

Risk Management, Traceability and Measuring Productivity with POAS - Point of Act System -

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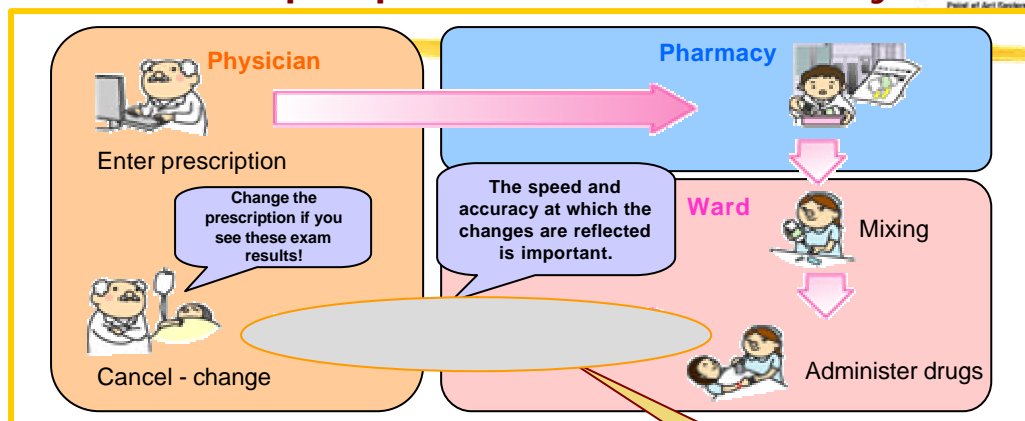
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GS1 HUG™ Global Healthcare User Group
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Injection operations from the perspective of medical safety

Injection order



? 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.

Digitalization of this section was achieved with the use of POAS.

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A system with the same granularity of paper = paperless



1. Electronic medical charts for **peace of mind and safety**
Compliance with the new Pharmaceutical Affairs Law, and traceability of drugs and medical supplies
2. **Real-time updating within 2 seconds** on any terminal in the hospital
 1. Prevention of medical accidents and utilization of IT.
 2. Realize zero-inventory (to reduce costs)
 3. True information sharing
3. Material flow, wards, Pharmaceutical Department and ME control room

A system with greater granularity was needed to achieve process controls for medical procedures.

How is this different from conventional systems?



Conventional systems

Enter schedule

- Before action
 - Digitalize slips
 - Record of action schedules
- After action
 - Record only the fact that the action was considered to have been taken (that insurance claims have been filed).
 - Even “real-time” systems had time lags (from 10 minutes to several hours)
- Is different from actual state.

Slip granularity

POAS

Enter action

- Before action
 - To-do list of planned actions
 - Confirm immediately before action (within 2 seconds)
- When action is performed
 - Recorded at the time of confirmation
 - Manage the “alibis” of actions and objects
 - Convert to data used for insurance processes
- Completely consistent with the actual state

Granularity of single items

Challenges of hospital information systems



From a safety standpoint

- Support for sudden changes with injections
- Real-time
- Traceability

A system is needed that supports drug products barcodes.

From a management standpoint

- Synch with material flows
- Management support
(Accurate costs for precision management and other tasks)

A system is needed that synchs with material flow from the moment it is introduced.

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A system that enables safety measures and improves management efficiency



Real-time management is crucial to ensure safety.

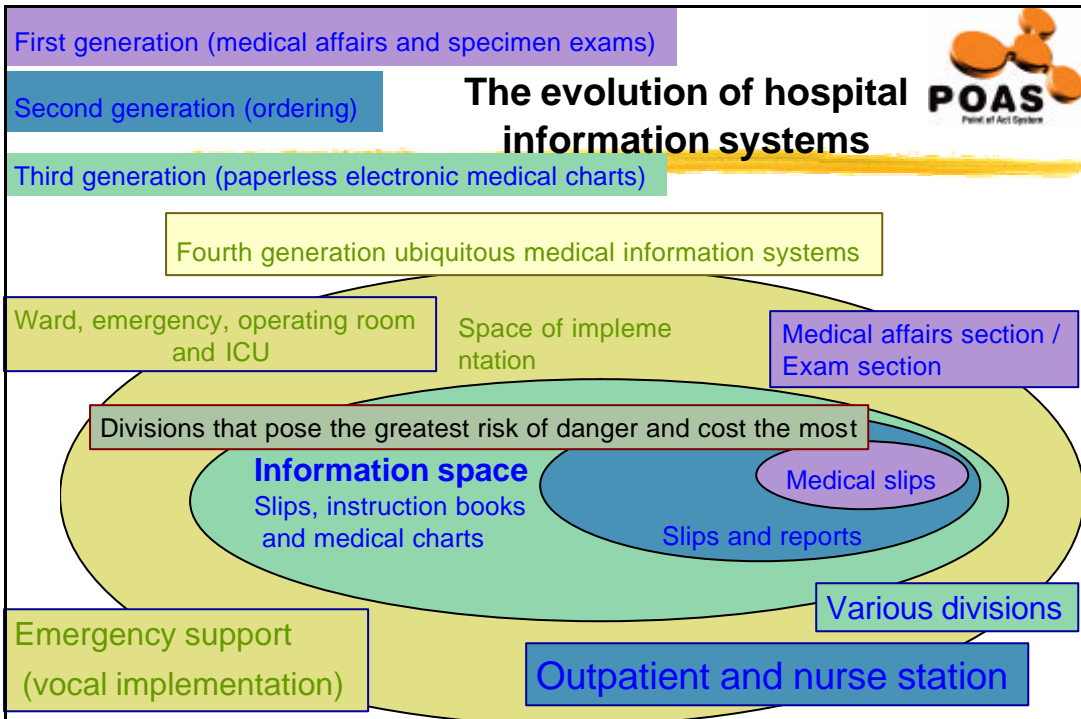
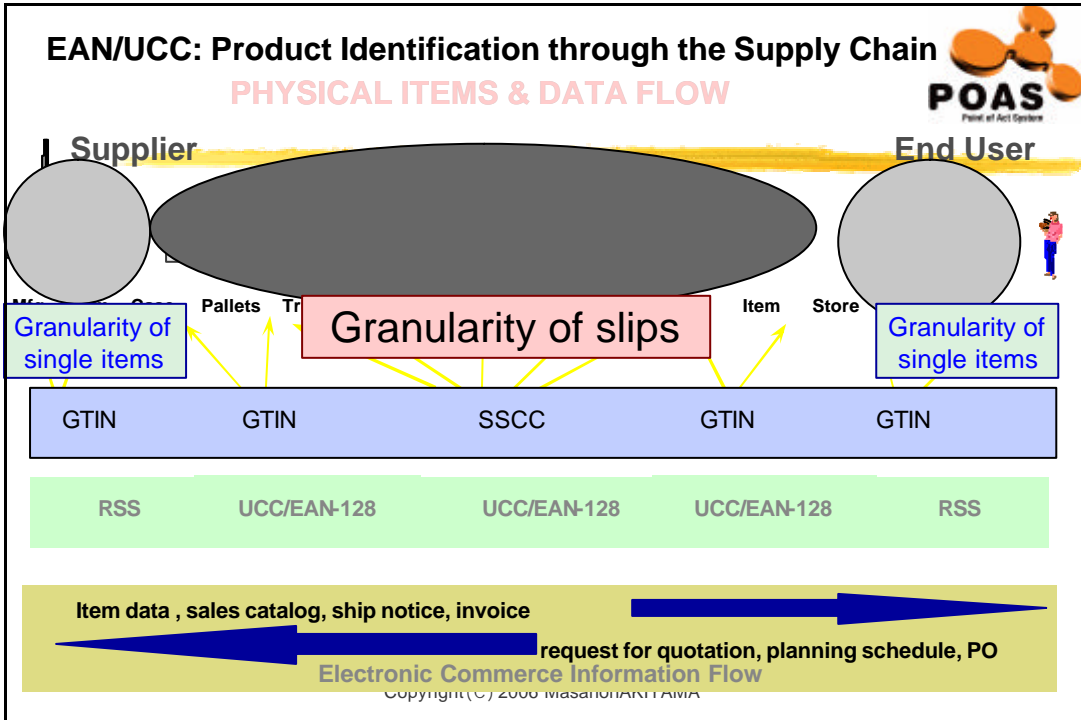
- Medical accounting calculations (eliminate billing omissions)
- Reduce patient waiting times

Management must be performed on a per-day basis to ensure safety. This would be impossible using electronic medical chart systems that are merely extensions of medical billing systems.

Unable to obtain in paper form (no slips).
Information is also obtained automatically.

