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Orthopedic Medication Safety

Nathamon Dejprapasorn, Clinical Pharmacist
Saowanee Siangyai, Registered Nurse

Ramathibodi hospital, Mahidol University

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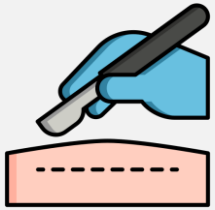
Outline

- Introduction
- Where medication errors hide in Orthopedic care
- Smart Collaboration: From error detection to error prevention
- Case Challenge

Orthopeadic Patient Journey


Admit


Pre-operation


OR


Post-operation


Recovery


Discharge

Medication Reconcile → Hold / continue → Monitor → Restart / adjust → Educate

Transitions of care = Opportunities of medication discrepancies/errors

Who can prevent medication error?

80-year-old woman:

Hip fracture

U/D: IHD
CKD
HT DM



- **Physician**
- **Nurse**
- **Pharmacist**
- **All of above**

Where medication errors hide

Medication history

Omitted home therapy

Prescribing

Dose / duplication / drug interaction

Administration

Timing / route

Monitoring

Delayed recognition

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Medication Reconciliation

- The process of comparing a patient's medication orders to all of the medications that the patient has been taking.
- To avoid medication errors such as omissions, duplications, dosing errors, or drug interactions.
- Should be done at every transition of care in which new medications are ordered or existing orders are rewritten.
- This process comprises five steps:
  1. develop a list of current medications
  2. develop a list of medications to be prescribed
  3. compare the medications on the two lists
  4. make clinical decisions based on the comparison
  5. communicate the new list to appropriate caregivers and to the patient

Barnsteiner JH. Medication Reconciliation. In: Hughes RG, editor. Patient Safety and Quality: An Evidence-Based Handbook for Nurses. Rockville (MD): Agency for Healthcare Research and Quality (US); 2008 Apr. Chapter 38.

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Medication Reconciliation

- Drug Discontinuation Before Surgery



Antiplatelets/Anticoagulants	→	bleeding
Antidiabetic drugs		
• SGLT-2 inh (-gliflozin)	→	euglycemic DKA
• GLP-1 agonists (-glutide)	→	aspiration
Herbals/dietary supplements	→	bleeding

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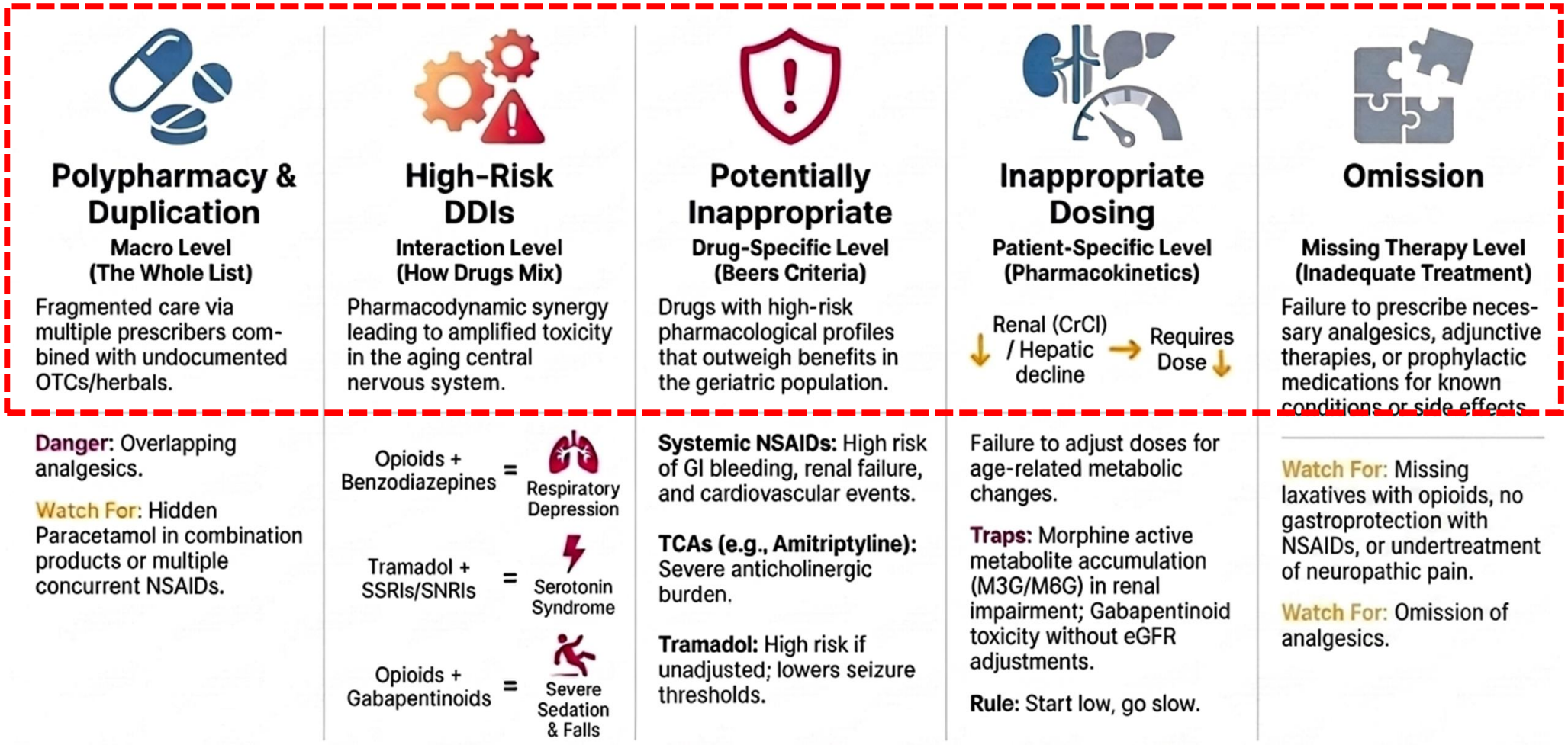
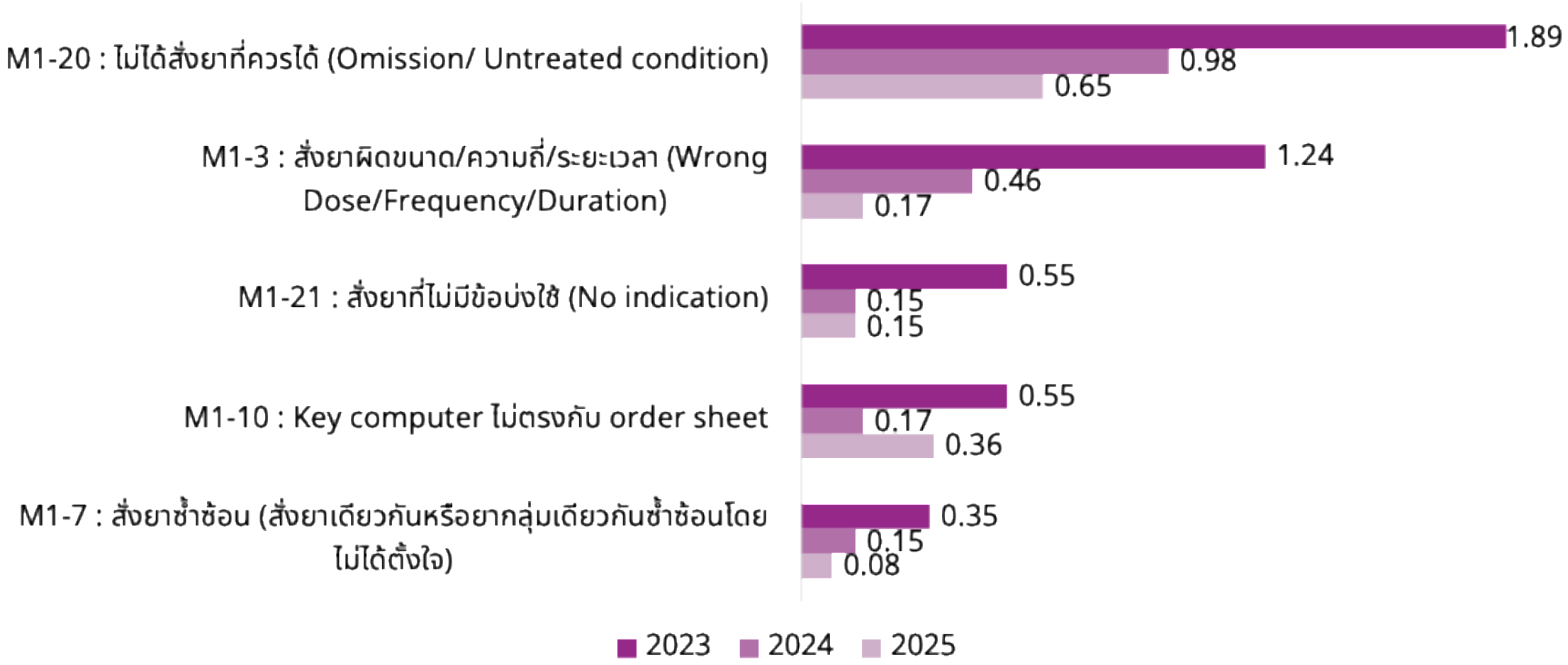
Medication Reconciliation: Common DRPs



