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Patient-Safety Improving Medication Information System for Care Workers in Taiwan

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Abstract

In Taiwan, 23% of medical errors come from medication error, however, pharmacists are barely possible to prevent or correct these errors at present. To reduce them, we constructed a computerized drug deliver cart with a drug information system plus drug image and a Web-based intravenous drug incompatibility system to assist first-line care workers practicing medication monitoring such as adverse drug reactions (ADR), educating patients correct medication usage, and reducing medication errors which are preventable. Both of these two systems are passive systems, and we think that maybe we could increase the frequency of using these systems by fixing them become more active, increases the rate of systems usage, and raise the pharmaco-vigilance of care worker in Taiwan.

Keywords:

drug information system, drug image, intravenous drug incompatibility system, care workers, adverse drug reactions, medication monitoring, pharmaco-vigilance

Introduction

Medication error is one important kind of medical errors. In America, at least 4,000 patients died due to medication errors every year, furthermore, 42% of medication errors were caused from anthropogenic source. Same as America, a study made in Japan shows that 16% of care workers had ever administrated drug to wrong patients, as a result, many computerized assistive system are provided, but few of medication administrating.

In Taiwan, especially for hospitalized patients, administrating and monitoring of medication are often executed by nurses. Care workers use paper-based drug administration records and IV solution administration records to insure if medications fit to physician's order sheets or not, which is a complicated but an important job. And the truth is, the currency of medication errors for inpatients is approaching 2%, which is very serious. To reduce this kind of error, we designed a computerized drug deliver cart combined with drug information system which could help checking these looks of drug, and let it be much easier for nurses to identify if adverse drug events occurred.

Another important issue for care workers in Taiwan is language problem, lots of medical and drug information were written in English, whereas information written in traditional Chinese form will be much easier for nurses to comprehend, therefore, to build a traditional Chinese-based drug information system seems to be a requisite.

Last but not the least, intravenous drug incompatibility is an important drug information for care workers in medication administrating, especially when dispensing intravenous mixture, therefore , we constructed an intravenous drug incompatibility system which would provide nurses an easy way to check when mixing different intravenous medicines, it could also reduce the working load of pharmacists.

Materials and methods

In our study, we designed three assisting systems to reach our goal to reduce medication errors caused by care workers, figure 1 shows these three structures of our system.

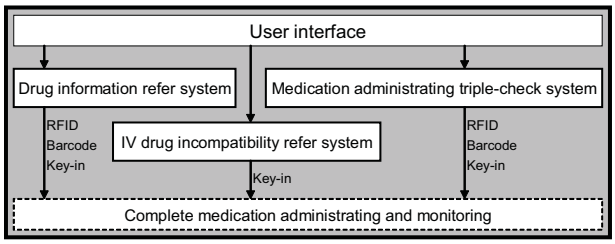

Figure 1 - Flowchart of computerized drug deliver cart

The first part is a drug deliver assisting system with RFID and bar-code devices which could help care workers practicing such as three-read five-right checks. The second part is to construct a drug information system with drug image for care workers. To build an easy-to-use drug information system for care workers in Taiwan, drug information have to be written in Chinese form, drug images is also added, moreover, we use bar-code and RFID query interface. Automatic update process is a necessity for our system, once a hospital changed their brand of a medicine, our system could respond immediately. Language translating is never an easy job, especially when it's in medical specialty, to find the way out, we cooperated with MIMS poc, MIMS poc have a complete drug information database

written in mandarin, it could also provide us accessible up-to-date drug information, and images of Taiwan's currently used medicines.

The last part is to construct an intravenous drug incompatibility system, in this system, we use key-in from touch panel instead of RFID or bar-code devices as input, care workers will choose two to three medicines' generic name by their fingers to check if intravenous incompatibility occurred, then the system will show four kinds of results to present if there is any problem adding them together.

Results

Figure 2 shows the prototype of our computerized drug deliver cart we'd constructed and the information display result of our drug information system with drug image. Ten kinds of drug related issues are chosen to provide care workers adequate drug information, they include brand name, generic name, usage, package, contraindication, precaution, side effects, drug interactions and drug image.

