PENGEMBANGAN SISTEM INFORMASI UNTUK MENGURANGI POTENSI MEDICATION ERROR

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Alaris PC

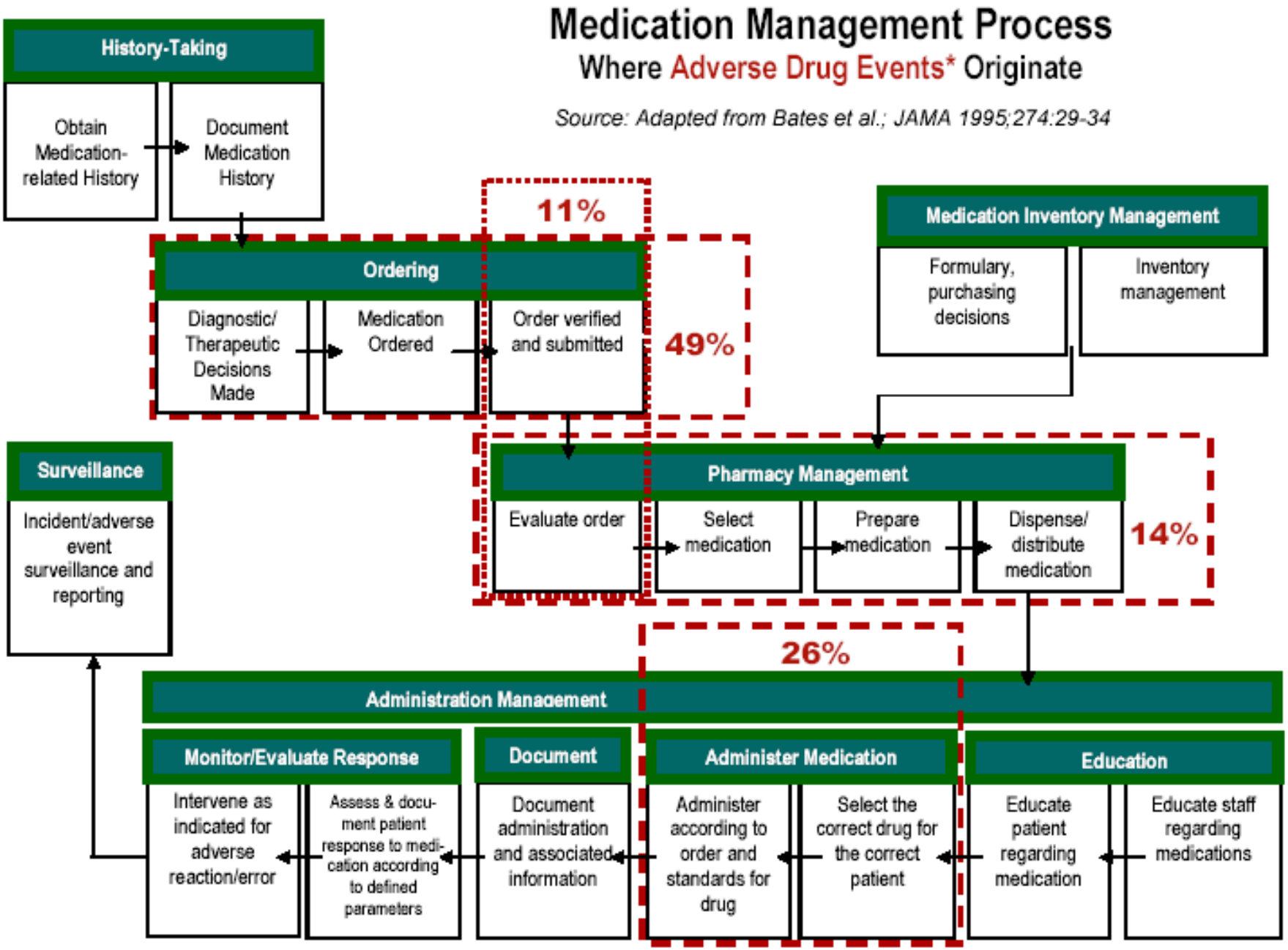
medication error

Near miss

Outcome:

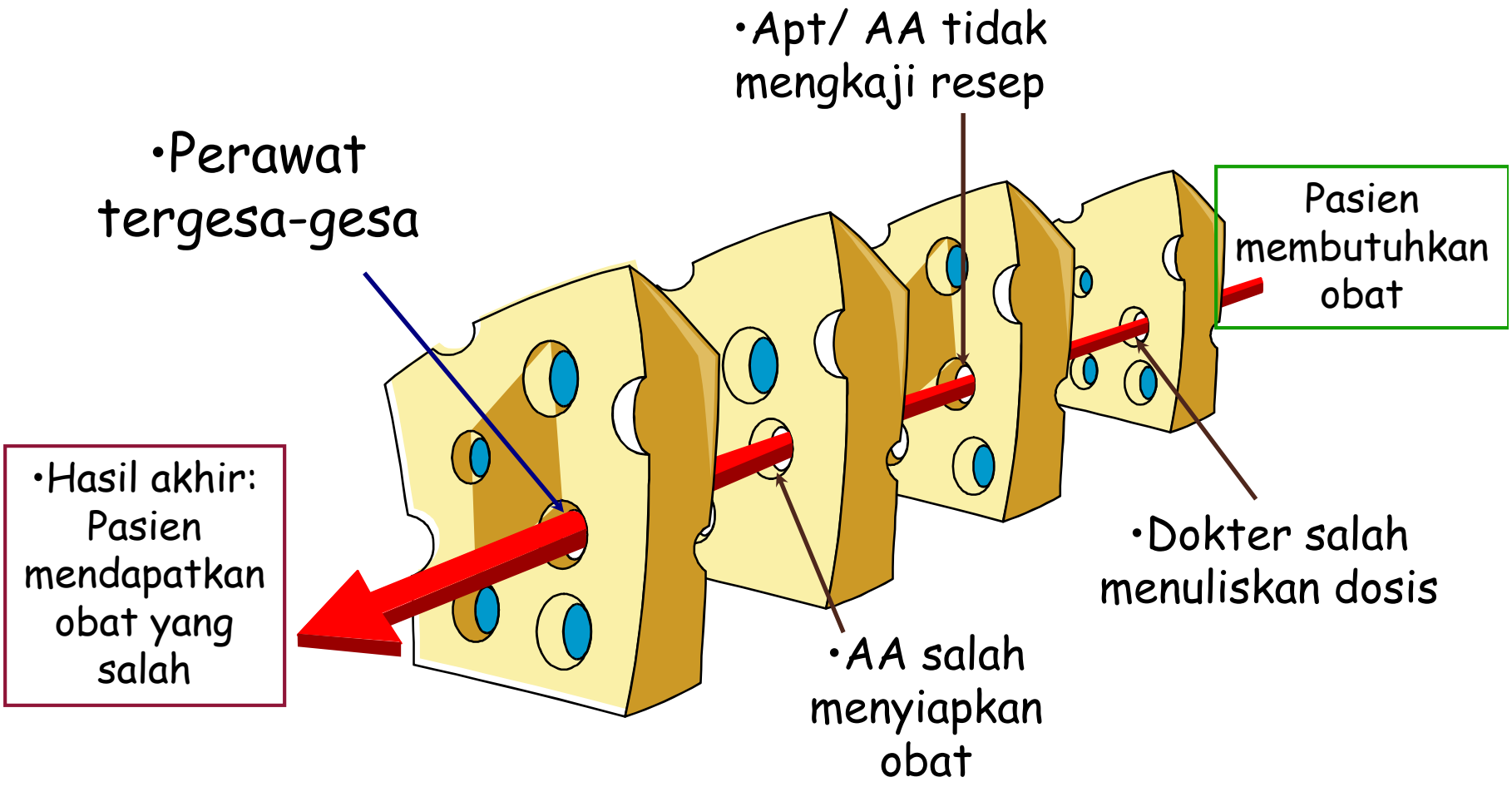
- Harm
- No harm

- Multidisipliner
- Multifaktorial



As Published in *Computerized Physician Order Entry: Costs, Benefits and Challenges*, Feb 2003, AHA

“Swiss Cheese” Model of System Error: Example



•*Adapted from Loyola University Health System Presentation* Safety Science: Human Error, *Quality and Patient Safety Committee, 2007*

Kategori Medication Error

- **Administrative error** :

  Kesalahan dalam proses penulisan instruksi secara administratif, misalnya: resep tidak lengkap, tulisan tidak terbaca, duplikasi instruksi, salah tulis, singkatan tidak standar

- **Clinical error** :

  Kesalahan dalam pengambilan keputusan klinis, misalnya: salah menetapkan dosis yang dibutuhkan pasien, ada interaksi obat, kontraindikasi

Prescribing error

- Obat tidak tepat
- Nama obat membingungkan
- Dosis tidak tepat
- Kekuatan obat tidak tepat
- Rute pemberian tidak tepat
- Jumlah obat tidak tepat
- Ada kontraindikasi
- Tulisan tidak dapat dibaca
- Penulisan angka, satuan tidak jelas
- Menggunakan istilah dan singkatan yang tidak lazim
- Instruksi verbal tidak jelas