AGS Beers Criteria® Update Expert Panel. J Am Geriatr Soc. 2023;71(7):2052-2081
Mekonnen AB, et al. Effectiveness of pharmacist-led medication reconciliation programmes on clinical outcomes at hospital transitions: a systematic review and meta-analysis. BMJ Open. 2016;6(2):e010003.

Medication Reconciliation:

Top 5 unintentional discrepancies/100 MR



Collect data from clinical pharmacists in Orthopedic Division, Ramathibodi hospital

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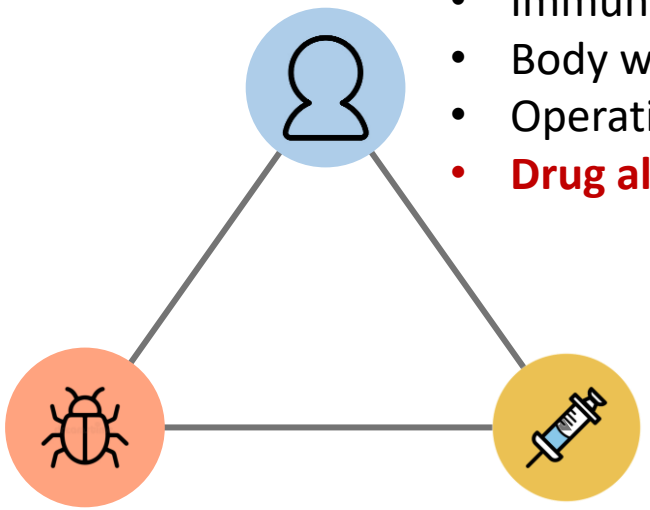
Surgical Antibiotic Prophylaxis

Type of Procedure	Recommended Agents[a,b]	Alternative Agents in Patients with β-Lactam Allergy	Strength of Evidence[c]
Orthopedic			
Clean operations involving hand, knee, or foot and not involving implantation of foreign materials	None	None	C
Spinal procedures with and without instrumentation	Cefazolin	Clindamycin,[d] vancomycin[d]	A
Hip fracture repair	Cefazolin	Clindamycin,[d] vancomycin[d]	A
Implantation of internal fixation devices (e.g., nails, screws, plates, wires)	Cefazolin	Clindamycin,[d] vancomycin[d]	C
Total joint replacement	Cefazolin	Clindamycin,[d] vancomycin[d]	A



- Immunocompetent/compromise
- Body weight, renal function
- Operation time/blood loss
- **Drug allergy**

- Normal flora
- Causative pathogens
- Risk of drug resistance

- Pharmacokinetic/dynamics
- Dosage regimen
- Side effects/special monitoring

ASHP Therapeutic Guidelines

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Surgical Antibiotic Prophylaxis



Based on type of procedure

- Skin flora are the most frequent organisms involved in SSIs after orthopedic procedures.

