



# NOVA SIM

LOGIC IN MOTION

Make the most of your resources with our simulation-based decision tools

## ► CHALLENGE

Vancouver Coastal Health Authority was dealing with increasing patient load, high bed utilization and expensive delays in a patient's journey through the system. The organization's leaders sought a robust, flexible modeling tool that would allow them to understand and ultimately improve their patient flow issues through better management of available capacity and resources.

## ► OUTCOME

NovaSim worked closely with VCH staff to develop a well-tested, high fidelity discrete event simulation model of the system-wide patient flow, which has been used on an on-going basis to understand, test and improve patient flow issues.

## ► SUMMARY

As the result of an extensive open bid process, Vancouver Coast Health (VCH) engaged NovaSim to develop a simulation-based analysis tool in support of its large patient flow improvement initiative. The simulation tool analyzes



dozens of patient types, hundreds of patient flow pathways and multiple facilities. The project succeeded in providing VCH with a tool to develop effective strategies for: (1) identifying obstacles to smooth patient flow (2) best matching operational capacity (beds) with current and anticipated patient needs (3) improving the patient experience by reducing delays.

## ► ORGANIZATION

The Vancouver Coastal Health (VCH) consists of a diverse set of facilities with complex patient flow patterns. VCH provides a full-spectrum of health care services ranging from hospital-based care to community-based services including long term care, rehabilitation and mental health services. The organization spans over 58,000 square kilometers, manages nearly 9,000 beds and provides services for over a million patient visits annually.

## Case Study: Simulation-based Patient Flow Improvement

### Vancouver Coastal Health Authority

## ▶ CHALLENGE

VCH was dealing with increasing patient load, high bed utilization and expensive delays in a patient's journey through the system. Committed to exceptional patient care, VCH launched an ambitious patient flow improvement initiative in 2004. In support of that initiative, VCH commissioned NovaSim to perform process analysis, data analysis and simulation modeling services, focusing on facilities in the greater Vancouver area. Dedicated VCH staff worked closely with NovaSim experts to develop a well-tested, high fidelity model of the system-wide patient flow, which has been used on an on-going basis to understand, test and improve patient flow issues.

## ▶ SOLUTION

VCH selected NovaSim for this assignment on the basis of its deep expertise in process and data analysis as well as discrete event simulation. The joint VCH-NovaSim project team chose to use a data-driven, evidence based and patient-centric approach to first understand and then model VCH's complex patient flow patterns. The resulting discrete event simulation model allowed VCH to evaluate the impact of proposed patient flow changes in a very accurate



and visual way. Because the model's advanced user interface allows VCH staff to change parameters, even adding new patient types or facilities, they now have a highly accurate model that can grow with them over time.

Focusing on the high-volume facilities within the greater Vancouver area, the primary goals of this study were to:

1. Understand, document and quantify patient flow patterns.

2. Understand, document and quantify sources of delay during the patient care journey including discharge / disposition delays.

3. Identify opportunities for improving patient flow through better management of available capacity and resources.

4. Provide an ongoing tool for evaluation of potential impacts of proposed patient flow initiatives.

## ▶ QUESTIONS ANSWERED

The VCH Patient Flow Simulation Tool consists of an Excel-based user interface that allows users to make changes to all parameters, and to import current data sets without requiring any expert knowledge in simulation whatsoever. The model's advanced user interface allows VCH staff to change parameters, even adding new patient types or facilities as needed to evaluate number 'what-if' questions. The following is just a small sample of the questions that can be explored:

- What would be the impact if we can alter the number of patients following a particular path? What if we introduce an entirely new path?

- Would it improve overall system KPIs if we add beds to any unit? What if we shift capacity from one area to another? How about making the number of beds in a unit vary by time of day or day of week?

- Are we using the most effective patient movement rules (i.e. prioritization schemes)?

- What if we create blended-purpose units (such as combined medical/surgical units)?

- If the composition of our patient population changes over time would our current policies be sufficient to manage the flow? What if our patient arrival volumes increase or decrease substantially?

## Case Study:

Simulation-based Patient Flow Improvement ■ Vancouver Coastal Health Authority

NovaSim began by conducting extensive interviews with staff to understand perceived current patient flow patterns, issues and areas for improvement. With this ground work in place, the team embarked on an intensive data mining analysis to support and supplement the information learned during the interviews. Several databases were integrated and analyzed in novel ways, uncovering many previously undetected patient flow patterns.

An intermediate deliverable, but a very important one, was the development of a "Patient Pathway Analysis Tool." Taking raw patient data files as inputs, the Patient Pathway Analysis Tool produced a clear picture of existing patient flow pathways, many of which had been previously undetected or underestimated.

The project team determined that a discrete event simulation model would be the right tool to bring together all of the knowledge gleaned from the process and data analyses. Because of the dynamic interaction inherent in such a complex system, it also became clear that a simulation model would be the only feasible method for analyzing the hundreds of patient flow pathways uncovered during the data analysis portion of the project. As patients move through the simulated system, the model reflects dynamic capacity limitations, patient placement priorities and other operating rules, including bed reservation and specification of alternate (overflow) units.

Building upon the work of the Patient Pathway Analysis Tool, the Patient Flow Simulation Model automatically reads and processes the necessary database files (DAD, ADT, ORMIS) to calculate important input parameters. The end user is then free to run scenarios using the base parameters or to modify them to explore specific what-if questions. Either way, when it comes time to simulate a scenario, a robust state-of-the-art simulation is automatically built based on the parameters contained in the user



interface, freeing the end user from having to gain any simulation expertise.

At the conclusion of any simulated scenario, the Patient Flow Simulation Model records and reports a large number of detailed statistics, including information related to patient volumes, length of stay, wait times and much more.

### ▶ OUTCOMES

The VCH Patient Flow Simulation Model was rigorously validated by comparing KPIs produced by the model with KPIs experienced by the real system under similar conditions. The model was found to be a very high fidelity representation of actual patient flow system behavior in the greater Vancouver area.

The innovative integration of extensive patient data analyses with simulation technology allowed VCH to better understand the needs of their patient population, as well as served to uncover non-intuitive and surprising ways that patients had been flowing through the system. The tool led to the illustration of many important lessons, such as the importance of having discharge better

synchronized with admission timing and the unexpected impacts of even slight delays in unexpected places.

Use of the tool has been ongoing. VCH Patient Flow Improvement staff now have a means for rapidly answering a wide range of what if questions from internal customers, allowing them to be more responsive when important questions are asked.

### ▶ FOR MORE INFORMATION:

If your organization is facing bed management issues, if you'd like a state-of-the-art tool to model your patient flow improvement scenarios, or if you need expert consulting for any patient flow issue, we'd be happy to help! Please contact:

**Kerrie Paige, PhD**

President

NovaSim, LLC

800-538-6394 x600

Kerrie@novasim.com

www.novasim.com

## Simulation-based Patient Flow Improvement Case Study

©2009, NovaSim, LLC