Dispensing error (1)

1. Salah membaca instruksi pengobatan / resep

- Tulisan dokter tidak dapat dibaca
- Nama obat mirip

  Contoh : Losec dibaca Lasix
- Penulisan permintaan obat yang tidak dimengerti

  Contoh : Captopril 1/2 tablet 25 mg

  Apakah yang diminta Captopril 12,5 mg

  atau 25 mg ?
- Singkatan yg tidak dimengerti

  Contoh : AZT ----> Azidovudin atau Azathioprin

Dispensing error (2)

2. Salah menghitung dosis:

- salah membaca permintaan tertulisnya
- salah mendengar permintaan lisan
- tidak memeriksa kesesuaian dosis

Dispensing error (3)

3. Salah dalam penyimpanan:

- susunan penyimpanan membingungkan
- menyimpan obat yang sudah kadaluarsa
- menyimpan obat tanpa identitas jelas
- Menyimpan obat LASA berdekatan

Dispensing error (4)

4. salah mengambil obat dan meracik obat

- tidak teliti membaca etiket / label obat
- mengambil obat dari banyak wadah sekaligus
- menyiapkan lebih dari satu sediaan sekaligus
- teknik peracikan tidak benar
- menyiapkan dan meracik obat di tempat yang banyak gangguan (interupsi, cahaya kurang, bising, terlalu panas/dingin)

Dispensing error (5)

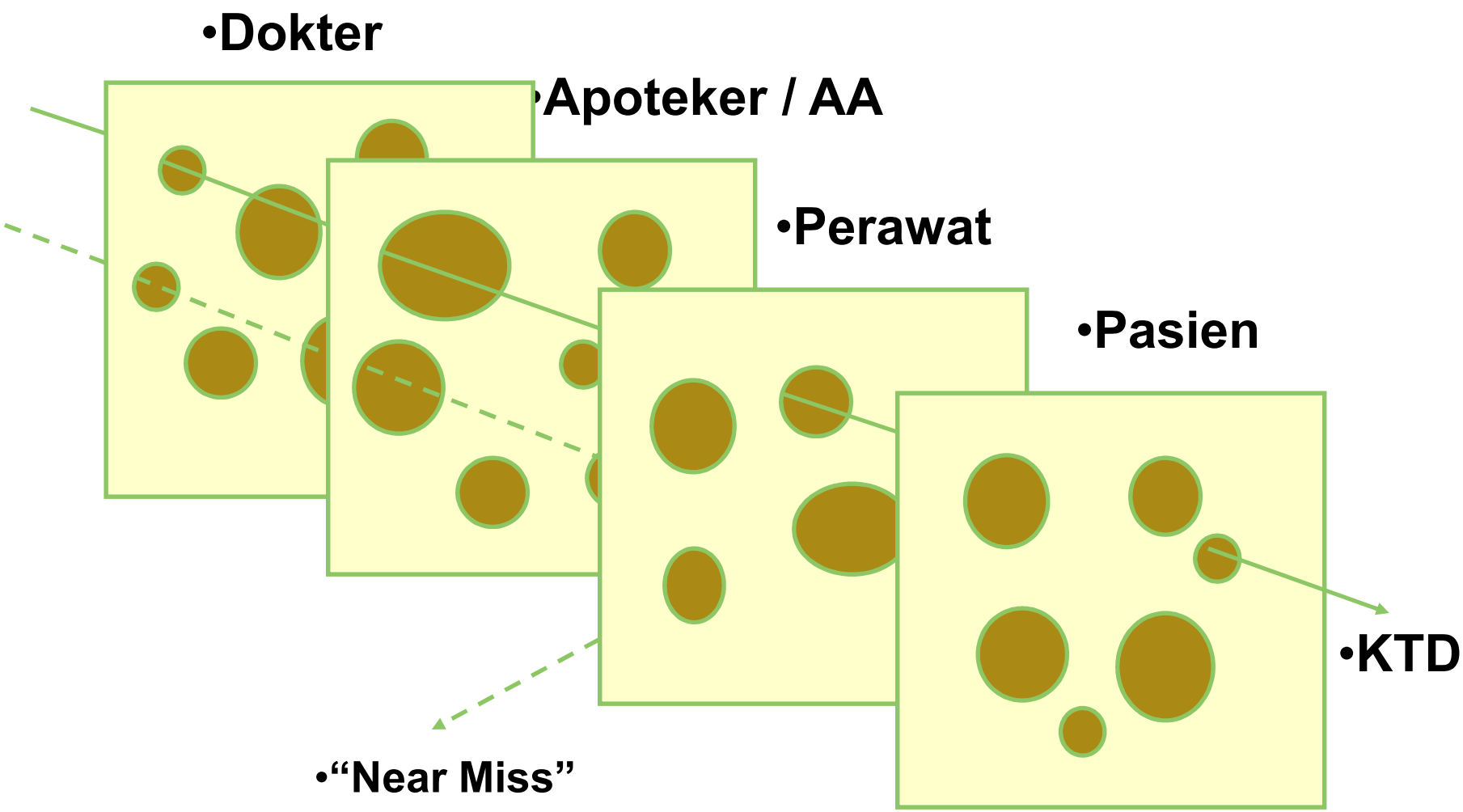
5. Salah memberi label / etiket:

- tidak memberi etiket dengan perintah / aturan pakai yang memadai
- memberi label yang tidak benar

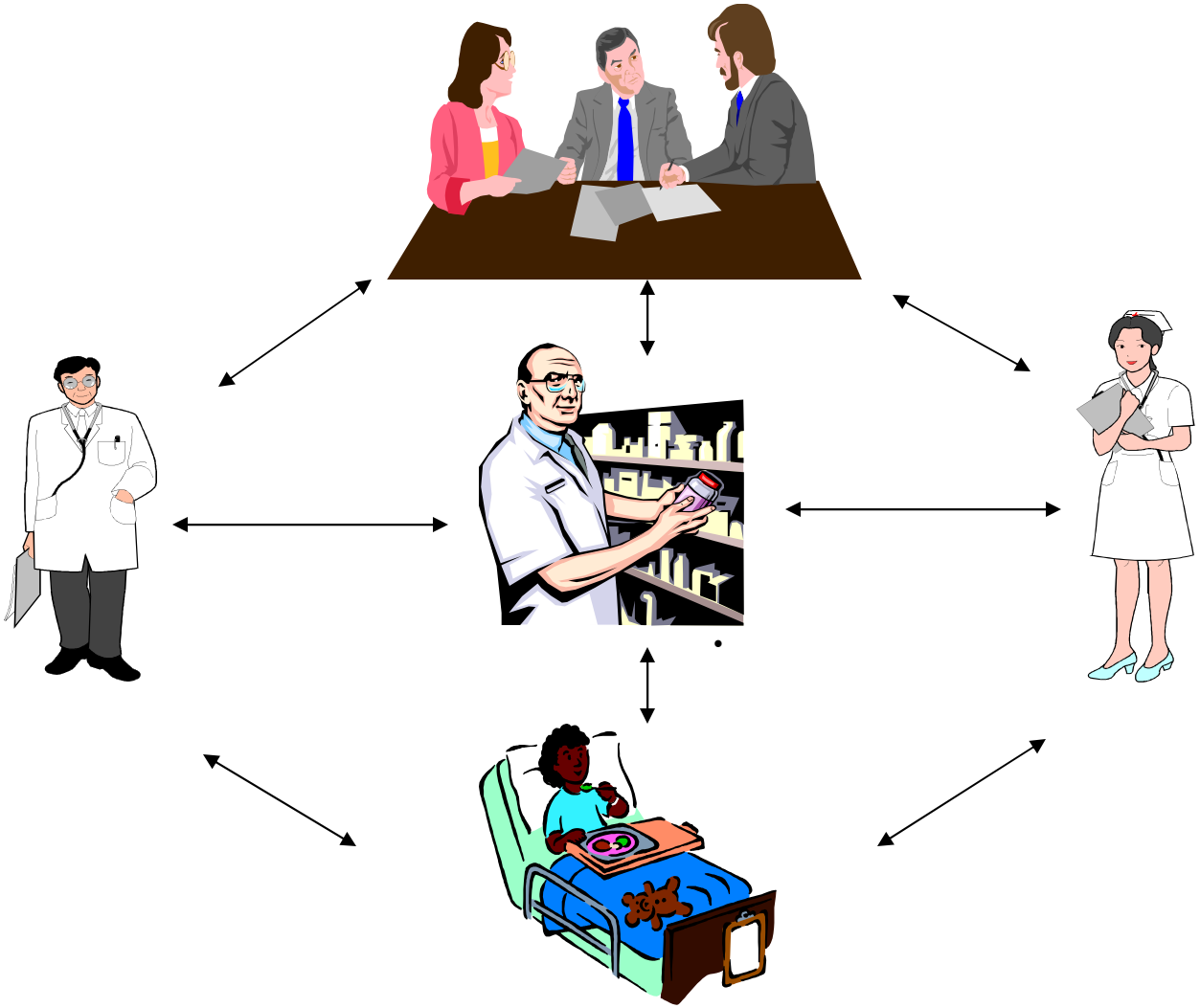
Administration error

1. Waktu pemberian tidak tepat
2. Terlewatnya dosis obat
3. Dosis tidak tepat
4. Memberikan obat yang seharusnya tidak diberikan
5. Obat tertukar
6. Cara pemberian yang tidak benar (rute, kecepatan)

