

A System Dynamics Model: Wait Times and Bed Capacity for Stem Cell Transplantation in Ontario

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Objective

Cancer Care Ontario (CCO) is the provincial agency responsible for the planning of adult cancer services. Since 2010, this has included hematopoietic stem cell transplantation (SCT) in Ontario.

Allogeneic stem cell transplants (ALLOSCT) are procedures where the patient receives a stem cell graft from an external donor. These are complex procedures that can require special hospital rooms for up to 3 months.

The objective of this project is to develop a capacity planning model to investigate the effects on wait times of adding extra bed capacity for ALLOSCT in SCT centres.

Approach

A high-level process flow diagram was generated to understand patient flow at one hospital and validated through consultation. This flow diagram was used to construct a system dynamics model to simulate patient flow.

The model was parameterized with data from CCO, Discharge Abstract Database, hospital and clinical expert input. The simulation started on July 1, 2015 and was run for 1 year.

The effects at six months were projected for **five scenarios**:

1. Current state
2. Increase bed capacity by 1 bed
3. Increase bed capacity by 2 beds
4. Increase patient demand by 20
5. Combination of scenario 3 and 4

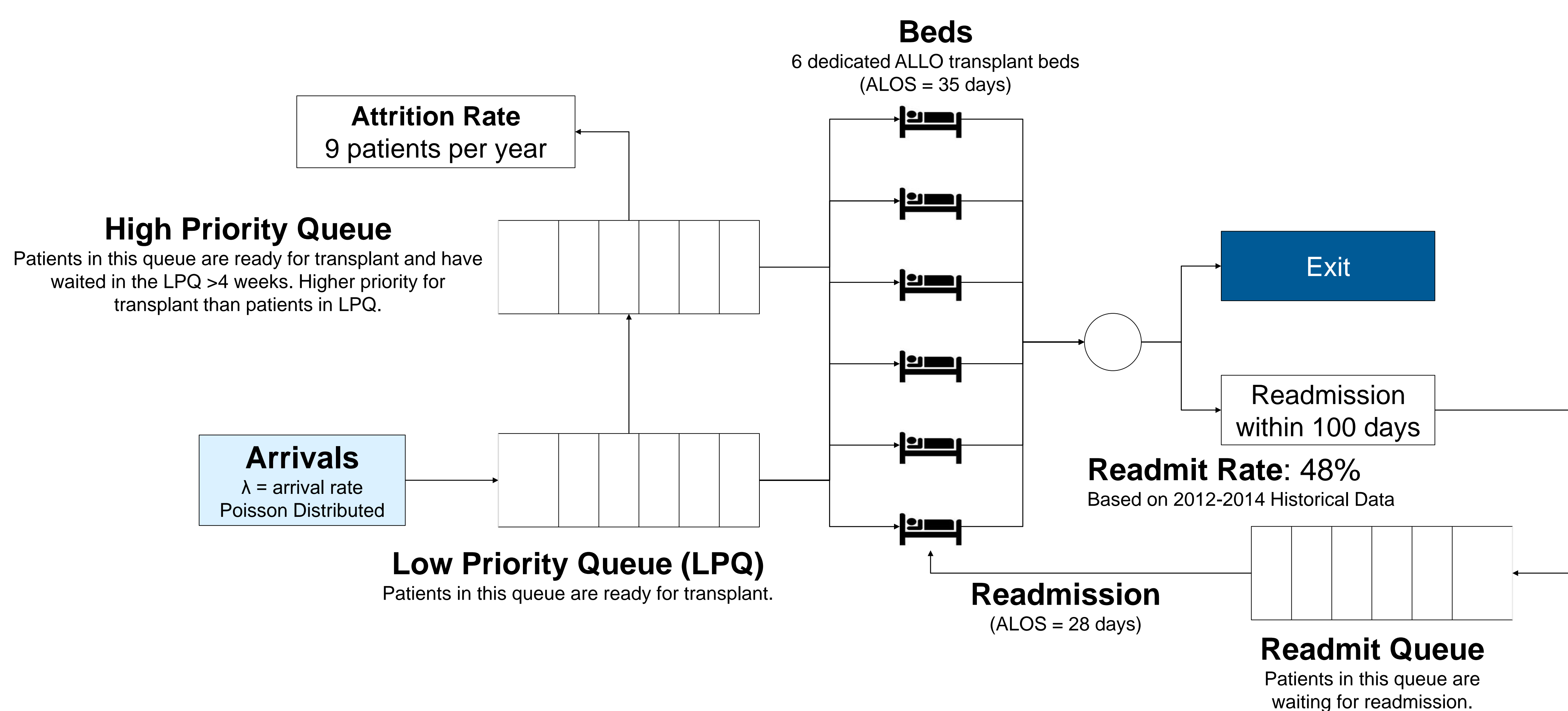
Results

The addition of 1 ALLOSCT bed resulted in a reduction of 22% and 11% to the ALLOSCT wait times and wait lists, respectively.