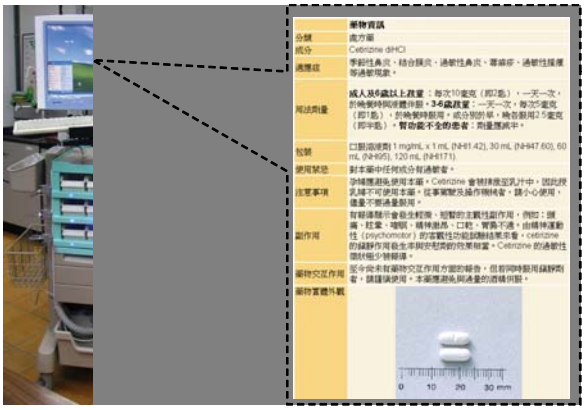

Figure 2 - The prototype of our computerized drug deliver cart and a Chinese translated drug information chart with drug image

Another function of our drug information system is MIMS poc SDK, combined with EMR information, four kinds of Alerts are provided, drug alert could find if any drug prescribed conflict with another, health alert also finds if any disease is contraindicated with those drug prescribed, allergy alert finds drug allergic problems, duplicate alert warns users when any medication is duplicate ordered. Figure 3 shows the drug decision support module.

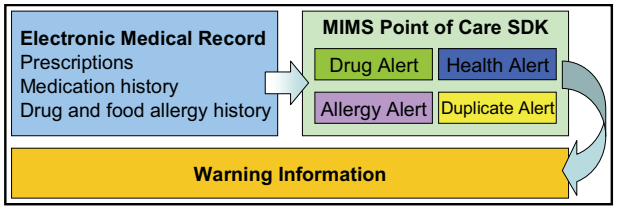

Figure 3 - The drug decision support module, based on patients' information in EMRs, this module could find preventable medication errors

The Web-based intravenous drug incompatibility system could also assist care workers dispensing intravenous mixture, they could simply find the answer by choosing drug's name through touch screen to check if incompatibility occurred. Since draw-down lists are not suitable when using on touch screen, we designed another kind of drug list to make it easier to choose form. Four kinds of answers would be displayed as the result, they are compatible, incompatible, variable results and no result. Nurses could then check the details of the result displayed which is written in traditional Chinese form. This system could also reduce the work burden of clinical pharmacists in Taiwan. Figure 4 shows the drug list we designed and the result of this system.

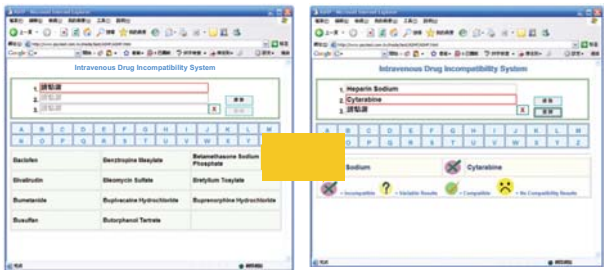

Figure 4 - The drug list of intravenous drug incompatibility system designed for touch panel (left side), larger items could make it much easier to choose by fingers, on the right side is the result displayed of the system, four different icons represent different results

Discussion

The main purpose of our study is to promote patient safety by reducing medication errors caused from care workers, however, nurses in Taiwan seems too busy that the rate of using of our system were lower than our expectation. A key question is that shall we make our system acts from passive to active? Will this

action raise the rate of using, help reducing medication errors or actually nurses would be even bothered? In the other sub-project, they used active way instead of passive one's, somehow nurses think it's too clumsy. To find the threshold that would both reduce medication errors and

with good usability would be an interesting part that we might study in the future.

Another issue is some of workers in the field of medical informatics seem lack of clinical experiences, in this situation the program designed might have low usability, to avoid trapping in the plight, maybe we have to spend more time communicating and observing. The most efficient way is to stay in a unit where we're going to cooperate for a period of time. After increasing the real experience, the design should be far more functional.