•Lapisan Penghalang



Medication error
=
Organisational / System error

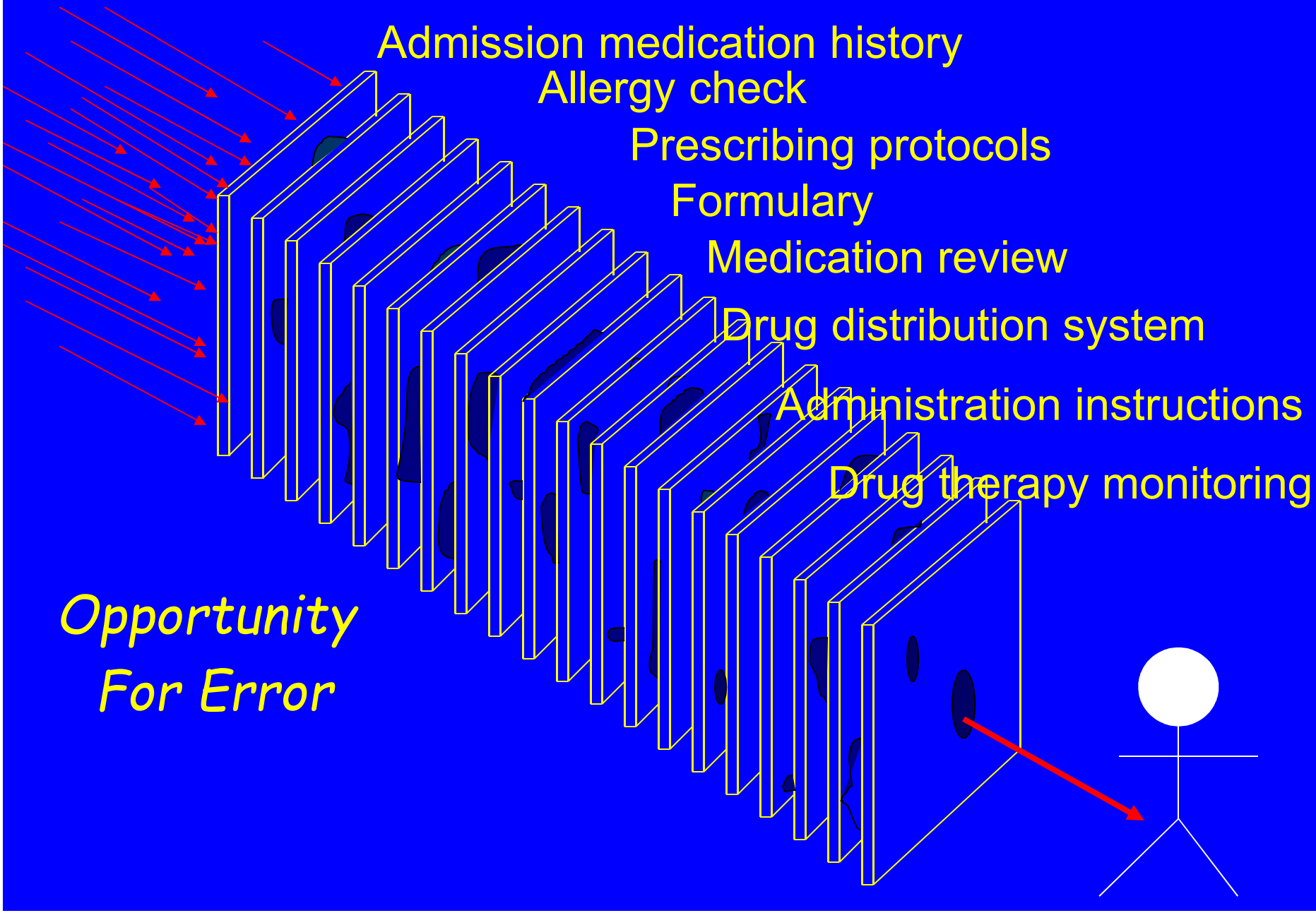


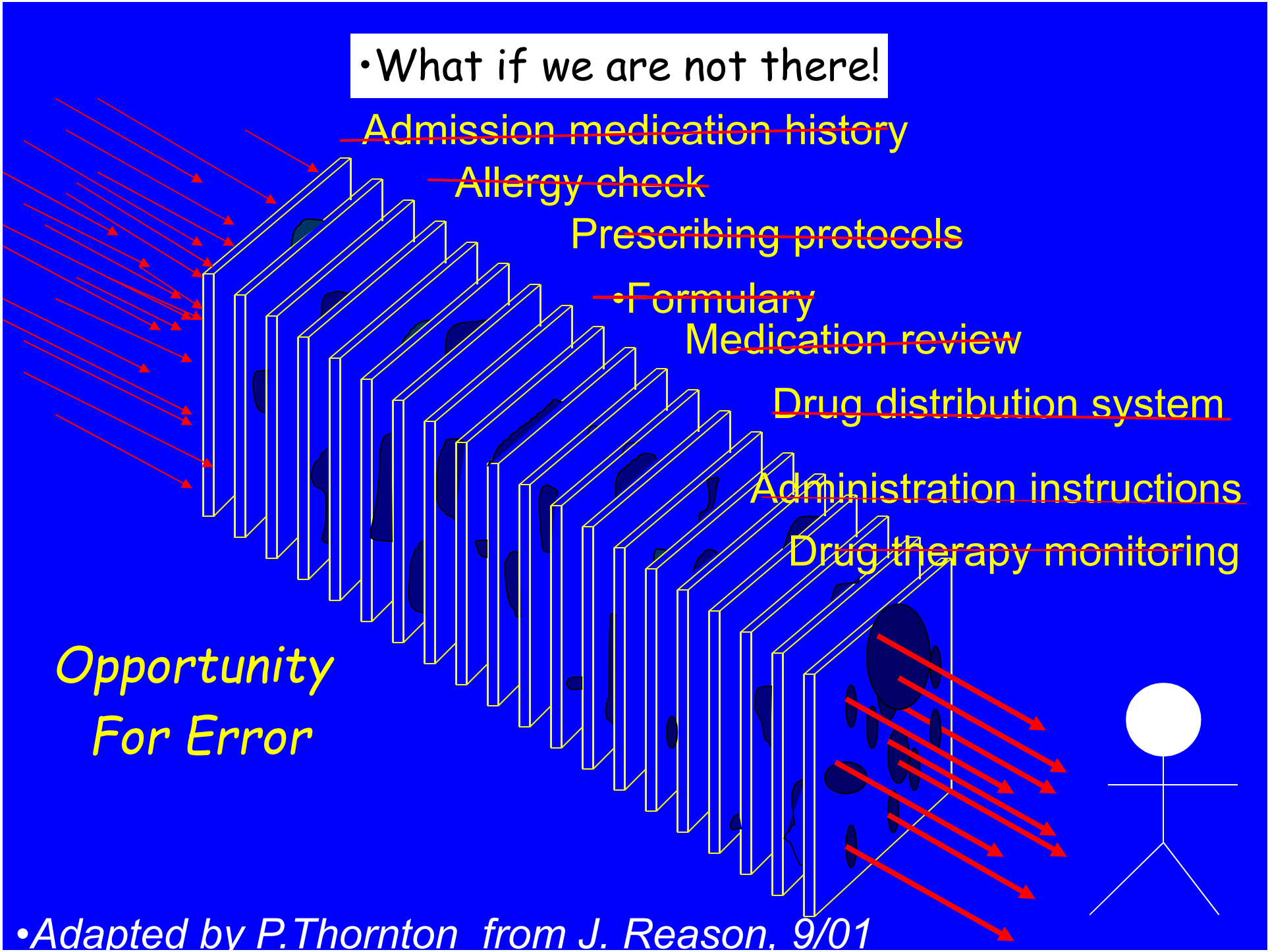
Error-Reduction Strategy	Power (leverage)
Fail-safes and constraints	High
Forcing functions	↑
Automation and computerization	
Standardization	
Redundancies	
Reminders and checklists	
Rules and policies	
Education and information	
Suggestions to be more careful or vigilant	Low