Redosing

- Prolong op time
- Excessive blood loss (>1500 ml)

Duration based on type of wound

- Clean
- Clean-contaminated

↓

24 hours*

แนวทางการติดตามการใช้ยาปฏิชีวนะหลังผ่าตัดโดยเภสัชกรคลินิก

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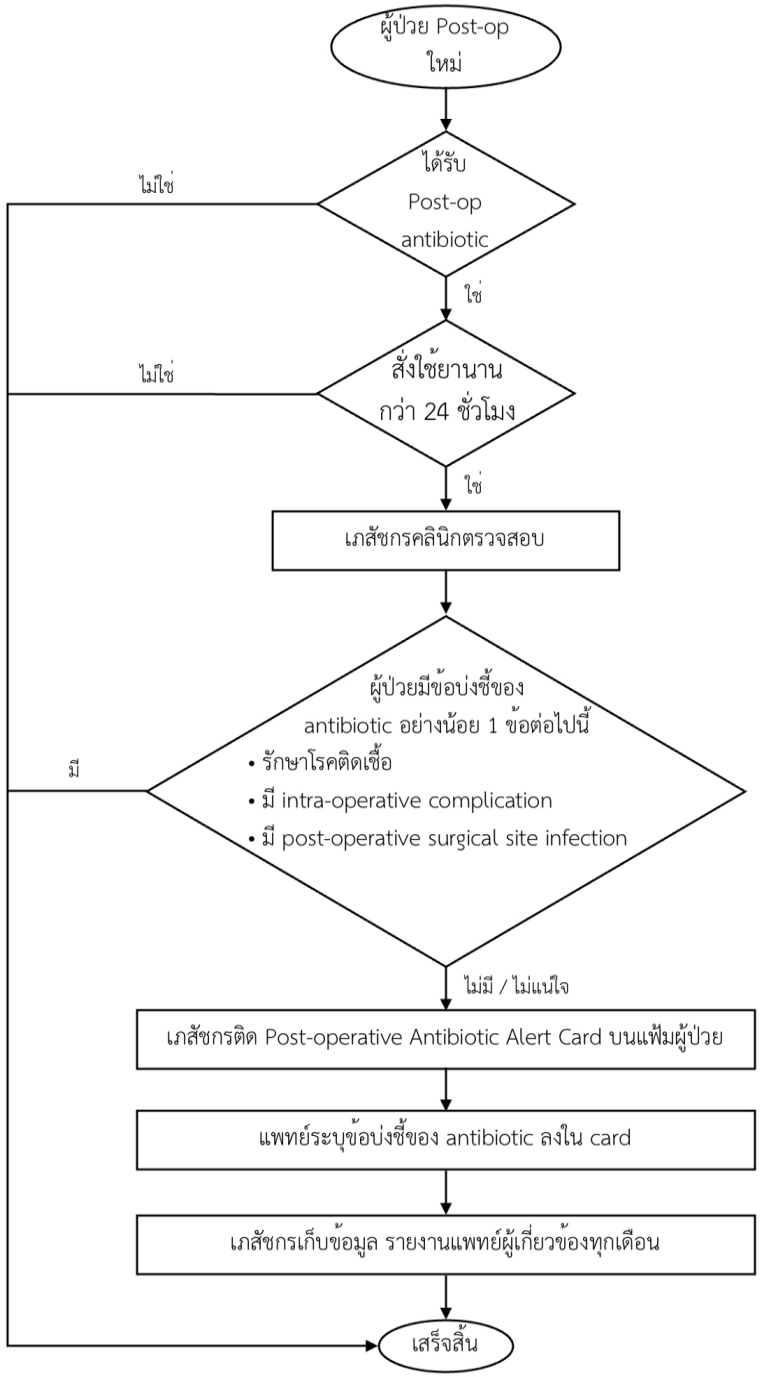


Post-operative Antibiotic Alert

Sticker ผู้ป่วย

Current ATB: _____
วันที่: _____
ลงชื่อเภสัชกร: _____

Operation: _____

โปรดระบุข้อบ่งชี้ของ Antibiotic

☐ สำหรับรักษาโรคติดเชื้อ
โปรดระบุ _____

☐ ผู้ป่วยมี intra-operative complication
โปรดระบุ _____

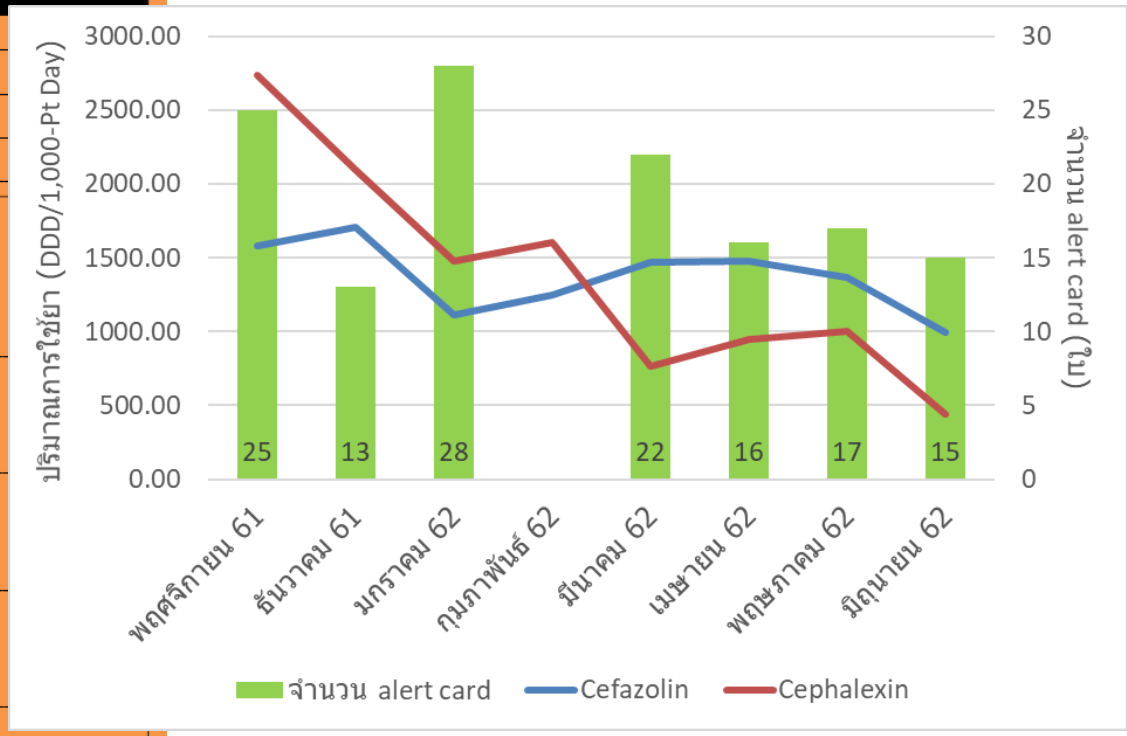
☐ สงสัย post-operative surgical site infection
โปรดระบุ _____