Conclusion

Care workers in Taiwan are medication administrators who play important roles in adverse drug reaction (ADR) reports. The adequate and easy-to-get drug information provided to nurses could raise their pharmaco-vigilance. Further more, it improves patient safety. Intravenous drug incompatibility system would also provide nurses an easy way to check when dispensing intravenous drug mixture, and reduce avoidable errors. Both of our programs exists as passive systems, we wonder that if they change to be more active, would the using rate raises or falls. It seems that we need to know clearly from their work and with our own experience, the design of assisting systems would be more acceptable.

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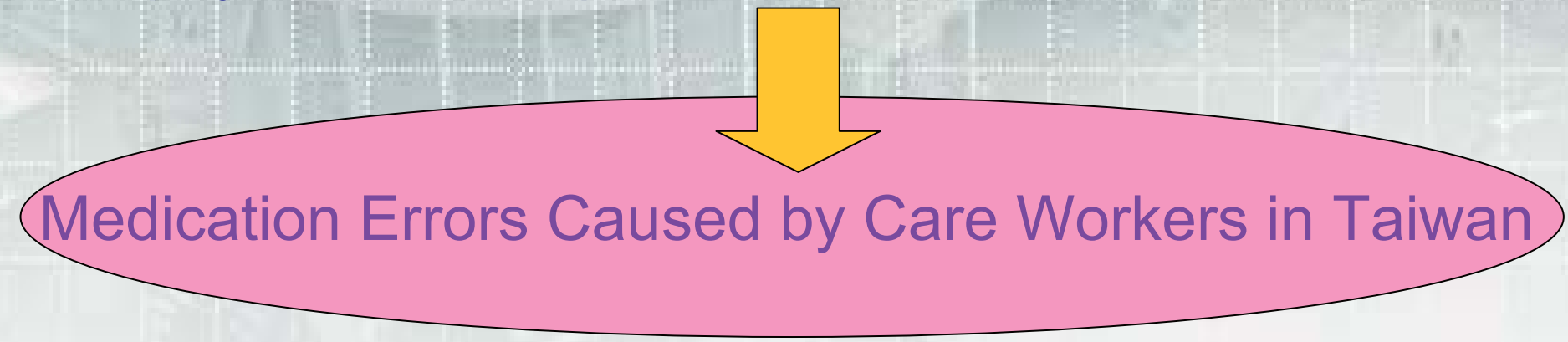
Introduction

- Medication errors
  - Most important kind of medical errors [1]
  - Killed 4’000 patients per year [2]
  - 42% of medication errors → anthropogenic source (USA) [3]
  - 16% nurses had given wrong drug to wrong patients (Japan)
- CPOE → Medication errors caused by physicians and pharmacists



Introduction (cont.)

- To reduce medication errors caused by care workers in Taiwan:

1. A computerized Drug Deliver Cart
   - ✓ With Bar Code & RFID devices
2. Drug Information System including Drug Image
   - ✓ Help nurses checking such as adverse drug events, educating patients right usage, etc.
3. Intravenous Drug Incompatibility System
   - ✓ To check if it's proper to mix different intravenous medicines

Language Problem

- Nurses in Taiwan:

English Information:
Have difficulty to read and comprehend

Chinese Information:
Easier and more friendly to use

Use Graph instead of script
Ex. Drug image

Language Translation:
Cooperate with MIMS poc
(Up-to-date Drug Information)

CMP
United Business Media

Result - Drug Deliver Cart with RFID and Barcode Devices

Touch Screen:
Instead of keyboard to increase usability

RFID & Bar Code devices:
Help nurses identifying patients and medications

Drug Drawers:
With patients' medication dispensed by pharmacists

Trash Can

Results – Drug Information System

Brand name &generic name:
Basic Drug information

Indications:
To show if the drug fits to the patient's diagnose

Usage:
To show if there is any special using way of this medicine.

Package:
To show the package and form of the drug.

