RFID pilot in Japan using SGTIN
~ Hospital case study ~

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Point of Act System (POAS) Overview

4 hospitals introduced POAS as health information system

International Medical Center of Japan (925 Beds)
Morioka Red Cross Hospital (464 Beds)
Kyoto Second Red Cross Hospital (680 Beds)
Japanese Red Cross Kochi Hospital (500 Beds)

International Medical Center of Japan (IMCJ) is Japan national center for advanced and pioneering medical care and have a function of national central hospital including care for VIP patients.

History of Implementation
5/2001  IMCJ
1/2003  Morioka Red Cross
3/2003  Kyoto 2nd and Kochi Red Cross
For Patient Satisfaction

POAS was designed to capture **all acts** in a hospital.

1. **Risk management**
   - analyzing causes of Medical accidents.

2. **Hospital Management**
   - Quality analysis: ABPM
   - Performance measurement: ABC

3. **Clinical Trial**
   - Cohort Study
   - Adverse event

**Entire Data of medical acts**
By auto identification electrical data capturing

**In real-time!**
Supply chain management of POAS

POAS manage materials and drugs by Serialized GTIN (SGTIN)

POAS and SGTIN enable IMCJ to

1. pay for drugs and materials at the point of action
2. link medical activity and materials/drugs (α1 = a1)
3. capture α2 and α3 that weren’t used for medical activities

Accurate Activity Based Costing and Inventory management

1M$ Saving/per year! for IV drugs
Change of status or movement of drugs or materials means there are activities to cause these change or movements.

By tracking these changes and movements, it would be possible to capture whole process of medical actions.
Injection operations from the perspective of medical safety

- An inter-divisional safety system is needed.
- A system is needed that reflects changes and cancellations in the information given to medical staff within a timeframe of 2 seconds.

The speed and accuracy at which the changes are reflected is important.

Digitalization of this section was achieved with Single Item management as POAS.
Conventional system ID: GTIN
POAS system ID: GTIN + serial number

Order
Act 1
Task: 5W1H
Act 2
Task: 5W1H
Act 3
Task: 5W1H

Data unit = Invoice (payment) unit

Injection prescription
11/1 to 11/3
Rp 1) 5% glucose 500 ml
Rp 2) Saline 500 ml
Rp 3) Saline 100 ml
Vitamedin 1A morning
K 2 1A evening
Pansporin 1 g
Morning and evening

Data granularity

Infection prescription
Rp 1) 5% glucose 500 ml
Vitamedin 1A morning
Rp 2) Saline 500 ml
K 2 1A evening
Rp 3) Saline 100 ml
Pansporin 1 g
Morning and evening

Data unit = People’s actions (changes) single item based

Management of the number of items

Individual (ID) management

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Automatically acquired information: Digitize

Consumption point of conventional electronic medical charts

Waste

Optimize

Consumption point of conventional systems used by the Pharmaceutical Division

most dangerous, unnecessary costs.
GS1: Product Identification through the Supply Chain

PHYSICAL ITEMS & DATA FLOW

Automatic granularity exchange

Granularity of shipping

Granularity of single item

GTIN / Serial ID  GTIN  SSCC  GTIN  GTIN / Serial ID

RSS / RFID  GS1-128  GS1-128  GS1-128  RSS / RFID

Item data, sales catalog, ship notice, invoice

request for quotation, planning schedule, POS

Electronic Commerce Information Flow
Facts of the Pilot Study

1. 1st Project scoped from the Source Marking to Bed-Sides

2. 1st Project adopting GS1 Standards in Japan (SGTIN/GLN)

3. SGTIN (GTIN + Serialized Number) on RFID

Items of Medical Supply

- Drugs
- Medical Materials
- Injection Drugs
- Medical Devices
- Instruments
Pilot study for single item management and traceability

Method

- Single item management of drugs by RFID with SGTIN96
- Collecting and tracing history of distribution of each drug by SGTIN96

