

The MIT Center for Digital Business

Improving Patient Safety and Hospital Performance Using Simulation Models and Real-time Data Capture Systems: Results from Japanese Hospitals

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New Opportunities in Data-Driven Simulation Modeling

Powerful new opportunity with **operations data** and **simulation models**:

➔ *Real-time data capture (bar-code, RFID, EHR, test data)*

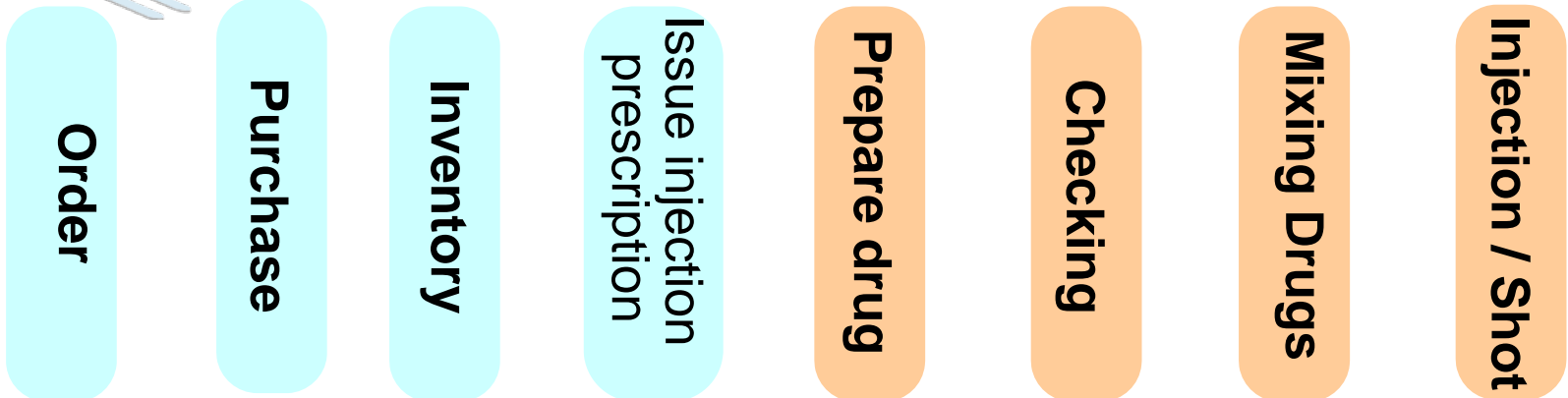
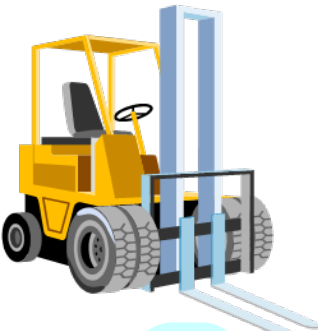
➔ *Data mining techniques*

➔ *System Dynamics Modeling*

To increase the efficiency in operations, improve management systems, and reduce risk