Contraindication:
To show some diseases or other special conditions that are contraindicated to the drug

Precaution:
To show that some patients with these special conditions should be closely monitored or consider withdraw this drug

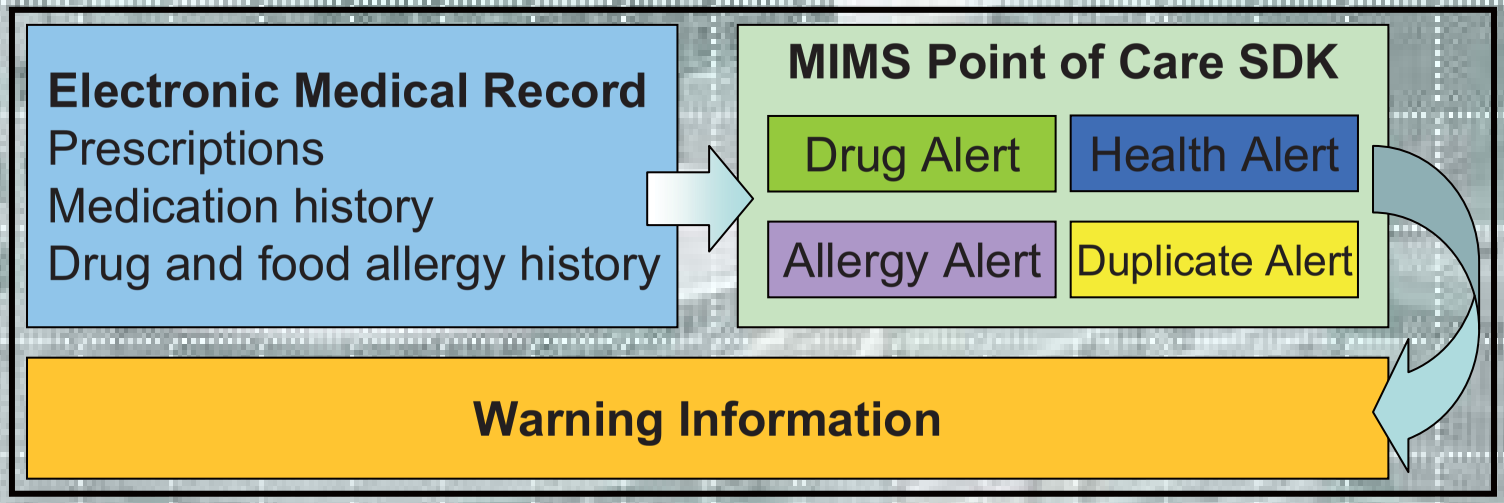
Side effects:
To show some side effects that patient would complained, nurses would note them and inform pharmacists and doctors

Drug interactions:
To show which drugs are forbidden to use with this medicine.

	藥物資訊
分類	處方藥
成分	Cetirizine diHCl
適應症	季節性鼻炎、結合膜炎、過敏性鼻炎、蕁麻疹、過敏性搔癢等過敏現象。
用法劑量	**成人及6歲以上孩童**：每次10毫克（即2匙），一天一次，於晚餐時與液體伴服。**3-6歲孩童**：一天一次，每次5毫克（即1匙），於晚餐時服用。或分別於早，晚各服用2.5毫克（即半匙）。**腎功能不全的患者**：劑量應減半。
包裝	口服溶液劑 1 mg/mL x 1 mL (NHI1.42), 30 mL (NHI47.60), 60 mL (NHI95), 120 mL (NHI171).
使用禁忌	對本藥中任何成分有過敏者。
注意事項	孕婦應避免使用本藥。Cetirizine 會被排泄至乳汁中，因此授乳婦不可使用本藥。從事駕駛及操作機械者，請小心使用，儘量不要過量服用。
副作用	有報導顯示會發生輕微、短暫的主觀性副作用，例如：頭痛、眩暈、嗜眠、精神激昂、口乾、胃腸不適。由精神運動性（psychomotor）的客觀性功能試驗結果來看，cetirizine 的鎮靜作用發生率與安慰劑的效果相當。Cetirizine 的過敏性徵狀極少被報導。
藥物交互作用	至今尚未有藥物交互作用方面的報告，但若同時服用鎮靜劑者，請謹慎使用。本藥應避免與過量的酒精併服。
藥物實體外觀	

