Let's Talk Informatics

Discrete-Event Simulation

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Bethune Ballroom, Halifax, Nova Scotia

Please be advised that we are currently in a controlled vendor environment for the One Person One Record project.

Please refrain from questions or discussion related to the One Person One Record project.

Informatics…

utilizes health information and health care technology to enable patients to receive best treatment and best outcome possible.

Clinical Informatics…

is the application of informatics and information technology to deliver health care.

AMIA. (2017, January 13). Retrieved from https://www.amia.org/applications-infomatics/clinical-informatics

Objectives

At the conclusion of this activity, participants will be able to…

- Identify what knowledge and skills health care providers will need to use information now and in the future.
- Prepare health care providers by introducing them to concepts and local experiences in Informatics.
- Acquire knowledge to remain current with new trends, terminology , studies, data and breaking news.
- Cooperate with a network of colleagues establishing connections and leaders that will provide assistance and advice for business issues, as well as for best-practice and knowledge sharing.

Session Objectives

- Introduction to Project Services & Performance Improvement department.
- Introduction to Discrete-Event Simulation.
- Identifying importance of Informatics to Discrete-Event Simulation.
- Presentation of simulation software with actual and sample models.

Conflict of Interest Declaration

- I do not have an affiliation (financial or otherwise) with a pharmaceutical, medical device, health care informatics organization, or other for-profit funder of this program.

Project Services & Performance Improvement

What do we do?

- Quality / process improvement
- Patient access and flow
- Clinic / service ops reviews
- Work measurement
- Facilities design
- Project management
- ***Simulation Modeling***

What Is Simulation?

- A system model.
- A statistically based analysis tool of a dynamic process.
- A time compression method.
- An experimentation tool for service optimization.
- An art and a science!

How Does Simulation Relate to Health Informatics?

Master of Health Informatics MHI

- How health information is used in health care delivery.
- How we can better use health information to improve health care.
- How we can incorporate information technology to improve health care.

The use of discrete-event simulation supports these objectives!

What Is Discrete-Event Simulation?

- The modeling of a system with a discrete sequence of events in time.
- Examples include:
  - Supermarket checkouts
  - Bank teller service
  - Toll booths
  - Patient arrival at Emergency
- It is labelled as discrete-event because the arrival / queuing / servicing events are *not continuous*.

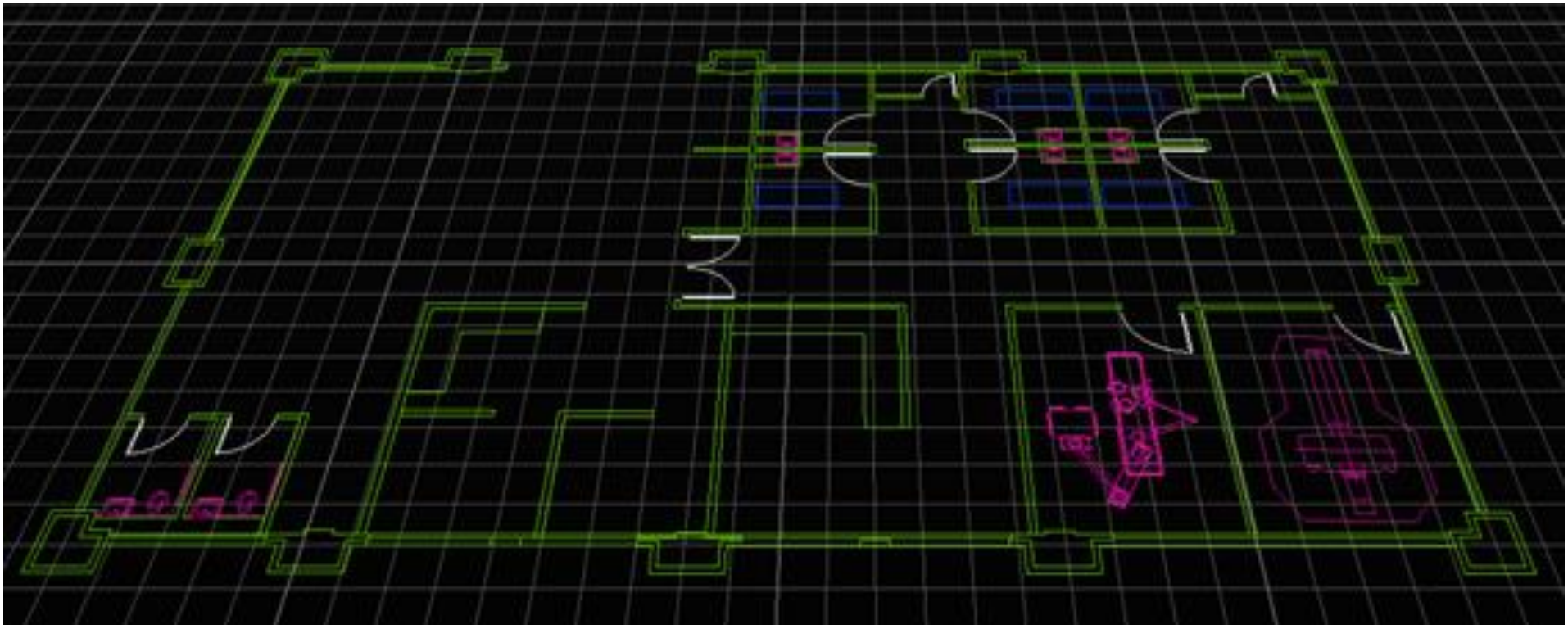
Why Use Simulation?

- The observation and documentation of reality is too expensive, disruptive or problematic.
- An analytical solution is not feasible / too complex.
- The ability to time-compress long running events.
- The ability to experiment different scenarios.

Simulation Software - FlexSim Healthcare (HC)

- FlexSim Healthcare is designed specifically for the unique challenges faced by today's health care facilities.
- It contains 3D visuals and graphics to observe exactly what's happening as the model is running.
- All modeling activities are derived from ***patient tracks***.
  - Create sequenced list of patient activities based on acuity and diagnosis as well as staff, resource and equipment requirements.
- NSHA software purchase in July 2017.

How Are FlexSim HC Models Built?



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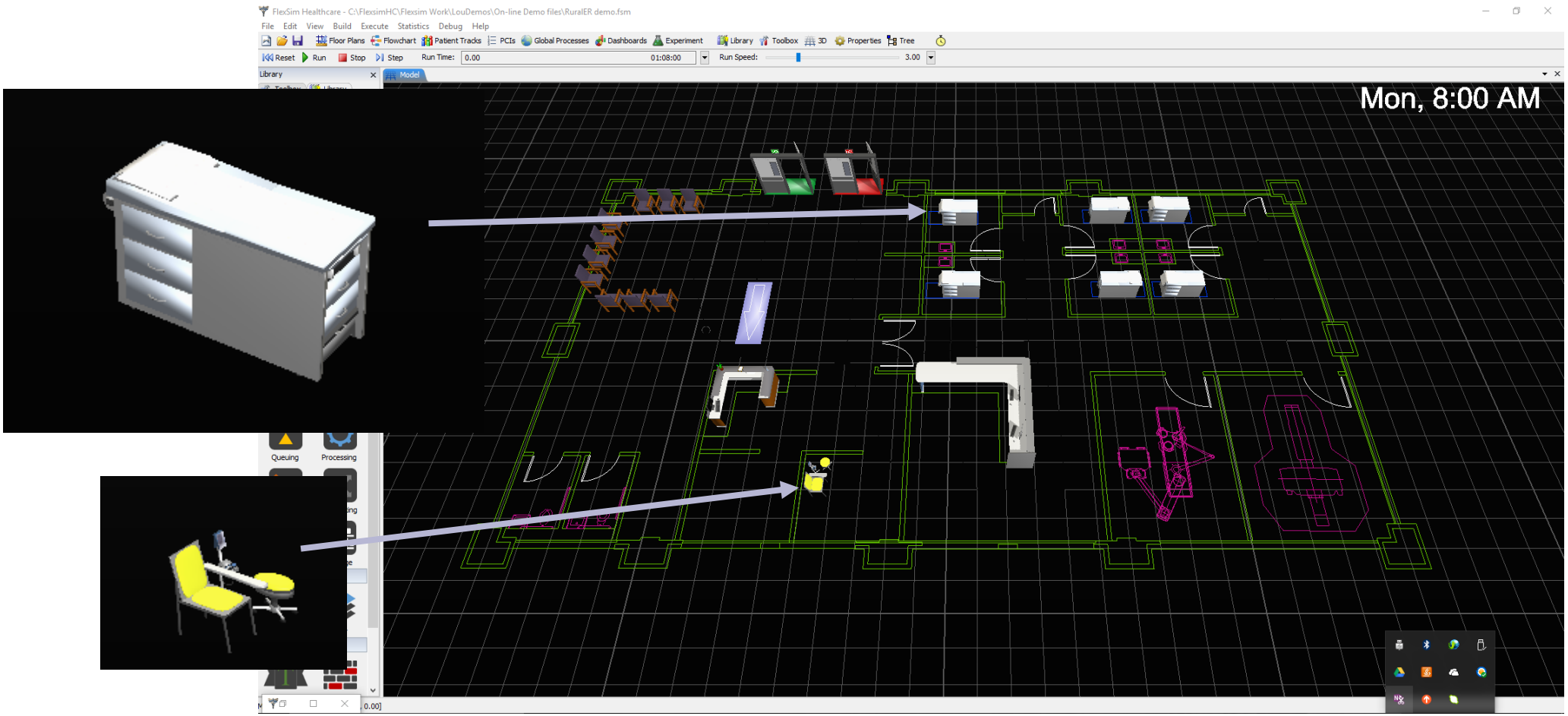