<table>
<thead>
<tr>
<th>SGTIN-96</th>
<th>Header</th>
<th>Filter Value</th>
<th>Partition</th>
<th>Company Prefix</th>
<th>Item Reference</th>
<th>Serial Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>00110000 (Binary value)</td>
<td>8</td>
<td>3</td>
<td>3</td>
<td>20-40</td>
<td>24-4</td>
<td>38</td>
</tr>
<tr>
<td>999,999 – 999,999,999,999</td>
<td>9,999,999</td>
<td>274,877,906,943</td>
<td>(Decimal capacity*)</td>
<td>(Decimal capacity)</td>
<td>(Decimal capacity*)</td>
<td></td>
</tr>
</tbody>
</table>

Source: GS1homepage
Morioka city is a rural city in the northern part of Japan. The location of the pilot study includes Morioka Red Cross Hospital, a Data Center (Santen), and a Wholesaler (Vital Net). The distance from Morioka to Nagoya is 400 miles (600km). For context, the distance from Boston to Niagara Falls is also approximately 400 miles (600km).
Web based Transmission Method

✅ Conventional (C/S) Application
  - Keep connection regardless of the existence of communication
    - “Keep-Alive” for sustaining connection
    - Difficult to operate stably under unstable network such as internet
    - Overpressure on network band with increase of clients
  - Increase of clients = Increase of connections
    - Overpressure on bandwidth of server database

✅ Web based Transmission Method
  - Using HTTP for connection between server and client
    - Disconnection in no communication
    - Strong for unstable network
  - Increase of connection is smaller with increase of clients
Distribute Data Management

- Centralized information management
  - Concentration of database access
  - Periodical Data Transcription by batch processing
    - Lose freshness of data

- Distribute Data Management
  
  Recording pointer for data at repository

- Recording data at the point of release
  - Using latest data at all time
    - Assuring real time
Network Structure of Pilot Study

- Trace Server
- Factory/Wholesaler server
- Internet
- Morioka Red Cross Logistic terminal
- Vital Net (Outside hospital)
- Hospital Server
- Logistic Server
- Data center (Nagoya)
- Search Server
- FTTH 100Mbps
- PHS 256kbps
- ADSL Mbps
- VPN (Encryption)

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System Overview

Public Org.

Central Trace Server

Middleware

Requester
(Authority, Hospitals, Pharma)

Query System with Web-Browser

Out of Project Scope

Local Trace Server

Pharmaceutical Manufacturers

Local System

RFID

Whole Sellers

Hospitals

Local Trace Server

Local System

RFID
Example of experimental scenario in pilot study

Detecting adverse event at receipt of Drugs

Pharmaceutical company

Enter the lot number of hazardous drug and adverse event

Real-time -within 2 seconds-

Pharmacy

Receipt

Prescription

Audit

Distribution

Wholesaler shipping

Return

Detecting adverse event

Detecting adverse event at receipt of goods
Process of entering adverse events

Nagoya

- Common Main Server Program
- Manufacture Main Server Program
- Wholesaler Main Server Program
- Searching Middle ware
- Manufacture Middle ware
- Wholesaler Middle ware
- Searching System
- Adverse Event Entering System
- Wholesaler Logistics System
- Hospital Logistics System
- Hospital Main Server Program
- Wholesaler Middle ware
- Hospital Middle ware

Morioka
Process of entering adverse events

Nagoya

1. Searching Middle ware
2. Manufacture Main Server Program
3. Wholesaler Main Server Program
4. Hospital Main Server Program

Morioka

1. Hospital Middle ware
2. Wholesaler Logistics System
3. Hospital Logistics System
4. Wholesaler Main Server Program
Process of Checking drugs

Nagoya

- Common Main Server Program
- Manufacture Main Server Program
- Wholesaler Main Server Program
- Searching Middle ware
- Manufacture Middle ware
- Wholesaler Middle ware
- Searching System
- Adverse Event Entering System
- Wholesaler Logistics System

Morioka

- Hospital Main Server Program
- Hospital Middle ware
- Hospital Logistics System

Adverse Event

① ② ③ ④ ⑤ ⑥
### Result of investigation 1

- **Average Processing time in hospital (mili second)**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Number of Operation</th>
<th>Time to refer DB ($\overline{6} - \overline{1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit</td>
<td>310</td>
<td>0.314</td>
</tr>
<tr>
<td>Mixing</td>
<td>307</td>
<td>0.264</td>
</tr>
<tr>
<td>Injection</td>
<td>601</td>
<td>0.292</td>
</tr>
</tbody>
</table>

