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Uncertainty Analysis of a Medical Resource Demand Model

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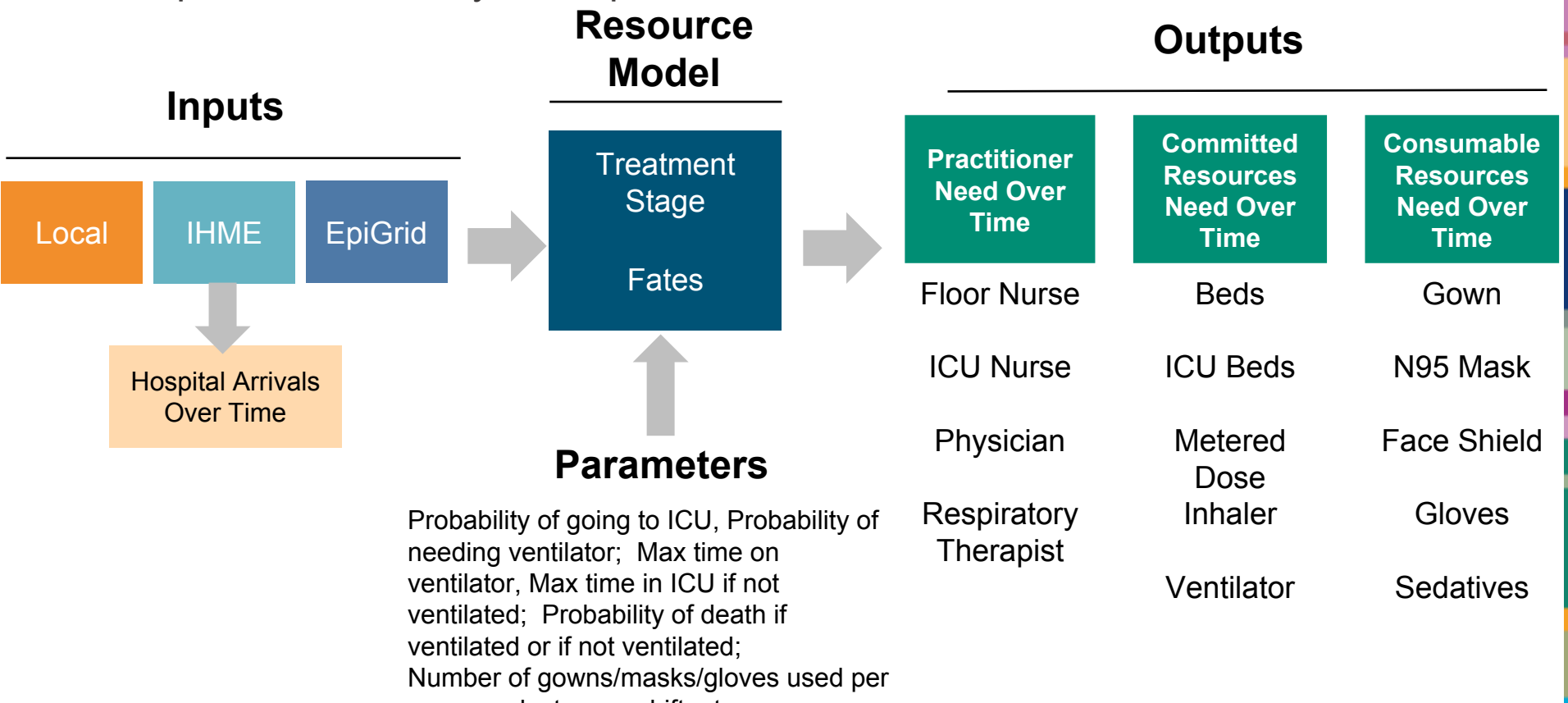
Work in collaboration with Walt Beyeler, Pat Finley, Teresa Portone, Erin Acquesta, Chris Frazier, Sean DeRosa, and others. Thank you!

Uncertainty Analysis of a Medical Resource Demand Model

Problem Statement

- Calculate resource demands for treating COVID-19 patients based on disease spread projections from epidemiology models
- Anticipate possible times and locations of medical resource shortfalls throughout the pandemic
- Incorporate uncertainty in the parameters of the resource model