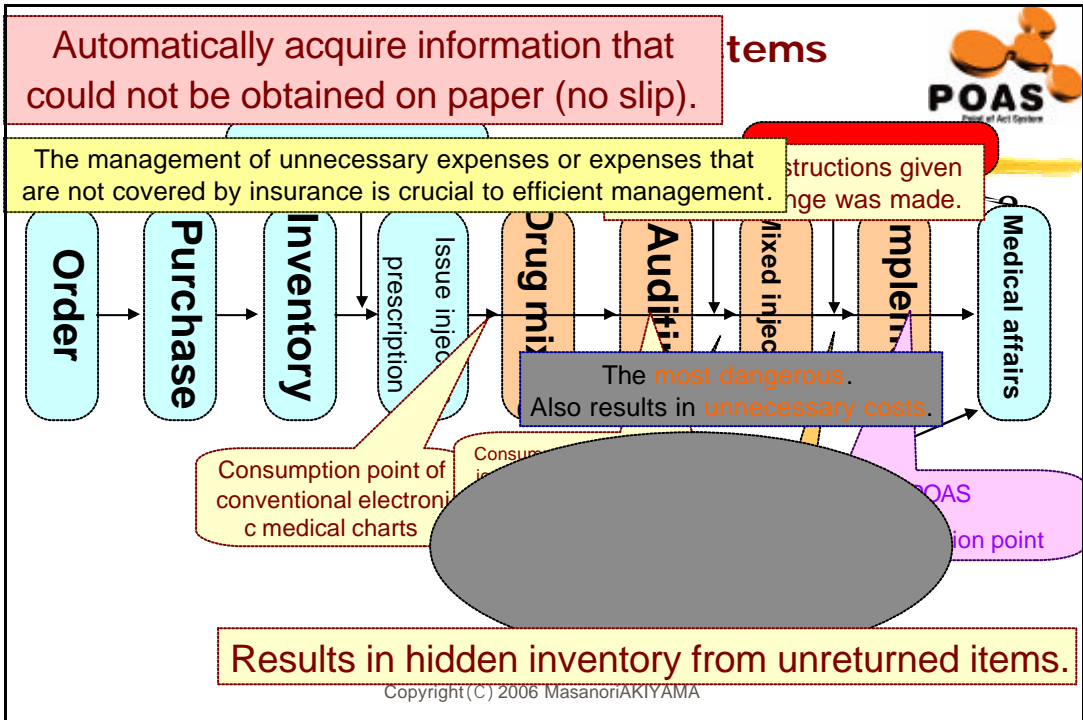
- EBM
- Medical collaboration

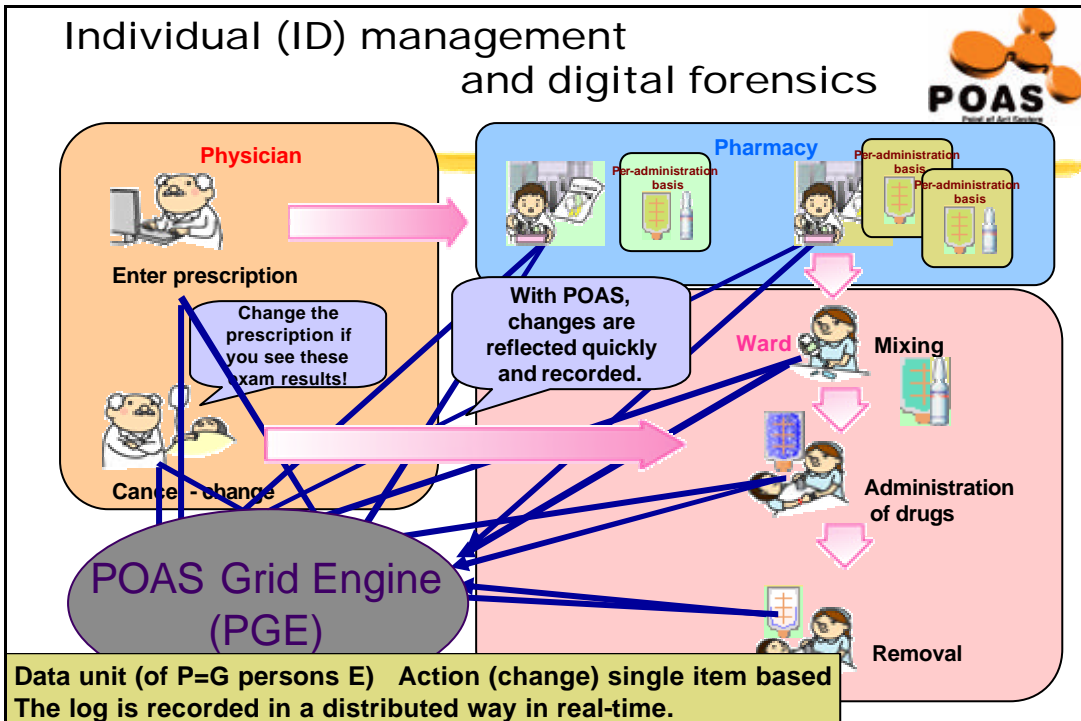
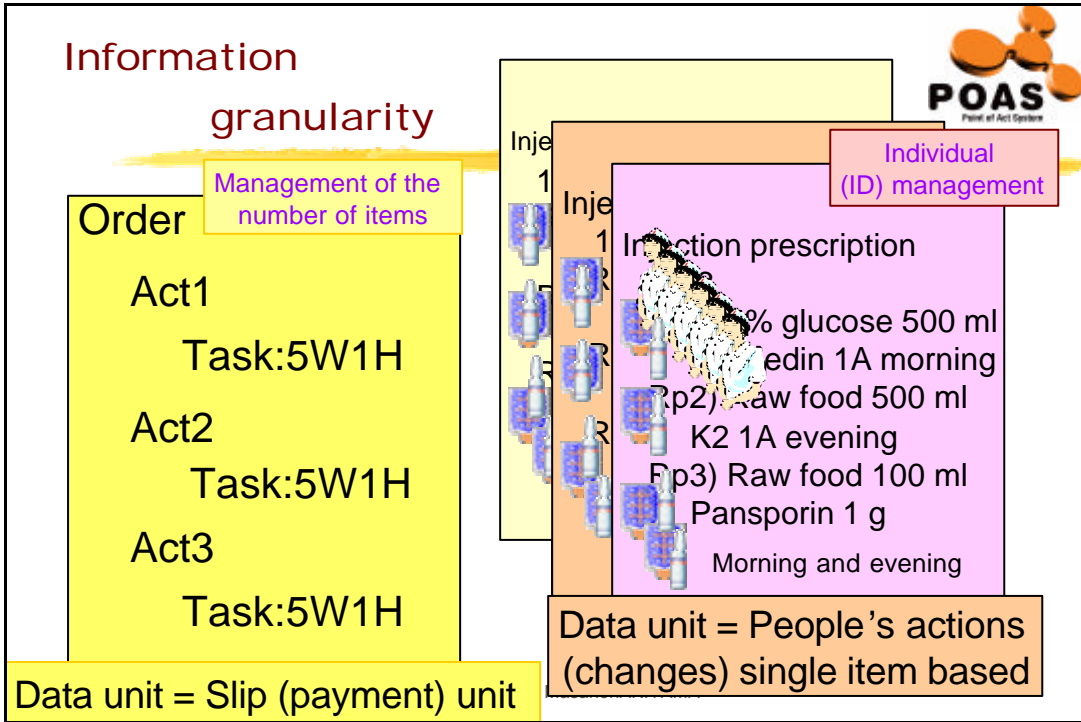
Costs that consequently cannot be covered by insurance.
(Unnecessary costs) can be managed.



Screenshot of a medical information system interface showing a grid of medication orders. The interface includes a top navigation bar with a date range of 2005/02/09-2005/02/15 and a 'Cancel' button. The main area displays a table of orders with columns for medication name, quantity, and status. Annotations include:

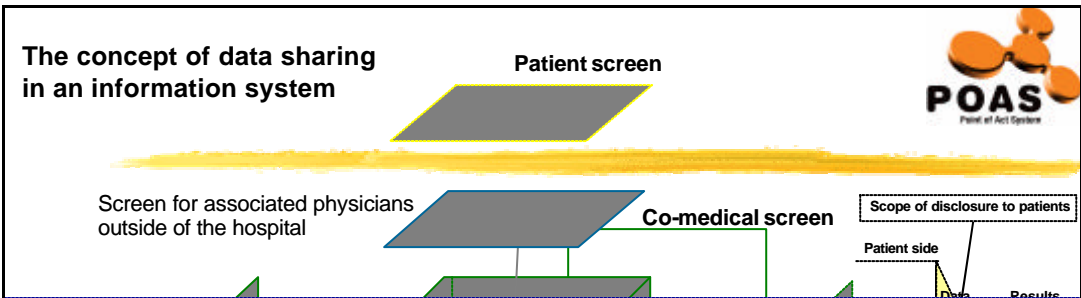
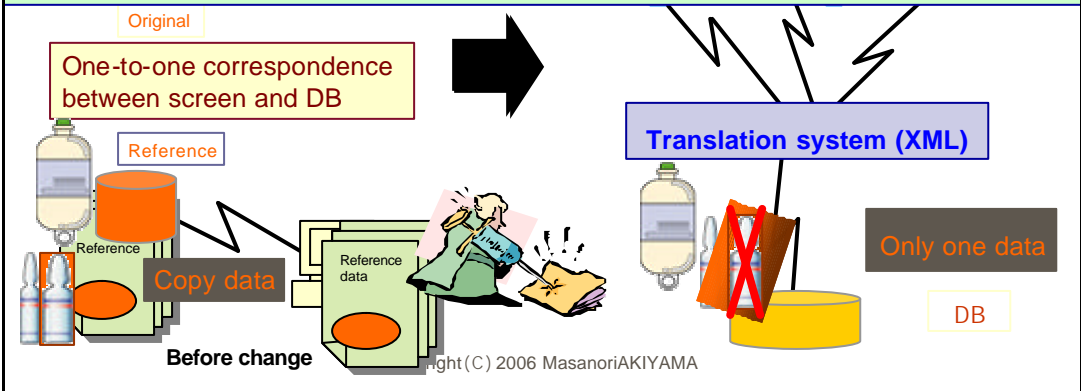
- Action ended**: A white box pointing to a medication order.
- Action in progress**: A blue box pointing to a medication order.
- Medical billing**: A red text label.
- Audited**: A yellow box pointing to a medication order.
- Ward**: A green text label.
- Instruction**: A pink box pointing to a medication order.
- Mixed injection complete**: A green box pointing to a medication order.
- Pharmaceutical Department**: A red text label.
- Do not include in cost when canceled**: A yellow callout bubble pointing to a medication order.
- Include in cost when canceled**: A yellow callout bubble pointing to a medication order.



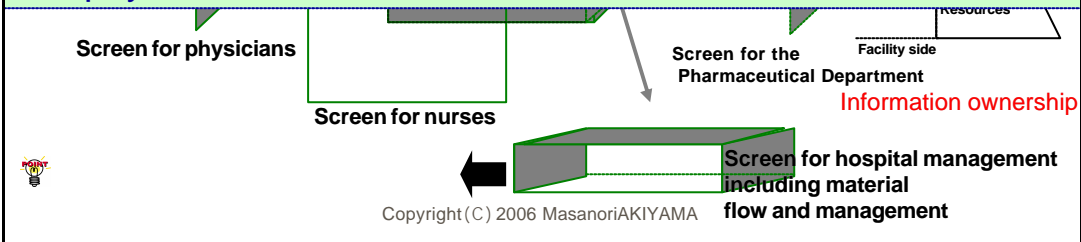




Simultaneous log in and bi-directional real-time
Physicians and nurses can share the same data simultaneously.



Realize bi-directional, real-time (within 2 seconds) sharing of information using IT.
The same data are shared between physicians and between the physician and the nurse at the same time.



Capable of analyzing accidents
from various perspectives



Provides an accurate picture of not only the person who caused the accident, but of the actions of other medical staff as well as the situation in the ward and outpatient clinic.

?

The problem can be resolved not as an issue of individual responsibility, but as one that relates to the organization.

Planar analysis ? Organizational (systemic) issues

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Objective and methods



- Objective: An analysis was performed on treatment information compiled by performing data mining on electronic medical charts. All the admission data at the National International Medical Center for a period of one year from November 2003 was used to extract elements that can be connected to medical safety measures.
- Method: All the treatment information used in this study was based on anonymous personal information obtained from admission data and appropriate security measures were taken to maintain information security. Additionally, a treatment information data warehouse optimized for this study was created. XML-based full automatic registration was used to ensure real-time and accurate entry of data.

