

PRD: Modul Farmasi & Stok Ubat - Pengurusan Ubat & Stok

Kod PRD: KLINIK-Farmasi-PR2026-01-pengurusan-ubat-stok **Modul:** Farmasi & Stok Ubat **Submodul:** Pengurusan Ubat **Tarikh Dicipta:** 2026-01-13 **Versi:** 1.0 **Pemilik Produk:** Pengurusan Klinik **Stakeholder:** Ahli Farmasi, Doktor, Jururawat, Pengurus Klinik

1. Ringkasan Eksekutif

1.1 Objektif

Sistem Pengurusan Farmasi & Stok Ubat bertujuan untuk mengautomasikan proses penerimaan preskripsi, pendispensan ubat, pengurusan stok ubat secara real-time, dan pematuhan Akta Racun 1952 bagi memastikan keselamatan pesakit dan kecekapan operasi farmasi di Poliklinik Al-Huda.

1.2 Skop

- Penerimaan preskripsi elektronik daripada modul EMR dan preskripsi manual
- Pendispensan ubat dengan semakan interaksi ubat (drug-drug, drug-allergy)
- Pengurusan stok ubat dengan pengesanan real-time dan FEFO/FIFO
- Pengurusan batch number dan tarikh luput ubat
- Pematuhan Akta Racun 1952 (Poison Register untuk Kumpulan A)
- Integrasi dengan modul EMR (terima preskripsi) dan Billing (auto-generate bil)
- Pengurusan pembekal dan pesanan pembelian (Purchase Order)
- Rekod Ubat Pesakit (Patient Medication Record - PMR)
- Pelaporan komprehensif (jualan, stok, luput, poison register)

1.3 Out of Scope

- Pengurusan klinik veterinar atau hospital besar (fokus: klinik swasta kecil-sederhana)
- Pengurusan ubat kawalan (narcotic) peringkat tinggi (fokus: poison schedule asas)
- E-commerce atau jualan online ubat
- Integrasi dengan sistem kerajaan (QUEST, myHEALTH)

2. Pernyataan Masalah

2.1 Masalah Semasa

- Stok tidak dikemaskini real-time:** Stok ubat dikemaskini manual, menyebabkan ketidaktepatan stok dan risiko dispensing ubat yang tidak mencukupi
- Tiada alert ubat luput:** Ubat yang hampir luput tidak dikesan awal, menyebabkan kerugian dan risiko dispensing ubat luput
- Tiada semakan interaksi ubat:** Tiada sistem automatik untuk menyemak drug-drug interaction atau drug-allergy interaction
- Pematuhan Akta Racun manual:** Poison Register untuk ubat Kumpulan A ditulis manual, memakan masa dan terdedah kepada kesilapan
- Preskripsi tidak terintegrasi:** Preskripsi daripada doktor perlu ditaip semula atau dicari manual
- Tiada Patient Medication Record:** Sejarah ubat pesakit tidak terpusat, menyukarkan semakan ubat terdahulu

2.2 Impak

- Risiko keselamatan pesakit (adverse drug reaction, medication error)
- Kerugian kewangan akibat ubat luput atau stok tidak tepat
- Ketidakpatuhan undang-undang (Akta Racun 1952)
- Kelewatan dalam dispensing ubat
- Beban kerja tinggi untuk ahli farmasi

3. User Stories

3.1 User Stories Utama

1. **Sebagai Ahli Farmasi, saya mahu** menerima preskripsi elektronik terus daripada modul EMR **supaya** saya tidak perlu menaip semula preskripsi dan mengurangkan risiko kesilapan **bila** doktor finalize preskripsi di EMR **saya sepatutnya** dapat melihat preskripsi baru dalam senarai tugas saya dengan status 'pending review'
2. **Sebagai Ahli Farmasi, saya mahu** merekod preskripsi manual daripada pesakit walk-in atau rujukan luar **supaya** semua preskripsi direkodkan dalam sistem walaupun tidak datang daripada EMR **bila** pesakit datang dengan preskripsi luar **saya sepatutnya** boleh input preskripsi manual dengan scan atau taip
3. **Sebagai Ahli Farmasi, saya mahu** menyemak stok ubat secara real-time semasa review preskripsi **supaya** saya tahu sama ada stok mencukupi sebelum dispensing **bila** saya buka preskripsi **saya sepatutnya** nampak status stok (Available/Low Stock/Out of Stock) bagi setiap ubat
4. **Sebagai Ahli Farmasi, saya mahu** sistem auto-check drug-drug interaction dan drug-allergy interaction **supaya** saya dapat mengelak adverse drug reaction **bila** saya review preskripsi **saya sepatutnya** dapat alert jika ada interaction dan cadangan alternatif
5. **Sebagai Ahli Farmasi, saya mahu** memilih batch number ubat berdasarkan FEFO (First Expiry First Out) **supaya** ubat yang hampir luput digunakan dahulu **bila** saya dispensing ubat **saya sepatutnya** sistem auto-suggest batch number yang paling hampir luput
6. **Sebagai Ahli Farmasi, saya mahu** sistem auto-deduct stok selepas dispensing **supaya** stok sentiasa tepat tanpa perlu update manual **bila** saya klik 'Dispense' **saya sepatutnya** stok berkurangan secara automatik mengikut kuantiti yang didisburse
7. **Sebagai Ahli Farmasi, saya mahu** mencetak label ubat dengan arahan penggunaan dan amaran **supaya** pesakit tahu cara guna ubat dengan betul **bila** saya dispensing ubat **saya sepatutnya** boleh print label dengan nama pesakit, nama ubat, dos, frekuensi, dan amaran
8. **Sebagai Ahli Farmasi, saya mahu** merekod nasihat farmasi (pharmaceutical care) yang diberikan kepada pesakit **supaya** dokumentasi lengkap untuk audit dan kesinambungan rawatan **bila** saya beri counseling **saya sepatutnya** boleh rekod nasihat dalam sistem dan ia disimpan dalam PMR pesakit
9. **Sebagai Ahli Farmasi, saya mahu** melihat Patient Medication Record (PMR) pesakit **supaya** saya tahu sejarah ubat pesakit termasuk alergi dan ubat terdahulu **bila** saya review preskripsi **saya sepatutnya** nampak senarai ubat semasa, sejarah ubat, dan alergi pesakit
10. **Sebagai Ahli Farmasi, saya mahu** dapat alert apabila stok ubat mencapai paras minimum **supaya** saya boleh buat reorder awal sebelum stok habis **bila** stok ubat kurang daripada minimum level **saya sepatutnya** dapat notification dan cadangan kuantiti reorder
11. **Sebagai Ahli Farmasi, saya mahu** dapat alert ubat yang akan luput dalam 3 bulan **supaya** saya boleh plan untuk guna dahulu atau return kepada pembekal **bila** ubat hampir luput **saya sepatutnya** nampak senarai ubat expiring soon dalam dashboard
12. **Sebagai Ahli Farmasi, saya mahu** sistem auto-maintain Poison Register untuk ubat Kumpulan A **supaya** saya patuh Akta Racun 1952 tanpa perlu tulis manual **bila** saya dispensing ubat poison **saya sepatutnya** sistem auto-rekod dalam poison register dengan tarikh, nama pesakit, kuantiti, dan balance
13. **Sebagai Ahli Farmasi, saya mahu** buat stock adjustment untuk ubat rosak atau expired **supaya** stok sistem sama dengan stok fizikal **bila** saya ada ubat rosak atau return **saya sepatutnya** boleh adjust stok dengan sebab dan approval
14. **Sebagai Ahli Farmasi, saya mahu** buat stocktake berkala **supaya** saya boleh verify stok fizikal dengan stok sistem **bila** end of month **saya sepatutnya** boleh print senarai stok dan input stok fizikal untuk variance report
15. **Sebagai Pengurus Klinik, saya mahu** melihat laporan jualan ubat, stok semasa, dan ubat luput **supaya** saya boleh buat keputusan perniagaan dan procurement **bila** saya buka modul laporan **saya sepatutnya** boleh generate laporan dengan filter tarikh, kategori ubat, atau pembekal

3.2 Edge Cases

1. **Sebagai Ahli Farmasi, saya mahu** override interaction alert dengan justifikasi **supaya** saya boleh dispensing ubat walaupun ada alert jika doktor confirm **bila** ada interaction alert tetapi doktor dah confirm **saya sepatutnya** boleh override dengan rekod justifikasi dan doktor yang approve
 2. **Sebagai Ahli Farmasi, saya mahu** handle partial dispensing **supaya** saya boleh dispensing sebahagian ubat jika stok tidak mencukupi **bila** stok kurang daripada kuantiti preskripsi **saya sepatutnya** boleh dispensing partial dengan rekod balance owed
 3. **Sebagai Ahli Farmasi, saya mahu** void atau cancel dispensing dengan sebab **supaya** saya boleh reverse dispensing yang salah **bila** saya dispensing salah ubat **saya sepatutnya** boleh void dengan justifikasi dan stok auto-restore
 4. **Sebagai Ahli Farmasi, saya mahu** handle ubat extemporaneous (compounding) **supaya** saya boleh rekod ubat yang dibuat in-house **bila** klinik buat compounding **saya sepatutnya** boleh rekod formula, bahan mentah, dan batch number compounded product
 5. **Sebagai Doktor, saya mahu** dapat notification status preskripsi **supaya** saya tahu sama ada preskripsi sudah didispenase atau ada masalah **bila** saya prescribed ubat **saya sepatutnya** dapat update status (Pending Review/Ready to Dispense/Dispensed/Issue) dalam EMR
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4. Keperluan Fungsian