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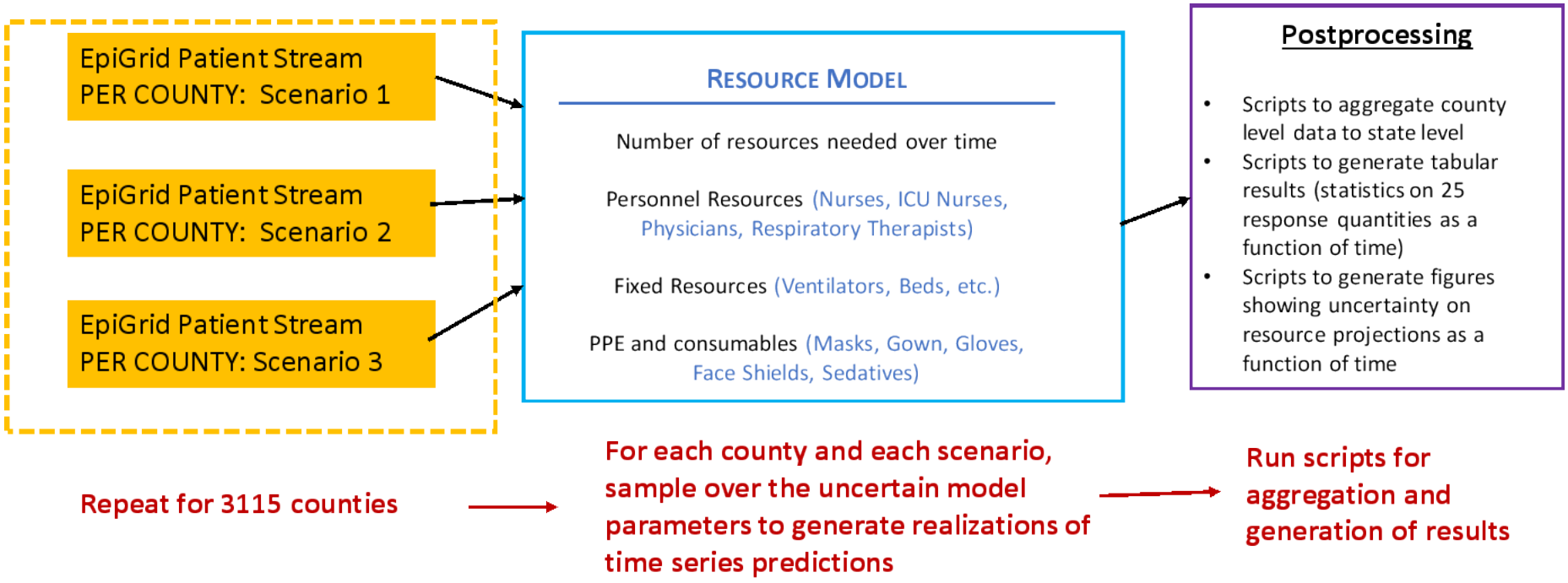
Approach

Approach: Use Latin Hypercube Sampling (a stratified sampling method to achieve good sample coverage) to propagate uncertainty in the parameters through the models and generate distributions on the output.

- We developed pre- and post-processing scripts to launch these on the HPCs.
- 3115 counties * 3 scenarios * 100 samples of resource model = 934,500 model evaluations
- This would have taken > 500 hours to run on one computer. **We were able to run in less than 5 hours on the HPCs.**



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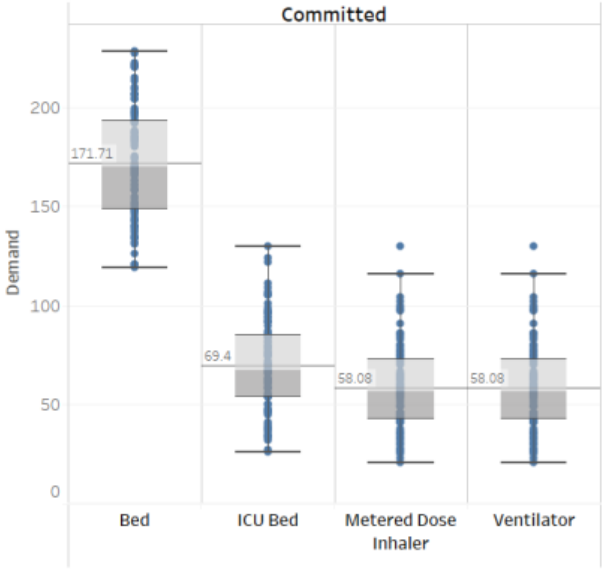
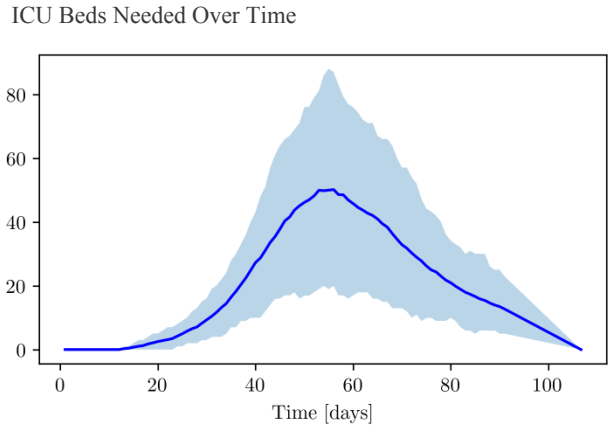
Results: Statistics on 25 resource needs for each of the 3115 counties in the country, including mean, standard deviation, and exceedance probabilities.

Maximum number of resource needs with a range of uncertainty



Resource needs over time with a range of uncertainty



State or county risk indicators