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Period in question **November 2003 through October 2004**

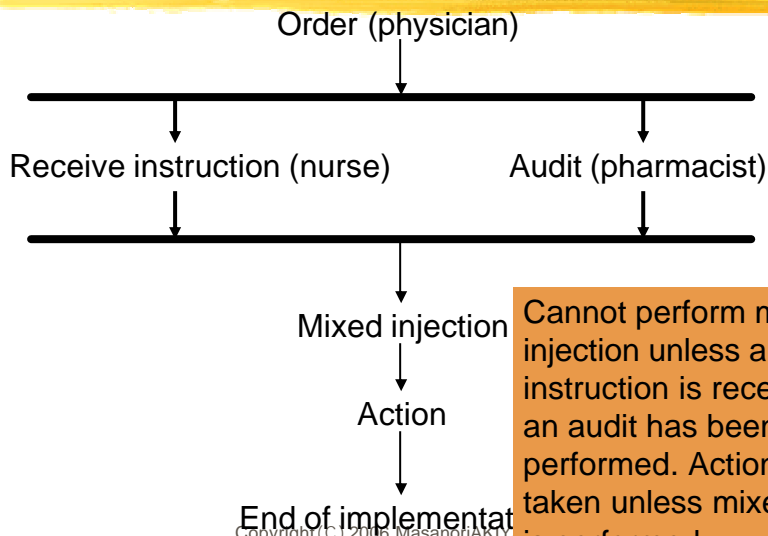
Method of observation **Summarized for the entire hospital and for each ward by month, by day of week and by time.**

System : The PDA sounds an alarm when there is an attempt to perform an IV drip using a non-mixed injection *3.

Report : Summary of the number of reports. Comparison of the information contained in reports and information recorded on the system.

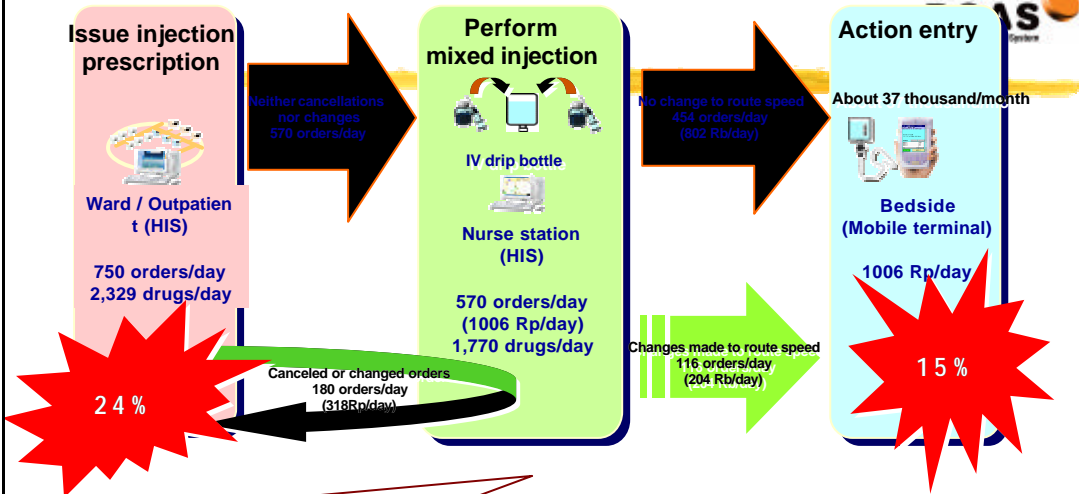
Interview: With wards that exhibited large fluctuations between different days of the week and those with characteristic alarm rates.

Flow from injection order to action



Cannot perform mixed injection unless an instruction is received and an audit has been performed. Action cannot be taken unless mixed injection is performed.

The effects of making injection action entries (calculated from performance data)



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Chronological record of medical actions taken (for one month)



	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00
?????	2,445	1,487	1,460	1,359	3,275	19,298	39,894	23,861	8,621	27,410	62,359	30,740	8,164	9,841	30,506	12,684	7,325	15,036	32,187
? ? PDA?	1,507	1,501	940	667	694	1,359	1,570	1,561	2,852	3,811	3,943	3,180	2,052	2,048	3,161	2,436	3,174	3,474	2,523
? ? :	67	18	13	6	17	186	273	115	96	313	762	407	149	182	436	210	160	162	213
? ? ? ? :	454	142	118	142	532	3,397	2,919	649	289	1,193	3,087	1,704	854	728	1,398	578	540	1,066	1,674
? ? ? ? ? :	665	219	136	137	515	3,209	2,501	603	291	484	1,171	1,855	1,192	935	1,557	719	659	996	1,270
1 ? ? ? ? ?	0	1	0	0	11	20	5	2	3	17	4	1	2	15	5	2	3	17	
IN ? ? ? ? ?	1	0	1	3	4	45	87	23	7	17	7	2	0	0	1	0	1	0	0
OUT ? ? ? ? ?	1	0	1	0															0
PTCD ? ? ? ? ?	2	0	0	0															0
SaO2	47	64	57	37															3,232
???????????	0	0	1	1															19
?????????	3	4	2	0															44
?????????	0	0	0	0	0	0	2	4	0	12	20	20	3	5	22	18	12	8	8
?????????	0	0	0	0	0	0	0	0	2	10	101	30	0	8	15	16	0	0	4
?????????	0	0	0	0	0	0	0	0	0	21	38	55	9	32	43	24	5	7	3
?????????	0	0	0	0	0	0	0	0	1	18	54	48	11	14	48	43	32	26	7
?????????	1	1	0	0															8
?????????	0	0	0																55
?????????	2	3	4																2
?????????	33	21	10	28	98	311	447	214	34	255	503	254	38	145	494	195	146	86	238
?????????	0	0	0	0	0	0	0	0	0	14	4	5	10	11	6	2			1

Covers not only records of injections and IV drips, but also records of nursing actions and care actions taken, and observations made.

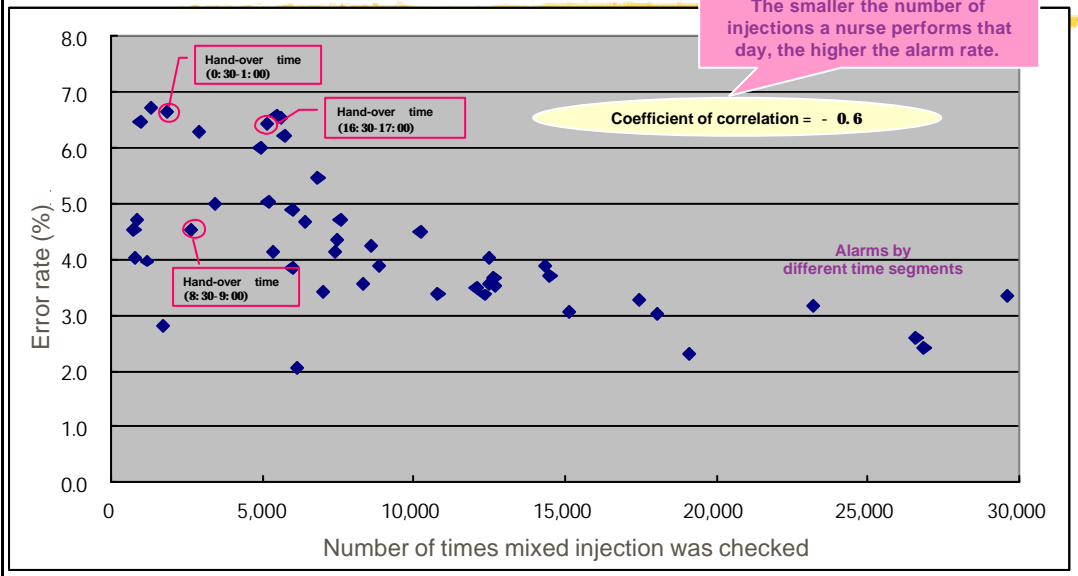
400 thousand/month -> About 80 million logs and 18 million records accumulated over two years.

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Comparison of the number of times mixed injections were checked and error rate (%) (by different time segments)



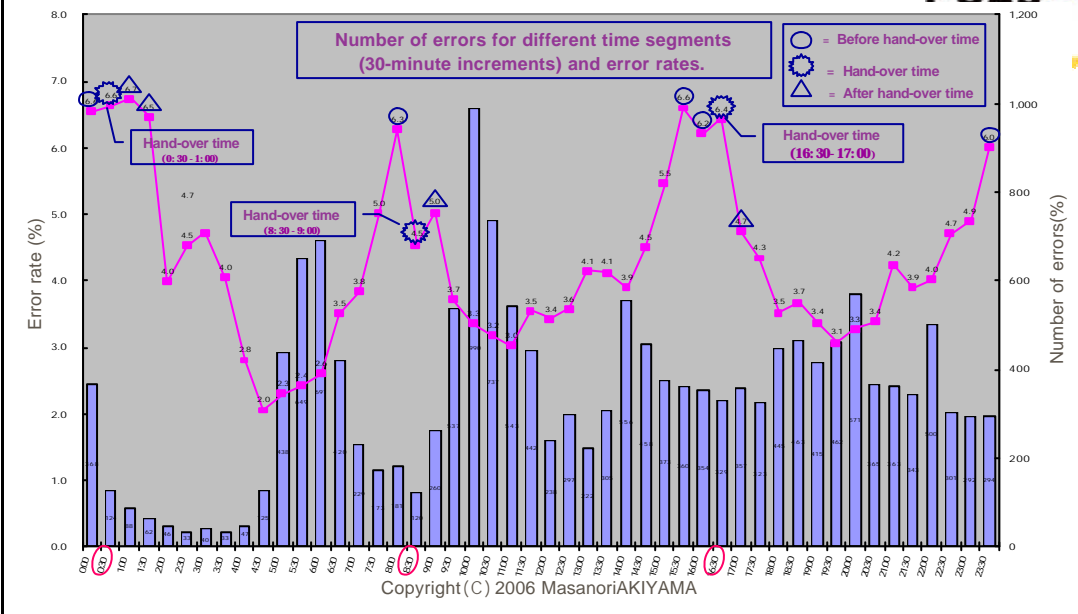
The number of check actions and the error rate have a slightly negative correlation.