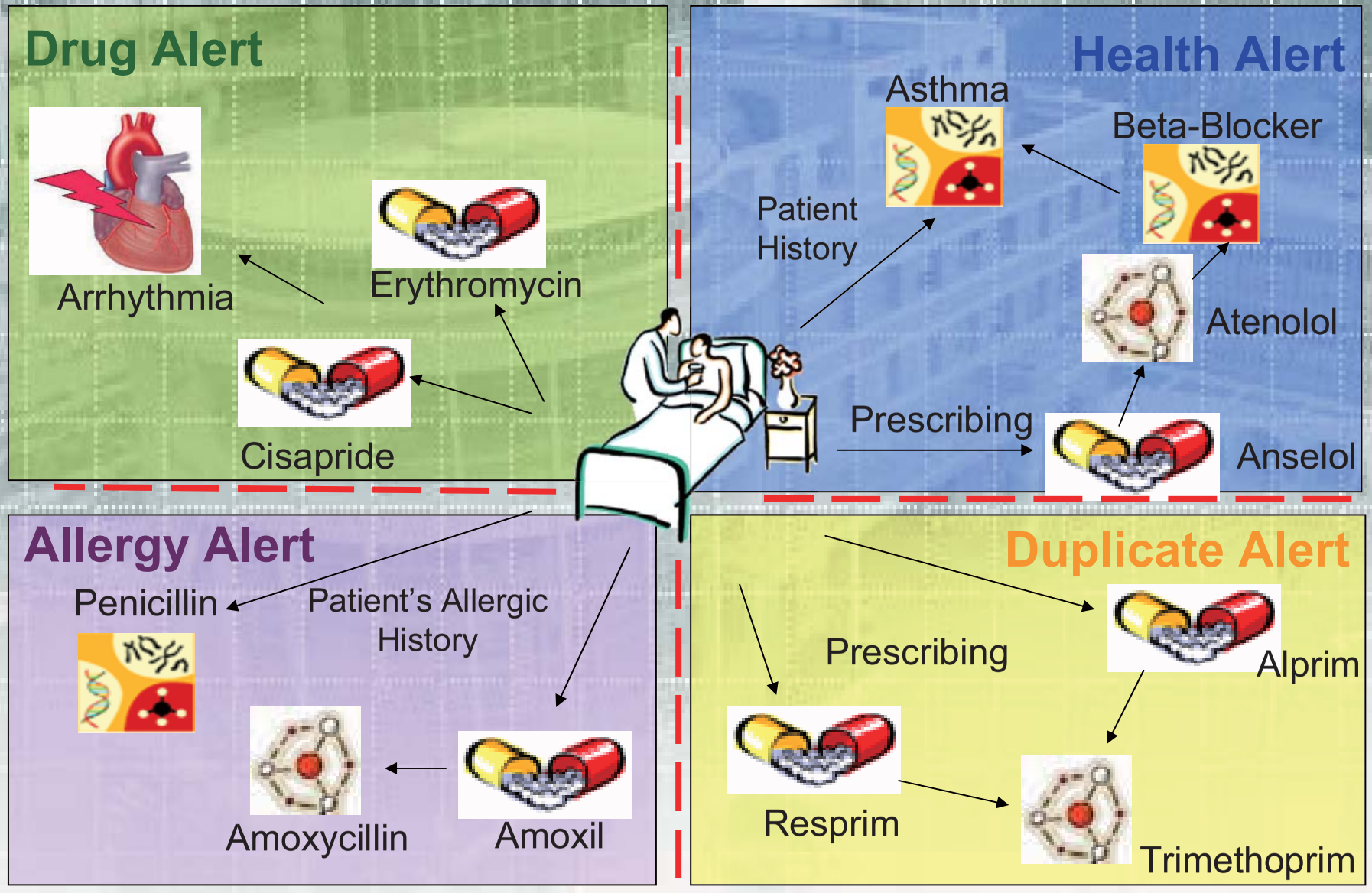
Drug Image:
Help recognizing the appearance of medicines