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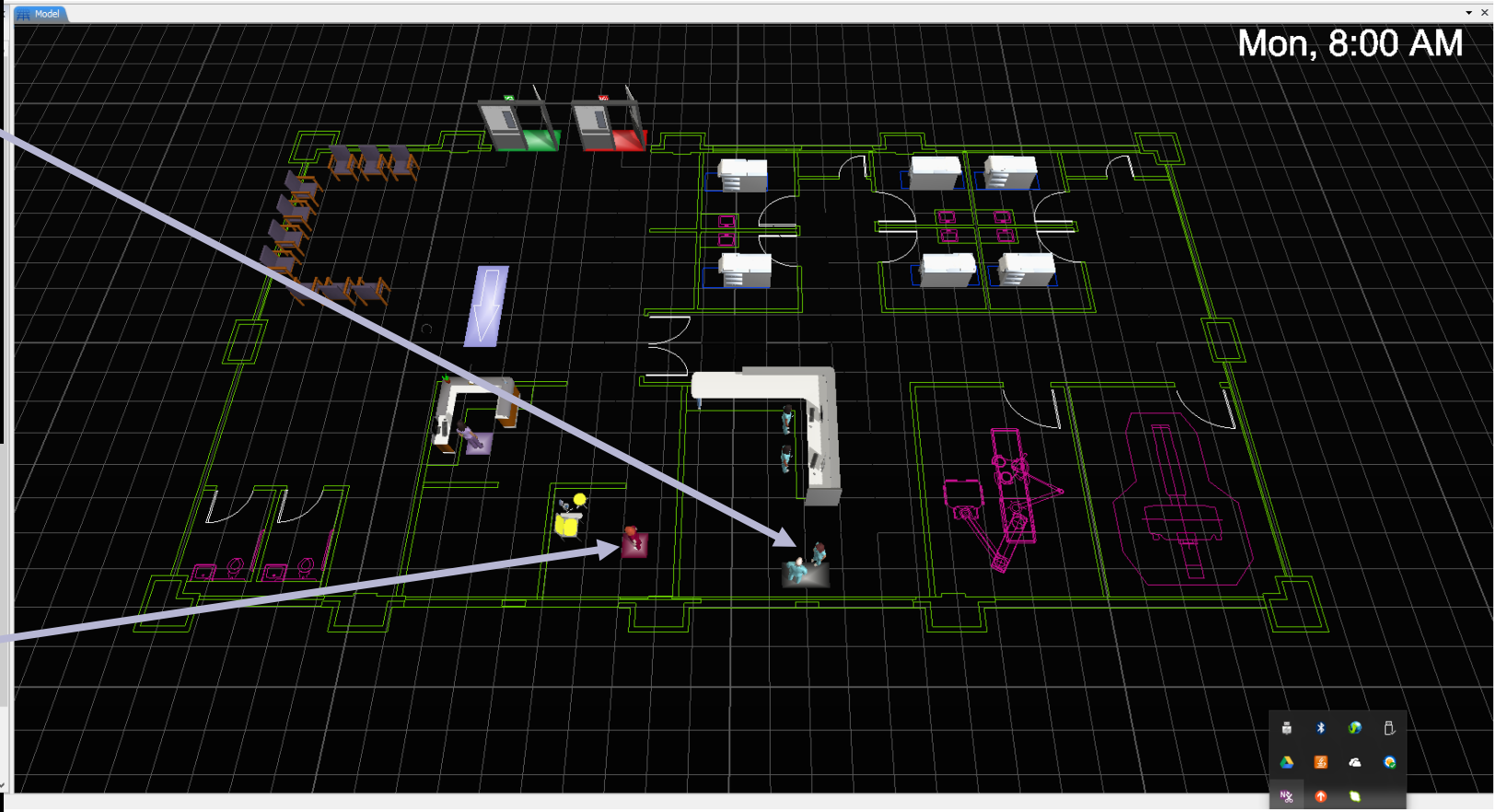

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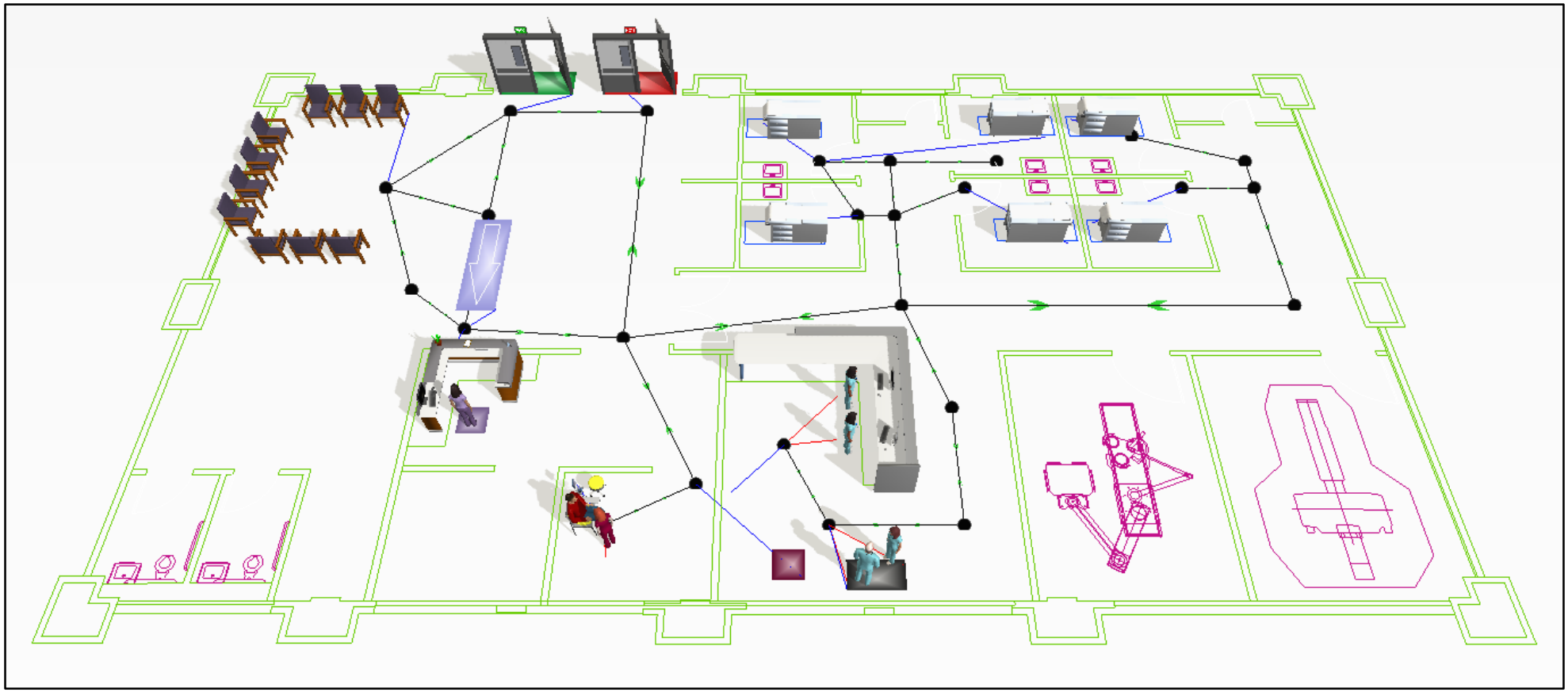