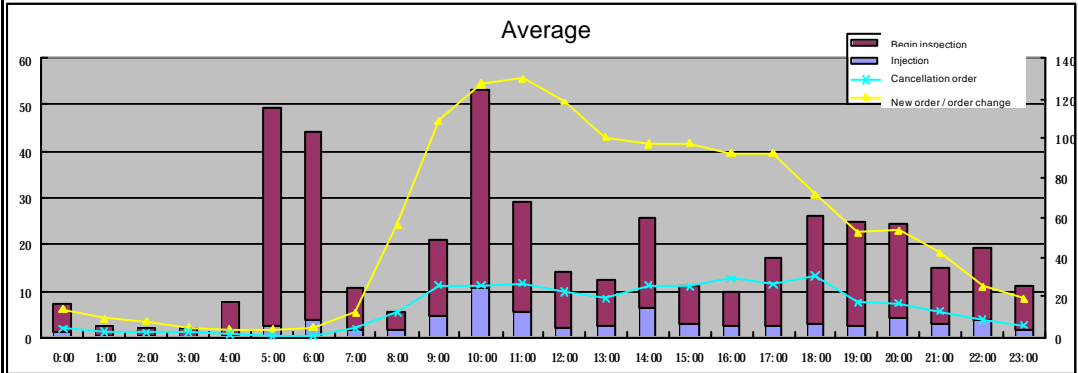
Alarm status by different time segments



Time segments with higher alarm rates become even clearer when seen in 30-minute increments.

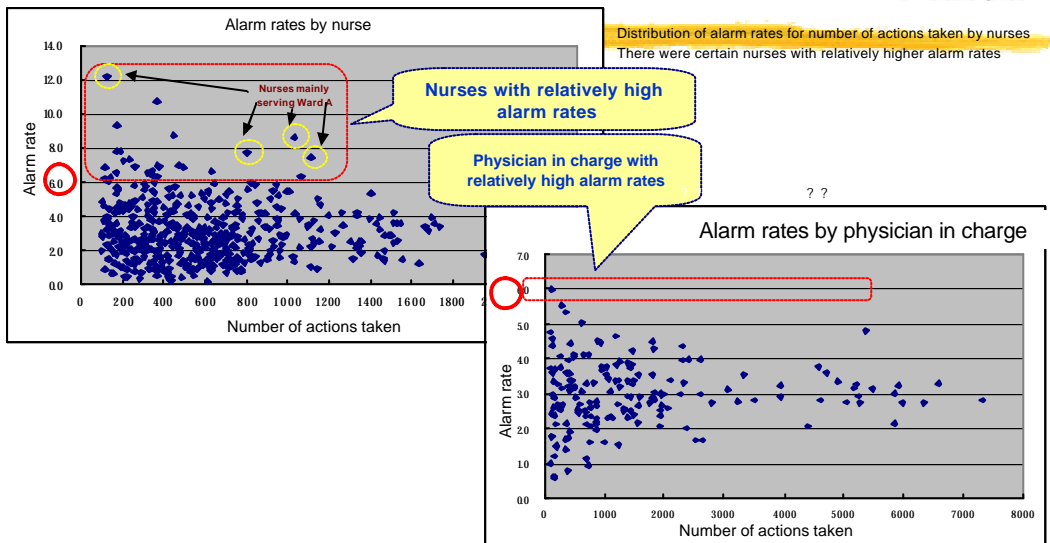


Time that injection and IV drips were started and order frequency



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4. Unusually high alarm rates among certain nurses or physicians



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Results and discussion

- ? The alarm rate was the highest in April with high rates prevailing through June and declining from July onward.
- ? According to decision tree analysis:
 - ? (1) Alarm rates rose during the late night (24-04), morning (09-09) and afternoon (13-18) time segments.
 - ? (2) Alarm rates for the first injection of the day were high regardless of the time segment.
 - ? (3) Alarm rates rose when the time on duty that day exceeded 6.5 hours. Alarm rates were higher the smaller the number of injections or IV drips performed that day by the nurse. Alarm rates were also higher around shift change times. And the rise in the alarm rate for the first injection was significant ($P=8.2 \times 10^{-23}$).
- ? High alarm rates before 10 AM.
 - ? High alarm rates during time segments where physicians frequently changed their instructions. Nurses would forget to mix drugs that were placed in cold storage.
- ? From the distribution of alarm rates for the number of actions taken by a nurse, we have discovered that 1-2% of the nurses had consistently high alarm rates or were “repeaters.”
- ? While risk management traditionally tended to focus on mental aspects, scientific analysis allows us to identify background elements.

Effects

- Data mining or the analysis of electronic medical charts contributes not only to statistical analyses performed from a purely medical standpoint, but also to risk management in medical practices.
- It was deduced that a system that accommodated barcodes applied to every single item would be effective.
- Systems using POAS are useful for medical safety and for improving management efficiency.

POAS's characteristics



????	???	?????		???? (?)	???
		?????	???		
???????????	925	300	6,800	32	1?
??? A?? (??)	1,205	1,900	20,000	300	10?
??? B?? (??)	1,203	500	8,000	200	7?
??? C?? (??)	1,178	1,000	3,500	65	6?
??? D?? (??)	1,154	1,320	7,700	155	2?
??? E?? (??)	1,150	700	7,000	108	4?
??? F?? (??)	800	600	10,000	300	7?

**Inventory was cut to a tenth.
A cost reduction of 225.5 million yen was achieved for pharmaceuticals and 241.62 million yen for medical supplies.**

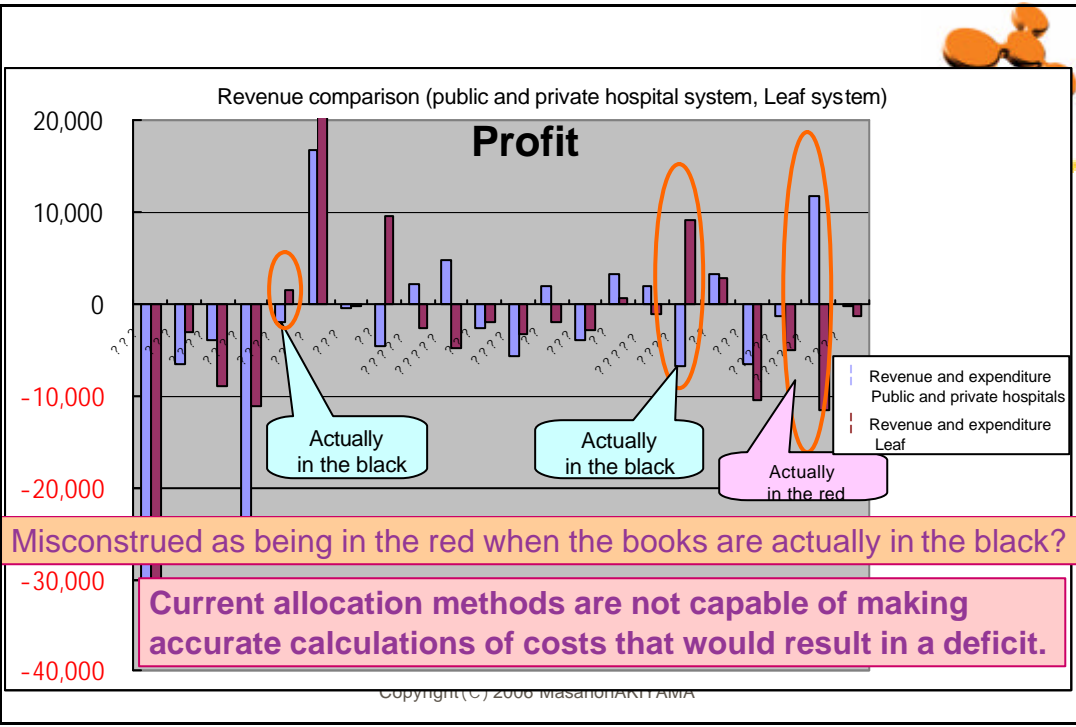
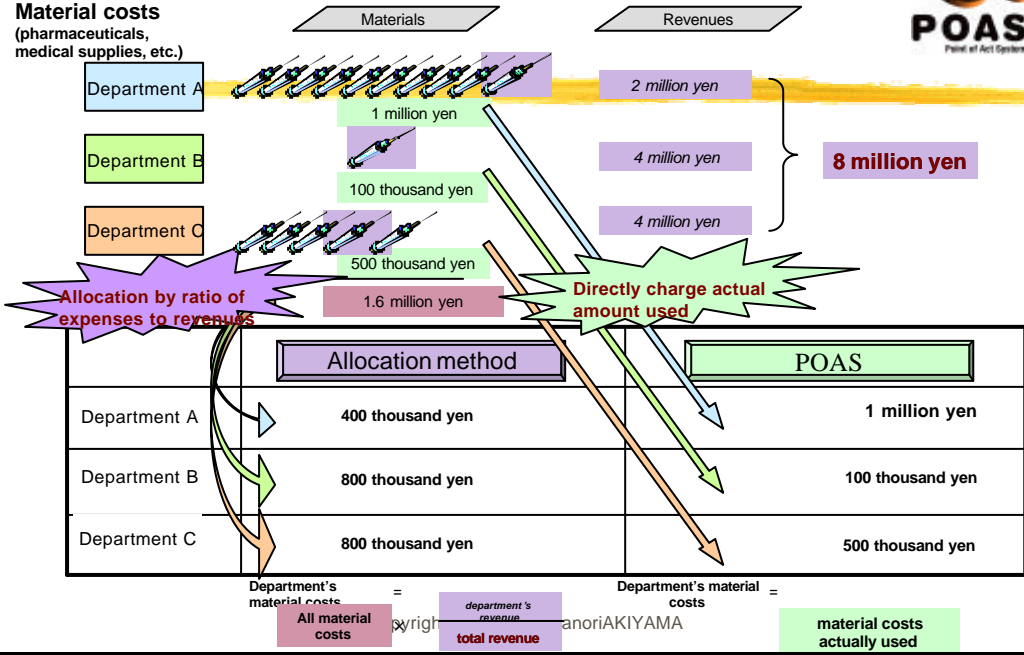
POAS-based hospital management



- Prevent medical accidents.
- Thorough inventory management
- Keywords are “real-time entry” and “single item management.”
- The accurate acquisition of information on bedside actions is crucial.
- Acquire cancellation and change data.
 - Only about 60% can be acquired in conventional systems.
 - POAS gives an overall picture.
- This improves medical safety and management efficiency.

