ASSURANCE OF LEARNING REPORT

CareConnect : Database Model and Design for Online Doctor Consultation Services

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CHAPTER 1
CASE DESCRIPTION

CareConnect is an online medical consultation platform that connects customers with certified doctors from various partner hospitals. Through CareConnect, customers can access healthcare services without needing to visit a clinic or hospital in person. Every interaction, starting from booking a consultation, conducting a live session with a doctor, completing administrative processes, to receiving prescribed medication, happens within one integrated digital ecosystem.

Each transaction entry shows how different parties operate together in one connected workflow. Customers request medical advice, doctors from partner hospitals provide consultations, and when necessary, pharmacies prepare the prescribed medication. If a patient orders the medicine through CareConnect, the platform also records the delivery process from pharmacy preparation to courier dispatch until the medication arrives safely at the patient's home.

Overall, this dataset gives a comprehensive picture of how CareConnect operates as a modern digital healthcare service. By integrating customers, doctors, hospitals, pharmacies, and delivery partners into a unified system, CareConnect makes healthcare more practical, efficient, and accessible. It illustrates how technology streamlines medical services, enabling users to receive reliable care and medication anytime and from anywhere.

CHAPTER 2
SAMPLE DATA

A. Dataset

IDCustomer	IdentitasCustomer (nama, gender, tgl lahir, alamat, email, no hp)	SpesialisasiDokter	NamaDokter	NamaRumahSakit	IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	DurasiKonsultasi
C001	Budi Suryanto, M, 15 Sept 1990, Jln. Mawar 5, budi@mail.com, 0812-3456-7890	Umum	Dr. Rina K.	RS Sehat Sentosa	T001	1/9/2025	Konsultasi & Obat	9:00	9:20	20 min
C002	Ayu L. , F, 20/5/1995, Jln. Sudirman 10, ayu@mail.com, 0857-1234-5678	Anak	Dr. Tono W.	RS Medika Utama	T002	1/9/2025	Konsultasi	14:30	14:45	15 min
C003	Jaka Pratama H., M, 3/11/1988, Jln. Merpati 7, jaka@mail.com, 081398765432	Gigi	Dr. Santi D.	RS Bina Karya	T003	2/9/2025	Konsultasi & Obat	11:00	11:25	25 min
C004	Sita Lianti Wirawan, F, 28/7/2000, Jln. Pelita 12, sita@mail.com, 0878-5432-1098	Kulit	Dr. Mira S.	RS Permata Harapan	T004	2/9/2025	Konsultasi	18:45	18:55	10 min
C005	Toni Kurniawan, M, 10/3/1975, Jln. Kenanga 22, toni@mail.com, 82187654321	Jantung	Dr. Agung B.	RS Asri Medistra	T005	3/9/2025	Konsultasi & Obat	8:30	9:00	30 min
C006	nia r., F, 14-Feb-1993, Jln. Gajah Mada 9, nia@mail.com, 0896-2109-8765	Umum	Dr. Rina K.	RS Sehat Sentosa	T006	3/9/2025	Konsultasi & Obat	16:15	16:33	18 min
C007	Riko Januar, M, 1 Agusutus 1998, Jln. Dahlia 3, riko@mail.com, 0819-7654-3210	THT	Dr. Heru S.	RS Mitra Sejahtera	T007	4/9/2025	Konsultasi & Obat	10:45	10:57	12 min
C008	maya dian, F, 1980-12-25, Jln. Permai 1A, maya@mail.com ,0856-4321-0987	Anak	Dr. Tono W.	RS Medika Utama	T008	4/9/2025	Konsultasi & Obat	15:00	15:20	20 min
C009	Fajar Gunawan, M, 19/4/1991, Jln. Anggrek 6, fajar@mail.com, 0811-3098-7654	Mata	Dr. Lia P.	RS Citra Husada	T009	5/9/2025	Konsultasi & Obat	9:30	9:47	17 min
C010	Gina M. , F, 6 Juni 1970, Jln. Melati 17, gina@mail.com, 0877 6543 2109	Jantung	Dr. Agung B.	RS Asri Medistra	T010	5/9/2025	Konsultasi & Obat	13:45	14:13	28 min
C011	dika mikhail gunawan, M, 29/10/1996, Jln. Cemara 4, dika@mail.com, 0858-9012-3456	Umum	Dr. Rina K.	RS Sehat Sentosa	T011	6/9/2025	Konsultasi & Obat	17:00	17:15	15 min
C012	Elsa Putri Setiawan, F, 23 Januari 2009, Jln. Kamboja 11, elsa@mail.com, 0812-4567-8901	Kulit	Dr. Mira S.	RS Permata Harapan	T012	6/9/2025	Konsultasi & Obat	10:10	10:30	20 min
C013	Hadi L. , M, 1982-05-18, Jln. Siliwangi 2, hadi@mail.com, 81356789012	Gigi	Dr. Santi D.	RS Bina Karya	T013	7/9/2025	Konsultasi & Obat	12:00	12:10	10 min
C014	Indah sari permata, F, 4/9/1999, Jln. Kartini 15, indah@mail.com, 0857-2345-6789	Umum	Dr. Rina K.	RS Sehat Sentosa	T014	7/9/2025	Konsultasi & Obat	14:40	15:02	22 min
C015	Kevin P., M, 9 Februari 1998, Jln. Veteran 33, kevin@mail.com, 0896-8765-4321	Jantung	Dr. Agung B.	RS Asri Medistra	T015	8/9/2025	Konsultasi & Obat	11:30	11:55	25 min
C016	Laila Mariana D., F, 1994-11-20, Jln. Diponegoro 7, laila@mail.com, 0821-3210-9876	THT	Dr. Heru S.	RS Mitra Sejahtera	T016	8/9/2025	Konsultasi & Obat	16:30	16:45	15 min
C017	Muhammad Miko, M, 2002-12-12, Jln. Mawar 20, miko@mail.com, 087810987654	Umum	Dr. Rina K.	RS Sehat Sentosa	T017	9/9/2025	Konsultasi & Obat	9:15	9:32	17 min
C018	nanda kertanegara, F, "10 Okt 1989", Jln. Sudirman 3, nanda@mail.com, 0819-6543-2109	Anak	Dr. Tono W.	RS Medika Utama	T018	9/9/2025	Konsultasi & Obat	14:00	14:18	18 min
C019	Muhammad okky, M, 21/7/1972, Jln. Merpati 11, oki@mail.com, 0856-0987-6543	Gigi	Dr. Santi D.	RS Bina Karya	T019	10/9/2025	Konsultasi & Obat	11:45	12:05	20 min
C020	putri gianti, F, 2/4/2001, Jln. Pelita 25, putri@mail.com, 81176543210	Kulit	Dr. Mira S.	RS Permata Harapan	T020	10/9/2025	Konsultasi & Obat	19:15	19:30	15 min
C021	Rian H, M, 1976-06-17, Jln. Kenanga 30, rian@mail.com, 0877-3210-9876	Jantung	Dr. Agung B.	RS Asri Medistra	T021	11/9/2025	Konsultasi & Obat	8:45	9:15	30 min