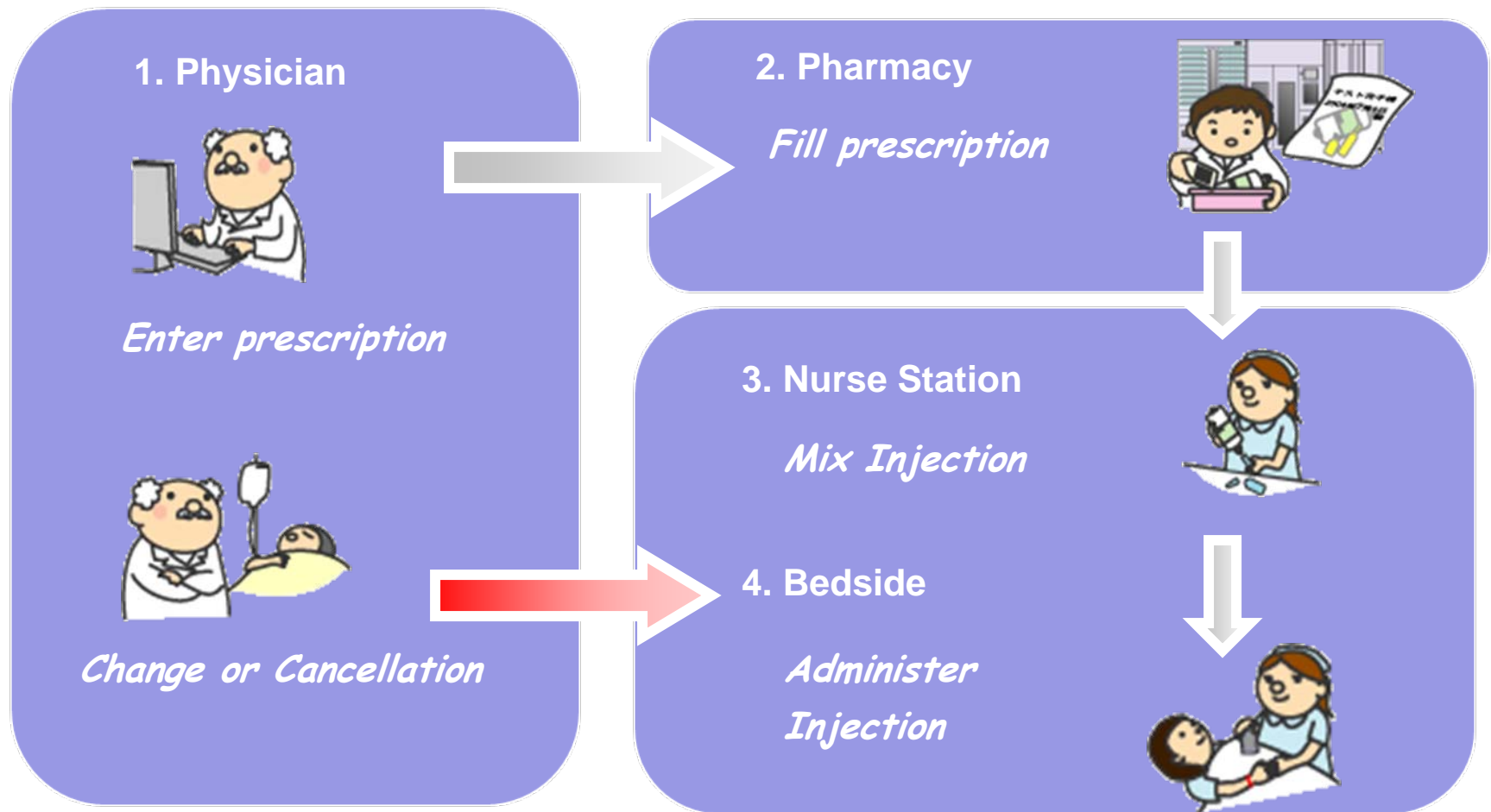
Example Data Capture: From Delivery to Injection



Order ID	Patient Code	Medical Dep't Code	Hospital Ward Code	Scheduled Inject Date	Delivery of Goods Date	Injection Execution Date	Medicine Code	Cost
3000008348984	02330525	S12	04	20-Apr-04	19-Apr-04		YT0272	3240
3000008349004	03411520	N09	08	01-Apr-04	31-Mar-04	01-Apr-04	YT0240	85
3000008349004	03411520	N09	08	01-Apr-04	31-Mar-04	01-Apr-04	YT0116	7632
3000008349004	03411520	N09	08	01-Apr-04	31-Mar-04	01-Apr-04	YT0139	394
3000008349004	03411520	N09	08	01-Apr-04	31-Mar-04	01-Apr-04	Y01265	116
3000008349004	03411520	N09	08	01-Apr-04	31-Mar-04	01-Apr-04	YT0349	17900