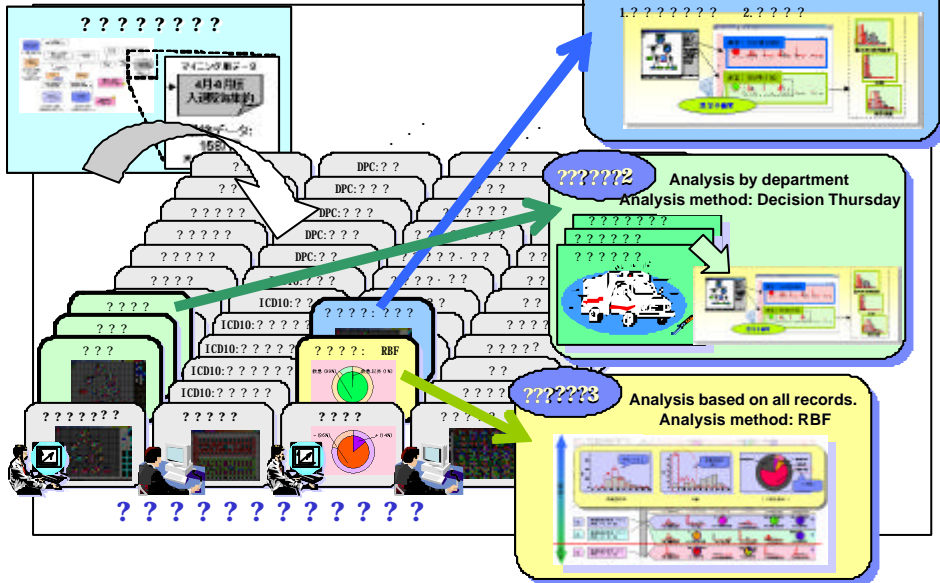
Cost calculation process (difference between the allocation method and POAS)

Material costs
(pharmaceuticals, medical supplies, etc.)



Analytic approach

This analysis takes these 3 approaches.

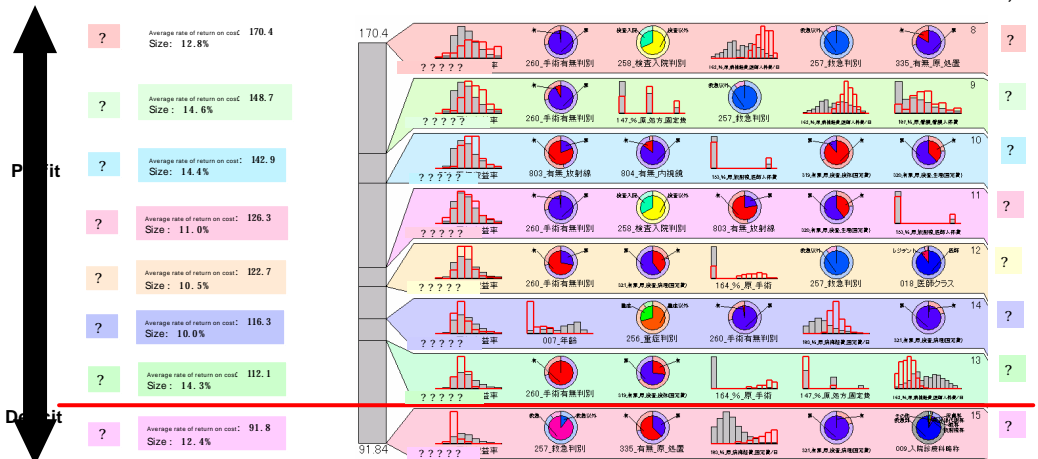


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RBF analysis test (1)

The analysis identifies profit and deficit elements by categorizing all data records into groups.

Number of data records: 1,585



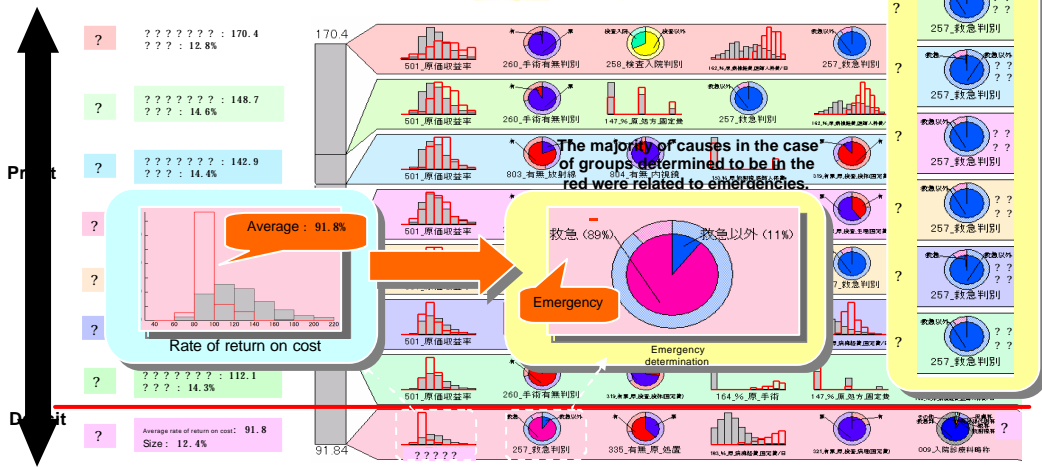
* RBF analysis = Radial Basis Function

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RBF analysis test (2)

First, the primary cause for Group (8)'s low rate of return on cost—100% or less (deficit)—was analyzed.

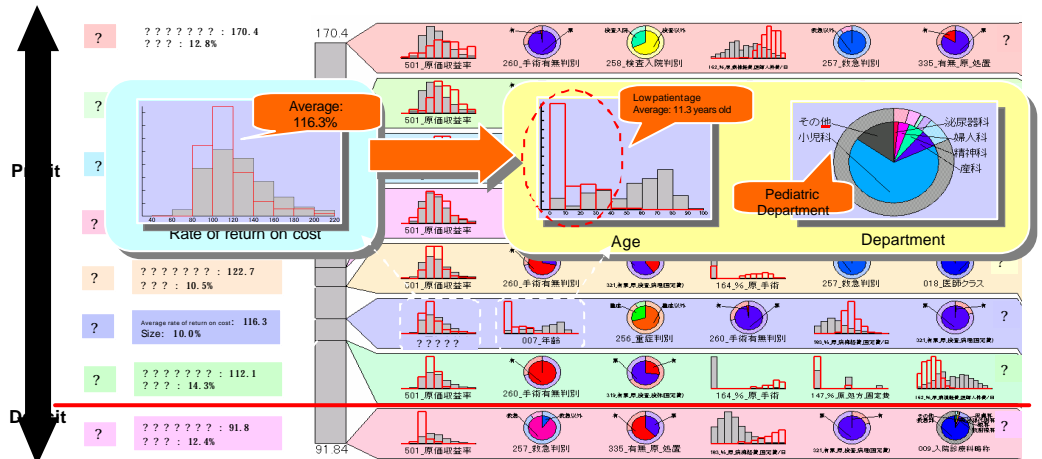
Emergency determination in other groups



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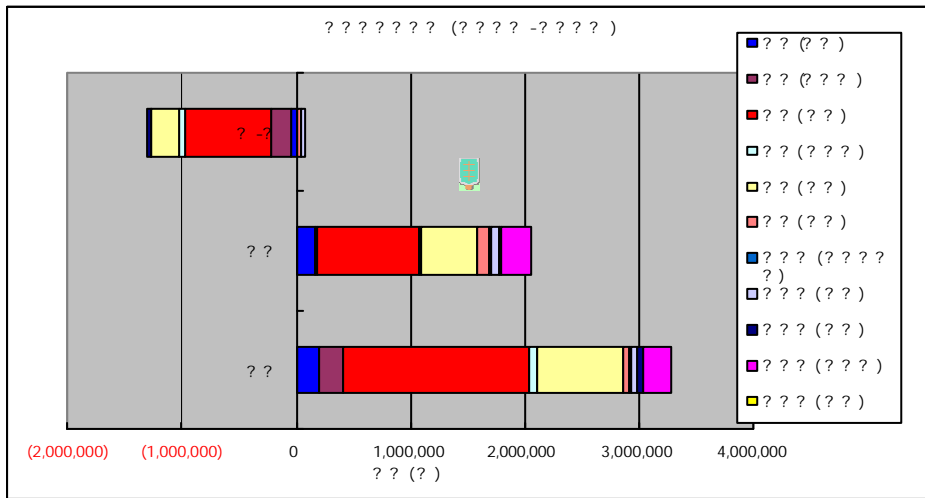
RBF analysis test (3)

The characteristics of pediatric patients are prominent in Group (7), which is almost in the red.



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Cost comparison (Pediatric Department)



Cost comparison (Pediatric Department)



➤ Overall characteristics

- The cost difference for prescriptions, injections and specimen exams is prominent.
- Under the allocation method, costs tend to be distributed proportionately less than what they actually are (direct-charging method).

➤ Prescription

- The difference between fixed costs is prominent.

➤ Injections

- The difference in pharmaceutical costs under the allocation method were the most prominent (-753,508 yen / -46%)

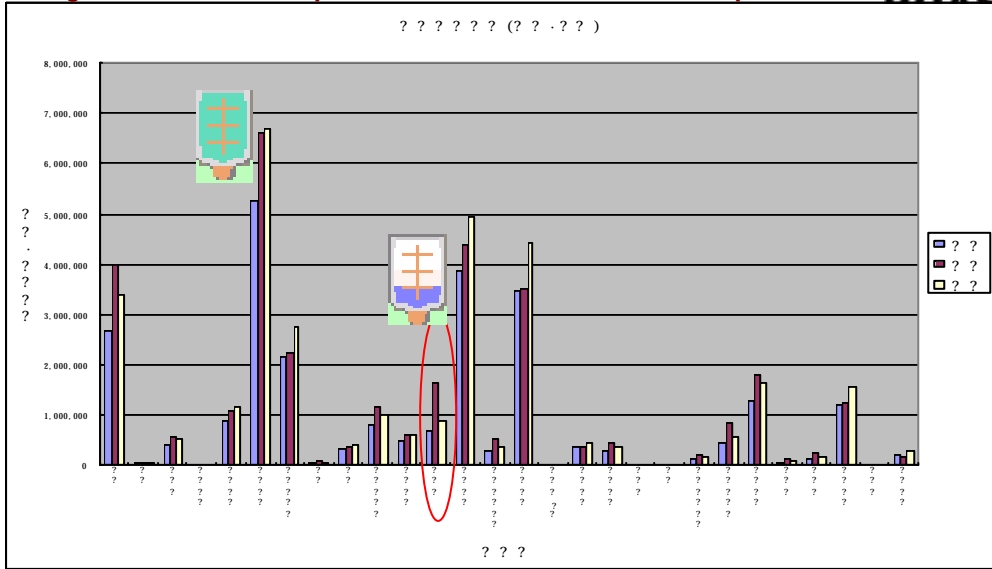
Account	Direct-charging	Allocation	Difference	% Diff	Account	Direct-charging	Allocation	Difference	% Diff	Account	Direct-charging	Allocation	Difference	% Diff
Pharmaceuticals	204,474	197,439	1,640,458	64,913	Pharmaceuticals	746,752	55,654	18,640	49,090	Pharmaceuticals	49,028	248,051	258	30,143,396
Prescriptions	155,698	32,336	886,950	14,264	Prescriptions	497,902	99,531	10,868	83,480	Prescriptions	23,812	254,750	7	28,928,239
Injections	(48,776)	(165,103)	(753,508)	(50,649)	Injections	(248,850)	43,877	(7,772)	34,390	Injections	(25,216)	6,699	(251)	(1,215,157)
Specimen Exams	(?)	(?)	(?)	(?)	Specimen Exams	(?)	(?)	(?)	(?)	Specimen Exams	(?)	(?)	(?)	(?)
Other	(?)	(?)	(?)	(?)	Other	(?)	(?)	(?)	(?)	Other	(?)	(?)	(?)	(?)