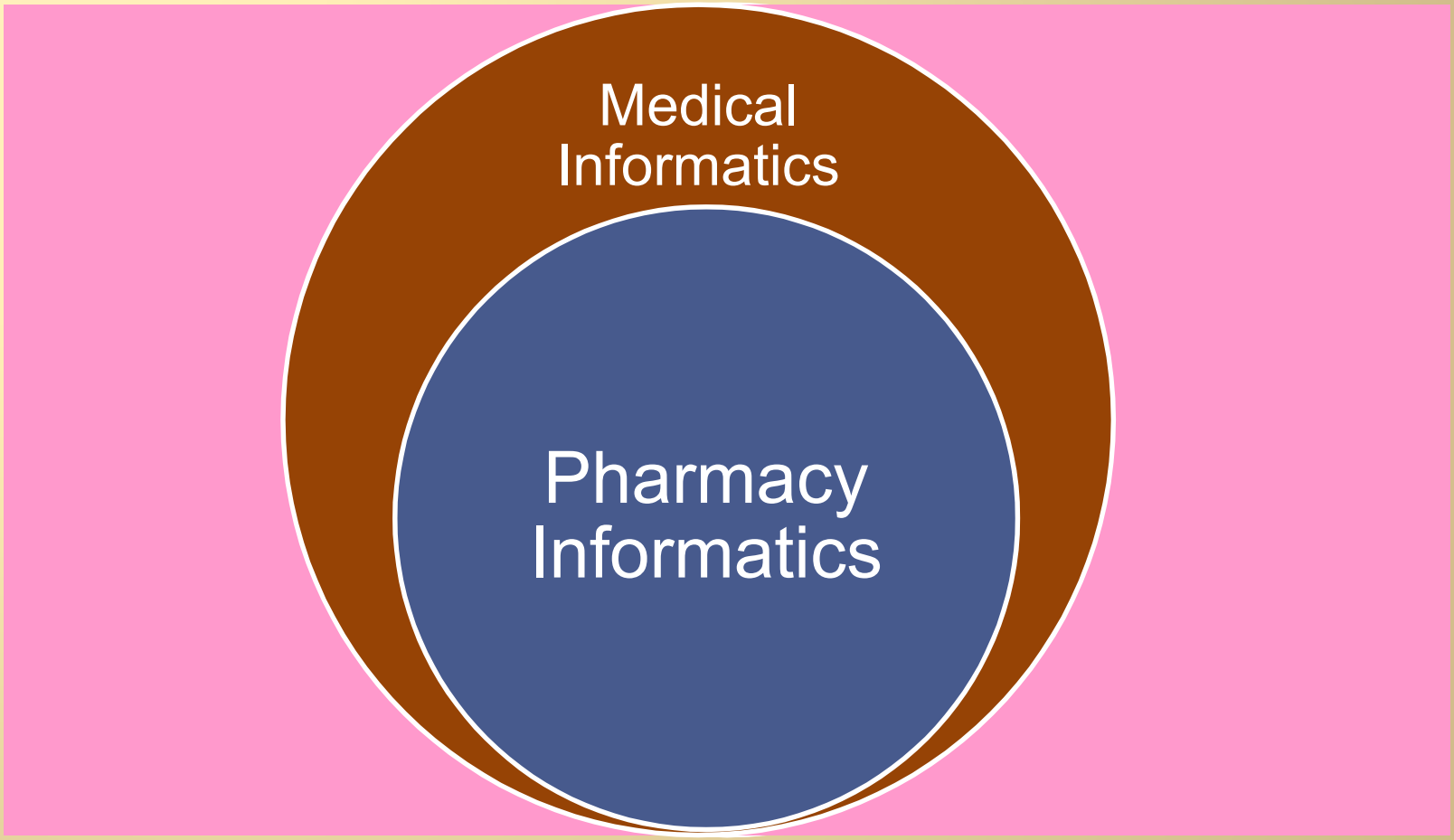
Table 1. Rank order of error-reduction strategies

Sumber: Institute for Safe Medication Practice

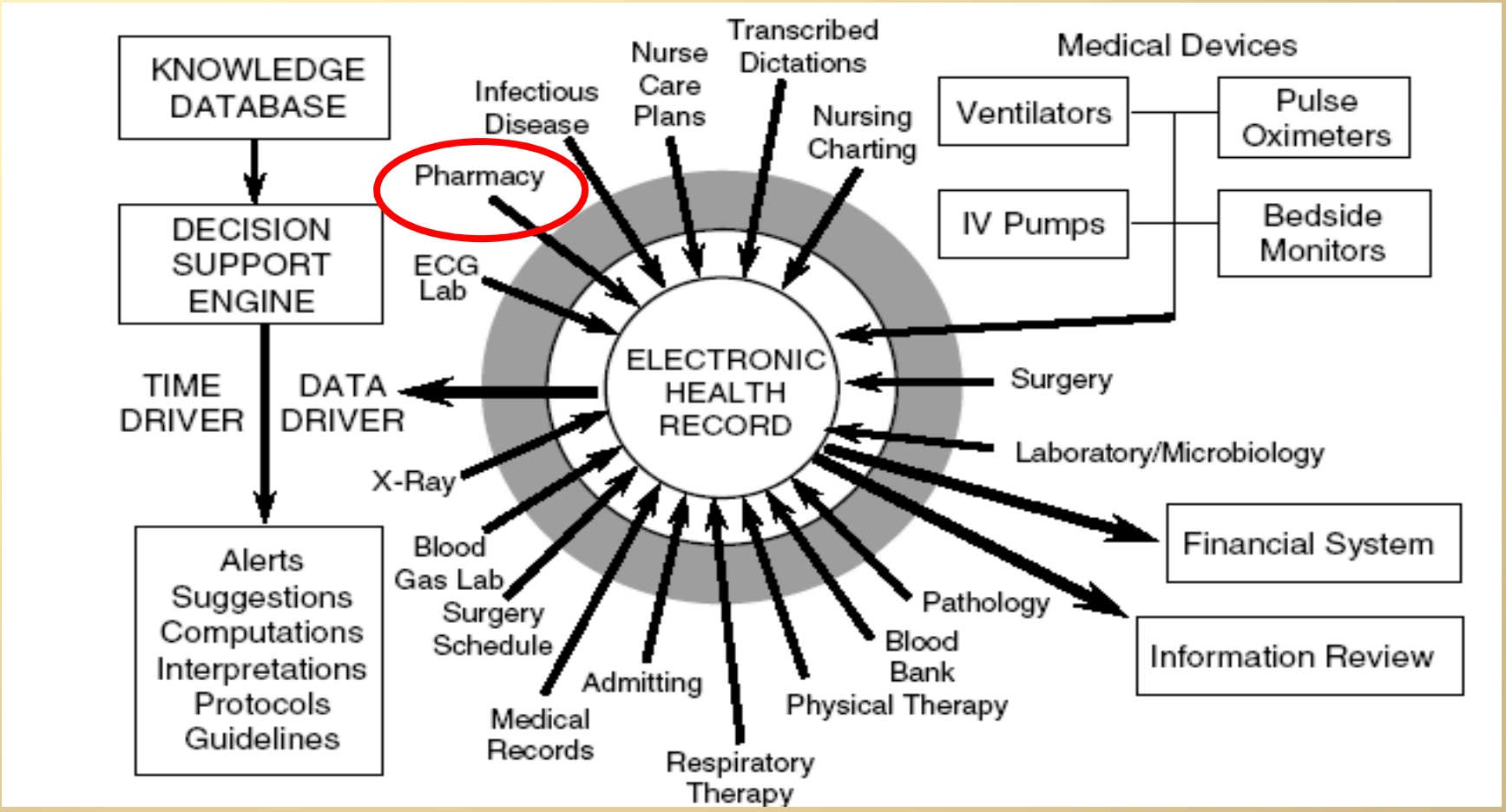
Peran Farmasi RS meminimalkan risiko




•What if we are not there!
Admission medication history
Allergy check
Prescribing protocols
•Formulary
Medication review
Drug distribution system
Administration instructions
Drug therapy monitoring
Opportunity
For Error
•Adapted by P.Thornton from J. Reason, 9/01


Medical
Informatics
Pharmacy
Informatics

ELECTRONIC HEALTH RECORD (EHR)