☐ อื่นๆ
โปรดระบุ _____

การให้ surgical ATB prophylaxis >24 ชั่วโมง เพิ่ม risk แต่ไม่ได้ benefit

ลงชื่อแพทย์_____ รหัส_____ วันที่ _____

Note: _____
_____



DOCTOR'S ORDER SHEET

Date / Hour	Orders for 1 day only	Date / Hour	Orders for Continuation	Date / Hour OFF
	Postoperative order for		☐ NPO	
	Post-op กลับ ward		☐ Diet : Regular/Low salt/DM	
	☐ Record vital signs q 15 min x 4 times		☐ Retained Foley's catheter	
	then q 30 min x 2 times, then q 1 hr. until stable		○ Keep urine output ..... mL/..... hr	
	☐ IV. fluid		☐ Record	
	○ 5% D/N/2 1000 ml. IV. drip ..... ml./hr. x ..... ขวด		○ Vital sign ○ I/O ○ Drain	
	○ Acetar 1000 ml. IV. drip ..... ml./hr. x ..... ขวด		☐ On pneumatic pump boot /Rt/Lt leg	
	○		☐ Deep breathing exercise	
			○ Incentive spirometer	
	☐ POC-Hb		☐ Elevate ..... ☐ Arm sling	
	○ At ward ○ q ..... hr ○ 20.00 น. ○ 6.00 น.		☐ Cold pack ..... q ..... hr	
	Notify if POC-Hb < ..... g/dL		☐	
	☐ Film			
	☐ Morphine ..... mg. iv. q 4 hr. ○ prn		**Medication**	
	☐ Pethidine ..... mg. iv. q ..... hr ○ prn		☐ None	
	☐ Ketolac/Dynastat ..... mg iv q 8 / 12 hr ○ prn		☐ Cefazolin 1 gm iv q 8 hr x 3 doses	
	☐ Metoclopramide/Ondansetron ..... mg. iv prn		☐ Cefuroxime 750 mg iv q 8 hr x 3 doses	
	for N/V q 6 hr.		☐ Clindamycin 600 mg q 8 hr. x 3 doses	
	☐ Acupan ○ 20 mg + NSS 100 mL IV in 6 hr		☐	
	○ 80 mg + NSS 100 mL IV in 2 hr		☐ มี indication prolong antibiotic	
	☑ POC- Glu premeal + hs ..... hr. keep 80-180 mg/dl		.....	

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Dose adjustment in renal impairment:

Antibiotics Pre- & Post-operative prophylaxis

- **Pre-operative:** No need dose adjustment (before incision)
- **Post-operative:** adjust dose as CrCl or eGFR

Drug	>50	30-50	10-30	<10 or HD
Cefazolin IV	No dose adjustment	1 g iv q 8-12 hr	0.5-1 g iv q 12 hr	0.5-1 g iv od
Cefuroxime IV	750 mg iv q 8 hr		750 mg iv q 12 hr	750 mg iv od
Cephalexin PO	500 mg PO QID		500 mg PO TID	500 mg PO BID
Cefuroxime PO	500 mg PO BID		250 mg PO BID	250 mg PO OD
Clindamycin IV/PO	No dose adjustment (600 mg iv q 8 hr / 300 mg PO TID)			

Lexicomp
Sanford Guide. Antimicorbial therapy

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Analgesic Optimization

Safe and effective in older adults
- Balance between benefits and burdens
- Lowest possible dose that provides adequate analgesia
- **"Start low, go slow"**

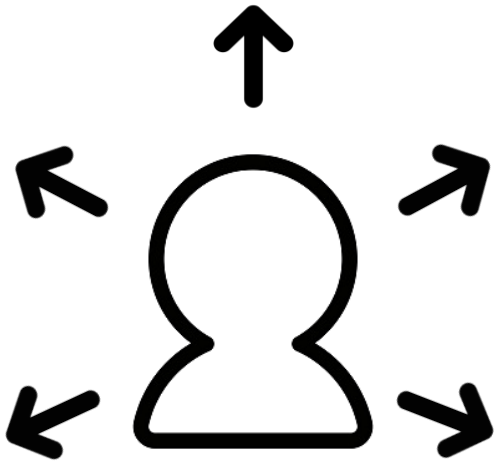
Opioids

Renal / liver impairment
Drug interaction
Delirium

Multimodal analgesia
- More effective pain relief
- Opioid-sparing effect
- ↓ doses of each analgesic
- ↓ severity of side effects of each drug