4.1 Penerimaan Preskripsi

FR-1: Sistem mesti boleh menerima preskripsi elektronik daripada modul EMR secara automatik apabila doktor finalize preskripsi

FR-2: Sistem mesti menyokong input preskripsi manual untuk pesakit walk-in atau rujukan luar dengan:

- Pilihan scan preskripsi kertas (PDF/Image)
- Input manual dengan search ubat
- Input maklumat doktor luar (nama, MMC number, klinik/hospital)

FR-3: Sistem mesti memaparkan senarai preskripsi dengan filter status:

- Pending Review
- Ready to Dispense
- Dispensed
- Cancelled
- On Hold (partial/stock issue)

4.2 Pengurusan Ubat (Drug Database)

FR-4: Sistem mesti mempunyai drug database dengan maklumat berikut:

- Nama ubat (generic + brand name)
- Dosage form (tablet, capsule, syrup, cream, etc.)
- Strength (e.g., 500mg, 10mg/ml)
- Poison Schedule Classification (Akta Racun 1952):
 - Kumpulan A (Group A Poisons)
 - Kumpulan B (Group B Poisons)
 - Kumpulan C (Group C Poisons)
 - First Schedule Poisons
 - Second Schedule Poisons
 - Non-poison
- Kategori ubat (Antibiotic, Analgesic, Antihypertensive, dll.)
- Route of administration (oral, topical, injection)
- Storage condition (room temp, refrigerated)

- Interaction database (drug-drug, drug-allergy)
- Pregnancy category
- Sokongan import dari MIMS atau NDFM (optional CSV import)

FR-5: Sistem mesti support custom drug entry untuk ubat compounding atau ubat baru

4.3 Workflow Dispensing

FR-6: Sistem mesti menyokong full dispensing workflow:

1. Review Preskripsi:

- Lihat preskripsi + patient info + medical history
- Semak PMR (Patient Medication Record)

2. Check Stok:

- Auto-check stok availability
- Alert jika low stock atau out of stock

3. Check Interaction:

- Auto-check drug-drug interaction
- Auto-check drug-allergy interaction (daripada patient allergies dalam EMR)
- Display alert dengan severity level (Contraindicated/Major/Moderate/Minor)
- Cadangan alternatif jika ada interaction

4. Dispensing:

- Pilih batch number (auto-suggest FEFO)
- Confirm kuantiti dispensing
- Auto-deduct stok
- Rekod pharmacist yang dispensing

5. Label Printing:

- Print label ubat dengan:
 - Nama pesakit + IC/Passport
 - Nama ubat (generic + brand)
 - Dos dan frekuensi
 - Arahan penggunaan
 - Amaran (e.g., "Ambil selepas makan", "Elak alkohol")
 - Tarikh dispensing + expiry date

6. Pharmaceutical Care (Counseling):

- Rekod nasihat farmasi
- Tanda checklist counseling points (e.g., cara guna, side effects, storage)
- Signature pesakit (optional)

FR-7: Sistem mesti support partial dispensing:

- Dispensing sebahagian ubat jika stok tidak mencukupi
- Rekod balance owed
- Alert untuk fulfill balance apabila stok masuk

FR-8: Sistem mesti allow override interaction alert dengan:

- Justifikasi (free text)
- Doktor yang approve override
- Rekod audit trail

FR-9: Sistem mesti allow void/cancel dispensing dengan:

- Sebab (salah ubat, salah dos, pesakit tak ambil, dll.)
- Auto-restore stok
- Rekod audit trail

4.4 Pengurusan Stok Ubat

FR-10: Sistem mesti track stok ubat dengan:

- Batch number (compulsory untuk poison schedule drugs)
- Tarikh luput
- Supplier
- Cost price per unit
- Selling price per unit
- Stok semasa (real-time)
- Minimum stock level (reorder point)
- Maximum stock level

FR-11: Sistem mesti auto-deduct stok selepas dispensing dengan:

- FEFO (First Expiry First Out) atau FIFO (First In First Out)
- Track stok per batch number

FR-12: Sistem mesti provide low stock alert:

- Notification apabila stok \leq minimum level
- Cadangan kuantiti reorder berdasarkan average usage
- Generate reorder list

FR-13: Sistem mesti provide expiry alert:

- Alert ubat yang akan luput dalam 3 bulan
- Senarai ubat expired yang perlu dispose
- Track ubat expired dalam laporan

FR-14: Sistem mesti support stock adjustment:

- Reason: Damaged, Expired, Return to Supplier, Lost, Theft, Correction
- Approval workflow (jika adjust > threshold, perlu approval Pengurus)
- Rekod audit trail

FR-15: Sistem mesti support periodic stocktake:

- Print stock list untuk physical count
- Input physical count
- Generate variance report (System stock vs Physical stock)
- Auto-adjust stok selepas approval

4.5 Patient Medication Record (PMR)

FR-16: Sistem mesti menyimpan PMR untuk setiap pesakit dengan:

- Ubat semasa (current medications)
- Sejarah ubat (dispensing history dengan tarikh)
- Alergi ubat (daripada EMR)
- Adverse drug reaction (ADR) history
- Pharmaceutical care notes

FR-17: Sistem mesti auto-update PMR selepas setiap dispensing

4.6 Pematuhan Akta Racun 1952 (Poison Register)

FR-18: Sistem mesti auto-maintain Poison Register untuk ubat Kumpulan A (Group A Poisons) dengan rekod:

- Tarikh dispensing
- Nama ubat (poison)
- Kuantiti dispensed
- Nama pesakit + IC/Passport
- Alamat pesakit
- Nama doktor + MMC number
- Balance stok selepas dispensing
- Nama ahli farmasi

FR-19: Sistem mesti allow print Poison Register untuk inspection oleh Kementerian Kesihatan

FR-20: Sistem mesti alert ahli farmasi jika ubat adalah poison schedule untuk ensure proper handling

4.7 Pengurusan Pembekal & Purchase Order

FR-21: Sistem mesti support pengurusan pembekal (supplier) dengan:

- Nama pembekal
- Contact person + phone + email
- Alamat
- Payment terms (COD, 30 days, 60 days)
- Status (Active/Inactive)

FR-22: Sistem mesti support Purchase Order (PO) dengan:

- Auto-generate PO berdasarkan reorder list
- Manual create PO
- Track PO status (Draft/Sent/Partial Received/Fully Received/Cancelled)
- Print PO untuk email/fax kepada supplier

FR-23: Sistem mesti support Goods Receipt:

- Receive stok berdasarkan PO atau receive stok tanpa PO
- Input batch number, expiry date, kuantiti received
- Auto-update stok selepas goods receipt
- Generate Goods Receipt Note (GRN)

FR-24: Sistem mesti support return to supplier:

- Reason: Damaged, Expired, Wrong item
- Track return status
- Auto-adjust stok

4.8 Integrasi Dengan Sistem Lain

FR-25: Integrasi dengan Modul EMR:

- Auto-receive preskripsi elektronik daripada EMR apabila doktor finalize
- Send status update preskripsi kembali ke EMR (Pending Review/Dispensed/Issue)
- Auto-populate drug allergy daripada EMR patient profile

FR-26: Integrasi dengan Modul Billing:

- Auto-generate bil untuk ubat yang didispense
- Hantar data: Nama ubat, kuantiti, harga per unit, total harga
- Support GST/Sales tax calculation (jika applicable)

4.9 Pelaporan

FR-27: Sistem mesti provide laporan berikut:

1. Sales Report:

- Jualan ubat by period (daily/weekly/monthly)
- Breakdown by kategori ubat
- Top selling drugs
- Revenue by drug

2. Stock Report:

- Current stock level (semua ubat atau by kategori)
- Stock movement (in/out) by period
- Slow moving drugs
- Stock value (total cost)

3. Expiry Report:

- Ubat yang akan luput dalam 1/3/6 bulan
- Ubat yang sudah luput (belum dispose)

4. Poison Register Report:

- Senarai dispensing ubat poison (Kumpulan A) by period
- Format follow Akta Racun 1952 requirement

5. Dispensing Report:

- Number of prescriptions dispensed by period
- Dispensing by pharmacist
- Average dispensing time
- Partial dispensing report
- Void/cancelled dispensing report

6. Supplier Report:

- Purchase by supplier
- Outstanding PO
- Goods receipt by supplier

7. Variance Report (Stocktake):

- System stock vs Physical stock
- Variance by drug
- Variance value

FR-28: Semua laporan mesti boleh export ke PDF dan Excel

5. Keperluan Teknikal

5.1 Arkitektur Sistem

Framework: Laravel 12 **Frontend:** Blade Templates + Bootstrap 5 + CoreUI **Database:** MySQL 8.0 **Pattern:** Service Layer + Repository Pattern **Validation:** FormRequest **Routing:** Spatie Route Attributes