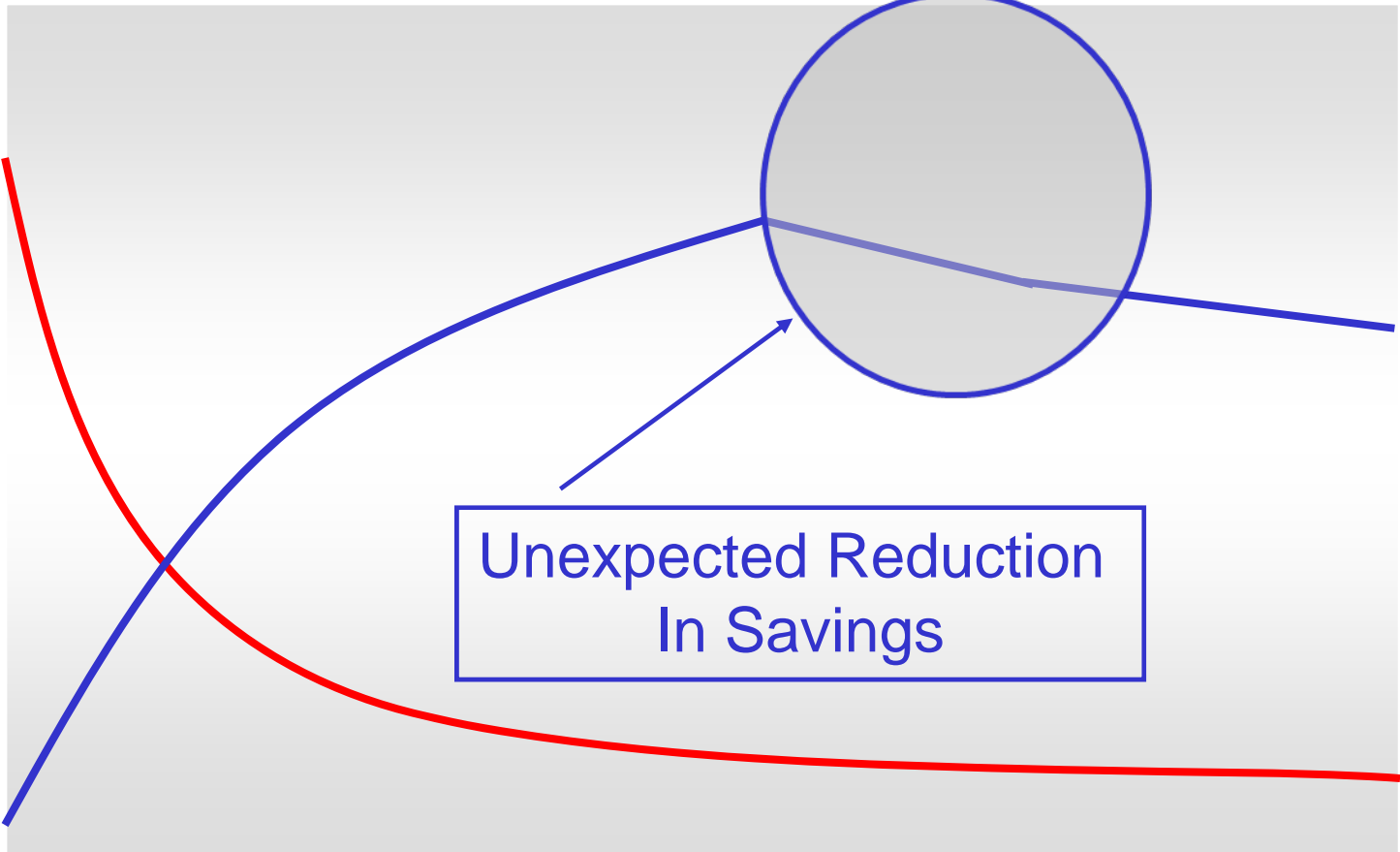
Injection Process Flow and POAS Improvements