Paracetamol

Liver impairment



Gabapentinoids

Renal impairment

NSAIDs

Renal impairment
Cardiovascular disease
Gastrointestinol

Nefopam

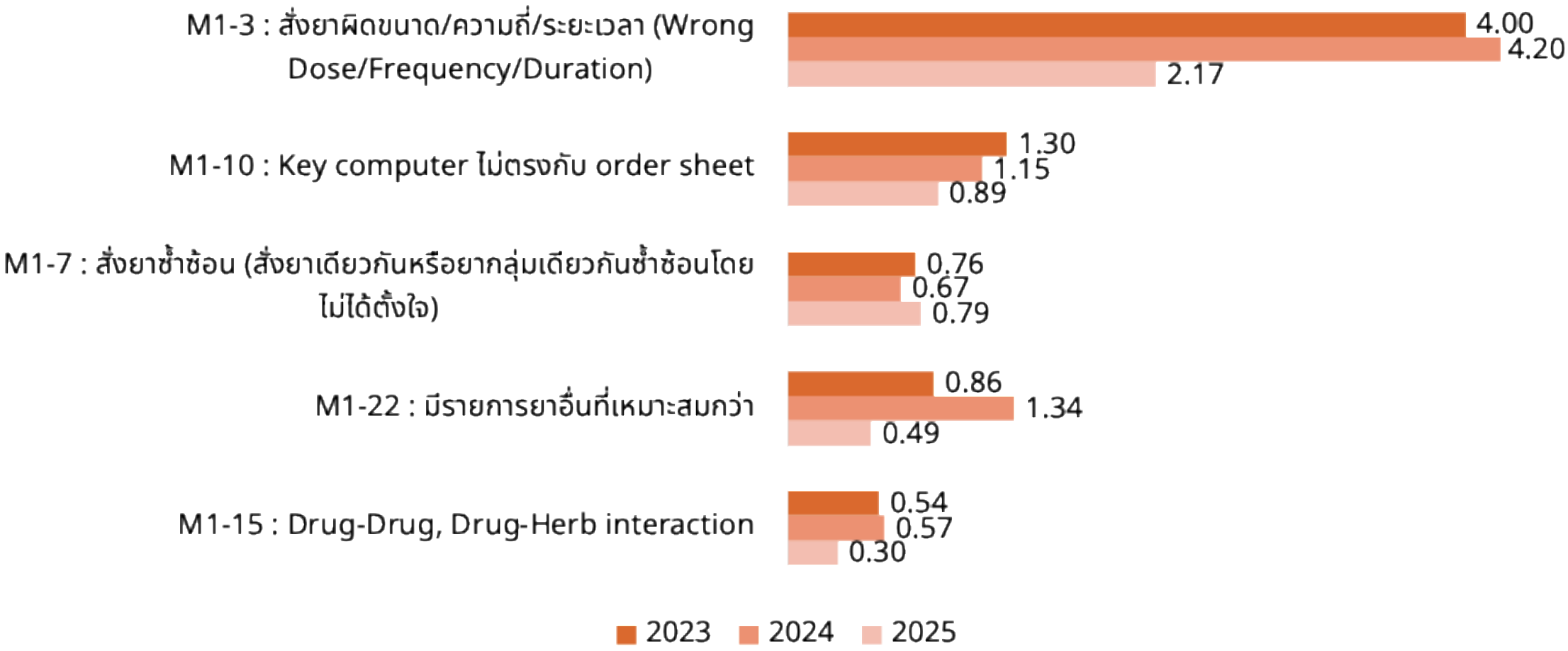
Renal / liver impairment
Drug interaction

Common Pitfalls in CPOE and ordering

- **Drug duplication/commission**
  - Concomittent NSAIDs (parecoxib and etoricoxib)/Opioids (tramadol/codeine)
- **Drug interactions**
  - nefopam - pethidine/tramadol (serotonergic effects)
  - warfarin - NSAIDs (bleeding risk)
  - fluoxetine - codeine (no analgesic effect)
- **Dosage too high**
  - Antibiotics
- **Drugs with contraindication**
  - All NSAIDs in CKD patients (CrCl<30 ml/min)
  - COX-2 inhibitors in CABG

Drug related problems (DRPs)

Top 5 DRPs/100 patient day



Collect data from clinical pharmacists in Orthopedic Division, Ramathibodi hospital

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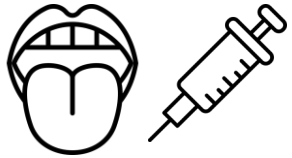
6 Rights of medication administration