5.2 Struktur Database

Jadual: **ubat** (Drug Database)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
kod_ubat	varchar(50) UNIQUE NOT NULL	Auto-generated (UBT-00001)

nama_generik	varchar(255) NOT NULL	Generic name
nama_brand	varchar(255) NULL	Brand name
dosage_form	varchar(100) NOT NULL	Tablet, Capsule, Syrup, etc.
strength	varchar(100) NOT NULL	e.g., 500mg, 10mg/ml
route	varchar(100) NOT NULL	Oral, Topical, Injection, etc.
poison_schedule	enum('group_a','group_b','group_c','first_schedule','second_schedule','non_poison') NOT NULL	Poison classification
kategori	varchar(100) NOT NULL	Antibiotic, Analgesic, etc.
unit	varchar(50) NOT NULL	Tablet, Bottle, Tube, etc.
storage_condition	varchar(255) NULL	Room temp, Refrigerated
pregnancy_category	char(1) NULL	A, B, C, D, X
harga_kos	decimal(10,2) NOT NULL DEFAULT 0	Cost price per unit
harga_jual	decimal(10,2) NOT NULL DEFAULT 0	Selling price per unit
min_stok	int NOT NULL DEFAULT 0	Minimum stock level (reorder point)
max_stok	int NOT NULL DEFAULT 0	Maximum stock level
status	enum('active','discontinued') NOT NULL DEFAULT 'active'	Status
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: stok_ubat (Drug Stock)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
batch_number	varchar(100) NOT NULL	Batch number (compulsory for poison)
tarikh_luput	date NOT NULL	Expiry date

supplier_id	bigint UNSIGNED NULL	FK → supplier.id
grn_id	bigint UNSIGNED NULL	FK → goods_receipt.id (reference)
kuantiti_awal	int NOT NULL	Initial quantity received
kuantiti_semasa	int NOT NULL	Current quantity available
harga_kos	decimal(10,2) NOT NULL	Cost price per unit (at time of purchase)
tarikh_terima	date NOT NULL	Date received
status	enum('available','expired','damaged','returned') NOT NULL DEFAULT 'available'	Status
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Index: UNIQUE(ubat_id, batch_number, tarikh_luput) **Note:** Satu ubat boleh ada multiple batch dengan tarikh luput berbeza

Jadual: preskripsi (Prescriptions)

Column	Type	Desc
id	bigint UNSIGNED PK	Prima
kod_preskripsi	varchar(50) UNIQUE NOT NULL	Auto-gener (RX-YYYYMM0001)
jenis	enum('electronic','manual') NOT NULL	Source
emr_id	bigint UNSIGNED NULL	FK → emr.id (jika electronic)
pesakit_id	bigint UNSIGNED NOT NULL	FK → pesakit.id
doktor_id	bigint UNSIGNED NULL	FK → doktor.id (jika electronic)
doktor_luar_nama	varchar(255) NULL	External doctor name (jika manual)
doktor_luar_mmc	varchar(50) NULL	External doctor number (jika manual)
doktor_luar_klinik	varchar(255) NULL	External clinic name (jika manual)
tarikh_preskripsi	date NOT NULL	Prescription date

scan_preskripsi	varchar(255) NULL	Path to scan prescription (if not)
status	enum('pending_review','ready_to_dispense','partially_dispensed','dispensed','cancelled','on_hold') NOT NULL DEFAULT 'pending_review'	Status
reviewed_by	bigint UNSIGNED NULL	FK → id (ahli farmasi yang review)
reviewed_at	timestamp NULL	Review timestamp
catatan	text NULL	Notes pharmacist
created_at	timestamp	Create timestamp
updated_at	timestamp	Update timestamp

Jadual: `preskripsi_item` (Prescription Items)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
preskripsi_id	bigint UNSIGNED NOT NULL	FK → preskripsi.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
kuantiti_prescribed	int NOT NULL	Quantity prescribed
dos	varchar(255) NOT NULL	e.g., "500mg"
frekuensi	varchar(255) NOT NULL	e.g., "3 kali sehari"
tempoh	varchar(100) NULL	Duration, e.g., "7 hari"
arahan	text NULL	Instructions, e.g., "Ambil selepas makan"
kuantiti_dispensed	int NOT NULL DEFAULT 0	Total dispensed so far
kuantiti_balance	int NOT NULL DEFAULT 0	Balance owed (for partial)
status	enum('pending','dispensed','partial','cancelled') NOT NULL DEFAULT 'pending'	Item status
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: `dispensing` (Dispensing Records)

Column	Type	Description
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id	bigint UNSIGNED PK	Primary key
kod_dispensing	varchar(50) UNIQUE NOT NULL	Auto-generated (DSP-YYYYMMDD-0001)
preskripsi_id	bigint UNSIGNED NOT NULL	FK → preskripsi.id
preskripsi_item_id	bigint UNSIGNED NOT NULL	FK → preskripsi_item.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
stok_ubat_id	bigint UNSIGNED NOT NULL	FK → stok_ubat.id (batch selected)
batch_number	varchar(100) NOT NULL	Batch number dispensed
kuantiti_dispensed	int NOT NULL	Quantity dispensed
harga_jual_unit	decimal(10,2) NOT NULL	Selling price per unit
jumlah_harga	decimal(10,2) NOT NULL	Total price
tarikh_dispensing	date NOT NULL	Dispensing date
dispensed_by	bigint UNSIGNED NOT NULL	FK → users.id (ahli farmasi)
pharmaceutical_care	text NULL	Counseling notes
status	enum('dispensed','voided') NOT NULL DEFAULT 'dispensed'	Status
void_reason	text NULL	Reason if voided
voided_by	bigint UNSIGNED NULL	FK → users.id
voided_at	timestamp NULL	Void timestamp
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: drug_interactions (Drug Interaction Database)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
ubat_a_id	bigint UNSIGNED NOT NULL	FK → ubat.id (first drug)
ubat_b_id	bigint UNSIGNED NOT NULL	FK → ubat.id (second drug)
severity	enum('contraindicated','major','moderate','minor') NOT NULL	Severity level
description	text NOT NULL	Interaction description
recommendation	text NULL	Clinical recommendation
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Index: UNIQUE(ubat_a_id, ubat_b_id)

Jadual: patient_medication_record (PMR)

Column	Type	Description
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id	bigint UNSIGNED PK	Primary key
pesakit_id	bigint UNSIGNED NOT NULL	FK → pesakit.id
dispensing_id	bigint UNSIGNED NOT NULL	FK → dispensing.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
tarikh_dispensing	date NOT NULL	Dispensing date
dos	varchar(255) NOT NULL	Dosage
frekuensi	varchar(255) NOT NULL	Frequency
kuantiti	int NOT NULL	Quantity dispensed
pharmaceutical_care	text NULL	Counseling notes
dispensed_by	bigint UNSIGNED NOT NULL	FK → users.id (ahli farmasi)
created_at	timestamp	Created timestamp

Note: PMR adalah historical record, tidak akan di-update atau delete

Jadual: `poison_register` (Akta Racun 1952 Compliance)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
dispensing_id	bigint UNSIGNED NOT NULL	FK → dispensing.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id (must be poison schedule)
tarikh_dispensing	date NOT NULL	Dispensing date
nama_ubat	varchar(255) NOT NULL	Drug name
batch_number	varchar(100) NOT NULL	Batch number
kuantiti_dispensed	int NOT NULL	Quantity dispensed
balance_stok	int NOT NULL	Stock balance after dispensing
pesakit_nama	varchar(255) NOT NULL	Patient name
pesakit_ic	varchar(50) NOT NULL	Patient IC/Passport
pesakit_alamat	text NOT NULL	Patient address
doktor_nama	varchar(255) NOT NULL	Doctor name
doktor_mmc	varchar(50) NULL	Doctor MMC number
ahli_farmasi	varchar(255) NOT NULL	Pharmacist name
created_at	timestamp	Created timestamp

Note: Auto-created for Group A poisons only

Jadual: `supplier` (Suppliers)

Column	Type	Description
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id	bigint UNSIGNED PK	Primary key
kod_supplier	varchar(50) UNIQUE NOT NULL	Auto-generated (SUP-00001)
nama	varchar(255) NOT NULL	Supplier name
contact_person	varchar(255) NULL	Contact person
telefon	varchar(50) NULL	Phone number
email	varchar(255) NULL	Email
alamat	text NULL	Address
payment_terms	varchar(100) NULL	e.g., COD, 30 days, 60 days
status	enum('active','inactive') NOT NULL DEFAULT 'active'	Status
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: **purchase_order** (Purchase Orders)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
kod_po	varchar(50) UNIQUE NOT NULL	Auto-generated (PO-YYYYMMDD-0001)
supplier_id	bigint UNSIGNED NOT NULL	FK → supplier.id
tarikh_po	date NOT NULL	PO date
tarikh_jangka_terima	date NULL	Expected delivery date
jumlah_kos	decimal(10,2) NOT NULL DEFAULT 0	Total cost
status	enum('draft','sent','partial_received','fully_received','cancelled') NOT NULL DEFAULT 'draft'	Status
catatan	text NULL	Notes
created_by	bigint UNSIGNED NOT NULL	FK → users.id
approved_by	bigint UNSIGNED NULL	FK → users.id
approved_at	timestamp NULL	Approval timestamp
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: **purchase_order_item** (PO Items)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
po_id	bigint UNSIGNED NOT NULL	FK → purchase_order.id

ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
kuantiti_order	int NOT NULL	Quantity ordered
kuantiti_received	int NOT NULL DEFAULT 0	Quantity received so far
harga_kos_unit	decimal(10,2) NOT NULL	Cost price per unit
jumlah_kos	decimal(10,2) NOT NULL	Total cost for this item
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: goods_receipt (Goods Receipt)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
kod_grn	varchar(50) UNIQUE NOT NULL	Auto-generated (GRN-YYYYMMDD-0001)
po_id	bigint UNSIGNED NULL	FK → purchase_order.id (NULL jika receive tanpa PO)
supplier_id	bigint UNSIGNED NOT NULL	FK → supplier.id
tarikh_terima	date NOT NULL	Receipt date
invoice_number	varchar(100) NULL	Supplier invoice number
catatan	text NULL	Notes
received_by	bigint UNSIGNED NOT NULL	FK → users.id
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: goods_receipt_item (GRN Items)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
grn_id	bigint UNSIGNED NOT NULL	FK → goods_receipt.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
batch_number	varchar(100) NOT NULL	Batch number
tarikh_luput	date NOT NULL	Expiry date
kuantiti_received	int NOT NULL	Quantity received
harga_kos_unit	decimal(10,2) NOT NULL	Cost price per unit
jumlah_kos	decimal(10,2) NOT NULL	Total cost
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Note: Setiap GRN item akan create entry dalam `stok_ubat`

Jadual: stock_adjustment (Stock Adjustments)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
kod_adjustment	varchar(50) UNIQUE NOT NULL	Auto-generated (ADJ-YYYYMMDD-0001)
stok_ubat_id	bigint UNSIGNED NOT NULL	FK → stok_ubat.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
batch_number	varchar(100) NOT NULL	Batch number
jenis	enum('in','out') NOT NULL	Adjustment type (increase/decrease)
kuantiti	int NOT NULL	Quantity adjusted
sebab	enum('damaged','expired','return_to_supplier','lost','theft','correction','other') NOT NULL	Reason
catatan	text NULL	Notes
tarikh_adjustment	date NOT NULL	Adjustment date
created_by	bigint UNSIGNED NOT NULL	FK → users.id
approved_by	bigint UNSIGNED NULL	FK → users.id (jika perlu approval)
approved_at	timestamp NULL	Approval timestamp
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: stocktake (Physical Stocktake)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
kod_stocktake	varchar(50) UNIQUE NOT NULL	Auto-generated (STK-YYYYMM-01)
tarikh_stocktake	date NOT NULL	Stocktake date
status	enum('draft','completed','approved') NOT NULL DEFAULT 'draft'	Status
total_variance_value	decimal(10,2) NOT NULL DEFAULT 0	Total variance value
created_by	bigint UNSIGNED NOT NULL	FK → users.id
approved_by	bigint UNSIGNED NULL	FK → users.id
approved_at	timestamp NULL	Approval timestamp
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: stocktake_item (Stocktake Items)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
stocktake_id	bigint UNSIGNED NOT NULL	FK → stocktake.id
ubat_id	bigint UNSIGNED NOT NULL	FK → ubat.id
stok_ubat_id	bigint UNSIGNED NOT NULL	FK → stok_ubat.id
batch_number	varchar(100) NOT NULL	Batch number
system_qty	int NOT NULL	System quantity
physical_qty	int NULL	Physical count (input by user)
variance_qty	int NOT NULL DEFAULT 0	Variance (physical - system)
variance_value	decimal(10,2) NOT NULL DEFAULT 0	Variance value (variance_qty × cost)
catatan	text NULL	Notes for variance
created_at	timestamp	Created timestamp
updated_at	timestamp	Updated timestamp

Jadual: `interaction_alert_override` (Override Interaction Alerts)

Column	Type	Description
id	bigint UNSIGNED PK	Primary key
dispensing_id	bigint UNSIGNED NOT NULL	FK → dispensing.id
interaction_id	bigint UNSIGNED NOT NULL	FK → drug_interactions.id
justification	text NOT NULL	Reason for override
approved_by_doktor_id	bigint UNSIGNED NULL	FK → users.id (dokter yang approve)
overridden_by	bigint UNSIGNED NOT NULL	FK → users.id (ahli farmasi)
created_at	timestamp	Created timestamp

5.3 Models (Eloquent)

Models yang perlu dicipta:

- `Ubat` (Drug)
- `StokUbat` (DrugStock)
- `Preskripsi` (Prescription)
- `PreskripsiItem` (PrescriptionItem)
- `Dispensing`
- `DrugInteraction`
- `PatientMedicationRecord`
- `PoisonRegister`
- `Supplier`
- `PurchaseOrder`
- `PurchaseOrderItem`
- `GoodsReceipt`
- `GoodsReceiptItem`

- StockAdjustment
- Stocktake
- StocktakeItem
- InteractionAlertOverride

Relationships:

- Ubat hasMany StokUbat
- Ubat hasMany Dispensing
- Preskripsi hasMany PreskripsiItem
- Preskripsi belongsTo Pesakit
- Preskripsi belongsTo EMR (optional)
- PreskripsiItem belongsTo Ubat
- Dispensing belongsTo Preskripsi
- Dispensing belongsTo StokUbat
- Dispensing belongsTo User (ahli farmasi)
- PurchaseOrder hasMany PurchaseOrderItem
- GoodsReceipt hasMany GoodsReceiptItem

5.4 Services & Repositories

Services:

- PreskripsiService - Handle preskripsi workflow
- DispensingService - Handle dispensing workflow (check stock, check interaction, dispense, update stock)
- StokUbatService - Handle stock management (receive, adjust, stocktake)
- DrugInteractionService - Check drug-drug and drug-allergy interactions
- PoisonRegisterService - Auto-maintain poison register
- PurchaseOrderService - Handle PO workflow
- ReportService - Generate all reports

Repositories:

- UbatRepository
- StokUbatRepository
- PreskripsiRepository
- DispensingRepository
- SupplierRepository
- PurchaseOrderRepository

5.5 FormRequests (Validation)

- StoreUbatRequest
- StorePreskripsiRequest
- DispensingRequest
- StockAdjustmentRequest
- StorePurchaseOrderRequest
- GoodsReceiptRequest

6. Workflow

6.1 Workflow Penerimaan Preskripsi Elektronik

Doktor finalize preskripsi di EMR

↓

Sistem auto-create entry dalam jadual `preskripsi` (jenis=electronic, status=pending_review)

↓

Sistem auto-create entry dalam jadual `preskripsi_item` untuk setiap ubat

↓

Sistem send notification kepada Farmasi

↓

Ahli Farmasi dapat alert preskripsi baru dalam senarai tugas

6.2 Workflow Dispensing Ubat

1. REVIEW PRESKRIPSI

Ahli Farmasi buka preskripsi (status: pending_review)

↓

Lihat maklumat pesakit + preskripsi + PMR + alergi

↓

Klik "Review"

2. CHECK STOK

Sistem auto-check stok untuk semua ubat dalam preskripsi

↓

Display status: Available (hijau) / Low Stock (kuning) / Out of Stock (merah)

↓

Jika out of stock → Alert ahli farmasi, option: Cancel item / Partial dispense

3. CHECK INTERACTION

Sistem auto-check drug-drug interaction (antara ubat dalam preskripsi)

↓

Sistem auto-check drug-allergy interaction (dengan patient allergies)

↓

Jika ada interaction → Display alert dengan severity + description

↓

Ahli Farmasi boleh:

- Hubungi doktor untuk clarification
- Override dengan justifikasi (rekod dalam `interaction_alert_override`)
- Suggest alternative drug

4. DISPENSING

Ahli Farmasi klik "Dispense" untuk setiap item

↓

Sistem auto-suggest batch number (FEF0 - earliest expiry first)

↓

Ahli Farmasi confirm batch number + kuantiti dispensing

↓

Sistem create entry dalam jadual `dispensing`

↓

Sistem auto-deduct stok (`stok_ubat.kuantiti_semasa`)

↓

Sistem update `preskripsi_item.kuantiti_dispensed` dan `kuantiti_balance`

↓

Jika ubat adalah Group A Poison → Sistem auto-create entry dalam `poison_register`

5. LABEL PRINTING

Ahli Farmasi klik "Print Label"

↓

Sistem generate label dengan:

- Nama pesakit + IC
- Nama ubat (generic + brand)
- Dos + frekuensi

- Arahan penggunaan
- Amaran
- Tarikh dispensing + expiry date

↓

Print label untuk tampil pada ubat

6. PHARMACEUTICAL CARE (COUNSELING)

Ahli Farmasi rekod nasihat farmasi dalam `dispensing.pharmaceutical_care`

↓

Checklist counseling points (optional):

- Cara guna ubat
- Side effects
- Storage condition
- Masa makan (before/after meal)

↓

Signature pesakit (optional)

7. FINALIZE

Selepas semua item dispensed → Status preskripsi update ke "dispensed"

↓

Sistem auto-create entry dalam `patient_medication_record` (PMR)

↓

Sistem send data to Billing module untuk auto-generate bil

↓

Sistem send status update ke EMR (status: Dispensed)

6.3 Workflow Partial Dispensing

Ahli Farmasi review preskripsi

↓

Stok tidak mencukupi untuk sesuatu ubat

↓

Ahli Farmasi pilih "Partial Dispense"

↓

Input kuantiti partial (e.g., prescribed 30, stok only 15, dispense 15)

↓

Sistem update:

- preskripsi_item.kuantiti_dispensed = 15
- preskripsi_item.kuantiti_balance = 15
- preskripsi_item.status = 'partial'
- preskripsi.status = 'partially_dispensed'

↓

Sistem alert ahli farmasi bila stok masuk untuk fulfill balance

↓

Bila stok dah ada, ahli farmasi dispensing balance (15 lagi)

↓

Sistem update:

- preskripsi_item.kuantiti_dispensed = 30
- preskripsi_item.kuantiti_balance = 0
- preskripsi_item.status = 'dispensed'
- preskripsi.status = 'dispensed' (jika semua item dah full)

6.4 Workflow Goods Receipt (Terima Stok)

1. CREATE PURCHASE ORDER (P0)

Pengurus/Ahli Farmasi create P0
↓
Pilih supplier
↓
Add ubat + kuantiti order + harga kos
↓
Status P0: Draft
↓
Submit untuk approval (optional)
↓
Selepas approved → Status P0: Sent
↓
Print/Email P0 kepada supplier

2. TERIMA STOK

Stok sampai dari supplier
↓
Ahli Farmasi create Goods Receipt Note (GRN)
↓
Link to P0 (atau tanpa P0 jika urgent purchase)
↓
Input untuk setiap ubat:
- Batch number
- Tarikh luput
- Kuantiti received
- Verify harga kos
↓
Sistem create entry dalam jadual `goods_receipt_item`
↓
Sistem auto-create entry dalam jadual `stok_ubat`:
- ubat_id
- batch_number
- tarikh_luput
- kuantiti_awal = kuantiti_received
- kuantiti_semasa = kuantiti_received
- supplier_id
- grn_id
- tarikh_terima
- status = 'available'
↓
Sistem update `purchase_order_item.kuantiti_received`
↓
Jika semua items fully received → Status P0: Fully Received
↓
Sistem check jika ada pending partial dispensing untuk ubat ini → Alert ahli farmasi

6.5 Workflow Stock Adjustment

Ahli Farmasi dapati ubat rosak/expired/lost
↓
Create Stock Adjustment
↓
Pilih ubat + batch number
↓

```
Pilih jenis: In (increase) atau Out (decrease)
↓
Input kuantiti adjustment
↓
Pilih sebab: Damaged / Expired / Return to Supplier / Lost / Theft / Correction / Other
↓
Input catatan (justification)
↓
Jika adjustment > threshold (e.g., > RM500 atau > 100 unit) → Perlu approval Pengurus
↓
Selepas approved → Sistem update `stok_ubat.kuantiti_semasa`
↓
Rekod audit trail dalam `stock_adjustment`
```

6.6 Workflow Stocktake

```
End of month / periodic stocktake
↓
Pengurus create Stocktake (status: draft)
↓
Sistem generate stocktake items dengan semua stok_ubat (status: available)
↓
Sistem populate `system_qty` dari `stok_ubat.kuantiti_semasa`
↓
Print stock list untuk physical count
↓
Ahli Farmasi/Staff kira stok fizikal
↓
Input `physical_qty` untuk setiap item
↓
Sistem auto-calculate:
- variance_qty = physical_qty - system_qty
- variance_value = variance_qty × harga_kos
↓
Sistem calculate `total_variance_value` (sum of all variance_value)
↓
Submit stocktake untuk approval
↓
Pengurus review variance report
↓
Jika variance acceptable → Approve stocktake
↓
Sistem auto-adjust stok:
- Update `stok_ubat.kuantiti_semasa` = physical_qty
- Create entry dalam `stock_adjustment` untuk setiap variance (sebab: Correction, with reference to stocktake_id)
↓
Status stocktake: Approved
```

7. Keperluan UI/UX

7.1 Design System

- **Framework:** Bootstrap 5 + CoreUI
- **Icons:** CoreUI Icons / Font Awesome

- **Color Scheme:** Professional medical color palette (blue/green tones)
- **Responsive:** Mobile-first design (support tablet untuk farmasi counter)

7.2 Key Pages & Components

1. Dashboard Farmasi

- Summary cards:
 - Pending Prescriptions (count)
 - Low Stock Alerts (count)
 - Expiring Soon (count)
 - Today's Dispensing (count)
- Quick action buttons: New Manual Prescription, View Prescriptions, Check Stock
- Alerts/Notifications panel (low stock, expiring drugs, partial dispense ready)
- Recent dispensing list (last 10)

2. Senarai Preskripsi

- Table dengan columns: Kod Preskripsi, Pesakit, Doktor, Tarikh, Status, Actions
- Filter: Status (Pending/Ready/Dispensed/Cancelled), Tarikh, Doktor
- Search: Kod preskripsi, nama pesakit, IC pesakit
- Status badge dengan color coding:
 - Pending Review: badge-warning
 - Ready to Dispense: badge-info
 - Dispensed: badge-success
 - Cancelled: badge-danger
 - Partially Dispensed: badge-secondary
- Actions: View/Review, Dispense, Cancel

3. Review & Dispensing Page

- Section 1: Patient Info
 - Nama, IC, Umur, Jantina
 - Alergi ubat (highlight dalam red box jika ada)
 - Button: View PMR
- Section 2: Prescription Details
 - Doktor, Tarikh preskripsi
 - Preskripsi items table:
 - Nama ubat, Dos, Frekuensi, Kuantiti, Status stok (icon: ✓/△/✗), Actions
- Section 3: Interaction Alerts (jika ada)
 - Alert box dengan severity color:
 - Contraindicated: danger (red)
 - Major: warning (orange)
 - Moderate: info (yellow)
 - Minor: secondary (grey)
 - Description + Recommendation
 - Button: Override (with justification modal)
- Section 4: Dispensing Form (untuk setiap item)
 - Select batch number (dropdown dengan FEFO suggestion, show expiry date)
 - Input kuantiti dispensing
 - Display selling price + total
 - Button: Dispense / Partial Dispense
- Section 5: Pharmaceutical Care
 - Textarea: Counseling notes
 - Checklist: Counseling points (optional)

- Section 6: Actions
 - Button: Print Label, Finalize & Send to Billing, Cancel Prescription

4. Drug Database Management

- Table dengan columns: Kod Ubat, Nama Generik, Brand, Strength, Poison Schedule, Kategori, Stok Semasa, Min Stok, Actions
- Filter: Kategori, Poison Schedule, Status
- Search: Nama ubat, kod ubat
- Actions: Edit, View Stock, View History
- Button: Add New Drug, Import from CSV

5. Stock Management

- Tab 1: Current Stock
 - Table: Kod Ubat, Nama Ubat, Batch Number, Tarikh Luput, Kuantiti, Min Stok, Status
 - Color coding:
 - Low stock ($\text{kuantiti} \leq \text{min_stok}$): background-warning
 - Expiring soon (< 3 months): background-info
 - Expired: background-danger
 - Filter: Status (Available/Low/Expired), Kategori, Poison Schedule
 - Actions: Adjust Stock, View History
- Tab 2: Goods Receipt
 - Button: New GRN, New PO
 - Table: Kod GRN, Supplier, Tarikh Terima, Total, Status, Actions
- Tab 3: Stock Adjustment
 - Button: New Adjustment
 - Table: Kod Adjustment, Ubat, Batch, Sebab, Kuantiti, Status, Actions
- Tab 4: Stocktake
 - Button: New Stocktake
 - Table: Kod Stocktake, Tarikh, Status, Total Variance, Actions

6. Patient Medication Record (PMR)

- Modal/Separate page
- Section 1: Patient Info + Allergies
- Section 2: Current Medications (active prescriptions)
- Section 3: Medication History
 - Timeline view (chronological)
 - Each entry: Tarikh, Ubat, Dos, Frekuensi, Kuantiti, Pharmacist, Counseling notes
- Section 4: ADR History (if any)

7. Purchase Order Management

- Table: Kod PO, Supplier, Tarikh PO, Tarikh Jangka Terima, Jumlah Kos, Status, Actions
- Filter: Status (Draft/Sent/Partial/Fully Received/Cancelled), Tarikh, Supplier
- Actions: View, Edit (jika Draft), Receive Goods, Print, Cancel
- Form: Create/Edit PO
 - Select Supplier
 - Add items (search ubat, input kuantiti order, harga kos)
 - Auto-calculate total
 - Button: Save as Draft, Submit for Approval, Send to Supplier

8. Reporting

- Select report type (dropdown)
- Date range picker

- Additional filters (kategori, supplier, pharmacist, etc.)
- Button: Generate Report, Export PDF, Export Excel
- Display report in table/chart format

9. Poison Register

- Read-only table (auto-maintained by sistem)
- Columns: Tarikh, Nama Ubat, Batch, Kuantiti Dispensed, Balance Stok, Pesakit (Nama + IC + Alamat), Doktor (Nama + MMC), Ahli Farmasi
- Filter: Tarikh range, Nama ubat
- Button: Print Poison Register (format for inspection)

7.3 Interaction Design

Real-time Stock Check:

- Apabila ahli farmasi review preskripsi, sistem auto-check stok real-time
- Display stock status icon:
 - ✓ (hijau): Stok mencukupi
 - ⚠ (kuning): Low stock (stok ada tetapi \leq min_stok)
 - ✗ (merah): Out of stock

Drug Interaction Alert:

- Modal popup dengan severity color
- Display interaction description + clinical recommendation
- Options:
 - Contact Doctor (akan update status preskripsi ke "On Hold")
 - Override (dengan justification textarea + doktor approval)
 - Cancel item

Batch Selection (FEFO):

- Dropdown dengan batch numbers sorted by expiry date (earliest first)
- Each option format: "Batch: ABC123 | Exp: 2026-06-30 | Qty: 500"
- Highlight batch yang recommended (paling hampir luput tetapi masih $>$ 3 months)

Label Printing:

- Preview label sebelum print
- Support print multiple labels (jika dispensing multiple items)
- Label template customizable (optional)

Counseling Checklist (Optional Enhancement):

- Pre-defined checklist based on drug category:
 - Antibiotic: "Habiskan dos walaupun dah sihat"
 - Antihypertensive: "Jangan stop sendiri"
 - Insulin: "Cara inject, storage dalam fridge"
 - etc.
- Ahli farmasi tick checklist + add free text notes

8. Keperluan Keselamatan

8.1 PDPA Compliance

- Semua maklumat pesakit (nama, IC, alamat, medication history) adalah confidential
- Access control: Hanya ahli farmasi yang bertugas boleh access PMR
- Audit trail: Log semua akses kepada PMR (siapa, bila, apa)

8.2 Role-Based Access Control (RBAC)

Role: Ahli Farmasi

- Full access: Review preskripsi, dispensing, stock management, PMR, reports
- Boleh override interaction alert (dengan justification + doktor approval)
- Boleh adjust stok (dengan approval jika > threshold)

Role: Pengurus Klinik

- View access: Semua data
- Approval: PO, stock adjustment (> threshold), stocktake
- Full access: Reports

Role: Admin

- Full access: Semua modul termasuk drug database management, supplier management

8.3 Audit Trail

- Log semua critical actions:
 - Dispensing ubat (siapa, bila, apa ubat, kuantiti, batch)
 - Stock adjustment (siapa, bila, sebab, kuantiti)
 - Interaction alert override (siapa, bila, justifikasi)
 - Void dispensing (siapa, bila, sebab)
 - Access PMR (siapa, bila, pesakit)
- Audit log tidak boleh di-edit atau delete

8.4 Data Integrity

- Stok tidak boleh negative (validation)
- Batch number + expiry date compulsory untuk poison schedule drugs
- Dispensing hanya boleh jika preskripsi status "ready_to_dispense"
- Void dispensing auto-restore stok (immutable record)

8.5 Akta Racun 1952 Compliance

- Poison Register auto-maintained untuk Group A drugs
- Rekod wajib: Tarikh, nama ubat, kuantiti, balance stok, pesakit details, doktor details, ahli farmasi
- Poison Register tidak boleh di-edit (immutable)
- Support print untuk inspection oleh Kementerian Kesihatan

9. Keperluan Prestasi

9.1 Response Time

- Preskripsi listing page: ≤ 1 saat
- Review preskripsi (with stock check + interaction check): ≤ 2 saat
- Dispensing action: ≤ 1 saat
- Stock listing page: ≤ 1 saat
- Report generation: ≤ 5 saat (untuk monthly report)

9.2 Scalability

- Support concurrent dispensing: 5-10 ahli farmasi at the same time
- Database dioptimumkan dengan proper indexing:
 - Index pada `ubat.kod_ubat` , `ubat.nama_generik`
 - Index pada `stok_ubat.ubat_id` , `stok_ubat.batch_number` , `stok_ubat.tarikh_luput`
 - Index pada `preskripsi.status` , `preskripsi.pesakit_id`
 - Index pada `dispensing.tarikh_dispensing` , `dispensing.dispensed_by`

- Caching untuk drug database dan interaction database (jarang berubah)

9.3 Data Volume

- Expected drug database: 500-1000 ubat
 - Expected stock entries: 2000-5000 batch entries (multiple batches per drug)
 - Expected dispensing transactions: 100-500 per day
 - Expected PMR entries: 1000-5000 per month
-

10. Keperluan Ujian

10.1 Unit Testing

- Service methods testing:
 - `DispensingService::checkStockAvailability()`
 - `DispensingService::checkDrugInteraction()`
 - `DispensingService::dispense()`
 - `StokUbatService::deductStock()`
 - `StokUbatService::adjustStock()`
 - `PoisonRegisterService::createPoisonRegisterEntry()`

10.2 Feature Testing

- Preskripsi workflow:
 - Test auto-receive preskripsi from EMR
 - Test create manual preskripsi
 - Test review preskripsi
- Dispensing workflow:
 - Test dispensing with sufficient stock
 - Test dispensing with low stock (alert)
 - Test dispensing with out of stock (prevent)
 - Test partial dispensing
 - Test drug-drug interaction alert
 - Test drug-allergy interaction alert
 - Test override interaction alert
 - Test void dispensing (stok restore)
 - Test poison register auto-creation (Group A drugs)
- Stock management:
 - Test goods receipt (auto-create stok_ubat entry)
 - Test stock adjustment (increase/decrease)
 - Test stocktake workflow
 - Test low stock alert
 - Test expiry alert

10.3 Integration Testing

- Integration dengan EMR:
 - Test auto-receive preskripsi daripada EMR
 - Test send status update kembali ke EMR (Dispensed/Issue)
- Integration dengan Billing:
 - Test auto-generate bil selepas dispensing
 - Test bil details (ubat nama, kuantiti, harga)

10.4 User Acceptance Testing (UAT)

- Ahli Farmasi test full dispensing workflow
- Pengurus test reporting dan stocktake

- Test FEFO batch selection (earliest expiry first)
 - Test label printing
 - Test poison register compliance
-

11. Langkah Implementasi

Fasa 1: Setup & Drug Database (1 minggu)

- ☐ Setup database schema (13 jadual)
- ☐ Create migrations
- ☐ Create models dengan relationships
- ☐ Seed drug database (import dari MIMS/NDFM atau manual)
- ☐ Seed interaction database (basic interactions)
- ☐ Create supplier dummy data

Fasa 2: Preskripsi Management (1 minggu)

- ☐ Create `PreskripsiController`, `PreskripsiService`, `PreskripsiRepository`
- ☐ Create preskripsi listing page (with filters)
- ☐ Create manual preskripsi form (input preskripsi luar)
- ☐ Implement auto-receive preskripsi from EMR (integration)
- ☐ Create review preskripsi page (view patient info + items)
- ☐ Unit testing + feature testing

Fasa 3: Dispensing Workflow - Part 1 (1 minggu)

- ☐ Create `DispensingService` dengan methods:
 - `checkStockAvailability()`
 - `getBatchesForDrug()` (FEFO sorting)
- ☐ Implement stock check real-time pada review page
- ☐ Implement batch selection dropdown (FEFO)
- ☐ Implement dispensing action (create dispensing record + deduct stock)
- ☐ Implement partial dispensing
- ☐ Unit testing + feature testing

Fasa 4: Dispensing Workflow - Part 2 (Drug Interaction) (1 minggu)

- ☐ Create `DrugInteractionService` dengan methods:
 - `checkDrugDrugInteraction()`
 - `checkDrugAllergyInteraction()`
- ☐ Implement interaction check pada review page
- ☐ Implement interaction alert modal (dengan severity + description)
- ☐ Implement override interaction alert (dengan justification)
- ☐ Create `InteractionAlertOverride` record
- ☐ Unit testing + feature testing

Fasa 5: PMR & Pharmaceutical Care (0.5 minggu)

- ☐ Create PMR page/modal (view medication history)
- ☐ Auto-create PMR entry selepas dispensing
- ☐ Implement counseling notes textarea
- ☐ Implement counseling checklist (optional)
- ☐ Implement label printing (template + preview)

Fasa 6: Poison Register & Compliance (0.5 minggu)

- ☐ Create `PoisonRegisterService::createPoisonRegisterEntry()`
- ☐ Auto-trigger poison register entry for Group A drugs after dispensing
- ☐ Create poison register view page (read-only table)
- ☐ Implement print poison register (formatted for inspection)
- ☐ Testing dengan sample Group A drugs

Fasa 7: Stock Management - Goods Receipt (1 minggu)

- ☐ Create `PurchaseOrderController`, `PurchaseOrderService`
- ☐ Create PO listing + create/edit form
- ☐ Implement PO approval workflow (optional)
- ☐ Create `GoodsReceiptController`, `GoodsReceiptService`
- ☐ Create GRN form (input batch number, expiry, kuantiti)
- ☐ Implement auto-create `stok_ubat` entry after GRN
- ☐ Implement auto-update PO status (partial/fully received)
- ☐ Unit testing + feature testing

Fasa 8: Stock Management - Adjustment & Stocktake (1 minggu)

- ☐ Create stock adjustment form (reason, kuantiti, approval)
- ☐ Implement auto-update stok after adjustment
- ☐ Create stocktake workflow:
 - Create stocktake (generate items with `system_qty`)
 - Input `physical_qty`
 - Calculate variance
 - Approval + auto-adjust stok
- ☐ Implement low stock alert (notification)
- ☐ Implement expiry alert (notification + listing)
- ☐ Unit testing + feature testing

Fasa 9: Integration dengan EMR & Billing (1 minggu)

- ☐ Implement listener untuk EMR event `PrescriptionFinalized` → auto-create preskripsi
- ☐ Implement event `PrescriptionDispensed` → send to EMR (update status)
- ☐ Implement event `PrescriptionDispensed` → send to Billing (auto-generate bil)
- ☐ Testing integration end-to-end:
 - Doktor finalize preskripsi → Farmasi receive → Dispensing → Billing generate

Fasa 10: Reporting (1 minggu)

- ☐ Create `ReportService` dengan methods untuk setiap report:
 - `generateSalesReport()`
 - `generateStockReport()`
 - `generateExpiryReport()`
 - `generatePoisonRegisterReport()`
 - `generateDispensingReport()`
 - `generateSupplierReport()`
 - `generateVarianceReport()`
- ☐ Create reporting page (select report type + filters + date range)
- ☐ Implement export to PDF (using DomPDF atau Snappy)
- ☐ Implement export to Excel (using Laravel Excel)