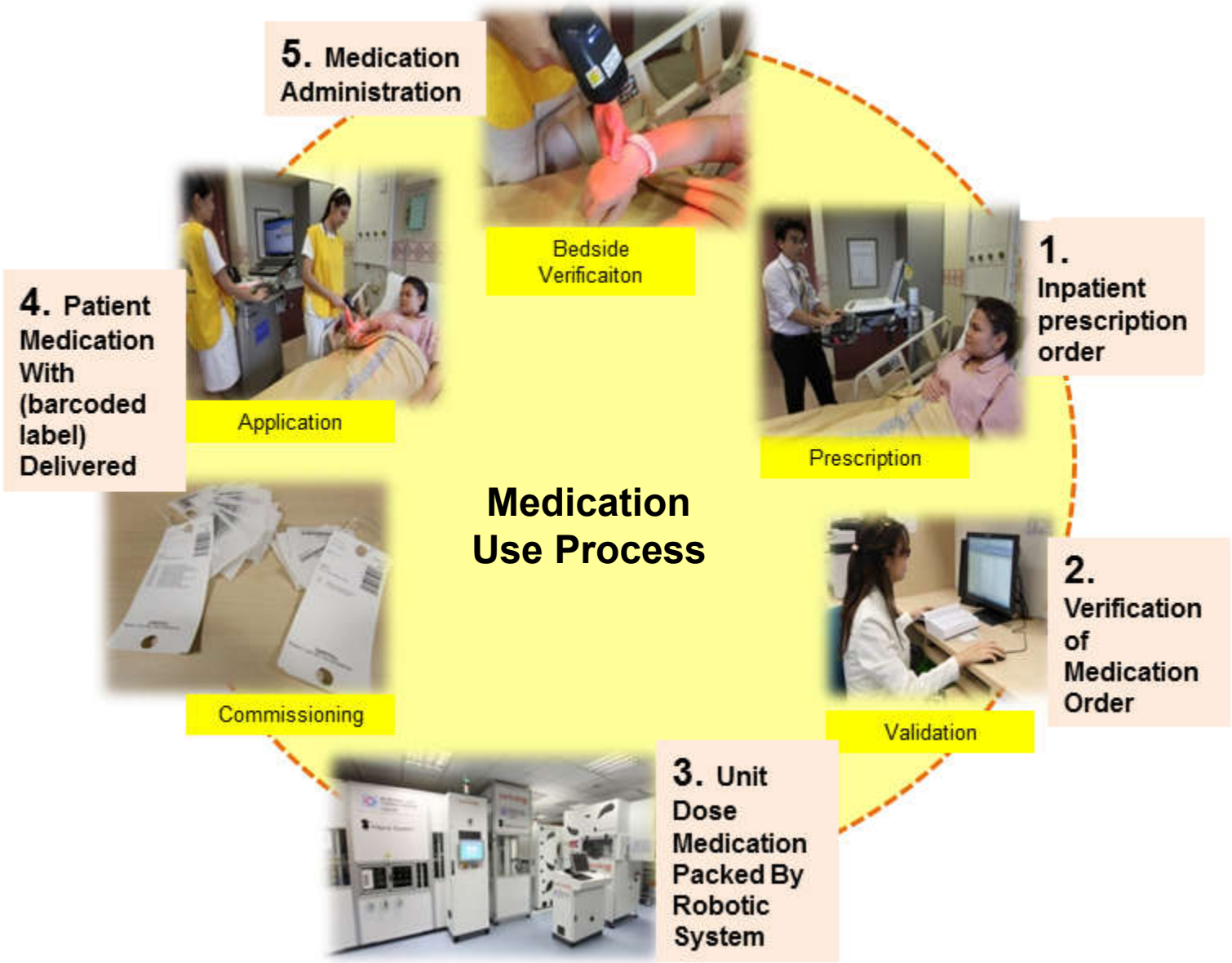


Peran TI Dalam Pelayanan Farmasi

- Menyediakan informasi yang cepat dan akurat
- Meningkatkan kolaborasi antar tenaga kesehatan
- Mengurangi *human error* (administratif, klinik) pada titik-titik pelayanan
- Memperbaiki automatisasi alur kerja
- Pemberian obat “5R” (tepat: pasien, obat, dosis, rute, waktu)

Pemanfaatan TI dalam Pelayanan Farmasi

- Electronic prescribing /CPOE (Computerized Physician/Provider Order Entry)
- Pharmacy Information System (PIS)
- CDDS (Clinical Decision Support System) : Alert system, guidelines
- Automated Dispensing Cabinet (terintegrasi dengan PIS)
- Robotic I.V. Admixture
- Electronic Medication Administration (EMR)

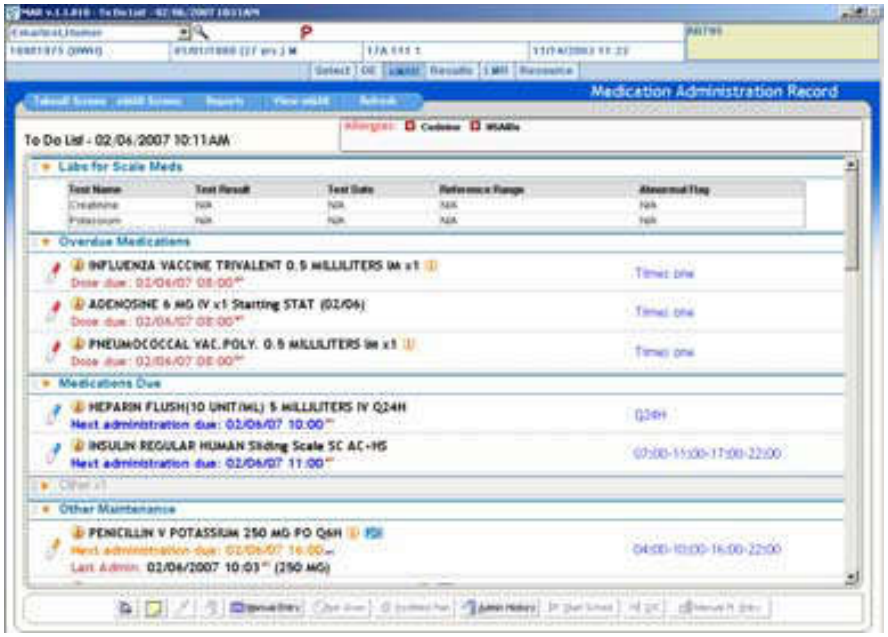

Medication Use Process
1. Inpatient prescription order
Prescription
2. Verification of Medication Order
Validation
3. Unit Dose Medication Packed By Robotic System
Commissioning
4. Patient Medication With (barcoded label) Delivered
Application
5. Medication Administration
Bedside Verificaiton

Pharmacy Information System / PIS

Bar-Code Labeling

By indoctrinating the idea that bar code scanning provides a high level of safety and protection for both patients and staff, our nurses bought in and are willing to follow the steps accordingly.

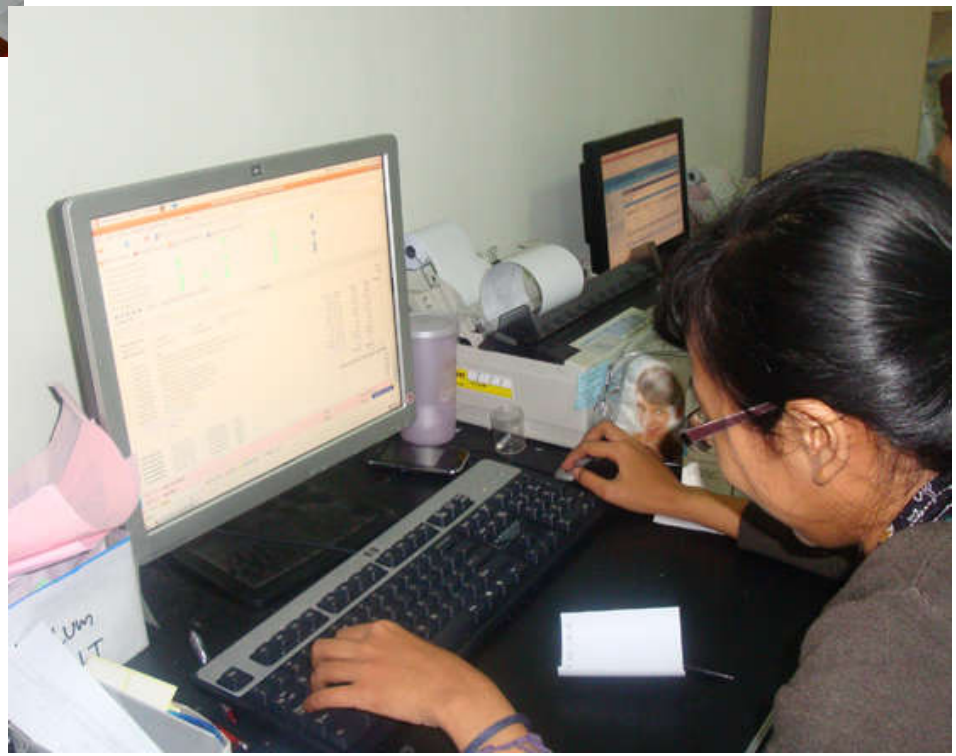
Electronic Medication Administration Record



CPOE

Komitmen multidisipliner :

- Pimpinan organisasi
- Dept/Unit Kerja
- IT Support
- Staf Medis
- Farmasi
- Perawat



Manfaat CPOE

- Menghilangkan masalah tulisan tidak dapat dibaca
- Meminimalkan kesalahan transkripsi
- Mempercepat pelayanan
- Meningkatkan akurasi dan kelengkapan resep
- Meningkatkan koordinasi antara dokter, apoteker/asisten apoteker, perawat
- Mencegah kesalahan dalam pengambilan keputusan klinis dengan “alert system”: dosis, alergi, kontraindikasi, interaksi obat

Easier to do the right thing

Harder to do the wrong thing

PENURUNAN MEDICATION ERROR DENGAN CPOE

Study	Settings	Results
Bates et al. 1998 (20)	Adult inpatients on medical, surgical, and intensive care wards at BWH	55% decrease in non-intercepted serious medication errors 17% decrease in preventable ADEs
Potts et al. 2004 (29)	20-bed pediatric critical care unit in a tertiary-care children's hospital	40.9% decrease in preventable ADEs 99.4% decrease in minor medication errors
Upperman et al. 2005 (30)	Tertiary care pediatric hospital	40% decrease in harmful ADEs
Colpaert et al. 2006 (4)	22-bed intensive care unit at tertiary care hospital	96% decrease in minor prescription errors 58% decrease in non-intercepted potential ADE 84% decrease in preventable ADE
Walsh et al. 2008 (31)	Pediatric hospital	7% decrease in non-intercepted serious medication errors
Doormaal et al. 2009 (14)	Two medical wards of the 1300-bed University Medical Center and two medical wards of the 600-bed teaching hospital	69% decrease in medication errors
Mir et al. 2009 (23)	The department of internal medicine in two hospitals	90% decrease in medication errors
Hug et al. 2009 (21)	Six Massachusetts community hospitals with 100 to 300 beds	81.5% decrease in preventable ADEs
Roberts et al. 2013(27)	Mayo Clinic Hospital, a 232-bed teaching hospital	CPOE implementation was associated with a reduced rate of insulinorders containing errors. There was a significant decrease in preventable ADEs after implementation.
Hernandez et al. 2015(28)	A before-after observatio nal study was conducted in the 66-bed orthopedic surgery unit of a teaching hospital (700 beds) in Paris France.	The use of CPOE led to a significant 92%decrease in prescribing errors