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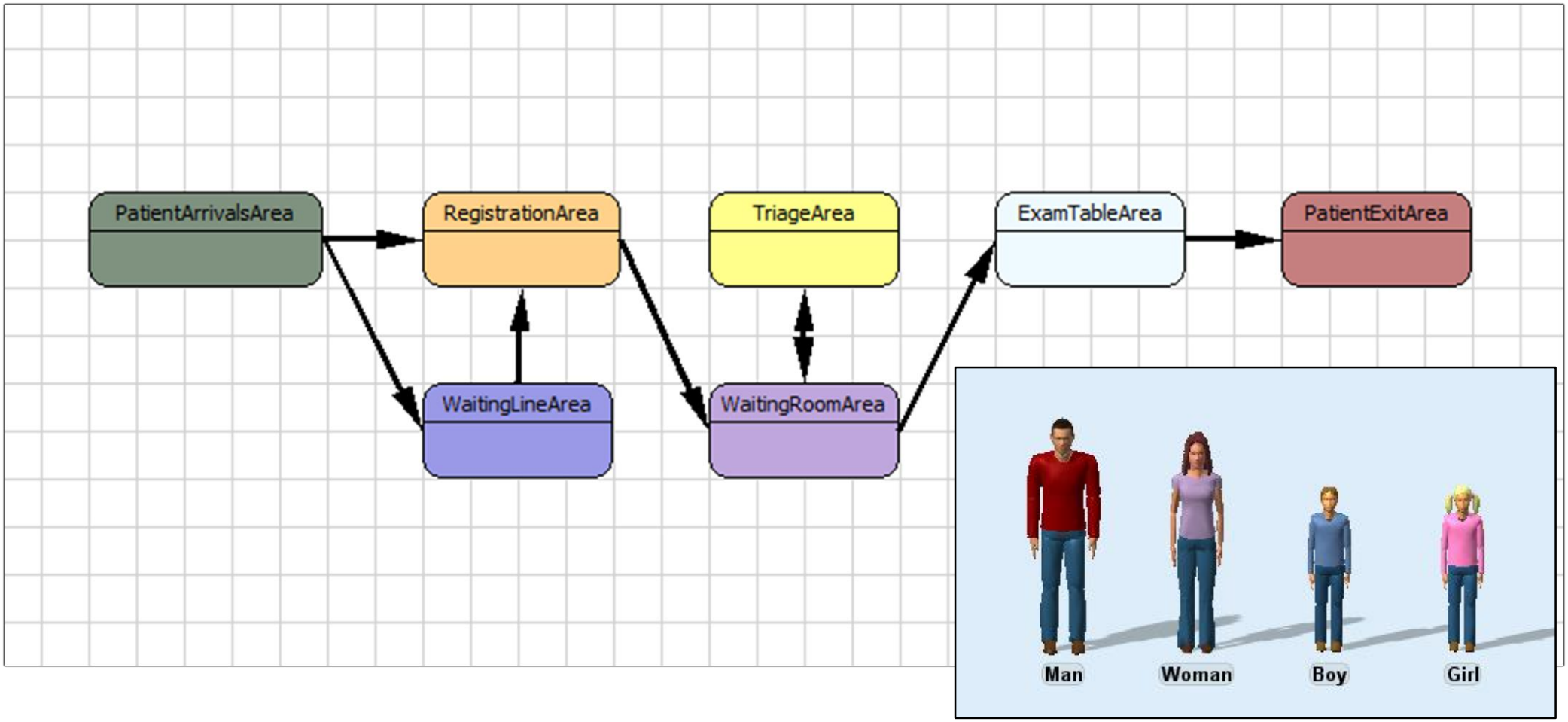

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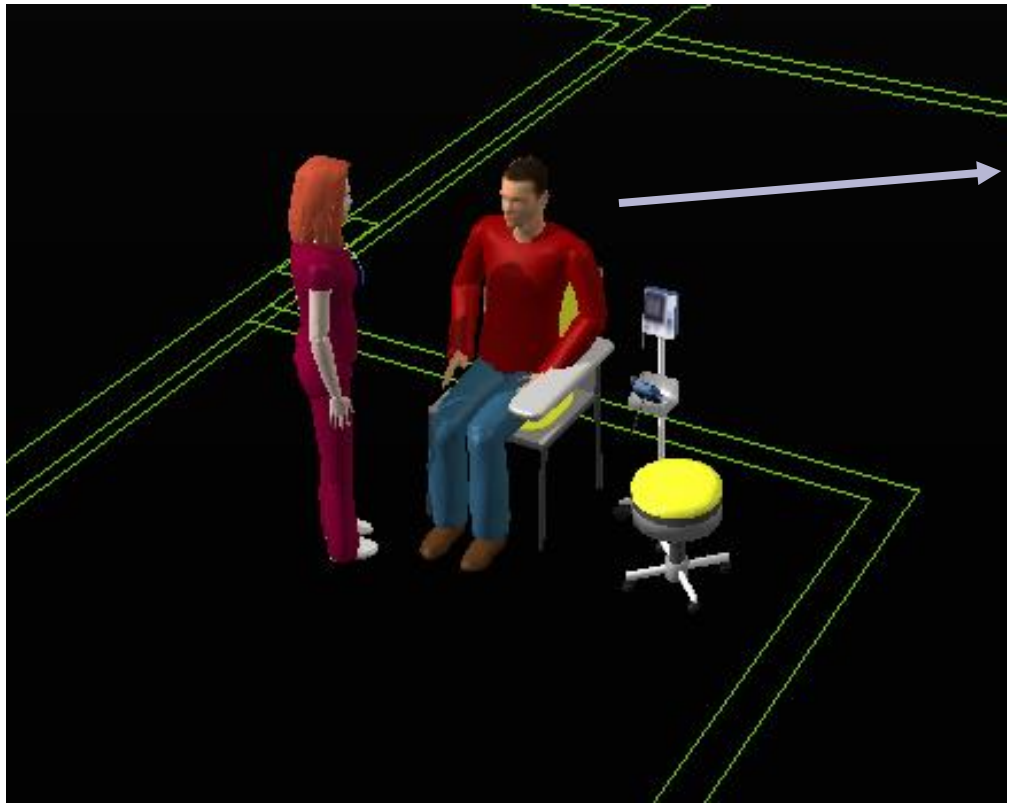
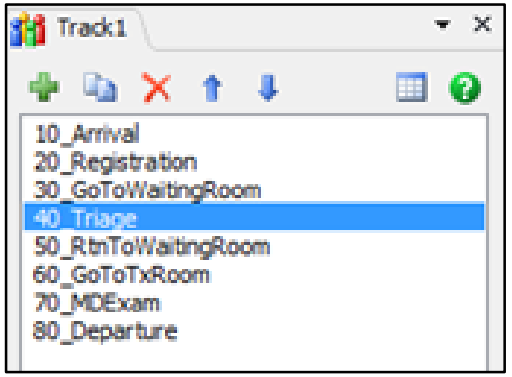
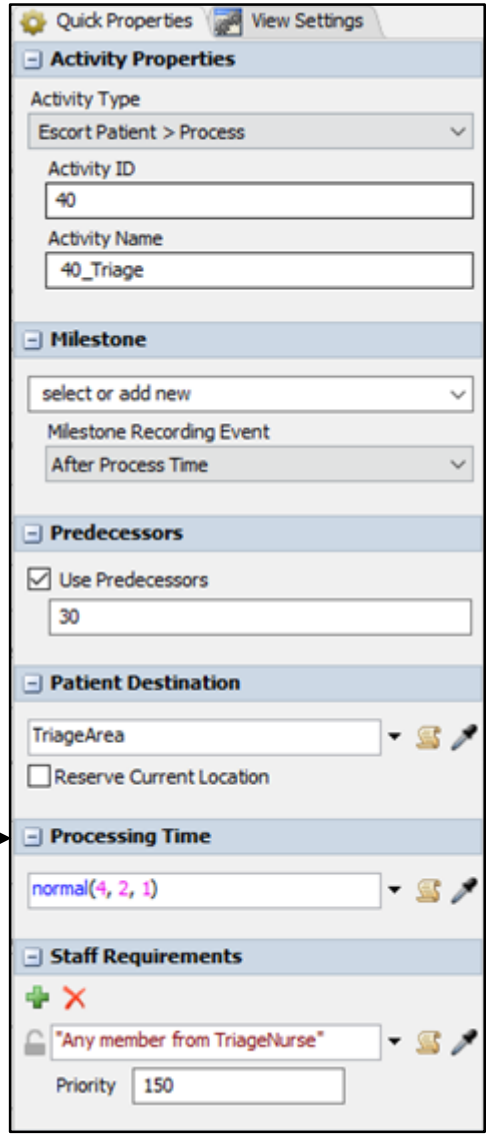