Changes in POAS Performance: Patient Risk and Hospital Operations

% Errors

POAS Savings



Unexpected Reduction
In Savings



SD Modeling Used to Investigate Changes in Performance

One example: Our modeling of the POAS system uncovered a process – *batch mixing* – that nurses had recently adopted

➔ Nurses thought batching (mixing drugs in groups) saved time

➔ Our model explored this process and uncovered its direct and indirect effects

➔ POAS data was used to recommend improvement, calibrate and validate our findings



Using IT Data with Simulation Models to Formulate Improvements

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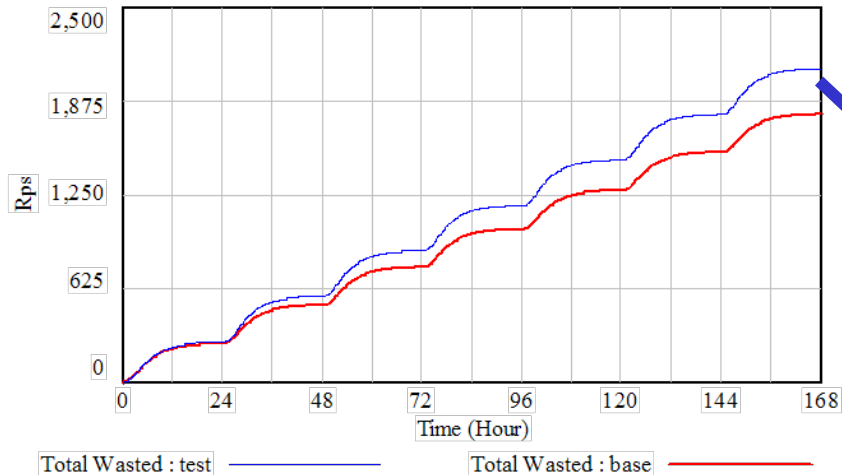
Novact-M
Funguard
Kenketsu Venoglobulin-IH
Rituximab
Gran Injection

**24.8% of
 Waste**



Simulation Results: Exempting Five Drugs From Batching

Total Cost (in millions of yen)



Base Run (Blue)

Improvement (Red)

MATERIALS SAVINGS

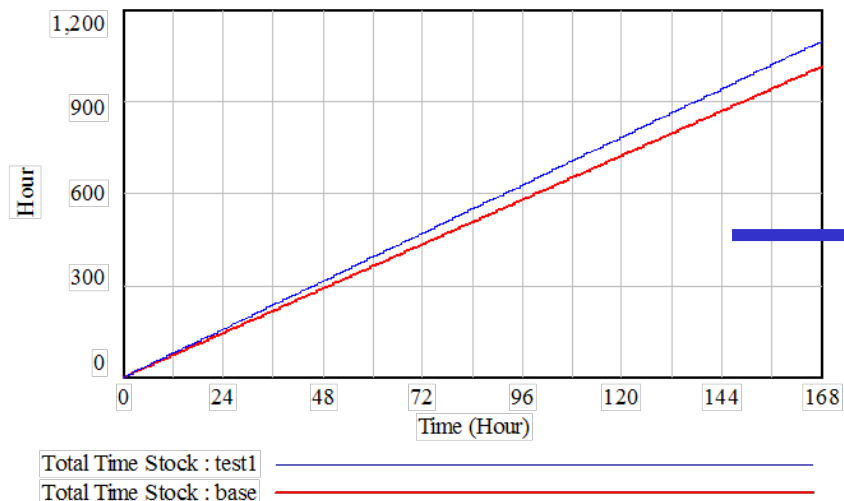
70 million yen/

600 thousand

USD Per Year

(Evidence for Managers)

Total Time (Nurse Hours)



