/articles/10.3389/fphar.2021.693426/full. On June 15, 2023, Senators Gary Peters (D-Michigan) and Joni Ernst (R-Iowa) introduced the Pharmaceutical Supply Chain Risk Assessment Act (S. 1961). The bill "would require federal agencies to create a list of critical drug products, conduct a comprehensive risk assessment of the entire pharmaceutical supply chain for those critical supply products and report and report to Congress on plans to mitigate the supply chain vulnerabilities identified."[6]

Monitoring the Global Supply Chain

The use of GIS to monitor the supply chain is becoming more widespread among many industries including the pharmaceutical industry. The ability to show locations of all points along the chain, as well as the relationships among those points, is a powerful visual tool. It can show the flow of goods and raw materials as well as any potential security issues in near real-time (Figure 1).

Figure 1



Source: https://www.esri.com/about/newsroom/publications/wherenext/monitoring-global-supply-chain/

Disruptions in the supply chain as a result of natural or man-made issues, and also be demonstrated. GIS can be especially useful when multiple events are occurring at the same time. For example, hurricane season and wildfire season occur at the same time of year in the US. These events can disrupt the supply chain at multiple points simultaneously. Figure 2 shows recent US wildfires and the location and potential path of a hurricane in the Atlantic Ocean.

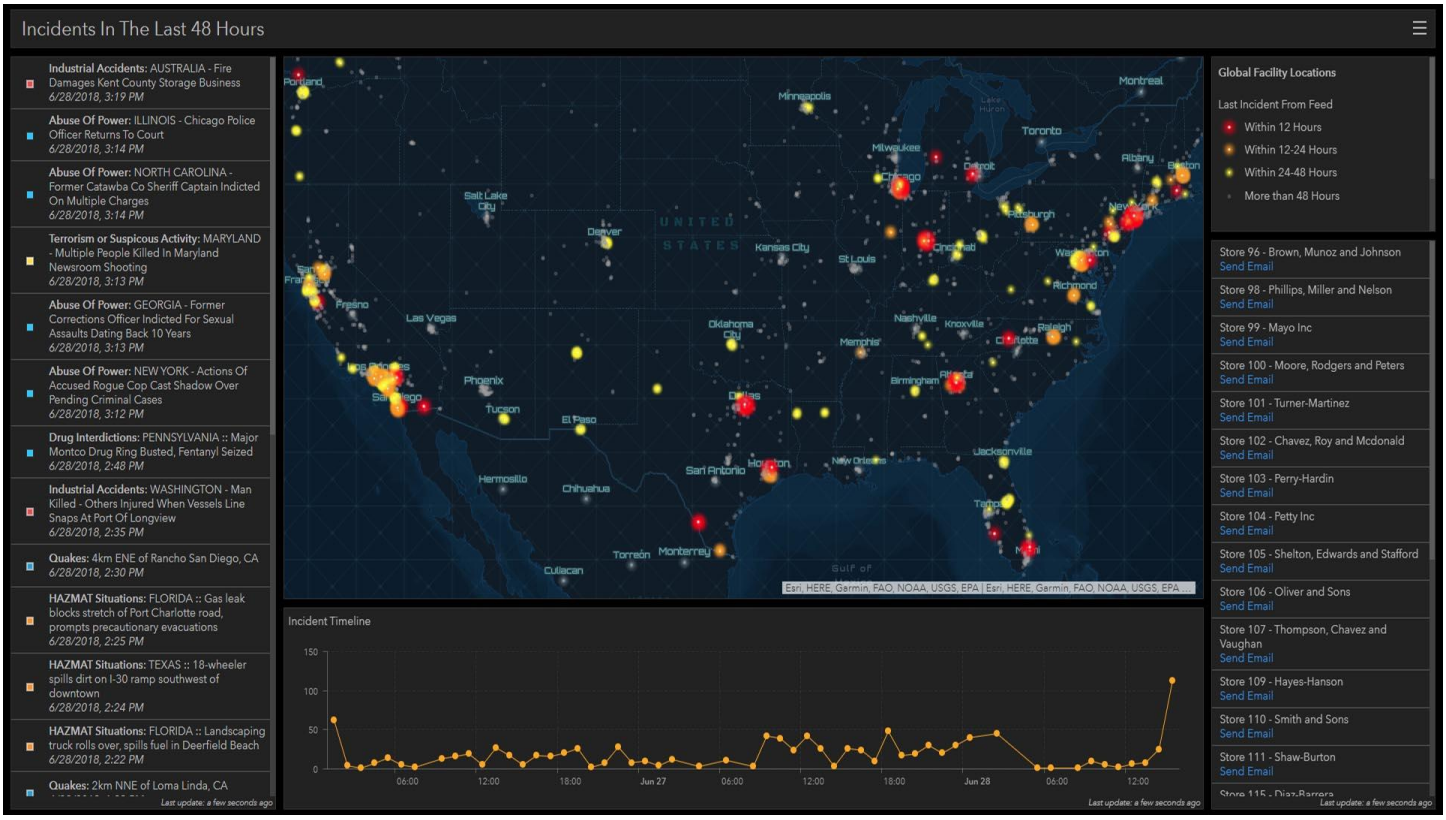
Figure 2

In addition, a dashboard can be created to present a near real-time view of the supply chain including the natural and man-made disruptions, available alternate paths for the chain, internal and external responses to the disruptions, and predicted impacts. Other potential disruptors including earthquakes, near real-time security issues, and logistics issues can also be included.

Single Pane of Glass

The combination of the use of cartographic representations of a corporation's supply chain in near real-time in combination with a summary dashboard are components of what is referred to as a "single pane of glass." According to Stephen Mashburn, a consultant with ESRI's Professional Services, a single pane of glass can be useful to executives as it is:

> "Essentially, on one screen, they see a holistic view of their organization—its facilities, moving assets, personnel, and vendors and partners in the supply chain. All that information is displayed in a single situational view. They're viewing data like incident feeds and weather data layered into the map, with incident information in a side panel or a screen crawl, and valuable metrics about their organization's health or potential risk in analytical panes below the map."[7]



Source: https://www.esri.com/about/newsroom/publications/wherenext/location-intelligence-and-corporate-security/

With this summary view displayed in near real-time, executives can move quickly to mitigate supply chain disruptions as well as understand threats to physical and human assets across the globe.

Conclusion

GIS is now being used to monitor threats to corporate and national security issues. Using cartographic visualizations and dashboards, sometimes in combination and with the ability to view incidents in near rea-time, potentially serious disruptions and threats to the supply chain can be mitigated. This may be especially important as the fall flu season approaches; an adequate supply of antivirals, anti-infectives and other essential drugs will be essential.

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References

[1] https://www.fightcancer.org/releases/nationwide-drug-shortage-could-cause-disruptions- cancer-patients-active-treatment. Accessed June 25, 2023.

[2] https://www.fiercepharma.com/manufacturing/failure-market-results-persisting-shortages-fda-oncology-director-says-report#:~:text=The%20root%20cause%20of%20shortages,quality%20issues%20after%20an%20inspection. Accessed June 25, 2023.

[3] https://www.accessdata.fda.gov/scripts/drugshortages/default.cfm. Accessed June 25, 2023.

[4] Ibid.

[5] https://www.frontiersin.org/articles/10.3389/fphar.2021.693426/full. Accessed June 25, 2023.

[6] https://www.mha.org/newsroom/federal-pharmaceutical-supply-chain-risk-assessment-bill-introduced/. Accessed June 25, 2023.

[7] https://www.esri.com/about/newsroom/publications/wherenext/location-intelligence-and-corporate-security/. Accessed June 25, 2023.