RIGHT PATIENT
using at least 2 identifiers eg. name, age



RIGHT ROUTE
eg. PO, IV, IM, NS



RIGHT DRUG
Match medication label to the order



RIGHT TIME
Admin at schedule time & interval



RIGHT DOSE
Strength, amount



RIGHT DOCUMENTATION
Record admin accurately after giving the dose

Right Reason Right Response Right Patient Education Right to Refuse

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Beyond the 6 Rights

Right Drug ≠ Safe Administration

RIGHT ORDER
Correct prescription

RIGHT PATIENT STATUS
Clinical readiness

SAFE TO GIVE
Informed decision

4 Clinical Safety Checks

PATIENT
Vitals • Sedation • Bleeding

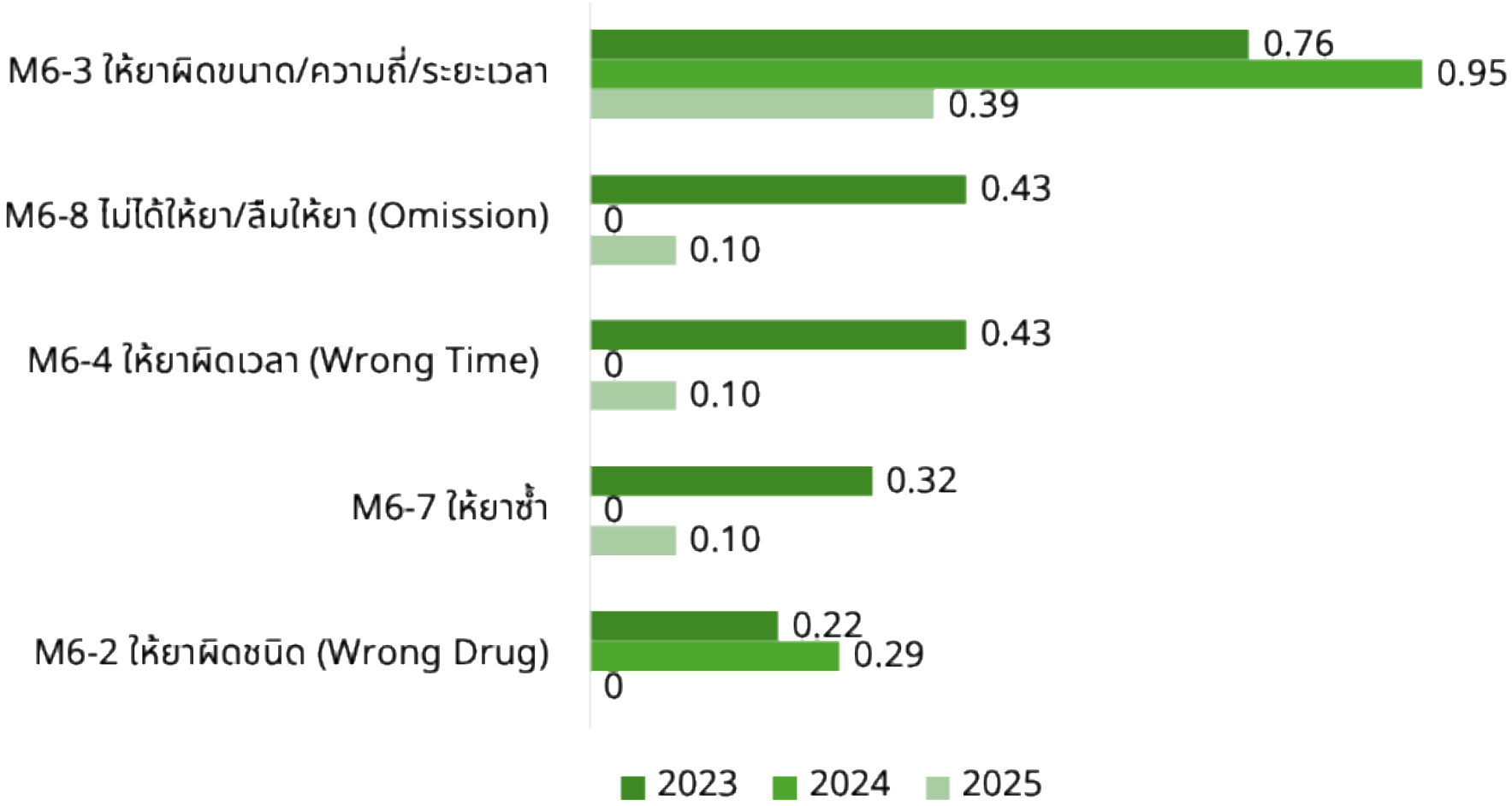
LABS
Renal function • Hb • Platelets

TIMING
Surgery • Last dose • Catheter

COMMUNICATE
Clarify • Escalate • Document

Administration:

Top 5 Administration errors/1000 patient day



Data from Incidence Occurrence Reports
Orthopedic Division, Ramathibodi hospital

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Early Detection

Medication Safety Does Not End After Administration



Medication	Before administration	After administration
Antibiotics	Allergy, indication, dose, infusion requirements	Hypersensitivity, renal function when indicated, adverse effects
Opioids	Pain score, sedation, RR, oxygenation	Sedation trend, respiratory depression, pain relief

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A bedside safety question

"The pain score improved…
but is the patient still safe?"

Observe → Assess → Communicate → Reassess

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A 2-minute medication safety huddle

1. Which patients are high-risk?
2. What changed clinically?
3. Which medication needs review?
4. Who will follow up?

Smart Collaboration:
From error detection to error prevention

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- Two perspectives. One safer decision.

CLINICAL PHARMACIST



Medication reconciliation
Identify discrepancies, polypharmacy, OTC use, and potentially inappropriate medication (PIMs).



Analgesic Optimization
Individualize drug selection and adjust dosages based on renal/hepatic function, and treatment goals.



Drug interaction
Detect drug-drug & drug-disease interactions to prevent falls, delirium, and serotonin syndrome.



ADR monitoring
Prevent and manage complications like sedation, constipation, and cognitive impairment.



Deprescribing & Education
Taper unnecessary medications safely and empower patients/caregivers with self-management strategies.

ORTHOPEDIC NURSE



Bedside assessment
Evaluate real-time pain levels, neurovascular status, fall risk, and bowel/bladder function.



Medication administration
Ensure accurate timing, dosage, and route of medications.



Patient monitoring
Closely observe vital signs, sedation levels, and post-operative mobility/rehabilitation progress..



Early warning sign
Promptly detect acute complications such as oversedation, delirium, or respiratory depression.



Patient & cargiver education
Reinforce medication adherence, fall prevention strategies, and safe mobility before discharge..

Three layers of safer care

↔

People

Collaborative Safety

Safety huddles · SBAR · rounds

☷

Process

Standardized Safety

Reconciliation · checklists · handoffs

⌘

Technology

Intelligent Safety

BCMA · smart pumps · alerts

Smart Collaboration:
From error detection to error prevention

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From data collection….

Analgesics is most common medication errors

- Duplicate NSAIDs
- NSAIDs/COXIBs in special population
- Morphine iv in Spinal morphine

Smart Collaboration:
From error detection to error prevention

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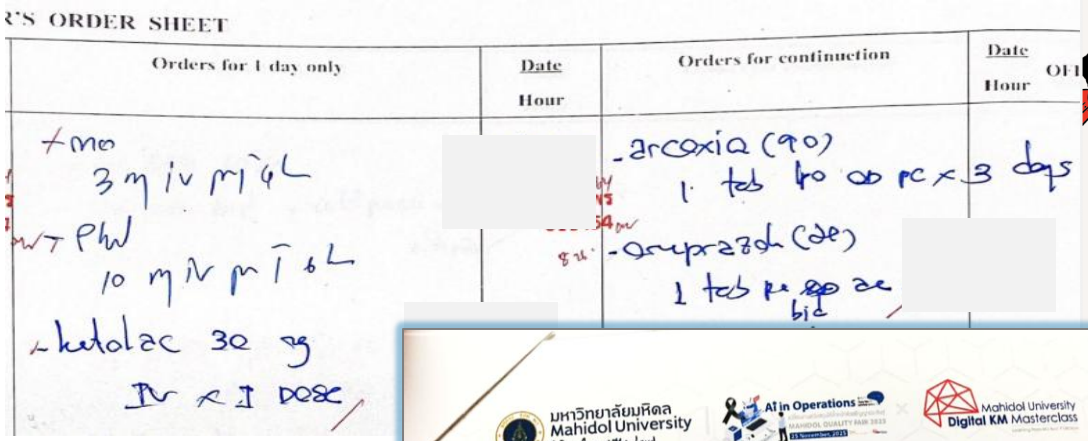
- Duplicate NSAIDs









ตารางการใช้ยาแก้ปวดร่วมกัน



NSAIDs to NSAIDs ห่างกี่ hr.??