Drug-related Decision Support

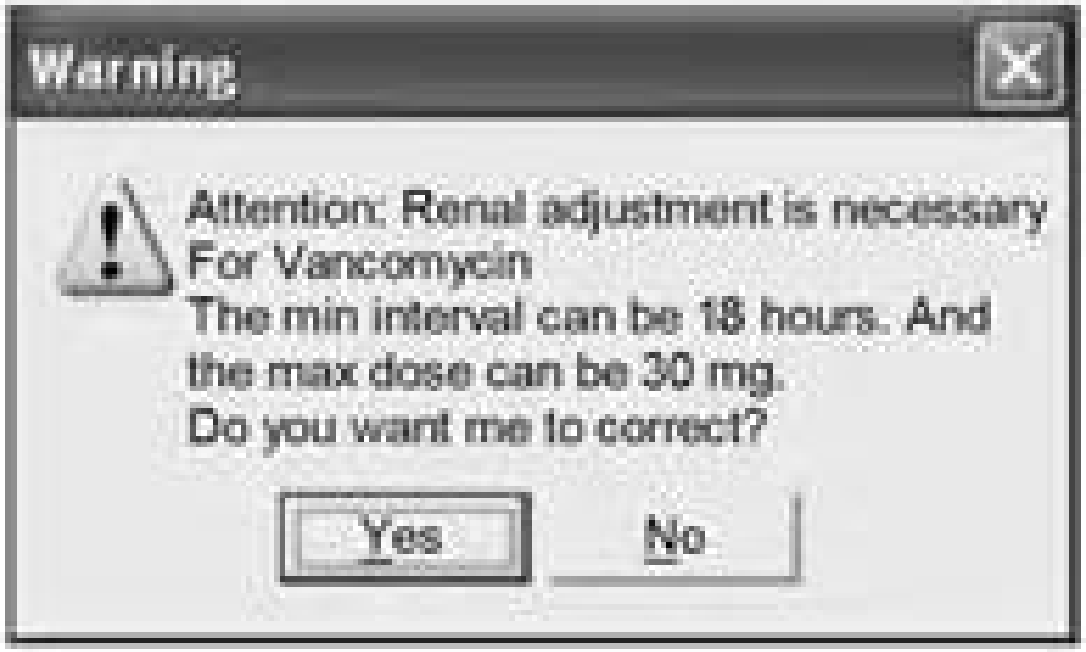
Dasar :

- Panduan obat formularium
- Interaksi Obat
- Cek alergi obat
- Panduan dosis lazim
- Cek adanya duplikasi
- Pedoman Terapi (contoh: Antibiotik)
- Kompatibiltas

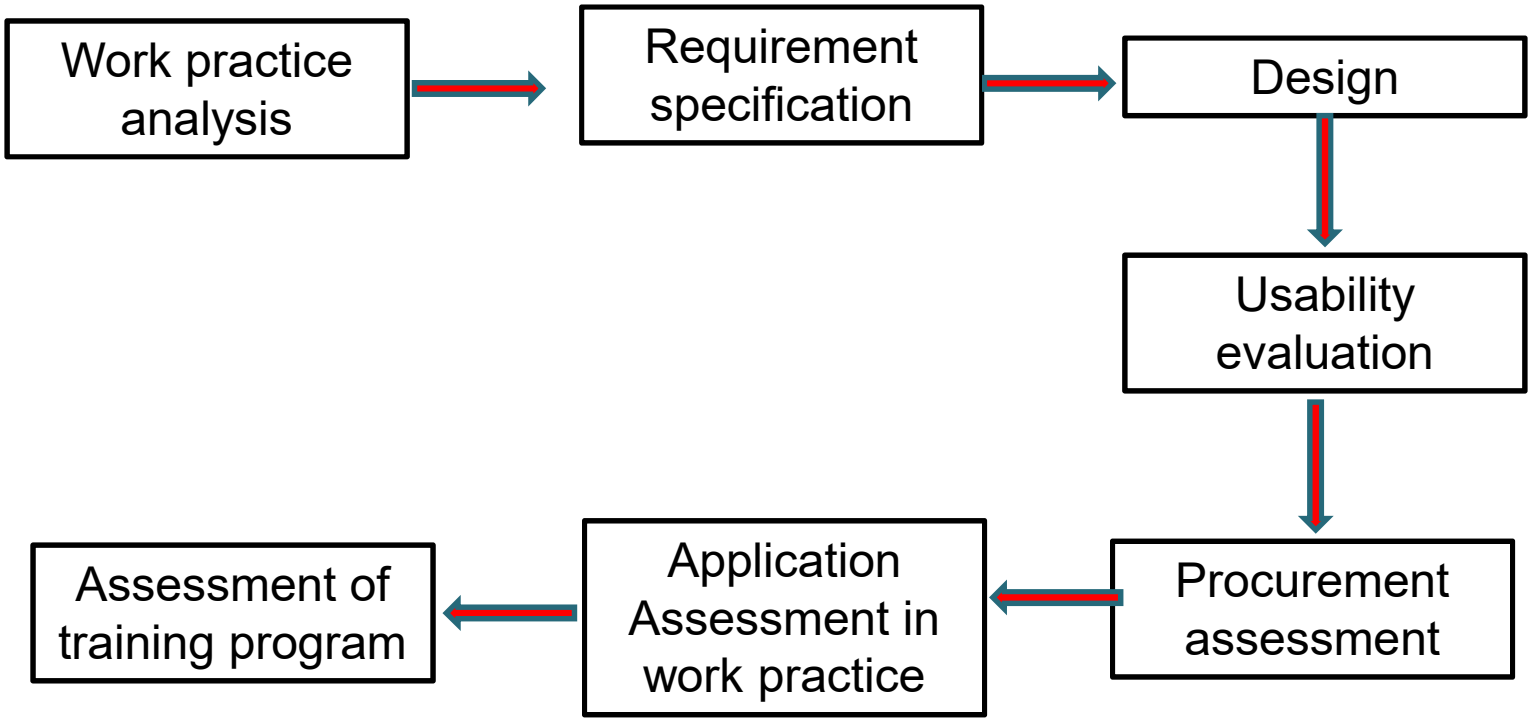
Drug-related Decision Support

Advanced :

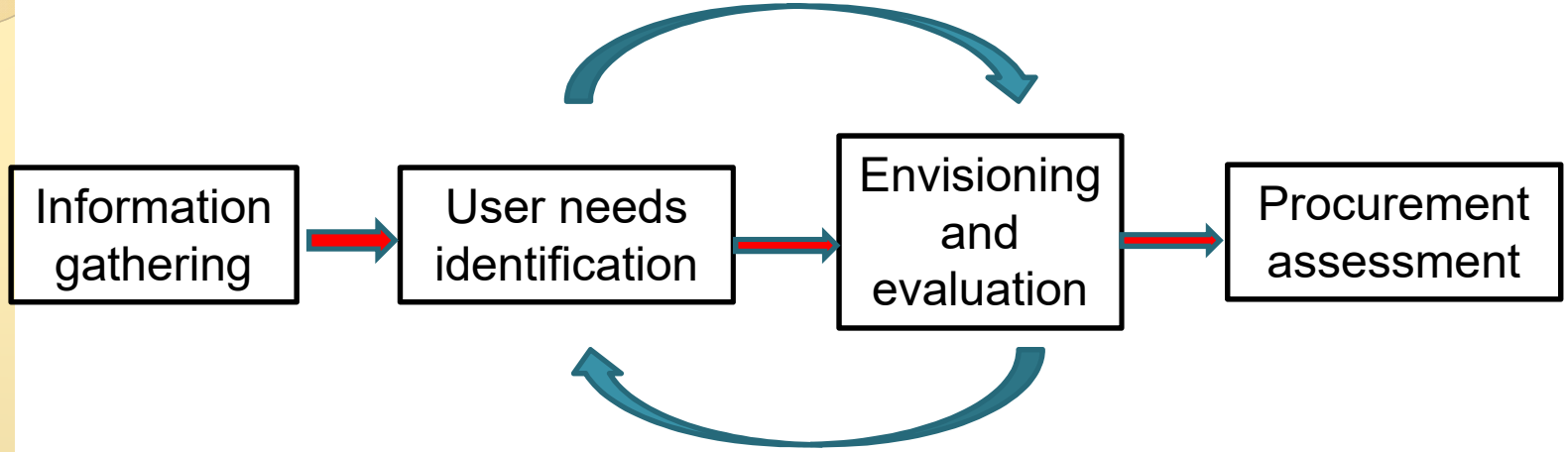
- Panduan dosis pada gangguan fungsi ginjal, pasien geriatri
- Panduan monitoring terapi obat dengan uji laboratorium
- Cek keamanan obat pada wanita hamil
- Kontraindikasi (DM, gagal fungsi organ)