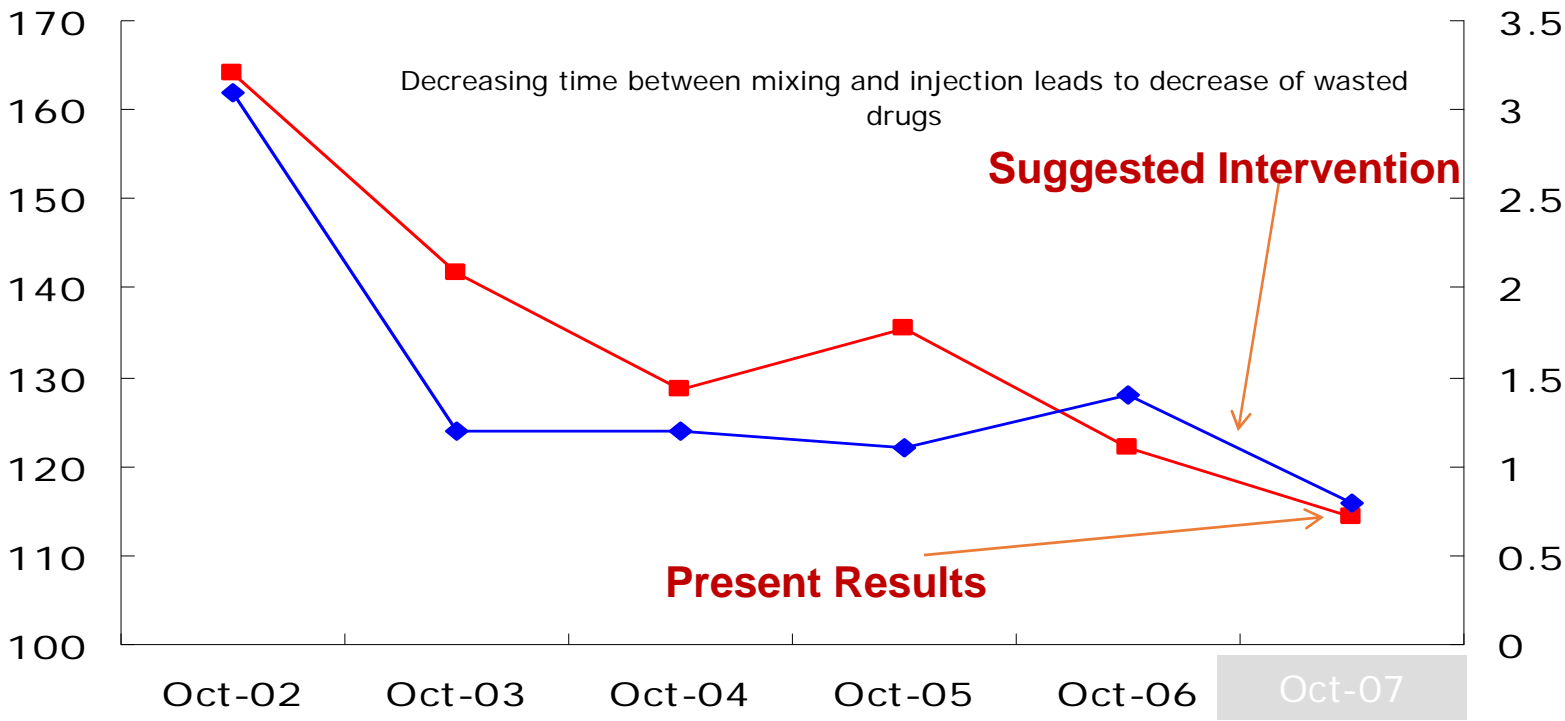
STAFF SAVINGS

4,000 Hours Of

Nurse Time Per Year

(Evidence for Nurses)

POAS DATA: Relationship between wasted rate and mixing time



—■— Time between mixing and injection (Left Axis) —◆— Wasted Rate (Right Axis)



Interviews with Nurses in IMCJ

Summary of Interviews

Nurses have been using PDA for every medication from the introduction. They sometimes had meetings to ensure right usage of PDA to prevent medication error.

They tried to reduce time between mixing and injection as a result of our first interview. But it was difficult because the scheduled orders were clustered at certain period of time. Need to change behaviors of physicians and pharmacists to reduce more.

These data sets are extremely worthwhile. We look forward to use this data to improve operations.