Processing Time **



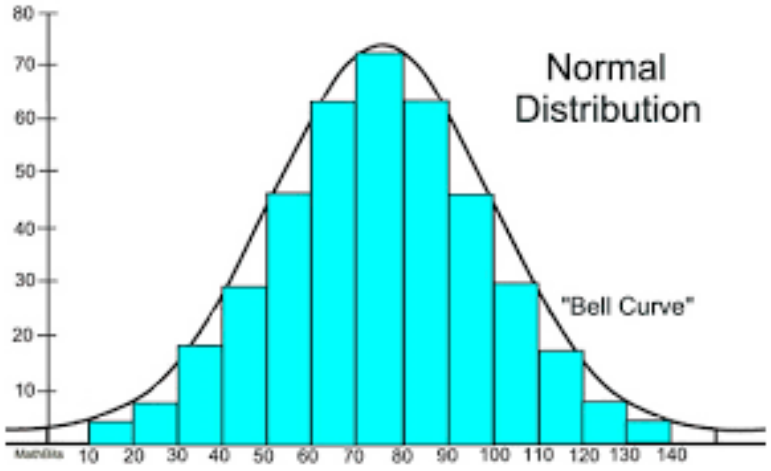
Arrival / Processing Time Collection

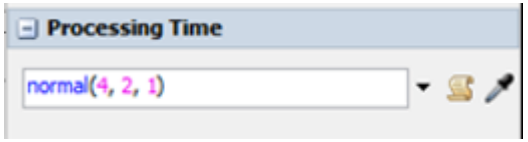
- From where is the data collected?
  - Various NSHA information management systems: STAR, PHS, Millennium, HSM, EDIS, MEDITECH, etc.
- What if data is not available?
  - Use manual data collection techniques: time studies, random sampling, etc.
  - What we want to avoid.
- *The simulation will only give accurate results if the data used is accurate!*

The Average Size Family – 2.5 Kids

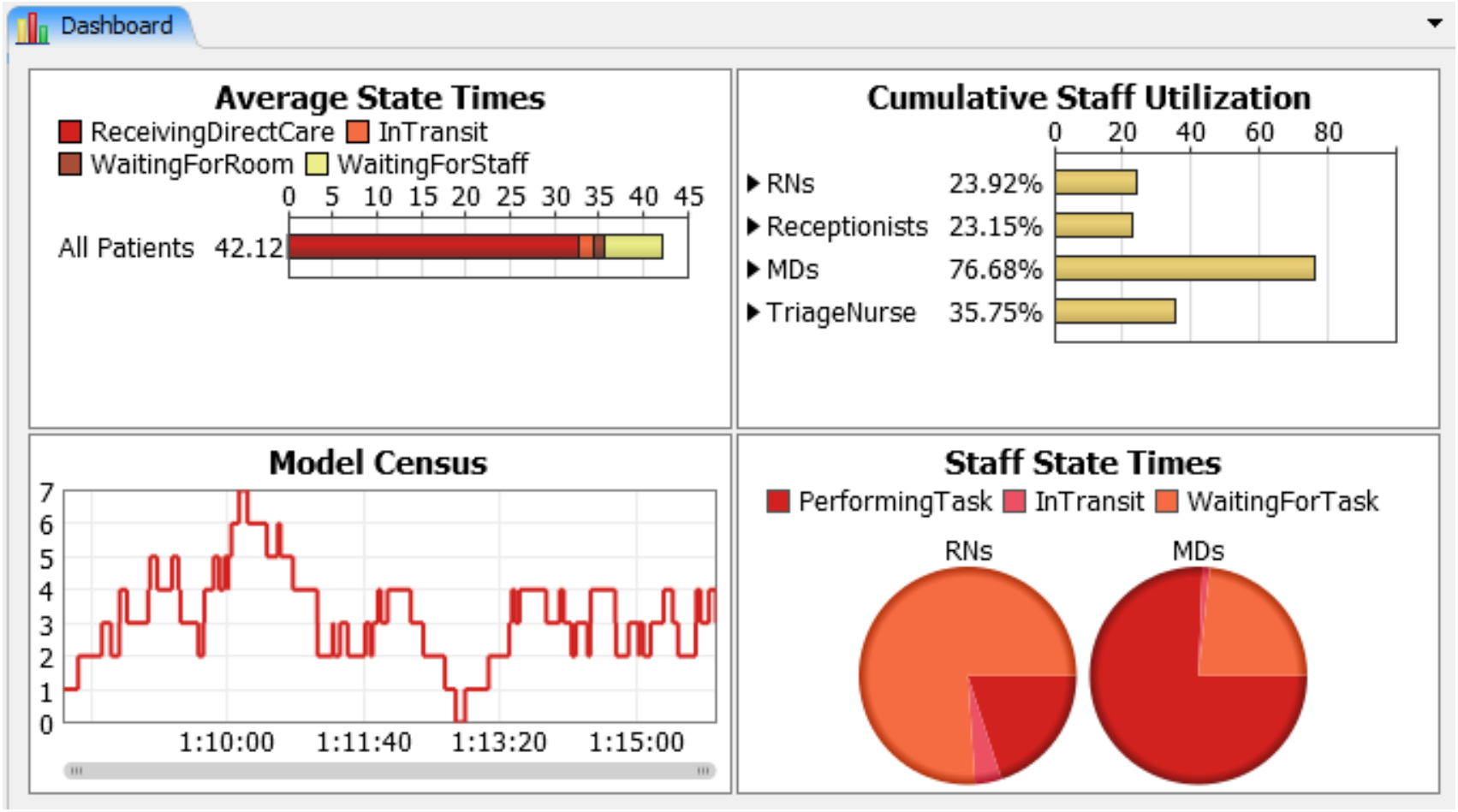
Data Requirements for Simulation Models

- *Raw data* is required (i.e. no averages, sums or other calculations).
- Simulation models with raw data will account for natural variations whereas models with non-raw data sets will not.