Warning
Attention: Renal adjustment is necessary
For Vancomycin
The min interval can be 18 hours. And
the max dose can be 30 mg.
Do you want me to correct?
Yes
No

Pengembangan Sistem TI



ANALISIS *USER REQUIREMENTS*



USABILITY

- Effectiveness and Safety
- Efficiency
- Satisfaction

→

- End-users
- End-users Managers

Medication Error Dengan CPOE

- **Administrative error** :

  kesalahan dalam proses penulisan instruksi secara administratif, misalnya: duplikasi instruksi, salah "klik" saat memilih pasien, obat, dosis, dll

→ Re-desain sistem (tampilan, format)

- **Clinical error** :

  kesalahan dalam pengambilan keputusan klinis, misalnya: salah menetapkan dosis yang dibutuhkan pasien, ada interaksi obat, kontraindikasi

→ Integrasi dengan *clinical decision support system*

Pengembangan Sistem TI Yang Baik

1. Sebelum mengembangkan sistem TI, pastikan pedoman dan prosedur sudah dibuat dan diuji **(Do not automate the bad process)**
2. Nilai kebutuhan organisasi akan TI (efektivitas, safety, efisiensi)
3. Tetapkan skala prioritas tahapan pengembangan sistem TI
4. Libatkan secara aktif staf yang akan menggunakan (*end-users* dan *end-users managers*)
5. Lakukan simulasi melibatkan *end-users*
6. Selama pengenalan teknologi baru, monitor dan evaluasi masalah secara terus menerus (lakukan pilot di unit-unit tertentu)
7. Adakan program pelatihan
8. Buat dan sosialisasikan kebijakan terkait TI ke semua staf

Pengembangan Sistem TI Yang Baik ...(lanjutan)

8. Setelah implementasi TI, lakukan evaluasi terhadap peningkatan keamanan dan kemampuan mendeteksi kesalahan.
9. Setelah implementasi, lakukan monitoring dan pelaporan kesalahan dan masalah yang disebabkan TI.
10. Evaluasi kembali tingkat keamanan dan kerahasiaan jika semakin banyak alat yang terhubung/interface dengan jaringan TI.

CONTOH IMPLEMENTASI TI DALAM MANAJEMEN DAN PENGGUNAAN OBAT

Austin Health, Melbourne

Electronic Patient Record

Clinical Informatics Unit

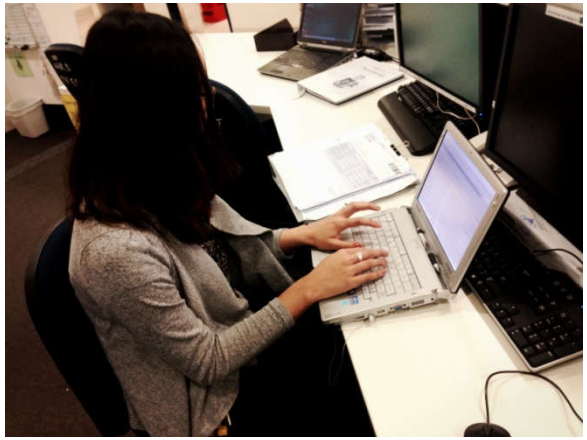
Since 2011 Austin Health has implemented a clinical system for patient care (Cerner)

- Inpatient Medication ordering and administration (MAR)
- Ordering of Prescriptions
- Ordering of Pathology and Radiology
- Electronic recording of specimen collection
- Electronic Discharge Summary
- Fluid Balance Chart
- Allied Health Referrals
- Patient care orders
- Results reporting and acknowledgement
- Documentation of some clinical information e.g. allergies, diagnoses, alerts, past history and procedures are recorded on Cerner

Improvements for pharmacists

- Each pharmacist has a personal laptop to carry out their daily functions in the system
- **PharmNet software:**
  - Includes a 'monitor' screen that shows the pharmacist all new and modified orders for patients in their specific ward(s)
  - Enables review of medication charts and generating dispensing labels remotely
  - Integrates with the dispensing system to prevent dual data entry
- Streamlined medication supply to the ward as system knows when resupply of medications due

No more looking around for missing drug charts!



Date	Medication (Print Generic Name)	Cross if Slow Release								
8/12	ISMN		0800							
Route	Dose	Frequency								
PO	60mg	od								
Pharmacist		Pcy r/v	Imprest							
Prescriber Signature	Print your Name	Pager								

Date	Medication (Print Generic Name)								
14/4/7	FAMCICLOVIR		800	CC.	SS	N. Dal			
Route	Dose	Frequency							
o	250mg	8/24	1200	JF 1400	not taken			17/4/07	
Pharmacist		Pcy r/v SB	Imprest						
Prescriber Signature	Print your Name	Pager	1700.	?	DS	Dal			
	Cmson								

IV TRIAL SOVIC

Date	Medication (Print Generic Name)														
13/4	MORPHINE					Date	14/4	15/4	16/4	17/4					
Route	Dose	Hourly Frequency	Max dose/24 hrs			Time	18 10	00 35	09 20	16 15					
IV/SC	0-2.5mg	2/24 PRN				Dose	2.5	2.5	2.5	2.5					
Indication		Pharmacist	Pcy r/v	Imprest		Route	SC	IV	IV	IV					
Prescriber Signature	Print your Name		Contact			Sign.									
	FOX		1816												

Medications	21/05/2014 08:00	20/05/2014 18:00	20/05/2014 16:00	20/05/2014 15:28	20/05/2014 15:24	20/05/2014 08:00
Scheduled						
atorvastatin 80 mg, Oral, Tablet, morning, First dose 21/05/2014 08:00:00	**80 mg** Last given: 20/05/2014 08:00 AEST					
atorvastatin						80 mg
clopidogrel 75 mg, Oral, Tablet, daily, First dose 21/05/2014 08:00:00	**75 mg** Last given: 20/05/2014 08:00 AEST					
clopidogrel						75 mg
metoprolol 50 mg, Oral, Tablet, BD, First dose 20/05/2014 18:00:00	**50 mg** Last given: 20/05/2014 08:00 AEST	**50 mg** Last given: 20/05/2014 08:00 AEST				
metoprolol						50 mg
Peripheral Pulse Rate						
Systolic Blood Pressure						
Diastolic Blood Pressure						
ramipril 5 mg, Oral, Tablet, daily, First dose 21/05/2014 08:00:00	**5 mg** Last given: 20/05/2014 08:00 AEST					
ramipril						5 mg
Systolic Blood Pressure						
Diastolic Blood Pressure						
Unscheduled						
cephazolin 2 g, IV, Vial, PRE-OP, First dose 20/05/2014 16:00:00, Indication: Surgical prophylaxis (adult greater than 80 kg)			**2 g** Not given within 5 days.			
cephazolin						
PRN						
PRN **glyceryl trinitrate (glyceryl trinitrate 600 microgram ...** 0.5 - 1 tab(s), Sublingual, Tablet, Dispersible, every 5 minutes, PRN for chest pain, First dose 20/05/2014 15:20:00				**0.5 - 1 tab(s)** Last given: 20/05/2014 15:24 AEST		
glyceryl trinitrate					* 1 tab(s)	
Systolic Blood Pressure						
Diastolic Blood Pressure						
PRN Response					PRN Response	
PRN **magnesium aspartate (Mag-Sup 500 mg oral tablet)** 2 tab(s), Oral, Tablet, BD, PRN for other: see indication, First dose 20/05/2014 15:21:00, Indication: If Mg is less than 1.0 mmol/L				**1,000 mg** Not given within 5 days.		
magnesium aspartate						

1. National Medication Chart vs. Power Chart

National Medication Chart	Cerner PowerChart
All orders are to be written legibly in ink	All orders placed electronically. 100% of orders are legible
No erasers or "whiteout" can be used. Must be rewritten if changes occur	All changes tracked transparently in the system. Certain fields locked down on 'Modify'
Adherence to national standards around terminology	Terminology hard-coded (via code sets). Avoids unsafe abbreviations and symbols
Essential details such as date of order, generic medication name, frequency and signature must be present	Order Entry Format will ensure fields are present in every order which must be accompanied by an electronic signature
Accurately portrays medication administration requirements	Task clearly states when medication to be given as well as contains last dose information. Tasks become 'RED' when overdue
Patient identification details present on ALL charts	Details present at all times in Cerner in the banner bar
If more than one chart exists, it should be clearly numbered	Only one chart exists for a patient in the same location

1. National Medication Chart vs. Power Chart

- **Electronic medication management system**
  - Drug chart does not run out of time or space
  - Decision support through alerts
  - Closed-loop medication management
  - Pre-built order sentences minimise risk of order entry errors
  - Ability to enforce prescribing guidelines and policies

1. National Medication Chart vs. Power Chart

Pre-Built Order Sentences: cephalexin

1. National Medication Chart vs. Power Chart

Medication administrations instructions: Ciprofloxacin

ciprofloxacin
750 mg, Oral, Tablet, BD (with or after food), First dose 20/05/2014 18:00:00, Approval: AL2005D14
Do not take dairy products, antacids, iron, calcium or zinc supp..

ciprofloxacin

750 mg	750 mg
Not given within 5 days.	Not given within 5 days.

ciprofloxacin

750 mg, Oral, Tablet, BD (with or after food), First dose 20/05/2014 18:00:00, Approval: AL2005D14

Do not take dairy products, antacids, iron, calcium or zinc supplements within 2 hours of taking this medicine.