Comparison of costs by account item under the direct-charging and allocation methods. (Pediatric Department) (unit: yen)

* Pathological and endoscopic exams were excluded because their revenue and expenditure add up to zero.

Ward costs, operations, anesthetics, treatments and nurse costs were excluded because these were excluded from the allocation.

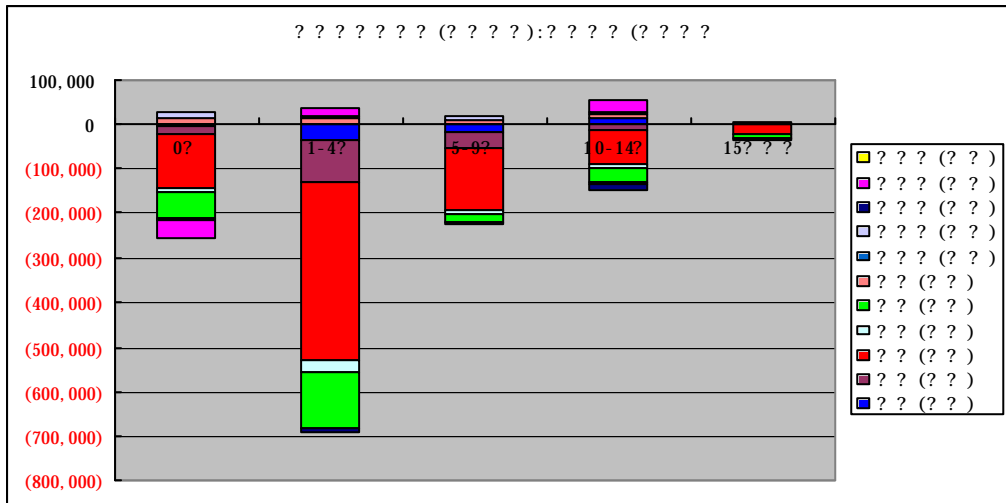
Comparison by department (injection and pharmaceutical components)



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Comparison by age groups:

Cost differences (total amounts)

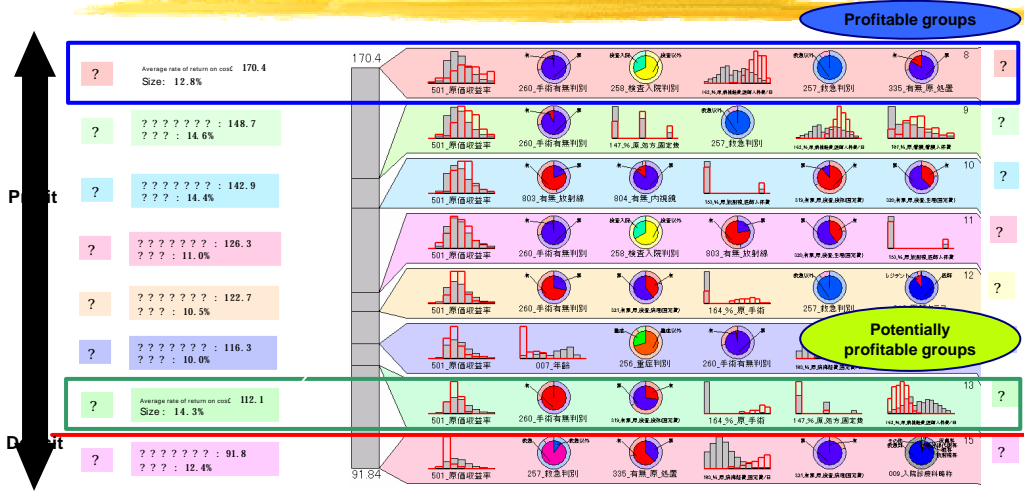


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RBF analysis test (6)



Groups that were almost in the red—excluding Group (8), which was actually in the red—were designated to be “potentially profitable groups” and were compared against groups with the highest rate of return on cost (profitable groups).

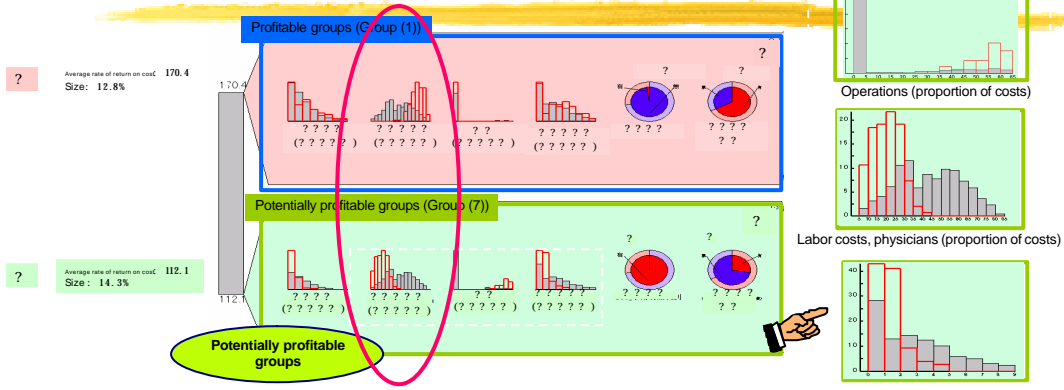


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RBF analysis test (7)



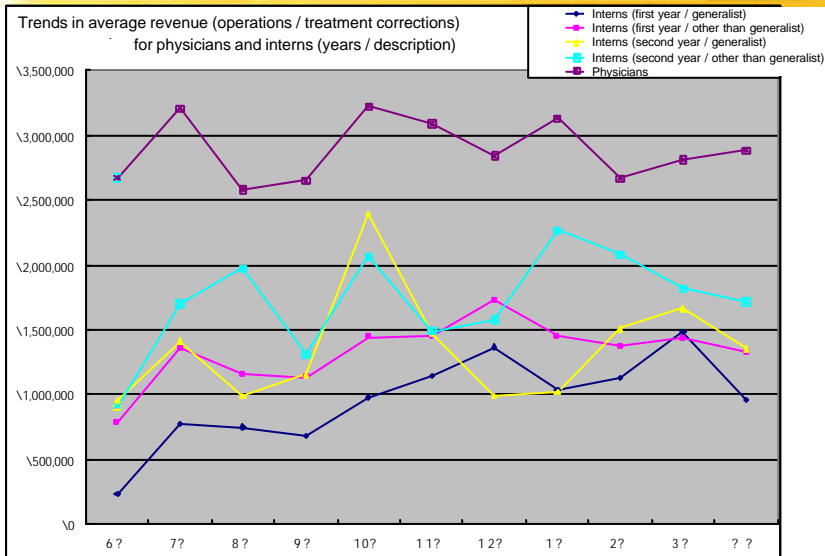
The profitable and potentially profitable groups were compared based on their rate of return on cost.



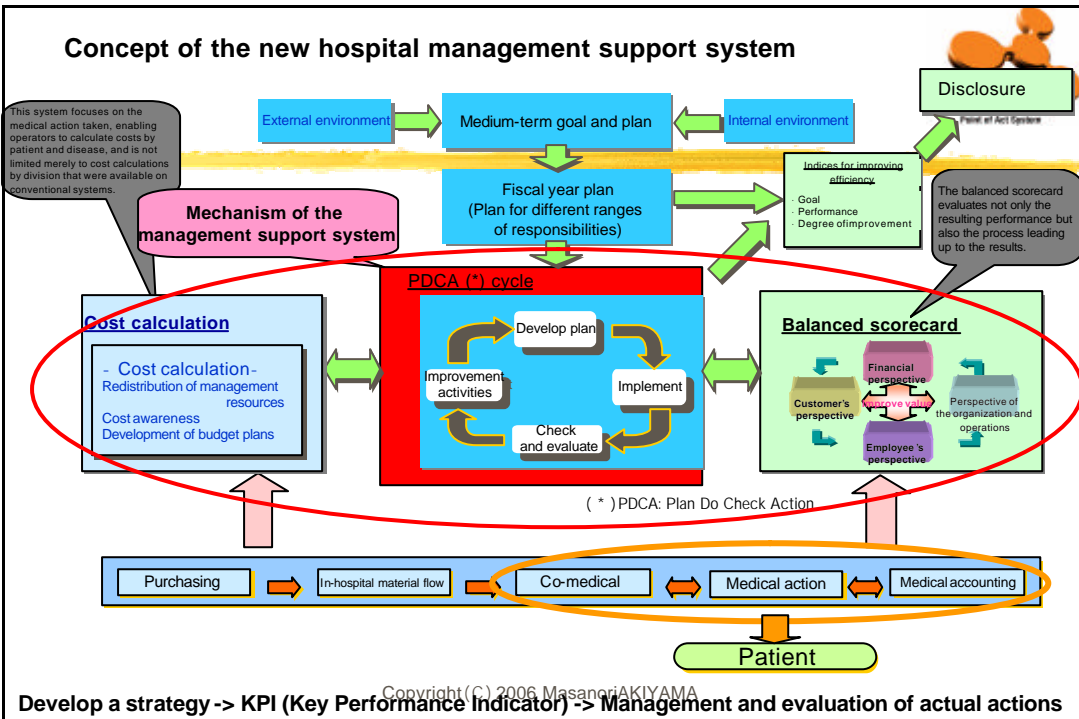
A characteristic of the potentially profitable groups is that they perform operations but perform relatively fewer specimen exams. The proportion of operation costs is high and the proportions of labor costs for physicians and nurses are low.