- ☐ Testing semua reports

Fasa 11: UAT, Bug Fixes & Deployment (1 minggu)

- ☐ UAT dengan ahli farmasi dan pengurus klinik
- ☐ Bug fixes berdasarkan UAT feedback
- ☐ Performance optimization (indexing, caching)
- ☐ Documentation (user manual untuk ahli farmasi)
- ☐ Deployment to production
- ☐ Training untuk ahli farmasi

Anggaran Masa: 10.5 minggu (2.5 bulan)

12. Kriteria Kejayaan

12.1 Metrics

1. Stock Accuracy:

- Target: $\geq 98\%$ (system stock vs physical stock after monthly stocktake)
- Measurement: Variance report

2. Dispensing Efficiency:

- Target: Average dispensing time ≤ 5 minit per preskripsi
- Measurement: Dispensing timestamp (from review to finalize)

3. Interaction Alert Detection:

- Target: 100% detection untuk contraindicated interactions
- Measurement: Audit log interaction alerts vs manual pharmacist check

4. Low Stock Prevention:

- Target: Zero stock-out untuk ubat kritikal (high usage drugs)
- Measurement: Low stock alert effectiveness (reorder before stock-out)

5. Expiry Waste Reduction:

- Target: $\leq 2\%$ ubat luput (by value)
- Measurement: Expiry report vs total stock value

6. FEFO Compliance:

- Target: $\geq 95\%$ dispensing menggunakan batch dengan earliest expiry
- Measurement: Dispensing report (batch selected vs earliest available)

7. Poison Register Compliance:

- Target: 100% auto-maintained (no manual entry)
- Measurement: Poison register audit (completeness + accuracy)

8. User Satisfaction:

- Target: $\geq 80\%$ ahli farmasi berpuas hati dengan sistem
- Measurement: UAT feedback form + post-implementation survey

12.2 Acceptance Criteria

Preskripsi Management:

- ☒ Sistem boleh auto-receive preskripsi elektronik daripada EMR
- ☒ Ahli farmasi boleh input preskripsi manual untuk pesakit walk-in

- ☒ Senarai preskripsi dengan filter dan search berfungsi dengan baik
- ☒ Status preskripsi dikemaskini real-time

Dispensing Workflow:

- ☒ Stock check real-time berfungsi (Available/Low Stock/Out of Stock)
- ☒ Drug-drug interaction alert muncul dengan betul (severity + description)
- ☒ Drug-allergy interaction alert muncul jika pesakit ada alergi
- ☒ Ahli farmasi boleh override interaction alert dengan justifikasi
- ☒ Batch selection auto-suggest FEFO (earliest expiry first)
- ☒ Stok auto-deduct selepas dispensing
- ☒ Partial dispensing boleh direkod dan fulfill kemudian
- ☒ Label ubat boleh dicetak dengan maklumat lengkap
- ☒ Pharmaceutical care notes boleh direkod

PMR:

- ☒ PMR auto-update selepas dispensing
- ☒ Ahli farmasi boleh view medication history pesakit (chronological)
- ☒ Alergi pesakit dipamerkan dengan jelas

Poison Register:

- ☒ Poison register auto-maintained untuk Group A drugs
- ☒ Rekod lengkap (tarikh, ubat, kuantiti, balance, pesakit, doktor, ahli farmasi)
- ☒ Poison register boleh dicetak untuk inspection

Stock Management:

- ☒ Goods receipt auto-create stok_ubat entry dengan batch number + expiry
- ☒ Low stock alert berfungsi (notification bila \leq min_stok)
- ☒ Expiry alert berfungsi (notification untuk ubat < 3 bulan expiry)
- ☒ Stock adjustment dengan approval workflow (jika $>$ threshold)
- ☒ Stocktake workflow lengkap (generate items \rightarrow input physical \rightarrow variance report \rightarrow auto-adjust)

Integration:

- ☒ Preskripsi daripada EMR diterima dengan betul (all items + patient info)
- ☒ Status preskripsi dihantar kembali ke EMR (Dispensed/Issue)
- ☒ Bil auto-generate di Billing module selepas dispensing (ubat + harga + kuantiti)

Reporting:

- ☒ Semua 7 reports boleh generate dengan betul
- ☒ Export to PDF dan Excel berfungsi
- ☒ Report data tepat dan sesuai untuk audit

13. Risks & Mitigation

13.1 Risks

Risk	Impact	Probability	Mitigation
Drug interaction database tidak lengkap	HIGH	MEDIUM	Import dari sumber dipercayai (MIMS, NDFM); allow ahli farmasi tambah custom interaction; periodic update
Stok tidak sync (double dispensing pada masa sama)	HIGH	LOW	Implement database transaction + row locking semasa dispensing; optimistic locking
FEFO tidak diikuti (ahli farmasi pilih batch salah)	MEDIUM	MEDIUM	Auto-suggest batch earliest expiry; warning jika pilih batch bukan earliest; audit report FEFO compliance

Slow performance bila drug database besar	MEDIUM	LOW	Proper indexing; caching drug database; pagination pada listing
Integration dengan EMR fail	HIGH	LOW	Implement retry mechanism; fallback to manual preskripsi input; alert admin jika integration fail
Ahli farmasi override interaction alert tanpa sebab kukuh	MEDIUM	MEDIUM	Compulsory justification field; require doktor approval; audit log untuk review
Ubat luput tidak dikesan	MEDIUM	LOW	Automated daily job untuk check expiry; email alert kepada pengurus; dashboard highlight expiring drugs
Poison register tidak complete (missing entries)	HIGH	LOW	Auto-triggered after dispensing (no manual entry); validation tidak boleh dispensing Group A tanpa patient details; audit check

13.2 Dependencies

Internal:

- Modul EMR mesti siap dan stabil (untuk auto-receive preskripsi)
- Modul Billing mesti ada API endpoint untuk receive dispensing data
- Patient database (pesakit) mesti ada (dengan IC, alamat, alergi)

External:

- Drug database source (MIMS atau NDFM) untuk import data ubat
- Interaction database source untuk import interaction data
- Printer support untuk label printing (thermal printer recommended)

Technical:

- Laravel 12 framework
- MySQL 8.0 database
- PHP 8.2+
- Server resources untuk support 5-10 concurrent users

14. Acceptance Criteria

14.1 Functional Acceptance

Preskripsi Management:

1. Sistem boleh auto-receive preskripsi elektronik daripada EMR dengan maklumat lengkap (pesakit, doktor, ubat items, dos, frekuensi)
2. Ahli farmasi boleh input preskripsi manual dengan scan atau manual entry
3. Senarai preskripsi memaparkan semua preskripsi dengan filter dan search yang berfungsi
4. Status preskripsi dikemaskini dengan betul (Pending → Ready → Dispensed/Cancelled)

Dispensing Workflow:

1. Stock check real-time berfungsi dan display status yang betul (Available/Low/Out of Stock)
2. Drug-drug interaction alert muncul dengan betul bila ada interaction dalam preskripsi
3. Drug-allergy interaction alert muncul bila ubat dalam preskripsi match dengan patient allergy
4. Ahli farmasi boleh override interaction alert dengan input justifikasi dan doktor approval
5. Batch selection auto-suggest FEFO (batch dengan earliest expiry muncul first)
6. Dispensing action auto-deduct stok dengan betul (kuantiti_semasa berkurangan)
7. Partial dispensing boleh direkod dan balance boleh fulfill kemudian

8. Void dispensing auto-restore stok dengan betul
9. Label ubat boleh dicetak dengan maklumat lengkap dan format yang sesuai
10. Pharmaceutical care notes boleh direkod dan disimpan dalam PMR

PMR & Poison Register:

1. PMR auto-update selepas setiap dispensing
2. PMR memaparkan medication history chronological dengan maklumat lengkap
3. Poison register auto-create entry untuk Group A drugs selepas dispensing
4. Poison register boleh dicetak dengan format yang sesuai untuk inspection

Stock Management:

1. Goods receipt auto-create stok_ubat entry dengan batch number dan expiry date
2. Low stock alert muncul bila stok \leq minimum level
3. Expiry alert muncul untuk ubat yang akan luput dalam 3 bulan
4. Stock adjustment dengan approval workflow berfungsi
5. Stocktake workflow lengkap (generate \rightarrow input physical \rightarrow variance \rightarrow auto-adjust)

Integration:

1. Preskripsi daripada EMR diterima dengan betul (real-time atau near real-time)
2. Status preskripsi dihantar kembali ke EMR (Dispensed/Issue)
3. Bil auto-generate di Billing module dengan data yang betul (ubat, kuantiti, harga)

Reporting:

1. Semua 7 reports generate dengan data yang tepat
2. Export to PDF dan Excel berfungsi tanpa error
3. Report performance: \leq 5 saat untuk monthly report

14.2 Non-Functional Acceptance

Performance:

- Preskripsi listing page load \leq 1 saat
- Review preskripsi (with stock + interaction check) \leq 2 saat
- Dispensing action complete \leq 1 saat
- Support 5-10 concurrent users tanpa lag

Security:

- PDPA compliant: PMR hanya accessible oleh authorized pharmacist
- Audit trail lengkap untuk semua critical actions
- Poison register immutable (tidak boleh edit atau delete)