2. Antibiotic Stewardship

- To promote appropriate and proper prescribing of antimicrobials
- Antimicrobial Stewardship programs aim to reduce chance of antimicrobial resistance, toxicity and unnecessary costs
- Multiple methods employed in the eMM context:
  - Electronic Approval System *(*external to Cerner)*
  - Specialised Care Sets and Order sentences including time offsets and drug level reminder tasks
  - Alerts
  - Reports

2. Antibiotic Stewardship – Care Sets

- Care Sets contain the ability to include prescribing guidance and information
- Ability to combine medications, pathology and radiology orders in one ordering window
- Ability to incorporate time off-sets on orders to facilitate drug level monitoring

2. Antibiotic Stewardship – Care Sets

Vancomycin: Initiation Care Sets

Component	Order Details
FOR INPATIENT USE ONLY	
.	
Loading dose (first dose):	
This care set includes a mandatory loading dose as per Austin Vancomycin Guidelines.	
If ordering ongoing therapy, escape and place order via 'vancomycin' orderable	
vancomycin	1.5 g, IV, Vial, ONCE only
.	
Subsequent treatment dose:	
Based on patient's estimated CrCl, select the appropriate vancomycin order and associated vancomycin level and level reminder	
The vancomycin level reminder MUST be ordered together with the vancomycin level to ensure nurses check that the level has been taken	
Estimated CrCl greater than 50 mL/min:	
vancomycin	1 g, IV, Vial, 12 hourly, First dose T;N+720
Vancomycin Level Pre Dose	Timed Study, Spec Type: Blood, T;N+1440, Clinician Collect
Vancomycin Level Reminder - Pre Dose	1 Level Due, ONCE only, First dose T;N+1435
Estimated CrCl 10 to 50 mL/min:	
vancomycin	1 g, IV, Vial, 24 hourly, First dose T+1;N
Vancomycin Level Pre Dose	Timed Study, Spec Type: Blood, T+2;N
Vancomycin Level Reminder - Pre Dose	1 Level Due, ONCE only, First dose T+1;N+1435

2. Antibiotic Stewardship – Care Sets

	FOR INPATIENT USE ONLY	
	.	
	RE-ASSESS PATIENTS FOR ONGOING AMINOGLYCOSIDE TREATMENT AFTER 72 HOURS. Aminoglycoside therapy beyond 72 hours MUST be in consultation with Infectious Diseases.	
	These recommendations are based on eTG Antibiotic v14 + Austin Health guideline 'Aminoglycoside Dosing & Monitoring Guidelines'.	
	STEP 1. Calculate the dose in mg using age & IDEAL BODY WEIGHT. For obese patients CONSULT INFECTIOUS DISEASES UNIT for advice.	
	Contact infectious diseases unit if a dose greater than 400 mg is required	
	Ideal body weight can be calculated via the 'Dose calculator'. First select an order and click on the button that looks like a capsule above a calculator at the top of the details tab. Enter the patient's height and weight, then change the 'Adjustment' drop down to 'Ideal Body Weight'. The ideal body weight will be displayed in the 'Adjusted weight' field.	
	Age more than 60 years: 4 mg/kg	
	Age 30 to 60 years: 5 mg/kg	
	Age 10 to 29 years: 6 mg/kg	
	STEP 2. Select the appropriate dosing frequency determined by creatinine clearance (CrCl) and complete the calculated dose in mg (from step 1), in the highlighted 'strength dose' field.	
	CrCl less than 30 mL/min: Consider alternate therapy or contact Infectious Disease Unit for advice.	
	.	
	CrCl 30 to 39 mL/min:	
☐	gentamicin	mg, IV, Ampoule, 48 hourly
	CrCl 40 to 60 mL/min:	
☐	gentamicin	mg, IV, Ampoule, 36 hourly
	CrCl greater than 60 mL/min:	
☐	gentamicin	mg, IV, Ampoule, 24 hourly
	STEP 3. The included 'Gentamicin Treatment Review' task is to alert the medical unit to review duration of gentamicin therapy. If therapy is to continue beyond 72 hours INFECTIOUS DISEASES MUST be consulted***	
☑	gentamicin treatment review	DR TO R/V, ONCE only, First dose T+2;N+5

2. Antibiotic Stewardship –Alerts

- Austin Health's 'Good Antimicrobial Prescribing Practice (GAPP)' policy required custom build in to Cerner.
- Currently using an online approval system (IDEA3S) to generate approval numbers based on selection criteria
- On paper
  - Approval number is written on the drug chart
  - Required before administration but not always followed
- In Cerner
  - Creative use of Discern Alert
  - Cannot proceed with order unless approval number is documented in appropriate field

2. Antibiotic Stewardship –Alerts

Discern: (1 of 1)

Cerner

GAPP Alert

You are attempting to order ceftriaxone

Austin Health's Good Antimicrobial Prescribing Policy (GAPP) requires this medication to have an ID Approval Number documented on the MAR before Pharmacy can dispense the agent and nursing staff can administer the drug.

Please obtain approval via IDEA3S hyperlink or contact the Infectious Disease registrar on pager 6056 (weekdays/normal hours) or switchboard (weekends/after hours)

Alert Action

- Remove ceftriaxone from order screen
- Enter Approval No. for ceftriaxone

IDEA3S | OK

Moving forward

- The future: enhancing data capture and interpretation capabilities
  - The more information we can get in the more powerful reporting and auditing becomes
- Potential for powerful audits:
  - Actual Administration Times vs. Scheduled Administration Times
    - Particularly interested in antibiotics
  - Number of missed doses
  - Patients who have received more than 4 grams of paracetamol
  - High Risk Drug audits

Acknowledgements

- Jane Booth
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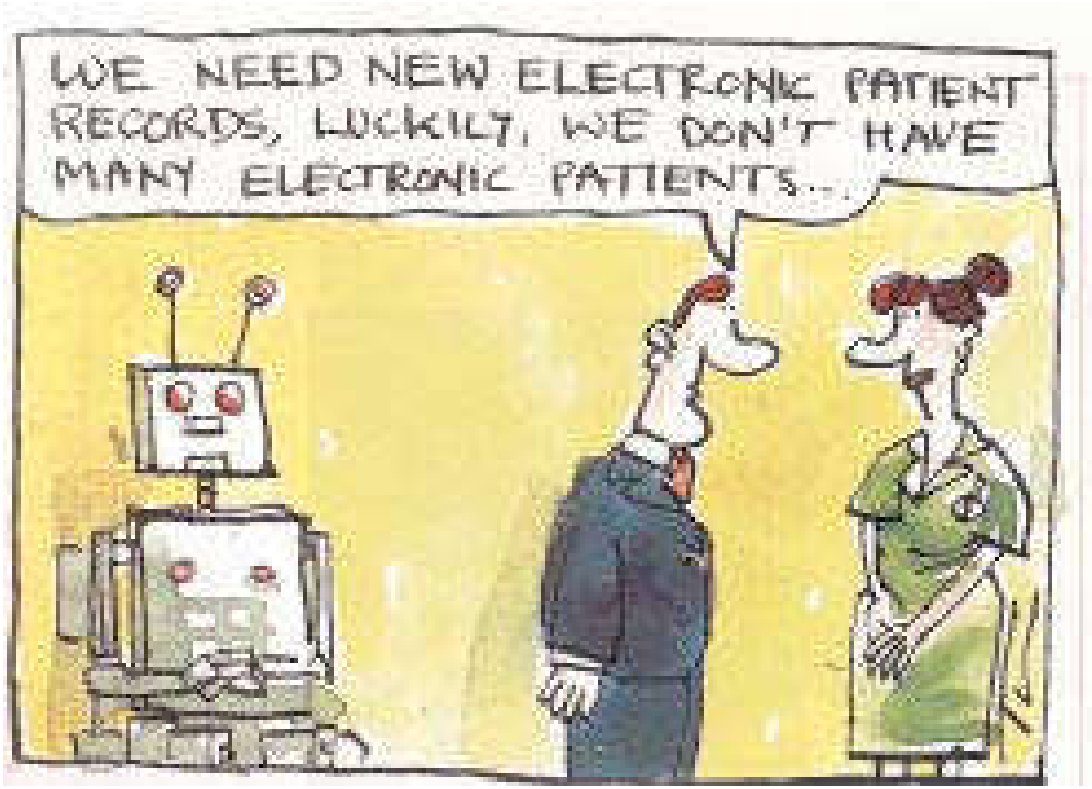
- Adrian Lio



TERIMA KASIH