

Supply Chain Micro-simulation

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Sandia National Laboratories - August 1, 2014

Micro-simulation is critical to medical supply chain management

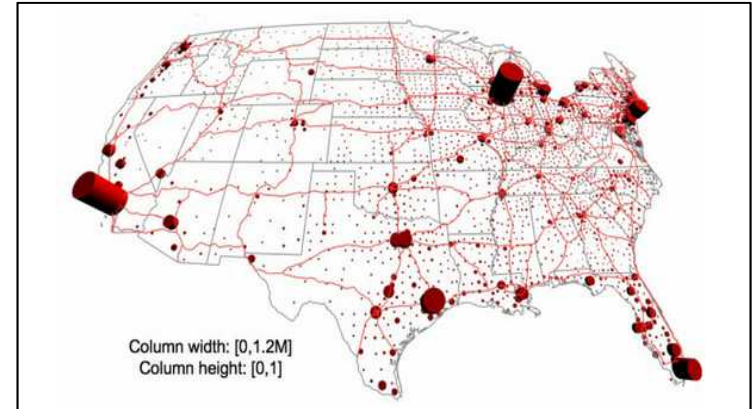
Benefits of current ELM/MOH strategy:

1. **Situational awareness** – where products are located and being processed in each stage in the supply chain
2. **Efficiency analysis** – what are the most cost-effective assets and portions of the supply chain, and why?

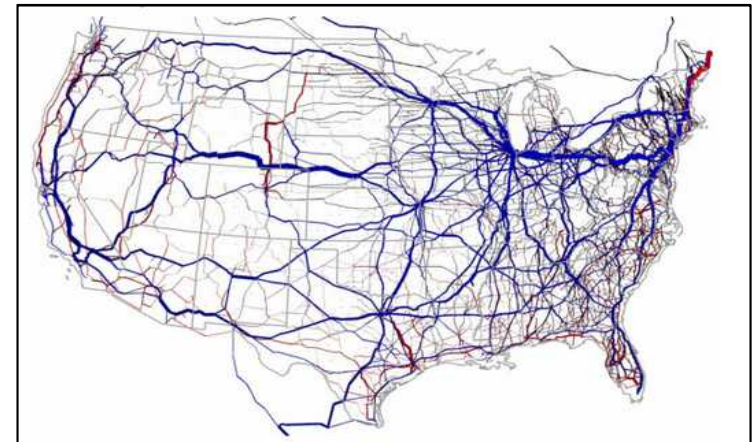
Micro-simulation leverages these benefits to provide the next level of analytics:

1. **Risk analysis** – what are the most critical supply-chain assets for ensuring the sufficient supply of safe medicine to patients?
2. **Resilience analysis** – how well can the supply chain absorb, respond to, adapt to, and recover from major disruptions?
3. **Investment analysis** – where must the next investments be made to ensure that delivery of medical supplies and services are still adequate, cost-effective, and resilient to potential disruptions.

Regional inventories



Rail and road shipments



An Example: U.S. Pharmaceuticals

Policy Issues:

- Key U.S. pharmaceuticals are in chronic shortage, largely due to private, highly regulated nature of pharmaceuticals production and overall supply chains (raw chemicals → precursors → finished products).
- U.S. agencies (FDA) have limited authority to address acute shortages within the chronic shortages.

Benefits of supply chain micro-simulation:

- Identifies key critical assets in the pharmaceuticals supply chains and impacts of their loss.
- Results used in resilient frameworks to assess resilience and resilience costs of different supply chains, and different shortage-prevention and loss-prevention mechanisms.
- Used in frameworks to assure that risk and resilience goals are met simultaneously.



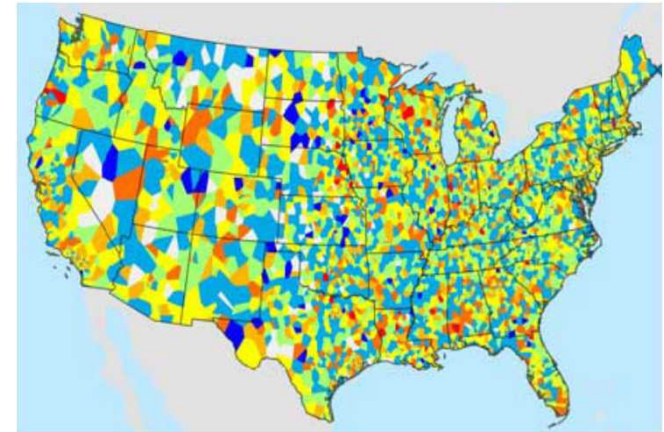
Surges in hospital occupancy

Policy Issue:

- The U.S. government needs to develop pre- and post-pandemic prevention and mitigation strategies to minimize death/injury and reduce economic impact.

Policy benefits of micro-simulations:

- Identified risks to supply chain and resulting impacts of pandemic-based loss of labor and productivity, including between transportation and the economic sectors that rely on it.
- Assessed supply chain resilience to differing levels of pandemic spread and government policies.
- Determined best policies for mitigation impacts (partial/early intervention is better than full/late).



REMI economic impact simulations



Table 4-3. Summary of healthcare simulations

Scenario	Baseline	Fear-40	CMG	CMG-SE	Antivirals	Pre-pandemic Vaccine	Anticipated
Number Illnesses	74 M	61 M	1.2 M	28 M	69 M	39 M	2.6 M
Number Hospitalized	8.1 M	6.6 M	140,000	3.0 M	7.6 M	4.2 M	280,000
Number Deaths	1.5 M	1.2 M	25,000	550,000	1.4 M	780,000	52,000
Peak Death Rate (per hour)	1,700	1,500	16	340	1,400	930	32
Day of Peak Death Rate	69	66	61	81	105	63	70
Cost of Healthcare	\$81 B	\$68 B	\$1.7 B	\$35 B	\$50 B	\$79 B	\$9.0 B