FlexSim Model Statistics



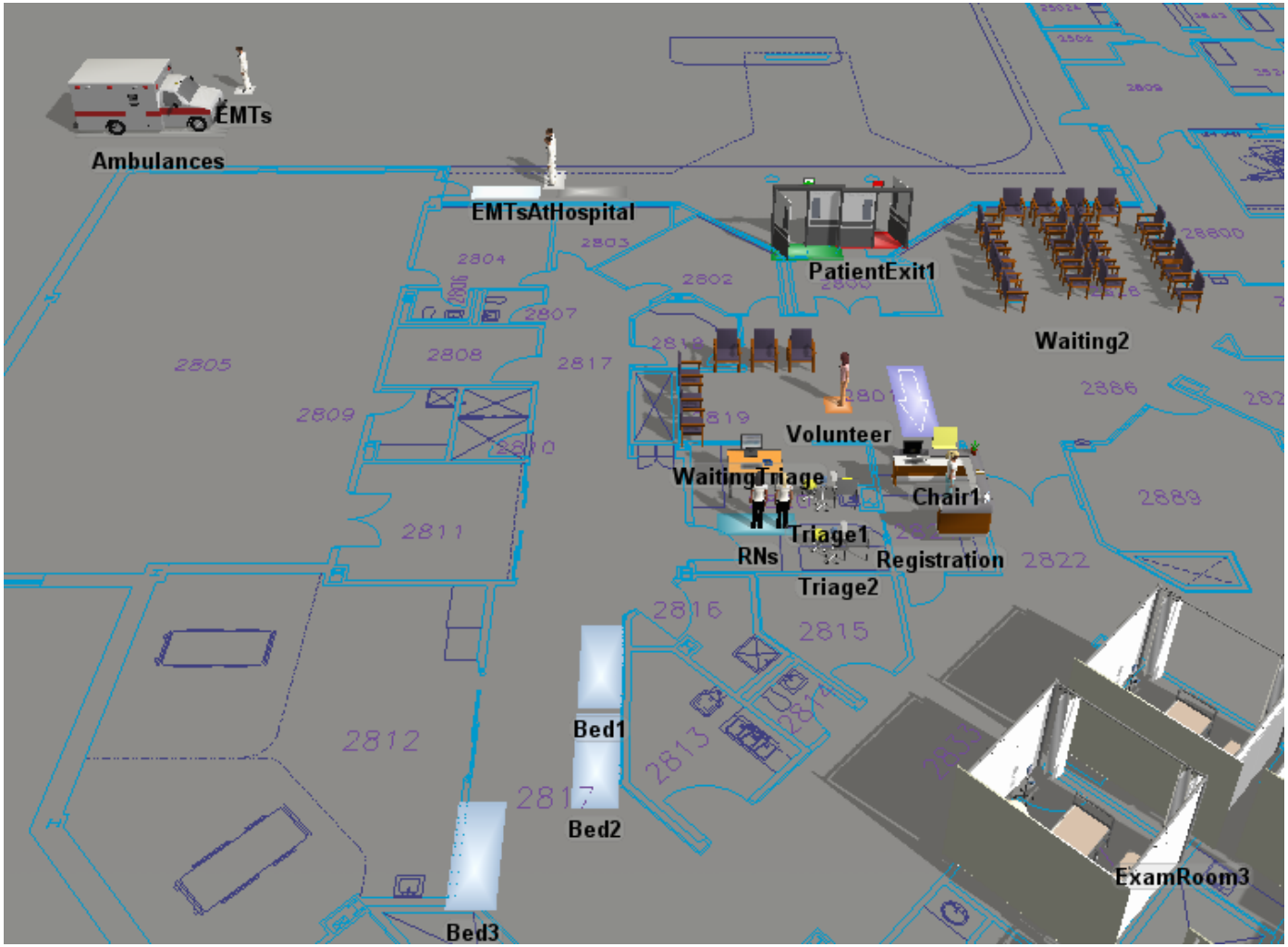
Steps to a Successful Simulation

1. **Establish Goals and Objectives.**
2. **Formulate and Define Model.**
3. **Collect Data.**
4. **Build, Verify and Validate.**
5. **Experiment, Analyze and Present.**

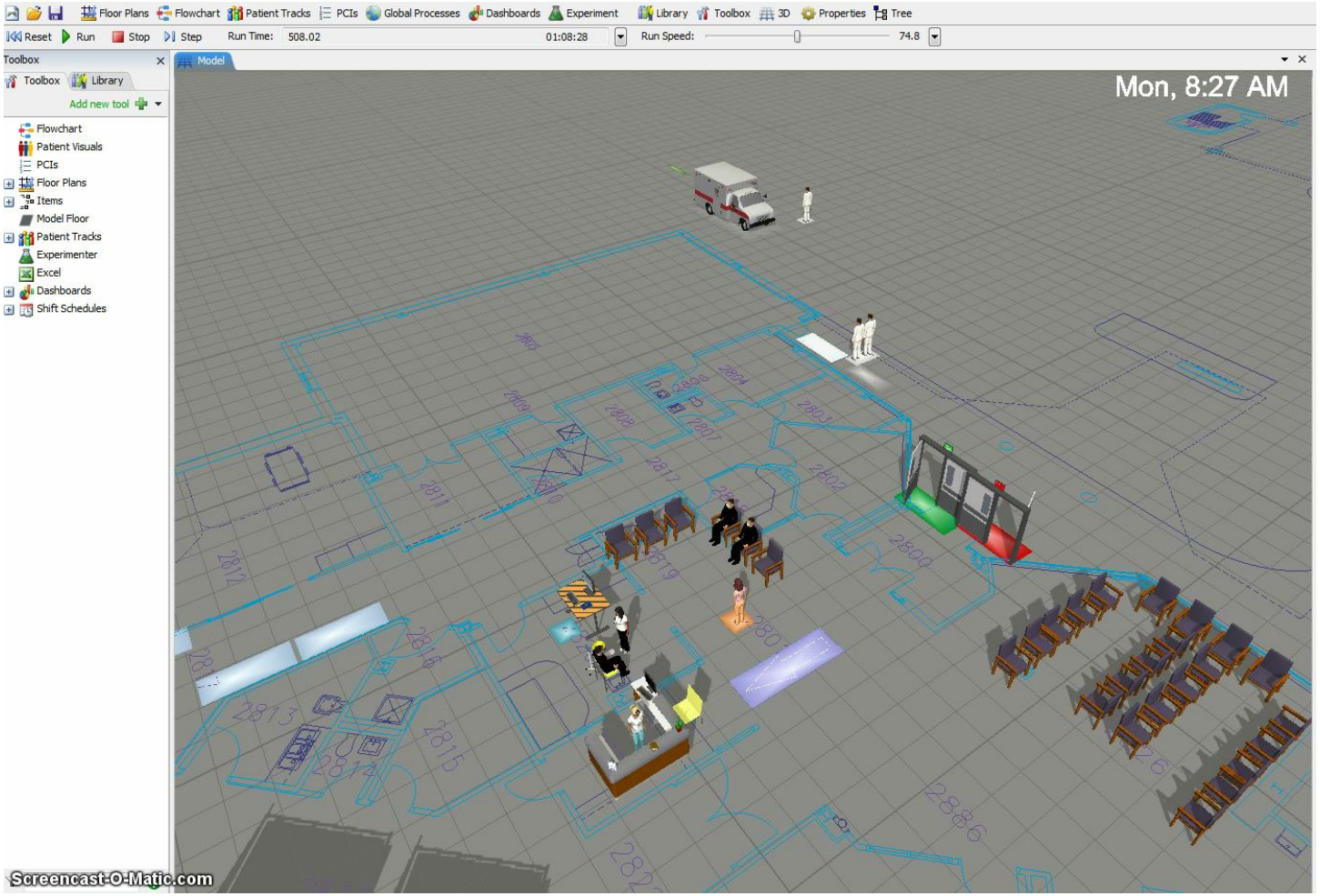
Actual Model – DGH Emergency Triage

- According to the Canadian Triage and Acuity Scale (CTAS) standard, patients must be seen within ten minutes of arriving at the emergency department.
  - Is there in fact a risk of not meeting the standard?
  - How much additional capacity is required to mitigate this risk?
  - When does this risk occur?
- Variable of interest is *patient wait time for triage*.
- Test variable is *number of nurses*.
- Model input (data) is *patient arrival distribution* and triage *time (λ)*.