Experienced physicians are more profitable because they are more skilled!

Trends in average revenue for physicians and interns (years / description)



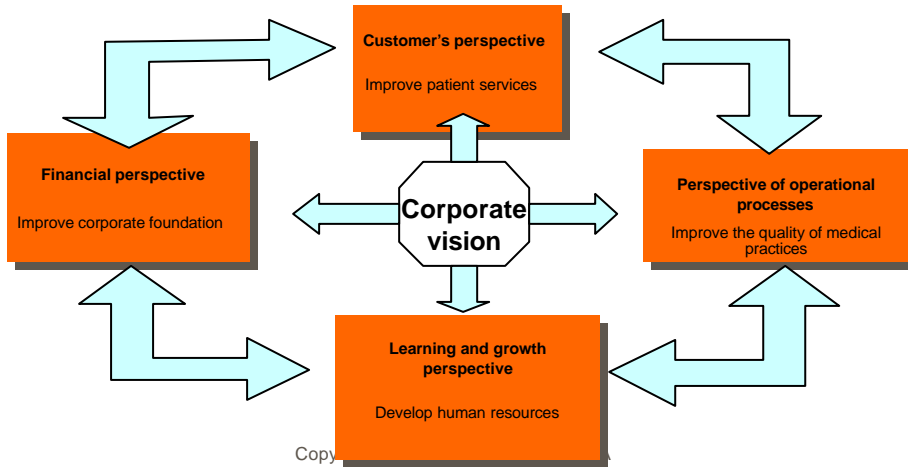
Concept of the new hospital management support system



The BSC (Balance Score Card)



This was developed as a system for evaluating corporate (business) performance and has been attracting attention as a method for achieving corporate visions. This method focuses on various events, not only from a cost management perspective, but through a balance of four contrasting perspectives to verify the level of achievement from each of these perspectives.

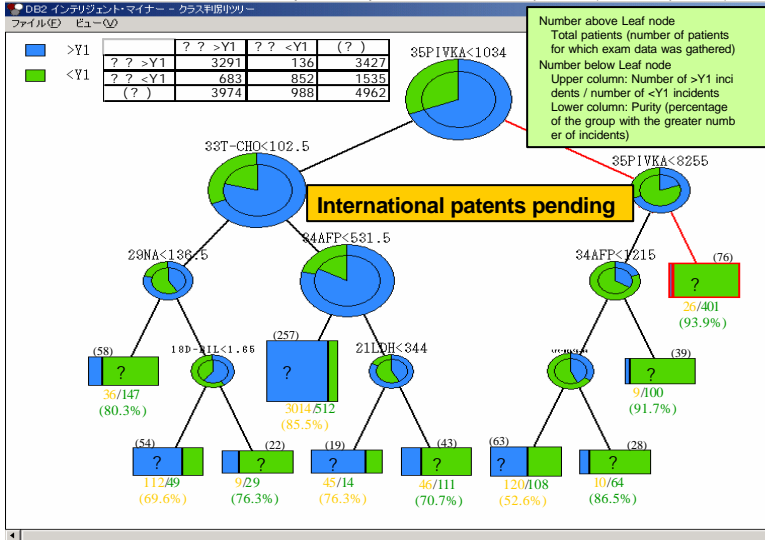


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Example of class identification: Results from a model for identifying patients with a one-year life expectancy



Rate of correct identification: 83% = (3291+852) / 4962 n = 4962 patients (total: 659 patients)



Number above Leaf node
Total patients (number of patients for which exam data was gathered)
Number below Leaf node
Upper column: Number of >Y1 incidents / number of <Y1 incidents
Lower column: Purity (percentage of the group with the greater number of incidents)

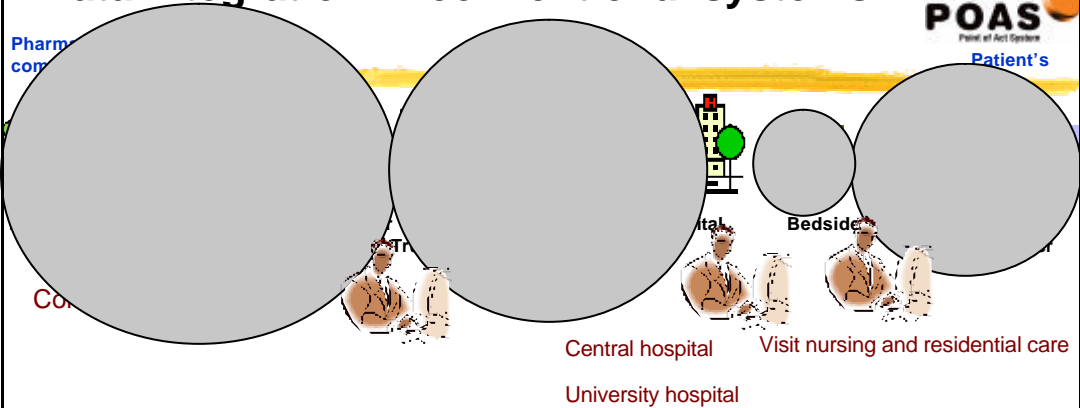
The method focuses on the square terminal node for an incident count of 100 or greater for either "<Y1" or ">Y1" and extracts locations where the purity is 85% or greater.

- (10) In contrast to the fact that 93.9% of the patients died within one year when one criterion, [(PIVKA > 8255 mAU/ml), was met;
- (9) And the fact that 91.7% of the patients died within one year when two criteria, [1034 < PIVKA < 8255] and [AFP > 1215 ng/ml], were met;
- (4) We have developed a model whereby 85.5% of the patients survived for one year or longer when three criteria, [PIVKA < 1034], [T-Cho > 102 mg/dl] and [AFP < 531], were met.

Data integration in conventional systems



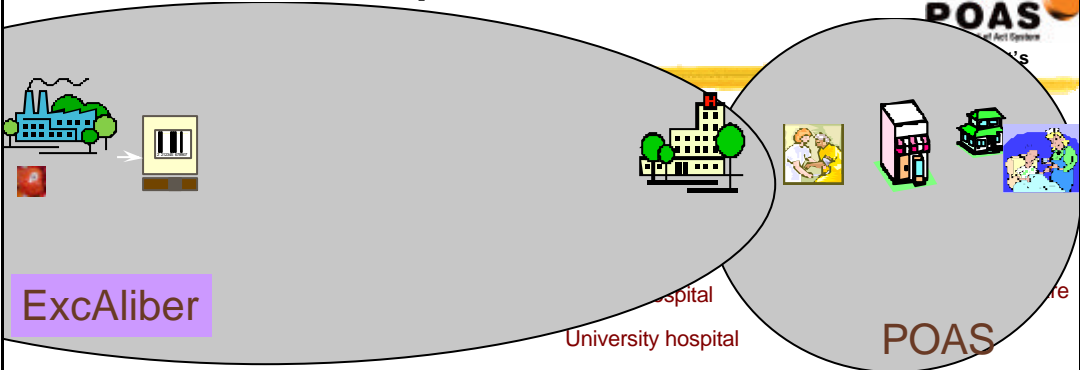
Pharm
com



1. Gather data on patients who have been released, receive care and are at home.
2. Share information through data transmission
3. Differences in granularity between systems are corrected manually.

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 Massachusetts Institute of Technology, Sloan School of Management, Center for eBusiness

Utilization of a ubiquitous network

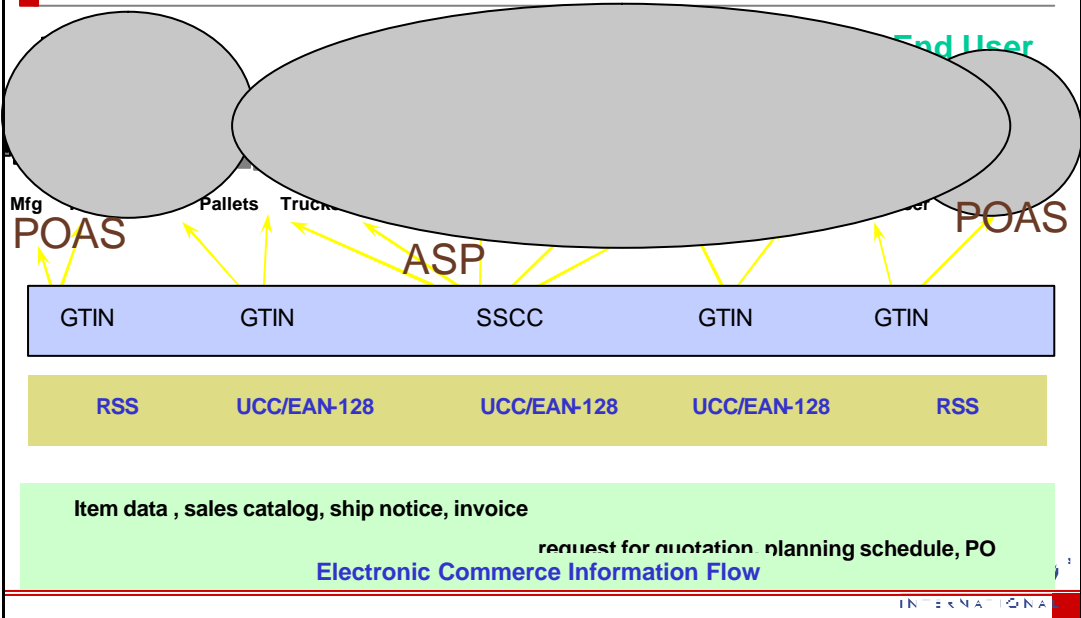


1. Mobile networks are used.
2. Community coordination: acute stage hospitals, recuperative hospitals and clinics
3. Coordinated residential nursing, caring and welfare

These are coordinated in real-time

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EAN/UCC: Product Identification through the Supply Chain



Changes to the system: Barcodes on pharmaceuticals



3 総合 14版 2004年(平成16年)1月6日 火曜日 厚労省 白 第17号 第17号

医薬品にバーコード 05年夏から表示 投与ミス防止策

厚労省、指導へ

【厚労省】医薬品にもバーコード
売れる新聞 中国で激戦
日産が年間新車販売の位に
高松サッカ―市船橋敗退
22日 夢と挑戦 ことも新聞
20日 勝北者と家族結ぶ携帯電話

The Ministry of Health, Labour and Welfare will be issuing instruction

To be institutionalized by the Ministry of Health, Labour and Welfare

- Introduce barcodes to drugs and medical supplies to protect patients from medical accidents.
- Begin supplying products with identification labels for **unit dosages** (administration unit: by single tablet, single ampule or single vial of the drug) on all drugs.
- The Pharmaceutical Department will be primarily responsible for introducing barcodes for each administration unit.
- **The FDA (Food and Drug Administration) has announced the Bar Code Label Requirement for Human Drug Products and Blood in March 2003 to ensure patient safety and drug traceability. This requirement was enacted as a regulation in February 2004.**
- This is likely to have a major impact on the Japanese market **so we must act quickly.**

Study group for the standardization of code labeling.
Safety Measures Section, Bureau of Drugs and Food
Ministry of Health, Labour and Welfare

Drug traceability

生物由来消費実績 - Netscape

実績 在庫

薬品名 献血アルブミンートニチャク 4.4%10... 指定なし ロットNo.