Drug Decision Support Module

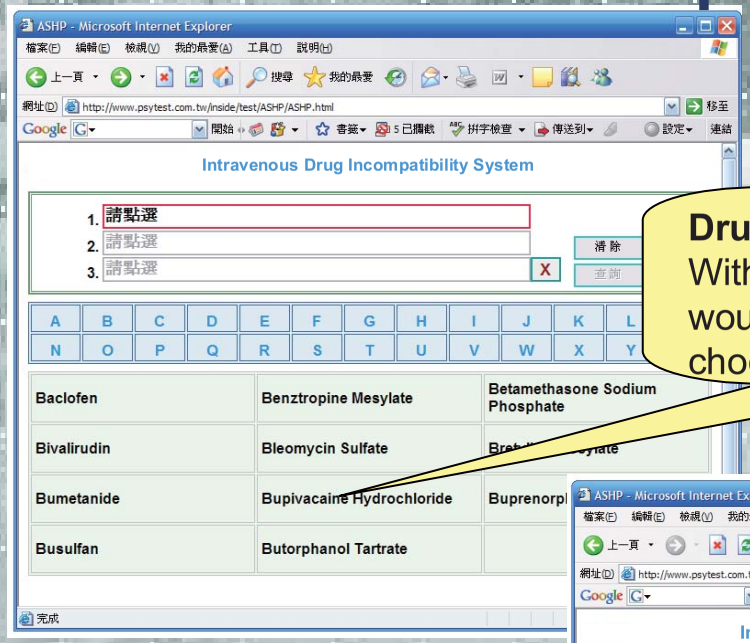


- ✓Drug Alert:
  - ✓ To find if any drug prescribed conflict with another
- ✓Health Alert:
  - ✓ To find if any disease is contraindicated with those drug prescribed
- ✓Allergy Alert:
  - ✓ To find drug allergic problems
- ✓Duplicate Alert:
  - ✓ Warn users when any medication is duplicate ordered

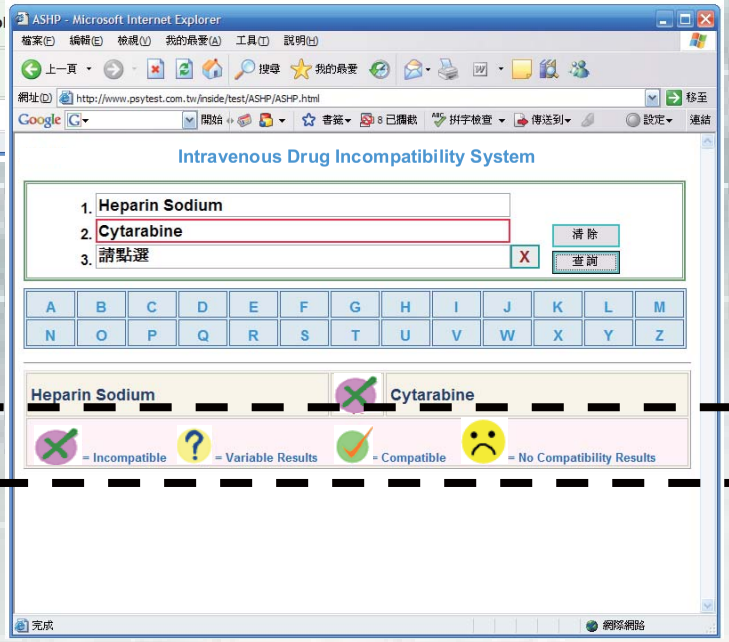
Drug Decision Support Module



Results - Intravenous Drug Incompatibility System



Drug list designed for touch panel: Without draw-down drug lists, it would be much easier for nurses to choose drug from touch panel.