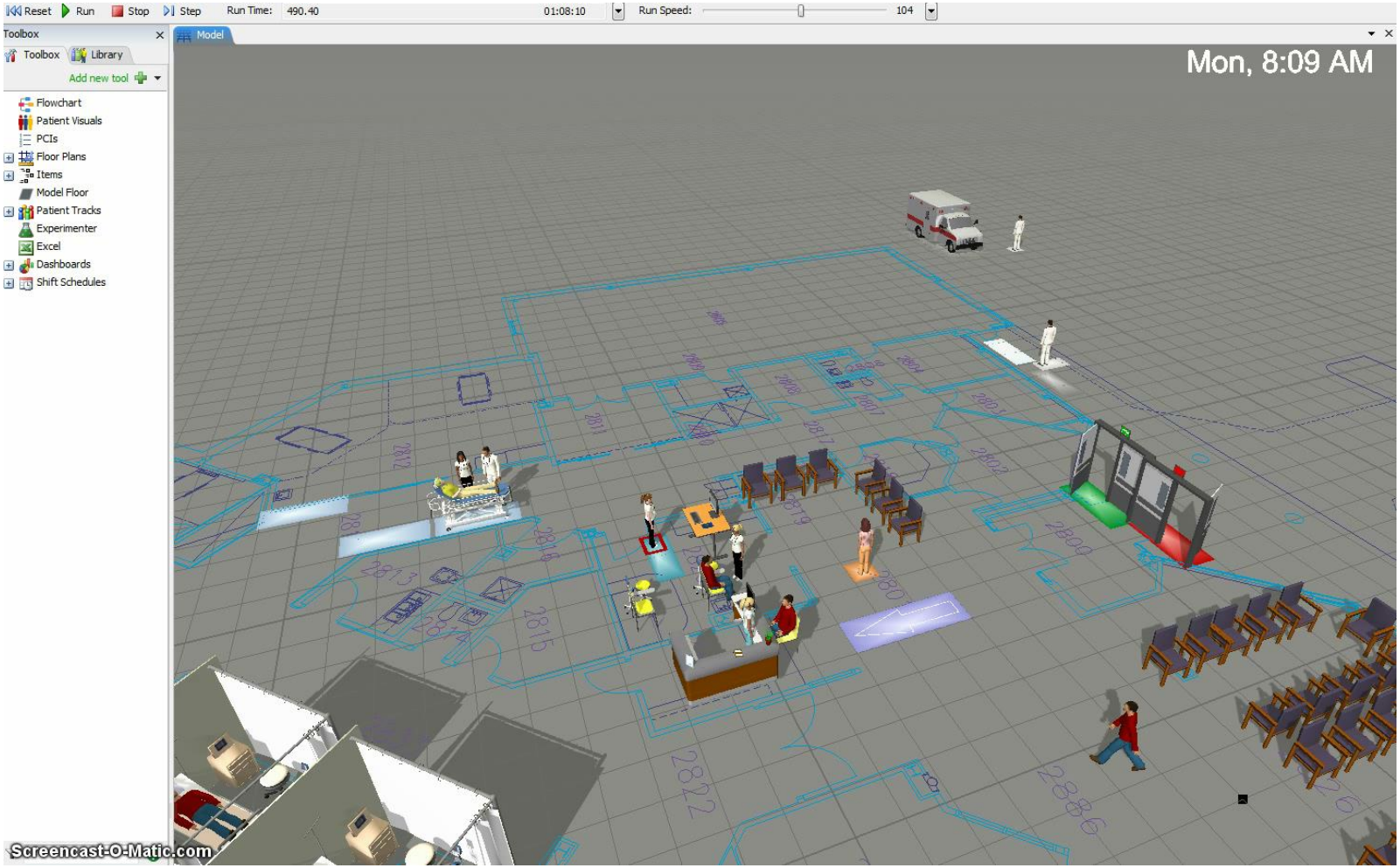
FlexSim Model – DGH Emerg Triage



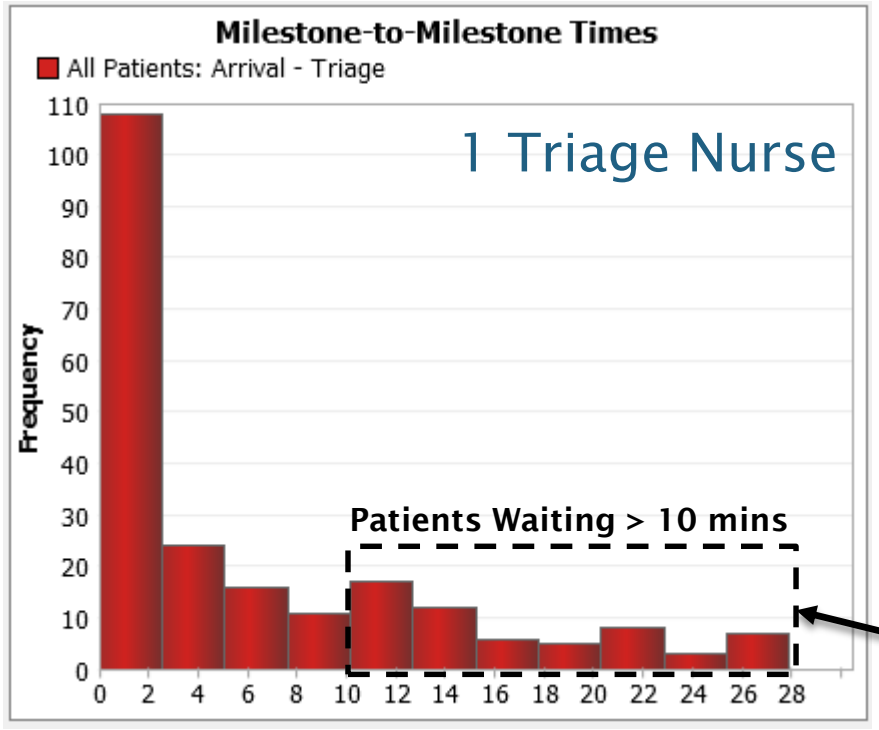
FlexSim Model–DGH Emergency Triage

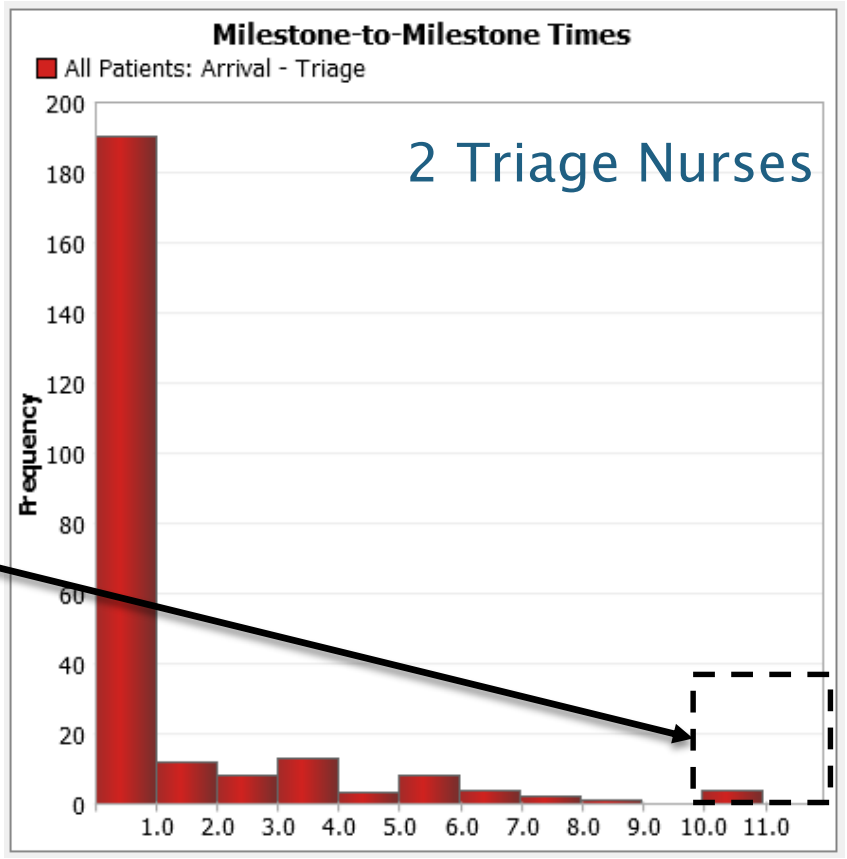


FlexSim Model–DGH Emergency Triage



Model Results





Planning Decisions

- Is there in fact a risk of not meeting standard?
  - Yes, the model highlights there is in fact a risk.
- How much additional capacity is required mitigate this risk?
  - Requires 1-2 nurses… depending on time of day and daily patient arrival volume.
- When does this risk occur?
  - Risk can be prevalent most hours of the day depending on patient arrival volumes; however, peak times present greater risk (9:00-14:00).