患者ID 使用日 2003/05/01 ~ 2003/06/30 指定なし 検索

薬品名	ロットNo.	使用日	患者ID	患者氏名	数量
献血アルブミンートニチャク 4.4%10...	1L2854	2003/05/02	03723584	田中 はな	1V
献血アルブミンートニチャク 4.4%10...	1L2854	2003/05/06	03048825	てすと 太郎	3V
献血アルブミンートニチャク 4.4%10...	1L2854	2003/05/07	01384215	川鉄 太郎	1V
献血アルブミンートニチャク 4.4%10...	1L2854	2003/05/08	01384215	川鉄 太郎	1V
献血アルブミンートニチャク 4.4%10...	1L2854	2003/05/08	01384215	川鉄 太郎	1V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/08	01384215	川鉄 太郎	1V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/09	01384215	川鉄 太郎	1V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/09	01384215	川鉄 太郎	1V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/14	03723441	日本 太郎	2V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/16	03730951	ジェイ エフ...	1V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/17	03730951	ジェイ エフ...	1V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/18	03702420	田中 一郎	2V
献血アルブミンートニチャク 4.4%10...	1L2856	2003/05/22	03439425	国際 一郎	1V
献血アルブミンートニチャク 4.4%10...	1L2858	2003/05/22	03439425	国際 一郎	1V
献血アルブミンートニチャク 4.4%10...	1L2858	2003/05/23	03439425	国際 一郎	1V
献血アルブミンートニチャク 4.4%10...	1L2858	2003/05/23	03439425	国際 一郎	1V
献血アルブミンートニチャク 4.4%10...	1L2858	2003/05/23	03439425	国際 一郎	1V
献血アルブミンートニチャク 4.4%10...	1L3120	2003/05/22	03709881	田中 はな	1V
献血アルブミンートニチャク 4.4%10...	1L3120	2003/05/23	01867741	国際 さくら	1V
献血アルブミンートニチャク 4.4%10...	1L3120	2003/05/24	01867741	国際 さくら	1V
献血アルブミンートニチャク 4.4%10...	1L3120	2003/05/24	03283185	てすと 太郎	2V
献血アルブミンートニチャク 4.4%10...	1L3120	2003/05/24	03439425	国際 一郎	1V
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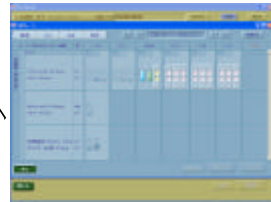
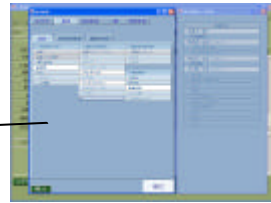
閉じる

テスト 看護婦(1234) バッテリ:80%	
テスト 患者1 最新化	
未	済
前ページへ	次ページへ
07/13 08:00	??
07/13 08:00	??
07/13 09:00	??
07/13 10:00	????
07/13 11:00	????? ▶
戻る	

Nursing system

Exam system

Injection system

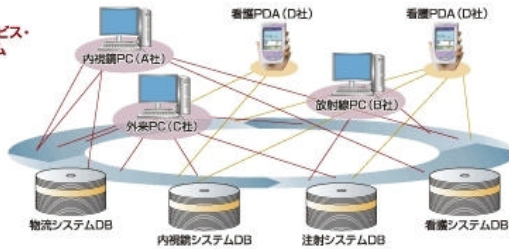


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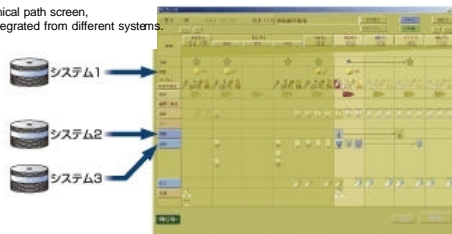
Ubiquitous service platform



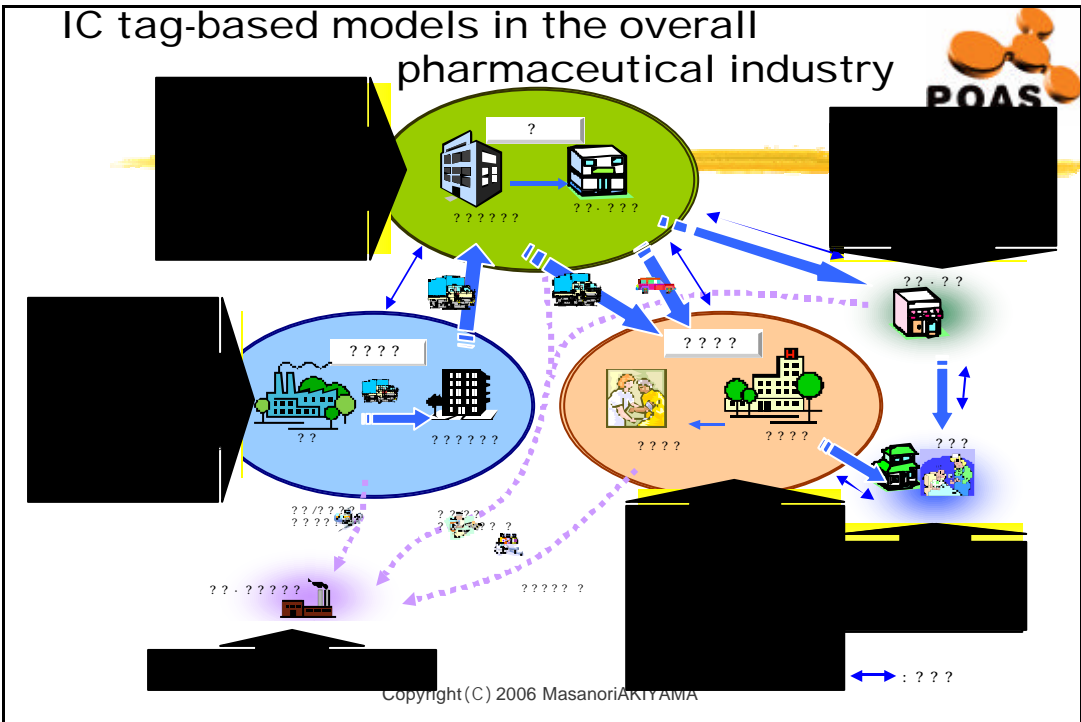
ユビキタス・サービス・プラットフォーム



For example, in the case of the clinical path screen, display data related to the path integrated from different systems.



IC tag-based models in the overall pharmaceutical industry







*** 普下し指示リスト ***

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メーカー名 商品コード	商品名/容量	ロット	使用期限	種別数	PL積付け数
アイコメテ 4804002	アイコメテ 10% 200Lx200	SCA		1	32
アイコメテ 4804002	アイコメテ 10% 600Lx100	SCA		40	24
アイコメテ 4804002	アイコメテ 10% 600Lx100	SCD		10	32
アイコメテ 4804002	アイコメテ 10% 200Lx100	SCD	2005/10	1	20
アイコメテ 4804002	アイコメテ 10% 200Lx100	SCD	2008/02	1	4
山本製薬 8704001	山本製薬 10% 200Lx100	20L	2008/03	2	60
山本製薬 8704001	山本製薬 10% 200Lx100	20L	2008/02	2	30
山本製薬 8704001	山本製薬 10% 200Lx100	20L	2007/11	13	32
山本製薬 8704001	山本製薬 10% 200Lx100	20L		3	64
山本製薬 8704001	山本製薬 10% 200Lx100	20L		1	24
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山本製薬 8704001	山本製薬 10% 200Lx100	20L		3	32

Verification of the use of electronic tags in medical applications



Research leader Masanori Akiyama

Overview of the research

- Develop technologies that enable electronic tag-based traceability schemes for drugs and blood to improve medical safety.
- Measure the affects of electronic tags and readers on pharmaceuticals as well as the affects of radiation and sudden temperature changes on electronic tags, and gather information. Conduct verifications on the traceability of drugs and blood products using electronic tags.
- Verification of security, privacy management and the management of patient condition, status and drug administration records, and traceability.

Ministry of Education, Culture, Sports, Science and Technology
"Effective and efficient promotion of the group of measures for science and technology coordination" ubiquitous networking group

Research organizations



- **Tokyo Medical University**
Overall design of the research and directions. Responsible for blood traceability experiments.
- **Tokyo Medical and Dental University**
Responsible for drug traceability experiments.
- **Kanto Medical Center NTT EC**
Provides the field for drug traceability experiments.
- **Hitachi Ltd.**
Assists drug traceability experiments. Provides MUChip technology.
- **CSK**
Assists blood traceability experiments.
- **Other executive committee members**
Provide experiment fields. Give advice from the standpoint of their respective specialties. Participate in discussions on research strategies.

First generation (medical affairs and specimen exams)

Second generation (ordering)

Third generation (paperless electronic medical charts)

Fourth generation ubiquitous medical information systems

The evolution of hospital information systems



Ward, emergency, operating room and ICU

Space of implementation

Medical affairs section / Exam section

Material flow

Ensure safety in divisions that pose the greatest risk of danger.

Information space

Slips, instruction books and medical charts

Slips and reports

Medical slips

A material flow-based system is crucial

Emergency support (vocal implementation)

Various divisions

Outpatient and nurse station

Coordination between facilities

Thank you for your attention.
Any Questions?

E-mail: poas@mit.edu

Think !
What kind of system do you want,
if your son or daughter were
patients?