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Improving Patient Flow in an Outpatient Infusion Center

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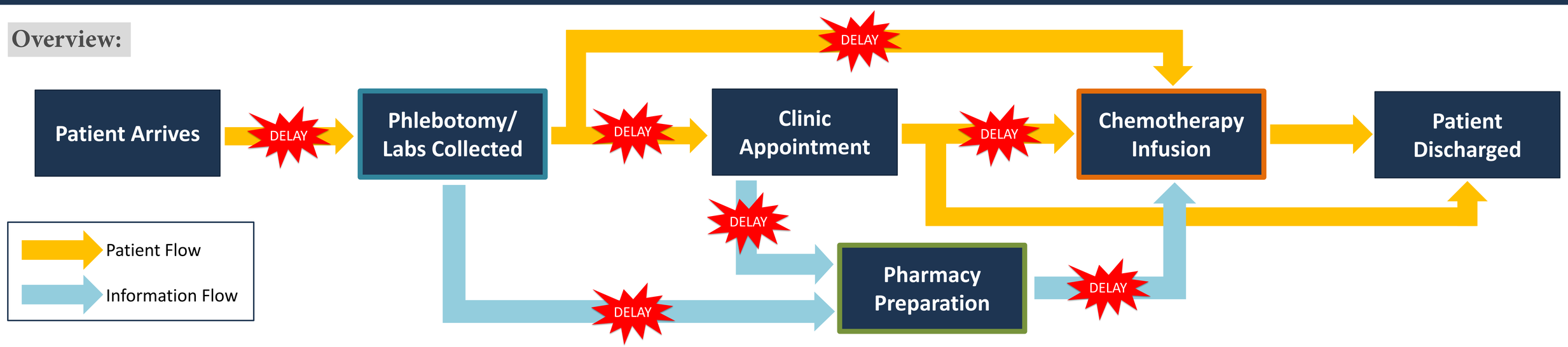
Overview:



Lab Process Analysis

Background:

- Lab results needed: (1) by provider before clinic appointment to assess patient and (2) by pharmacy to initiate drug preparation/infusion process
- Concerned about (1) patient waiting time (2) balanced workload (3) lab results being available during clinic appointment
- *Possible Solution:* "Uncoupling" patient visits (labs done at least one day prior to clinic appointment at any MLab Facility)

Methods:

- Analyzed previous time study data of phlebotomy and pathology
- Analyzed patient travel times

Findings:

Driving Duration	% of Patients to Closest Lab Facility
Less than 15 min	32%
15 – 30 min	20%
30 – 60 min	23%
1 – 2 hours	15%
2 – 4 hours	7%
Over 4 hours	3%

- Processing time for labs (CBCD, CMP, Type and Screen) exceeds one hour threshold
- *Conclusion:* Potential to uncouple visits for patients within close proximity to a lab facility (more convenient and better flow)

Pharmacy Pre-mix Tool

Background:

- Infusion drugs are expensive and their use uncertain (e.g. patient cancellation). Thus, pharmacy does not prepare most drugs in advance
- "Pre-mixing" may help improve patient waiting times/workload balance
- *Possible Solution:* Evaluate trade-offs of improved wait/workload vs. risk of drug waste, determine which drugs can be prepared in advance

Methods:

- Collected and analyzed data on prices, treatment times, deferral rate, etc.
- Developing mathematical formulation of tradeoff (in progress)

Input	Effect on Priority
Drug cost	Low cost → Higher priority
Probability of deferral or dosage change	Low probability → Higher priority
Number of patients receiving drug	Higher number of patients → Higher priority
Drug shelf life (hang by/expiration)	Long shelf life → Higher priority
Drug compounding time	Possibly short compounding time → Higher priority
Appointment time	Early appointment time → Higher priority
Length of infusion	Long infusion → Higher priority

Chemotherapy Infusion Scheduling

Background:

- Patients wait ~45 minutes after arrival at infusion until being seated in a chair, due to high treatment time variability
- *Possible Solution:* Improved scheduling of infusion patients could result in reduced total length of operations and patient wait time

Methods:

- Developed stochastic optimization model and solution algorithms that can generate appointment schedules, validated with (discrete-event) simulation
- Stochastic Optimization Model:

Minimize:

Trade-off between expected patient wait time and expected overtime

Subject to:

Patients are assigned to a time and a chair
Patients wait until a nurse and a chair are available
Uncertain treatment times (Sample Average Approximation method)
The day ends when the last patient is discharged

Findings:

- Allowing extra time for highly variable treatments and increasing appointment lengths in the middle of the day help to prevent and recover from propagating delays
- *Next Steps:* Incorporate patient acuity into model, develop and implement scheduling guidelines

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