Time Period During Day		0:00	6:45	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00	9:15	9:30	9:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00	14:15	14:30	14:45	15:00
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	Patients	Number of Triage Nurses Needed Throughout the Day																																		
Percentile	0.1	101	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.2	106	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.3	109	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.4	113	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.5	115	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.6	118	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.7	122	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.8	126	1	1	1	1	2	1	1	1	2	1	1	2	1	2	2	1	2	2	1	2	2	1	2	2	1	1	2	1	2	2	1	1	2	1	1
	0.9	134	1	1	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	0.95	139	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Time Period During Day		15:15	15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00	20:15	20:30	20:45	21:00	21:15	21:30	21:45	22:00	22:15	22:30	22:45	23:00	23:45
		15:30	15:45	16:00	16:15	16:30	16:45	17:00	17:15	17:30	17:45	18:00	18:15	18:30	18:45	19:00	19:15	19:30	19:45	20:00	20:15	20:30	20:45	21:00	21:15	21:30	21:45	22:00	22:15	22:30	22:45	23:00	0:00	
	Patients																																	
Percentile	0.1	101	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.2	106	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.3	109	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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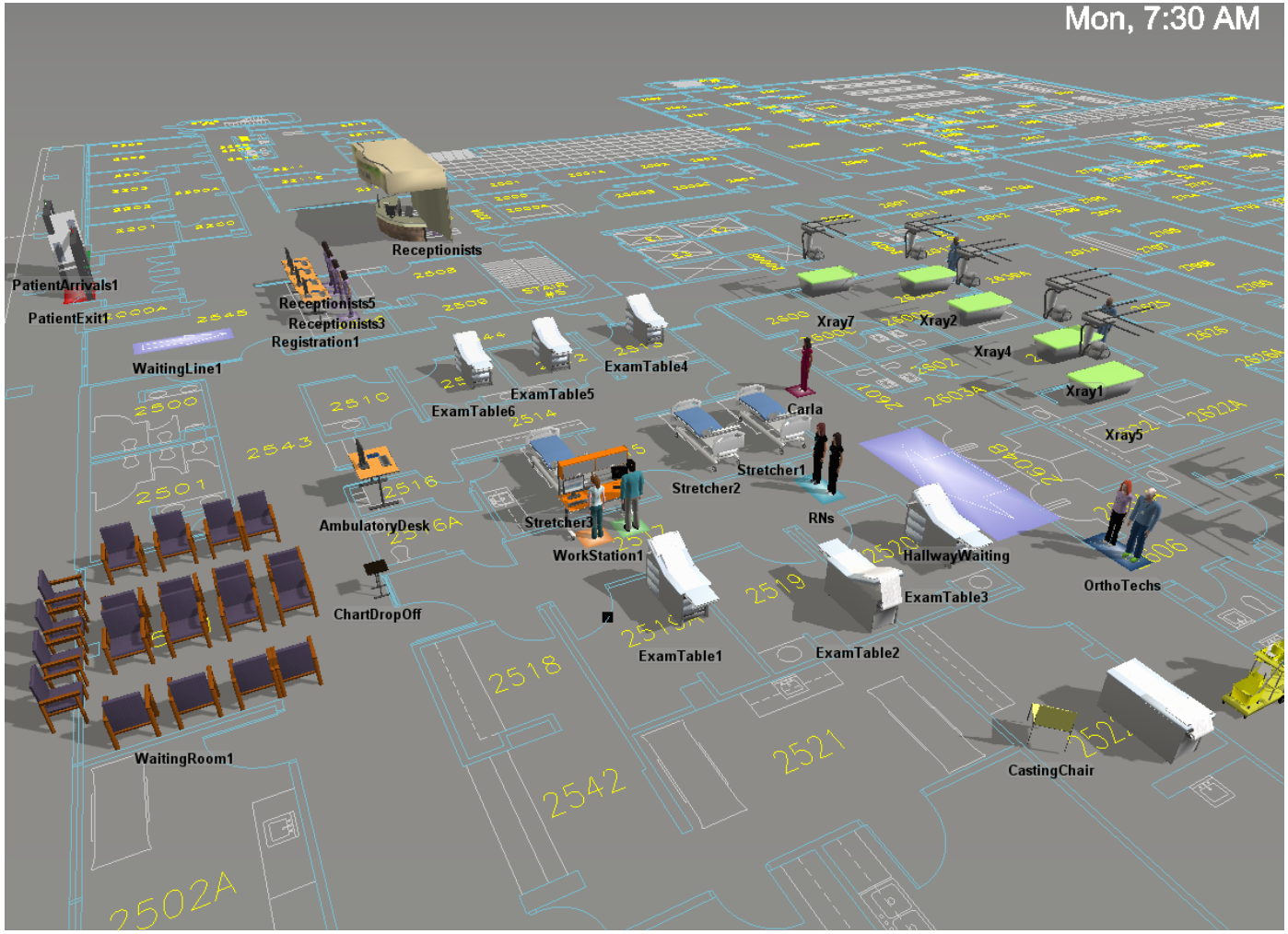
	0.5	115	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.6	118	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.7	122	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.8	126	2	1	1	2	1	1	1	1	1	2	1	1	1	2	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.9	134	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	1	2	1	2	1	2	2	1	1	1	1	1
	0.95	139	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1

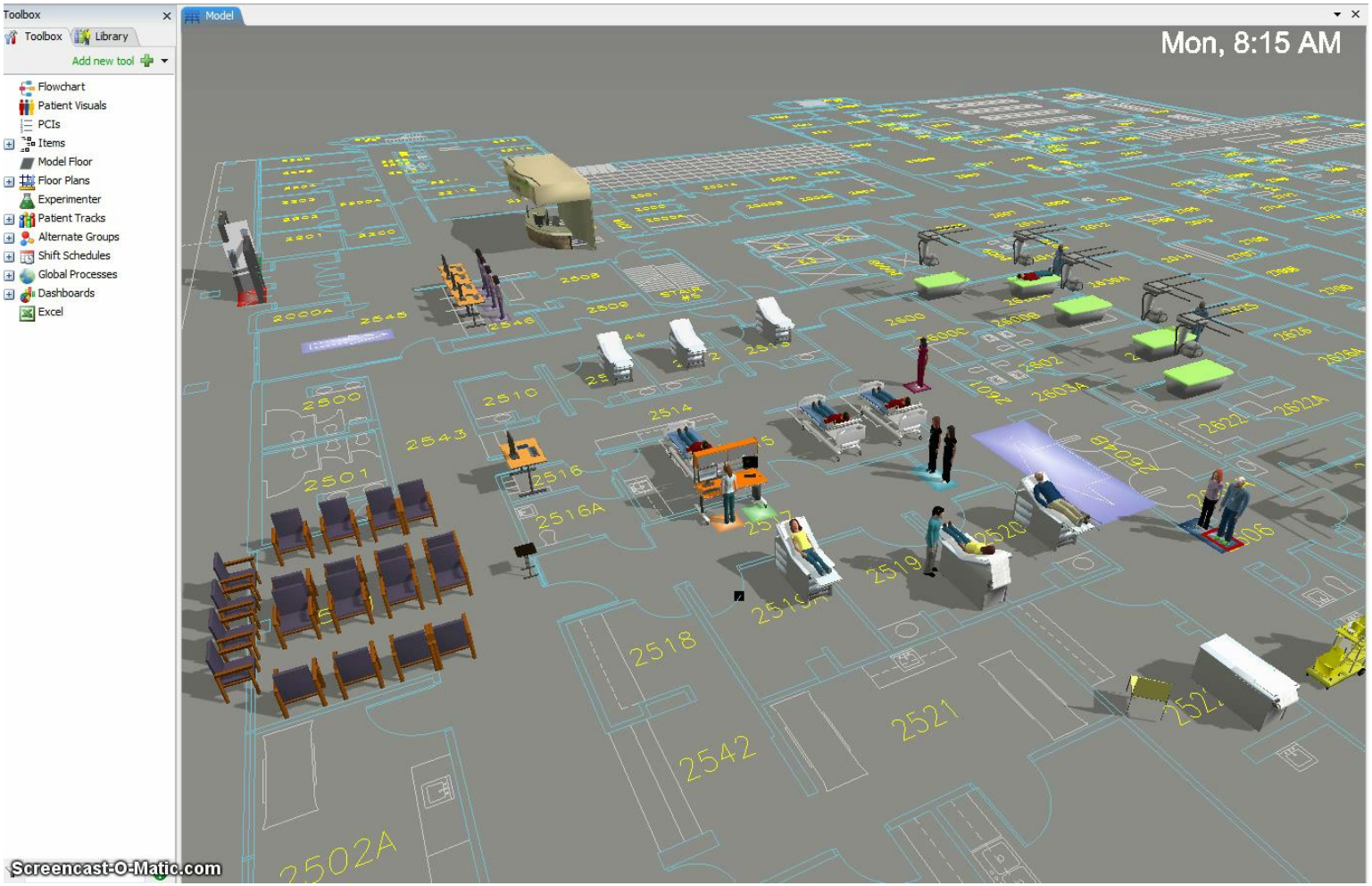
Actual Model – DGH Ortho Clinic

- Currently 6 beds dedicated to Orthopedic clinic with 1 physician scheduled per day in clinic.
  - Are 6 beds required to operate clinic?
  - Can clinic be operated with less beds while maintaining high resource utilization?
  - If so, what is the number of beds that are needed?
- Variables of interest are *physician utilization*, *patient throughput* and *clinic end time*.
- Test variable is *number of beds*.
- Model input (data) is *patient arrival distribution* and *physician appointment time (λ)*.