Incompatible: Two drugs could not added together

Compatible: Two drugs could added together

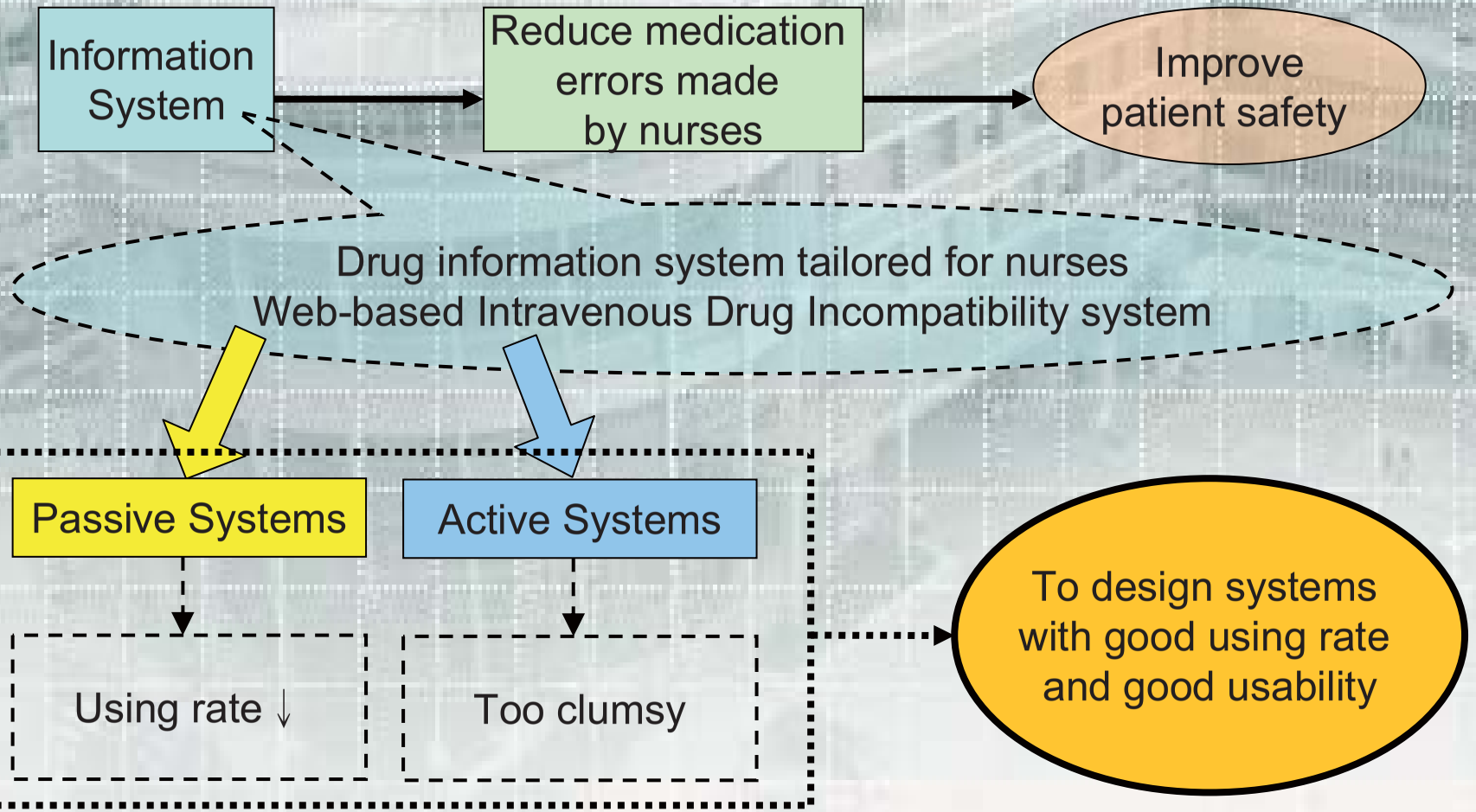
Variable results: Consult pharmacists to insure.

No results: No data available

Four kinds of results would show

Discussion

- The main purpose:



Conclusion

- Care workers in Taiwan
  - Medication administrators who play important roles in adverse drug reaction (ADR) reports where physicians and pharmacists would hardly to.
- Two of our systems:
  - The adequate and easy-to-get drug information system
    - ↑ Pharmaco-vigilance [11]
    - ↑ Patient safety
  - Intravenous drug incompatibility system
    - An easy way to check when dispensing intravenous drug mixture, and reduce avoidable errors
- Both of our systems exist as passive systems
  - Change to be more active, would the using rate raises or falls?
  - To know clearly from their work, and with our own experiences, then the design of assisting systems would be more acceptable.

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