Ketolac	6-8 hr	Arcoxia	24 hr
Dynastat	12 hr	Celebrex	12 hr
Ibuprofen	4-6 hr	Naproxen	8-12 hr

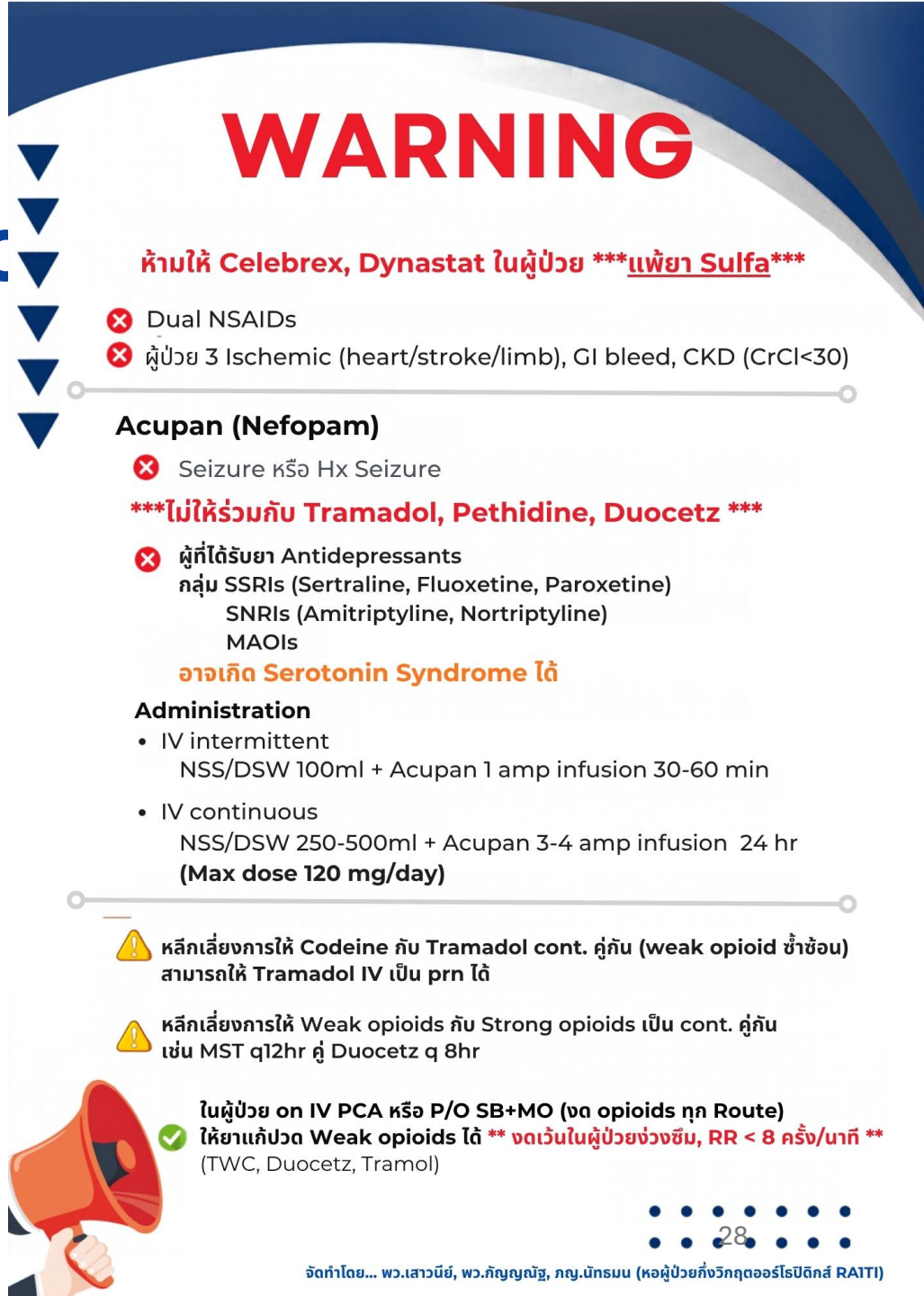
		MAX DOSE	120 mg/day	80 mg/day	120mg/day	400mg/day			
		แพ้ยา Sulfa Dynastat, Celebrex	KETOLAC (Ketorolac)	DYNASTAT (Perecoxib)	ACUPAN (Nefopam)	TRAMADOL	MORPHINE	FENTANYL	PETHIDINE
NSAIDs	ARCOXIA (Etoricoxib)		✗	✗	✓	✓	✓	✓	✓
NSAIDs	CELEBREX (Celecoxib)		✗	✗	✓	✓	✓	✓	✓
NSAIDs	NAPROXEN		✗	✗	✓	✓	✓	✓	✓
NSAIDs	IBUPROFEN		✗	✗	✓	✓	✓	✓	✓
NSAIDs	KETOLAC (Ketorolac)		⊖	✗	✓	✓	✓	✓	✓
NSAIDs	DYNASTAT (Parecoxib)		✗	⊖	✓	✓	✓	✓	✓
Weak opioids	TWC (Paracetamol+Codeine 300/15mg)		✓	✓	✓	⚠	✓	✓	✓
Weak opioids	DUOCETZ (Paracetamol+Tramadol 325/37.5mg)		✓	✓	✗	✓	✓	✓	✗
Weak opioids	TRAMADOL		✓	✓	✗	⊖	✓	✓	✗
Strong opioids	MORPHINE		✓	✓	✓	✓	⊖	✓	✓
Strong opioids	FENTANYL		✓	✓	✓	✓	✓	⊖	✓
Strong opioids	PETHIDINE		✓	✓	✗	✗	✓	✓	⊖
	ACUPAN (Nefopam)		✓	✓	⊖	✗ (*เว้นห่าง 6hr*)	✓	✓	✗ (*เว้นห่าง 4hr*)

✗ Dual NSAIDs. ✗ Arcoxia,Celebrex,Dynastat ในผู้ป่วย 3 Ischemia (heart,stroke,limb) ✗ Weak opioid PO cont. + Strong opioid PO cont.