FlexSim Model – DGH Ortho Clinic



FlexSim Model – DGH Ortho Clinic



FlexSim Model – DGH Ortho Clinic

Model Results (6 Beds vs. 3 Beds)

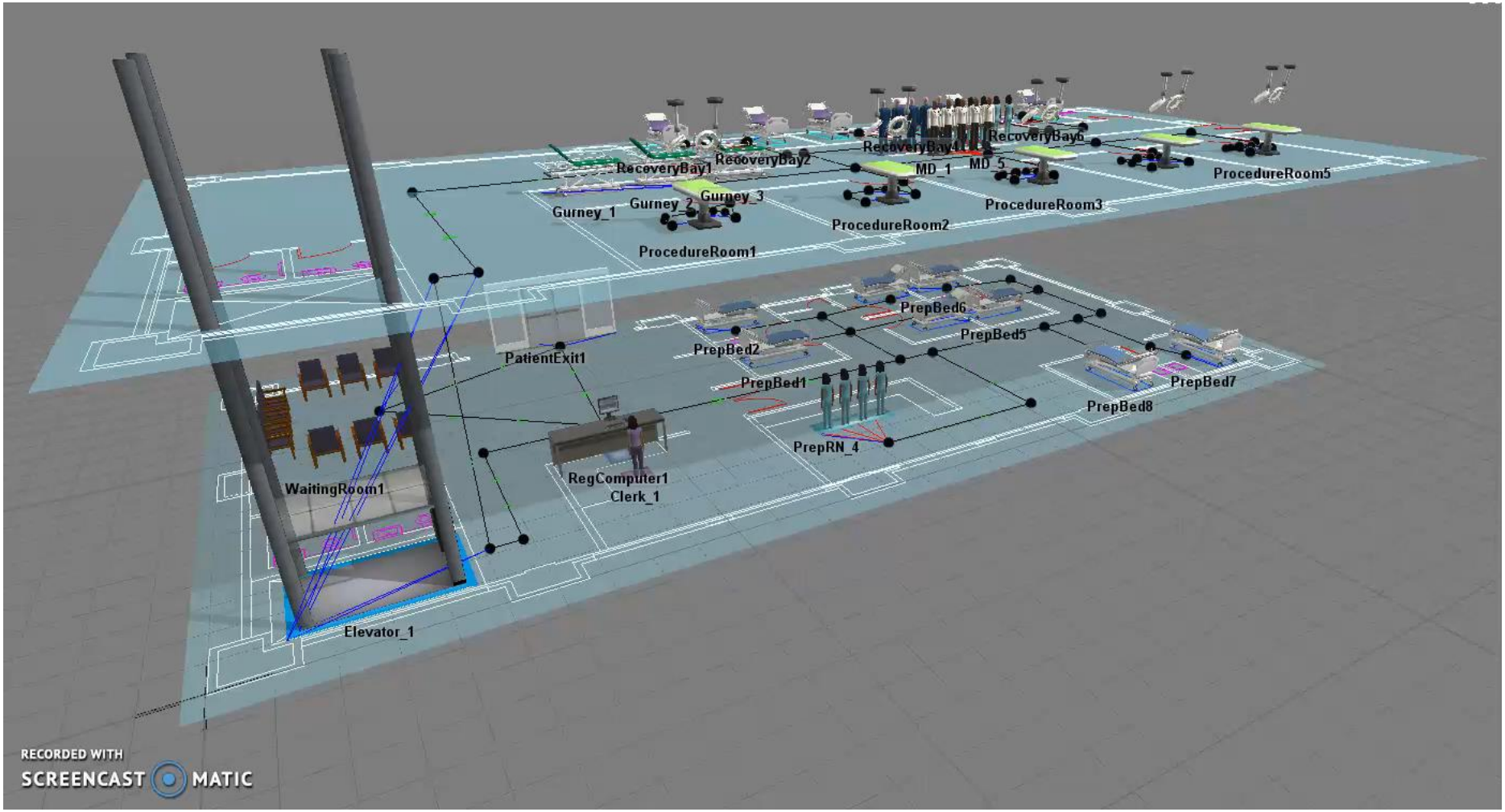
- Physician Utilization
  - 94.24% vs 94.60% - Less distance traveled
- Throughput Comparison
  - No difference in number of patients are seen.
- End Time Comparison
  - 14:01 vs 14:04

With these modeling conditions (arrival distribution and appointment time), you can operate with less rooms.

Model Takeaways

- The longer the physician appointment time, the less rooms required to maintain throughput and utilization.
- The greatest change within the clinic is where the patient spends their time waiting
  - More time in waiting room, less time waiting in exam room.

Sample Model from FlexSim



2nd Sample Model from FlexSim

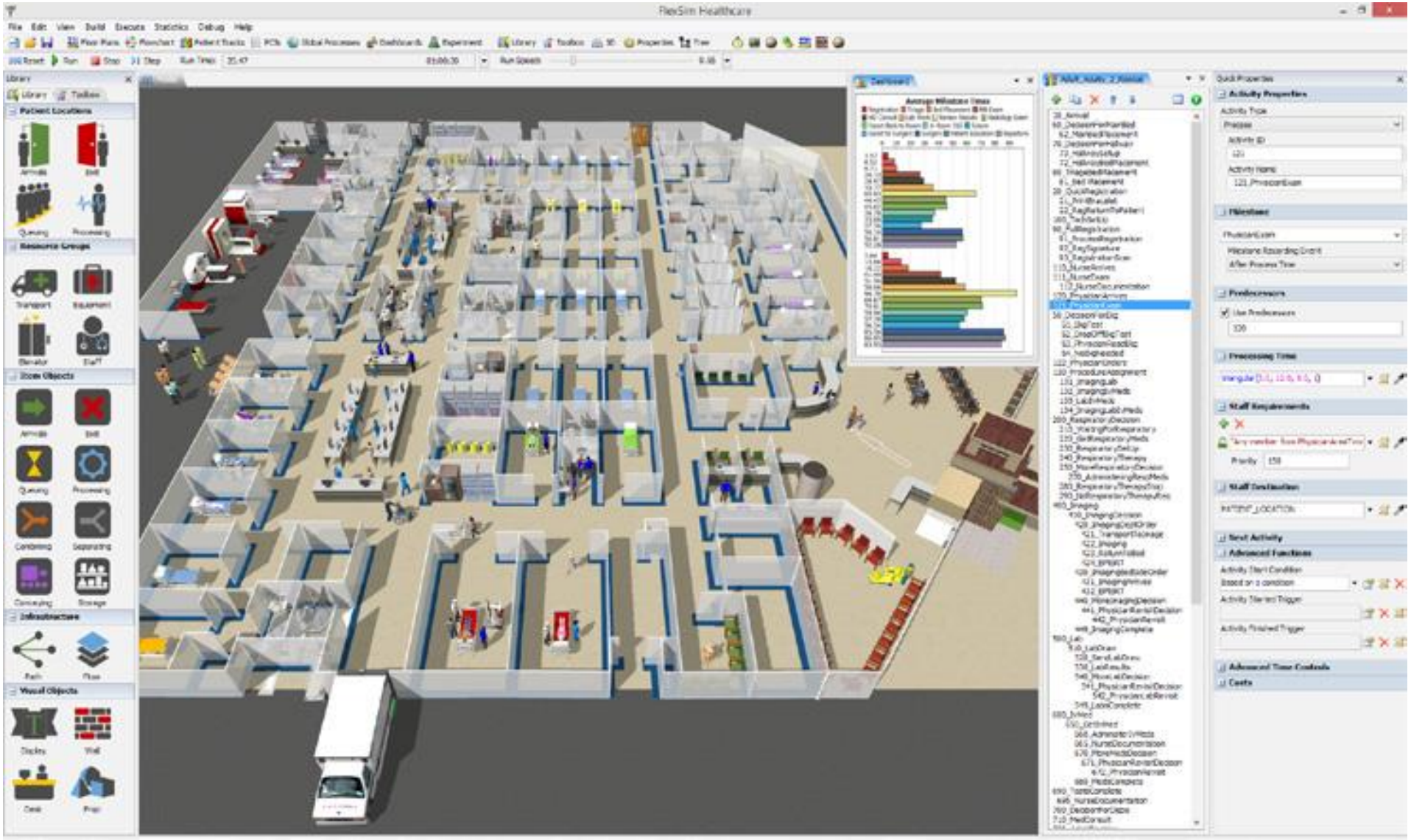
CASE STUDY

BETTER DECISIONS IN THE EMERGENCY DEPARTMENT

Baptist Health South Florida

How Baptist Health South Florida decreased Door to Provider time by 46%, optimized Staffing, and reduced Length of Stay

2nd Sample Model (con't)



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A certificate of attendance will be sent to you to personalize, along with the link for the evaluation.

Thank you for attending today's event.

This **Group Learning** program has been certified by the College of Family Physicians of Canada and the Nova Scotia Chapter for 1 Mainpro+ credit.