Demonstrating within 2 seconds
## Result of investigation2

### Average Processing time outside hospital (mili second)

<table>
<thead>
<tr>
<th>#</th>
<th>Contents of Operation</th>
<th>Line</th>
<th>Number of Operation</th>
<th>Average Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Operation of common trace server</td>
<td>-</td>
<td>338</td>
<td>42.3ms</td>
</tr>
<tr>
<td>2</td>
<td>Entering information on adverse event</td>
<td>PHS</td>
<td>3</td>
<td>724.0ms</td>
</tr>
<tr>
<td>3</td>
<td>Handling wholesaler's distribution</td>
<td>PHS</td>
<td>14</td>
<td>1130.9ms</td>
</tr>
<tr>
<td>4</td>
<td>Returned incoming at wholesaler</td>
<td>PHS</td>
<td>3</td>
<td>988.9ms</td>
</tr>
<tr>
<td>5</td>
<td>detection of Adverse drug event</td>
<td>ADSL</td>
<td>618</td>
<td>187.2ms</td>
</tr>
<tr>
<td>6</td>
<td>Entering information on adverse event with LAN environment</td>
<td>LAN</td>
<td>10</td>
<td>73.3ms</td>
</tr>
</tbody>
</table>

### Demonstrating within 2 seconds
### Sample of Data log (Outside hospital)

<table>
<thead>
<tr>
<th>日時</th>
<th>端末IP</th>
<th>API</th>
<th>処理時間</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008/02/08 11:24:08</td>
<td>192.168.5.111</td>
<td>URL:<a href="http://192.168.5.100:8080/iryoda/searchProductInfo">http://192.168.5.100:8080/iryoda/searchProductInfo</a></td>
<td>188ms</td>
</tr>
<tr>
<td>2008/02/08 11:26:08</td>
<td>192.168.5.111</td>
<td>URL:<a href="http://192.168.5.100:8080/iryoda/searchProductInfo">http://192.168.5.100:8080/iryoda/searchProductInfo</a></td>
<td>187ms</td>
</tr>
</tbody>
</table>

- **A. Data**
- **B. PDA ID**
- **C. API**
- **D. Time to process**
Sample of data log (Inside Hospital)

<table>
<thead>
<tr>
<th>A. Running Number</th>
<th>B. Program</th>
<th>C. Action</th>
<th>D. Timing</th>
<th>E. EPCID</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. Name of Drugs</td>
<td>G. PDA ID</td>
<td>H. User ID</td>
<td>I. Time Stamp</td>
<td></td>
</tr>
</tbody>
</table>
The evolution of hospital information systems

1G: Billing and Lab test: medical affairs and specimen exams
2G: CPOE: ordering
3G: EPR: paperless electronic medical charts
4G: Ubiquitous medical information systems for most dangerous / high costs areas

Un-digitized space

Digitized space

Department systems

Bedside, ER (emergency), (OR) operating room and ICU
*verbal communication  *high risk, and high costs

We need standardized UDI!
Conclusion

Not only cost saving but also Patient safety ---

- important to manage the verbal communication in Bedside, ER (emergency), (OR) operating room and ICU

- Single item management with unique serialized number

References:


World Alliance for Patient Safety - Technology for Patient Safety

Core Group Meeting

Imperial College, London

Monday 29-30, September 2008
WHO representative: Ed Kelley, Head, Strategic Programs, WHO World Alliance for Patient Safety, Geneva, Switzerland

Pauline Philip, Program Lead, WHO World Alliance for Patient Safety, Geneva, Switzerland

Chair: Prof Guang-Zhong Yang, Imperial College London, UK

Prof Stuart Whittaker, South Africa; Prof Azeem Majeed, UK

Prof Masanori Akiyama, Japan; Prof Richard Reznick, Canada

Dr Enrique Ruelas, Mexico; Raj Aggarwal, UK;
Discussion on information technology

- Micro vs. macro, example issues
- Primary care
- Emerging technologies
- Population level (detecting threats at a higher level)
- Guidelines for guidelines
- Design/interoperability/customisation
- Appropriate and accurate data capture
- Training and linkage to curriculum
- Evolvable
Thank you for your attention. Any Questions?

Think!

What kind of system do you want, if your son or daughter were a patient?

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