จัดทำโดย... พว.เสาวนีย์ เสียงใหญ่, พว.ภัญญณัฐ ศากยโรจน์, ภญ.นัทธมน เดชประภัสสร (หอผู้ป่วยกึ่งวิกฤตออร์โธปิดิกส์ RA1TI คณะแพทยศาสตร์ โรงพยาบาลรามาธิบดี)

Smart Collaboration: From error detection to erro

- NSAIDs/COXIBs in special population
- Nefopam interaction
- Weak opioid duplication
- Spinal/epidural analgesia



Spinal morphine

Layer 1: Communication Safety

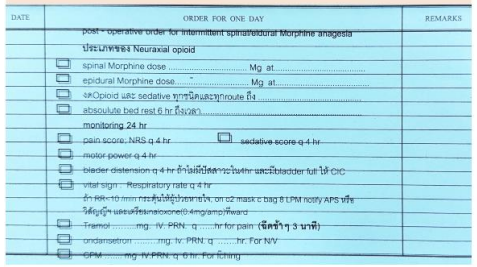
- I-SBAR Standardized Handover

พัฒนารูปแบบการส่งต่อข้อมูลผู้ป่วยที่ได้ Spinal Morphine ให้เป็นมาตรฐานเดียวกัน



- Standing Order for Spinal Anesthesia

ลดความคลาดเคลื่อนจากการคัดลอกคำสั่งด้วยลายมือให้ข้อมูลคำสั่งการรักษาและแนวทางการดูแลผู้ป่วยที่เป็นมาตรฐานเดียวกัน



Layer 2: Visual Safety

กำหนดจุดแจ้งเตือน 3 ตำแหน่ง (Triple Alert)



- Chart Alert

เตือนแพทย์ก่อน order เตือนพยาบาลก่อนรับคำสั่ง และใช้เน้นย้ำช่วงการส่งต่อผู้ป่วย



- MAR Alert

ป้องกันความคลาดเคลื่อนก่อนการเตรียมยาและบริหารยา

- Patient Identification Alert



ติดป้ายเตือนบริเวณข้อมือผู้ป่วย เพื่อให้บุคลากรทุกหน่วยรับทราบข้อควรระวังทันทีเมื่อพบผู้ป่วย



Layer 3: Human Competency

- Training



อบรมภายในหน่วยงานโดย Preceptor และเภสัชกรประจำหอผู้ป่วย

- Competency Assessment

ประเมินสมรรถนะการส่งเวร ความรู้ในการดูแลผู้ป่วยที่ได้ spinal morphine และการปฏิบัติงานตาม protocol

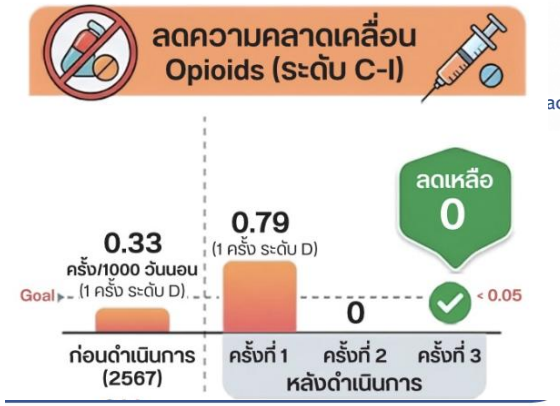


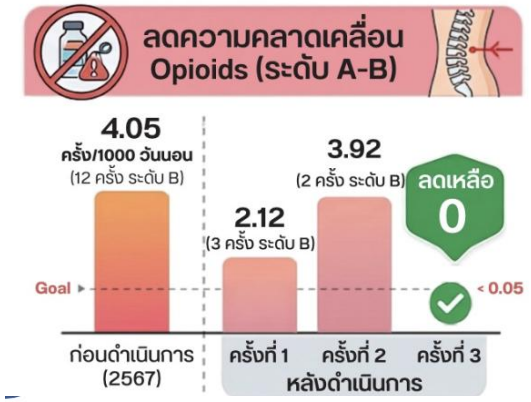
- Simulation

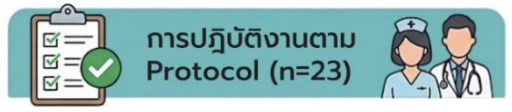
จำลองสถานการณ์ฝึกการตัดสินใจและการตอบสนองต่อสถานการณ์จริง

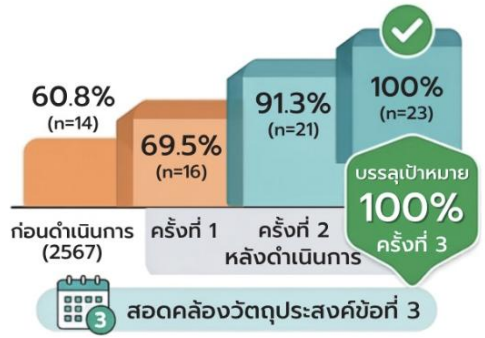












Who can prevent medication error?

80-year-old woman:

Hip fracture

U/D: IHD on antiplatelet
CKD
HT DM



Physician

Nurse

Pharmacist

All of above ✓

Case Challenge: postoperative day 1

- Renal function worsens
- Patient becomes increasingly drowsy

What should happen before the next dose?

Assess	Sedation · breathing · bleeding
Verify	Renal function · orders
Escalate	Nurse ↔ Pharmacist ↔ Physician

Three actions that prevent harm



Anticipate

Recognize risk early



Communicate

Close the loop



Standardize

Build safer systems

Safer medication. Better recovery.

Smart orthopedic care begins with teamwork.