Simulation and modeling analytical business methodologies can be successfully applied to the scientific planning process, with minimal resources. These methodologies allow decisionmakers to understand multiple scenarios when looking to build capacity and reduce costs, quantify possible long-term outcomes, and modify the weighting of priorities to understand impacts. Booz Allen Hamilton, a leading strategy and technology consulting firm, has extensive experience supporting laboratory planning by combining strong scientific expertise with cutting-edge computer modeling to provide a data-driven approach to laboratory planning.

Increasing Testing Capacity

Booz Allen has used discrete simulation modeling for various health clients over the last few years to address streamlining processes, increasing capacity, and understanding the most cost-effective approach to public health and medical laboratory testing. The modeling is completed with stakeholder input, use of current laboratory procedures, and operations research methodologies. The data is incorporated into discrete event simulation models using commercial off-the-shelf (COTS) simulation software to create analysis that drives innovation in our nation’s laboratories. The models are designed to capture both capacity for testing and bottlenecks by process and resource for the given testing algorithm. The models accomplish this through quantifiably defining the underlying processes such as work schedules, activity delays (i.e., specimen “hold times”), specimen queuing and batching, personnel assignments, equipment allocations, priorities, and associated business rules that govern daily operations.

Modeling Processes to Uncover Solutions

The Centers for Disease Control and Prevention (CDC), working with the Association of Public Health Laboratories, called on Booz Allen to provide a quantitative assessment of capacity at 38 of the 97 laboratories most likely to be testing specimens during an influenza pandemic. This sample size of 38 provides us with a 91-percent confidence level that our results are applicable to all laboratories that are in vitro diagnostic (IVD) qualified. Booz Allen drew on its expertise in capacity and resource modeling and simulation, laboratory management, and health IT to develop three computer-based real-time polymerase chain reaction (RT-PCR) laboratory models, which could then be customized for each of the 38 selected laboratories. The three models were the three testing algorithms available for influenza testing: (1) influenza A/B typing assay with full influenza A subtyping using baseline resources (9 specimens per plate); (2) influenza A/B typing assay with reflex influenza A subtyping using baseline resources (19 specimens per plate for typing; 9 specimens per plate for subtyping); and (3) influenza A/B typing using surge resources (19 specimens per plate). Booz Allen experts collected data on each laboratory’s unique processes, staffing, shift times, and equipment. With this information, Booz Allen and the laboratories addressed the following primary issues:

- What is each Public Health Laboratory’s baseline pandemic capacity?
- What is the shortfall, if any, between the laboratory’s capacity and the anticipated demand for testing during a pandemic?
• How can the laboratory increase its capacity to meet demands during a pandemic?
• Which testing algorithm is the most cost effective?

The models not only measured potential shortfalls in testing capacity, but also helped identify bottlenecks and ways to remove them to achieve required throughputs.

To address the resource constraints facing the laboratories, Booz Allen consultants employed optimization strategies to provide recommendations for increasing capacity around identified bottlenecks, coupled with strategies for decreasing demand and improving processes. For example, Booz Allen demonstrated how laboratories could accommodate larger volumes by “pooling” specimens for testing during the early stages of a pandemic, when influenza cases were still rare but sample testing demand was already high. This enabled the labs to quickly process far more samples while still accurately diagnosing infection.

Helping Laboratories With Improved Decisionmaking

The recommended resource optimizations could increase the average capacity by 80 percent for the influenza A/B testing with full influenza A subtyping algorithm and 83 percent for the influenza A/B testing with reflex to influenza A subtyping algorithm. Using the surge algorithm with surge resources (defined as algorithm and resources that are expected to be available to the laboratory during emergency periods of high testing demand) provided a capacity increase of 127 percent compared with the influenza A/B typing assay with reflex influenza A subtyping algorithm and baseline resources.

As a result of the project’s success, various US and foreign government agencies have asked Booz Allen’s modeling and simulation experts to help their laboratory networks assess capacity and improve performance in testing for influenza viruses as well as other disease agents.

“The process of building a model helped us understand the key variables involved in the testing process,” said Dr. Joe Miller, Chief Laboratory Preparedness Officer in the CDC’s Influenza Division. “I think we’re much better prepared to respond to a pandemic and make better decisions during the pandemic. In addition, the model can help us with budgeting and resource allocation decisions as we plan for the future.”

Ready to Help You

Our work with the CDC and the Public Health Laboratories is just one example of how Booz Allen’s global strategy and technology consultants can help government organizations use advanced analytics techniques to improve processes and achieve vital mission goals.

See our ideas in action at boozallen.com

About Booz Allen

Booz Allen Hamilton is a leading provider of management consulting, technology, and engineering services to the US government in defense, intelligence, and civil markets, and to major corporations, institutions, and not-for-profit organizations. Booz Allen is headquartered in McLean, Virginia, employs approximately 23,000 people, and had revenue of $5.76 billion for the 12 months ended March 31, 2013. In 2014, Booz Allen celebrates its 100th anniversary year. To learn more, visit www.boozallen.com. (NYSE: BAH)