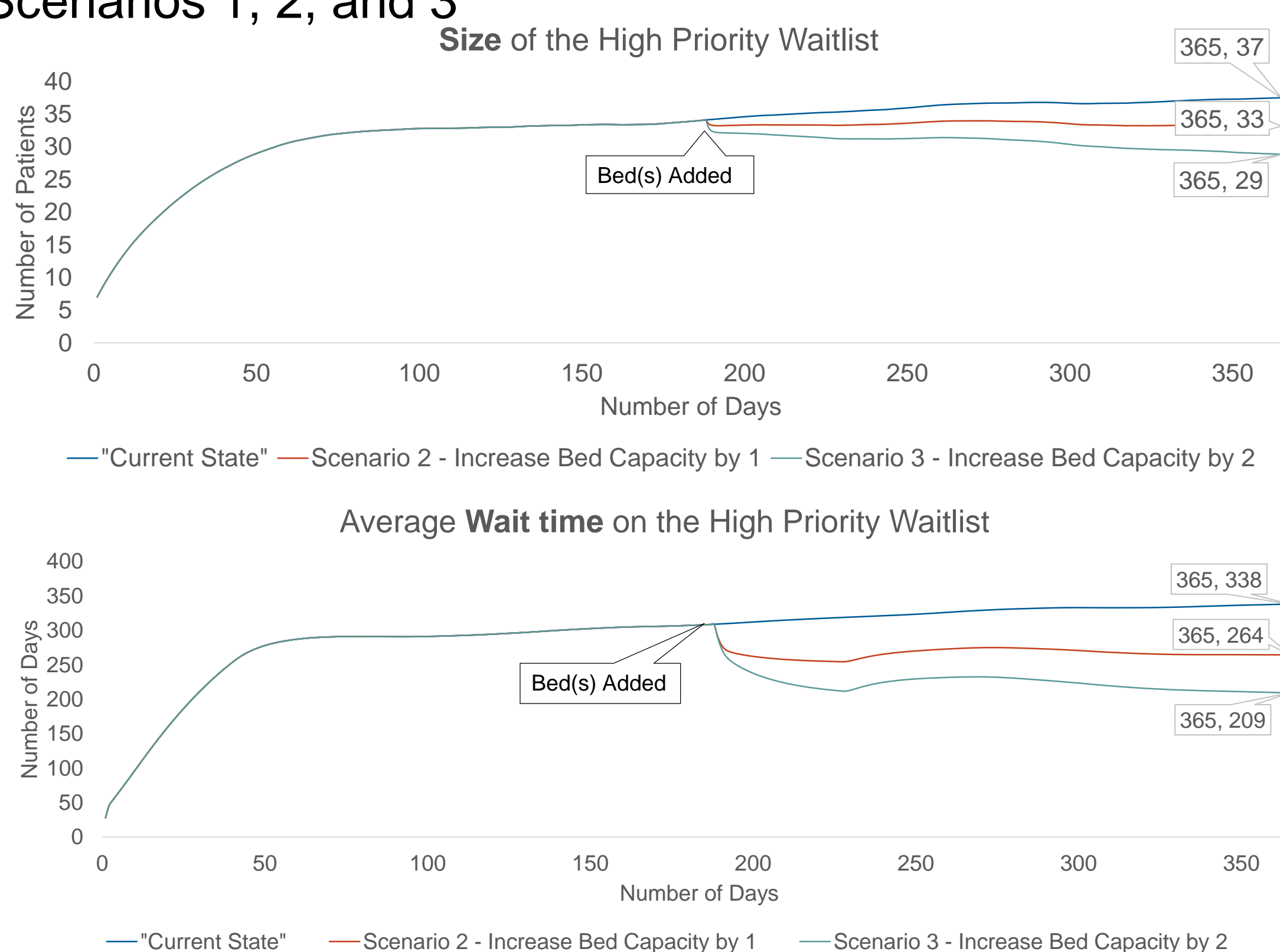
The addition of 2 beds resulted in a reduction of 38% and 22% to the wait times and wait lists, respectively.

If the demand increases by 20 patients per year, the addition of 2 beds resulted in a reduction of 16% in the wait times and while the wait list may experience a brief reduction, after 6 months, the wait list size will have increased by 9% as a result of the increased demand.