Usability:

- Ahli farmasi boleh complete dispensing dalam \leq 5 minit (UAT feedback)
- Interface intuitive dan mudah difahami (UAT feedback \geq 80% satisfied)
- Label printing berfungsi dengan printer thermal atau standard printer

Reliability:

- Zero data loss (stok, dispensing, PMR)
- Transaction integrity (stok tidak negative, dispensing tidak double)
- Integration dengan EMR dan Billing resilient (retry mechanism)

15. Lampiran

15.1 Contoh Preskripsi Elektronik (JSON Format from EMR)


```
{
  "emr_id": 123,
  "pesakit_id": 456,
  "dokter_id": 789,
  "tarikh_preskripsi": "2026-01-13",
  "items": [
    {
      "ubat_id": 101,
      "nama_ubat": "Amoxicillin 500mg",
      "kuantiti": 21,
      "dos": "500mg",
      "frekuensi": "3 kali sehari",
      "tempoh": "7 hari",
      "arahan": "Ambil selepas makan. Habiskan dos walaupun dah sihat."
    },
    {
      "ubat_id": 102,
      "nama_ubat": "Paracetamol 500mg",
      "kuantiti": 30,
      "dos": "500mg",
      "frekuensi": "3-4 kali sehari bila perlu",
      "tempoh": "bila perlu",
      "arahan": "Untuk sakit atau demam. Jangan melebihi 8 tablet sehari."
    }
  ]
}
```

15.2 Contoh Drug Interaction Alert

Scenario: Pesakit prescribed Warfarin (anticoagulant) + Aspirin (NSAID)

Interaction:

- **Severity:** Major
- **Description:** Concurrent use of Warfarin and Aspirin may increase the risk of bleeding due to additive anticoagulant effects.
- **Recommendation:** Monitor INR closely. Consider alternative analgesic (e.g., Paracetamol). If combination necessary, educate patient on bleeding signs (bruising, black stools, etc.).

Display:

 MAJOR INTERACTION DETECTED

Warfarin + Aspirin

Risk: Increased bleeding risk (additive anticoagulant effects)

Recommendation:

- Monitor INR closely
- Consider alternative: Paracetamol for pain
- If combination necessary, educate patient on bleeding signs

Actions:

[Contact Doktor] [Override (requires justification)] [Cancel Aspirin]

15.3 Contoh Poison Register Entry

Tarikh	Nama Ubat	Batch No.	Kuantiti Dispensed	Balance Stok	Pesakit	IC/Passport	Alamat	Doktor	MMC
2026-01-13	Codeine Phosphate 30mg (Group A Poison)	BTH-2024-001	20 tablets	480 tablets	Ahmad bin Ali	850101-01-1234	No 12, Jalan Merdeka, 50000 KL	Dr. Siti Aminah	MMC 12345
2026-01-13	Morphine Sulphate 10mg (Group A Poison)	BTH-2024-015	10 tablets	190 tablets	Fatimah binti Hassan	900202-14-5678	No 45, Jalan Raja, 41000 Klang	Dr. Ahmad Zaki	MMC 67890

15.4 Contoh Label Ubat

POLIKLINIK AL-HUDA

Pesakit: AHMAD BIN ALI

IC: 850101-01-1234

Tarikh: 13/01/2026

AMOXICILLIN 500MG CAPSULE

Dos: 500mg (1 capsule)

Frekuensi: 3 kali sehari

Tempoh: 7 hari

Kuantiti: 21 capsule

ARAHAN:

Ambil selepas makan.

Habiskan dos walaupun dah sihat.

⚠️ AMARAN:

Elak jika ada alergi Penicillin.

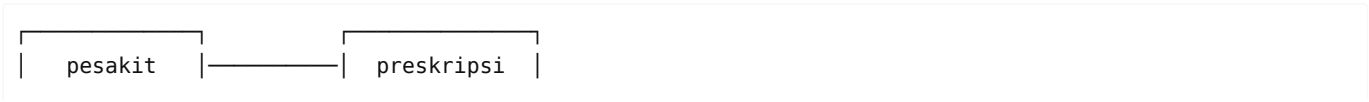
Jangan hentikan ubat tanpa nasihat doktor.

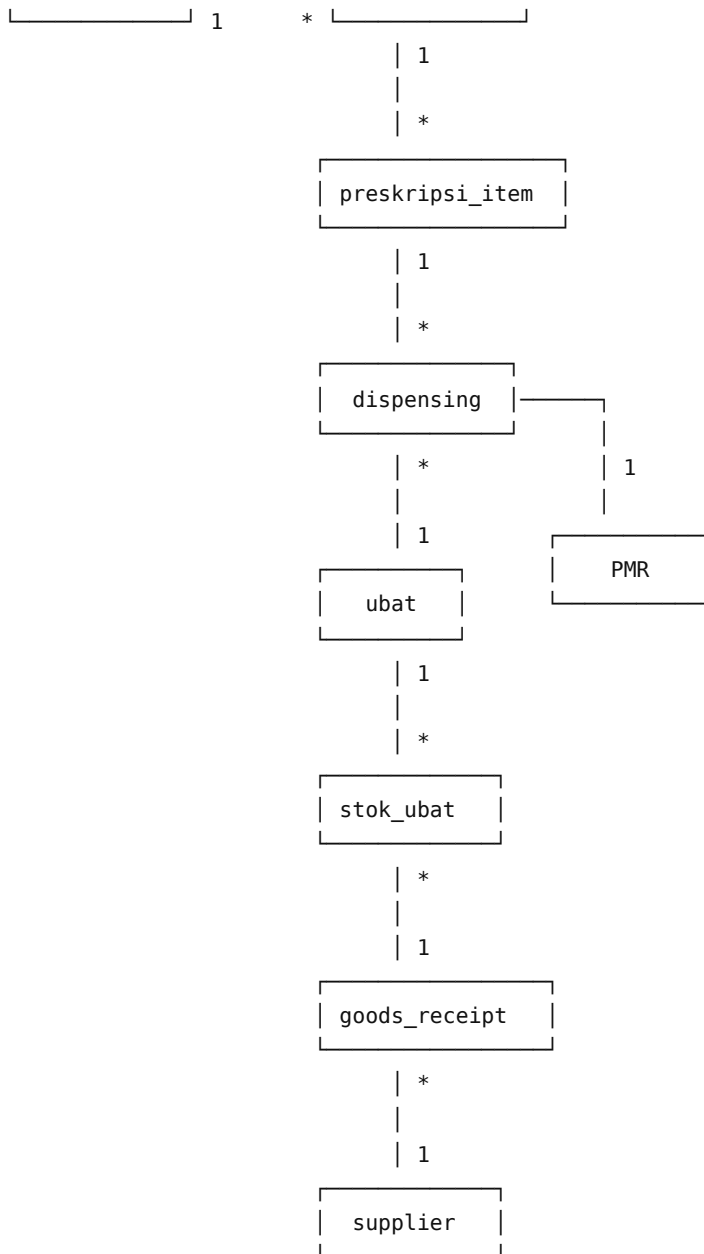
Batch No: BTH-2024-ABC

Expiry Date: 31/12/2027

Dispensed by: Nurul Hidayah (Ahli Farmasi)

15.5 Entity-Relationship Diagram (Simplified)





Key Relationships:

- 1 Pesakit → * Preskripsi
- 1 Preskripsi → * PreskripsiItem
- 1 PreskripsiItem → * Dispensing (support partial dispensing multiple times)
- 1 Ubat → * StokUbat (multiple batches)
- 1 StokUbat → * Dispensing
- 1 Dispensing → 1 PMR entry
- 1 Dispensing → 0..1 PoisonRegister entry (jika Group A poison)
- 1 Supplier → * GoodsReceipt
- 1 GoodsReceipt → * StokUbat

15.6 Akta Racun 1952 - Poison Schedule Overview

Group A Poisons (Kumpulan A):

- Highly toxic substances requiring strict record-keeping
- Examples: Morphine, Codeine, Strychnine
- **Requirement:** Maintain Poison Register with complete details

Group B Poisons (Kumpulan B):

- Moderately toxic substances
- Examples: Some pesticides, industrial chemicals
- **Requirement:** Labeled properly, restricted sale

Group C Poisons (Kumpulan C):

- Less toxic but still regulated
- **Requirement:** Proper labeling

First Schedule Poisons:

- Cannot be sold without prescription
- Examples: Prescription-only medicines (POM)

Second Schedule Poisons:

- Can be sold under pharmacist supervision
- Examples: Some over-the-counter medicines with restrictions

For this system: Focus pada Group A Poisons (auto-maintain Poison Register), others hanya require proper classification dalam drug database.

15.7 FEFO vs FIFO Example

Scenario:

- Ubat: Paracetamol 500mg
- Stok tersedia:

Batch No	Tarikh Terima	Tarikh Luput	Kuantiti
BTH-2024-001	2024-06-01	2026-06-30	500
BTH-2024-015	2024-08-15	2027-08-31	300
BTH-2024-020	2024-10-20	2026-03-31	200

FIFO (First In First Out):

- Akan pilih BTH-2024-001 (received first)

FEFO (First Expiry First Out):

- Akan pilih BTH-2024-020 (expire first: 2026-03-31)

Sistem ni implement FEFO untuk minimize ubat luput wastage.

END OF PRD

Appendix: Change Log

Version	Date	Author	Changes
1.0	2026-01-13	System	Initial PRD creation