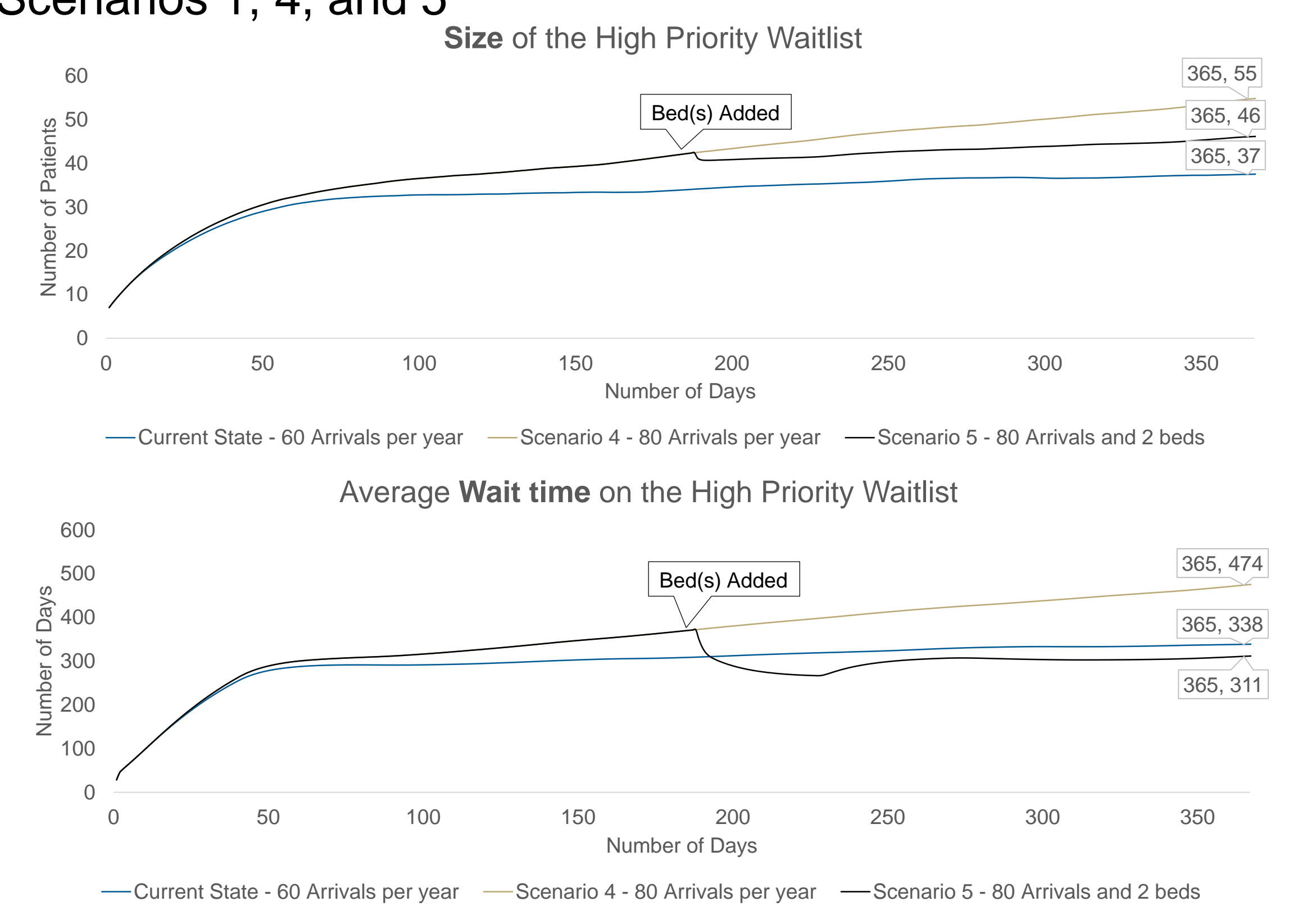
Process Flow Diagram



Scenarios 1, 2, and 3



Scenarios 1, 4, and 5



Results: Graphs of Simulation

Conclusion

Using a system dynamics model, we are able to model the relationship between ALLOSCT bed capacity and wait times at an SCT centre.

This quantifies the impact of adding bed capacity on the wait times at an SCT centre and helps to build a better business case for ALLOSCT bed expansion.

Future Work

The model can be used to estimate the bed requirements for all sites needed to meet an established provincial wait times benchmark.

It is recognized that bed capacity is not the sole bottleneck in the patient flow process. Other factors such as lab processing and staff availability need to be considered.

Acknowledgements

We would like to thank the Ontario Stem Cell Transplant Steering Committee and other contributors for their support, time and feedback for this project.