Figure 2.1 Dataset Overview (Rows 1–22, Columns 1–11)

C022	Siska Jesslyn K., F, 26/1/1997, Jln. Gajah Mada 14, siska@mail.com, 0858-9876-5432	Umum	Dr. Rina K.	RS Sehat Sentosa	T022	11/9/2025	Konsultasi & Obat	16:00	16:20	20 min
C023	umar k., M, 22/8/1992, Jln. Dahlia 8, umar@mail.com, 0812-0987-6543	THT	Dr. Heru S.	RS Mitra Sejahtera	T023	12/9/2025	Konsultasi & Obat	10:30	10:45	15 min
C024	Vina Shania F., F, 8/12/1981, Jln. Permai 5B, vina@mail.com, 0813-2109-8765	Anak	Dr. Tono W.	RS Medika Utama	T024	12/9/2025	Konsultasi & Obat	15:30	15:55	25 min
C025	wira mariadi, M, 11/4/1999, Jln. Anggrek 1, wira@mail.com, 0857-8901-2345	Mata	Dr. Lia P.	RS Citra Husada	T025	13/9/2025	Konsultasi & Obat	9:45	9:55	10 min
		Umum	Dr. Rina K.	RS Sehat Sentosa	T031	15/9/2025	Konsultasi & Obat	17:30	17:40	10 min
C026	Yuni Novita, F, 25/6/1971, Jln. Melati 9, yuni.novita@mail.com, 0896-4321-0987	Jantung	Dr. Agung B.	RS Asri Medistra	T026	13/9/2025	Konsultasi & Obat	13:30	13:57	27 min
C027	zaki oktavianus, M, 7/10/1995, Jln. Cemara 16, zaki@mail.com, 0821-7654-3210	Umum	Dr. Rina K.	RS Sehat Sentosa	T027	14/9/2025	Konsultasi & Obat	17:30	17:46	16 min
C028	Alya P., F, 1984-01-30, Jln. Kamboja 21, alya@mail.com, 0878-5432-1098	Kulit	Dr. Mira S.	RS Permata Harapan	T028	14/9/2025	Konsultasi & Obat	10:00	10:20	20 min
C029	Muhammad Bambang, M, 5/5/1983, Jln. Siliwangi 12, bambang@mail.com, 0819-3210-9876	Gigi	Dr. Santi D.	RS Bina Karya	T029	15/9/2025	Konsultasi & Obat	12:30	12:40	10 min
C030	cici r., F, 29/9/2000, Jln. Kartini 8, cici@mail.com, 0856-7890-1234	Umum	Dr. Rina K.	RS Sehat Sentosa	T030	15/9/2025	Konsultasi & Obat	15:00	15:20	20 min
C031	Jessica Liyanto, F, 6/9/2005, Jln. Mandala 3, jessica.liyanto@mail.com, 081278654386	Gigi	Dr. Santi D.	RS Bina Karya	T032	16/9/2025	Konsultasi & Obat	16:25	16:40	15 min
C032	Selena P., F, 20 November 1975, Jln. Mawar 2, lena@mail.com, 0857-9240-1358	Umum	Dr. Rina K.	RS Sehat Sentosa	T033	17/9/2025	Konsultasi & Obat	15:15	15:45	30 min
C033	Kevin Hartanto, M, 12-Apr-1992, Jln. Melati 18, kevin.h92@mail.com, 0813-5521-7788	Tulang	Dr. Vito B.	RS Harapan Kami	T034	17/9/2025	Konsultasi & Obat	16:15	16:45	30 min

Figure 2.2 Dataset Overview (Rows 23–35, Columns 1–11)

BiayaKonsultasi	NamaObat	HargaObat	Kuantitas	NamaApotek	AlamatApotek	TotalBiaya	MetodeBayar	StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
80.000	Paracetamol	6.000	500 mg	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	86.000	QRIS	Lunas	RS001A	Ahmad	Selesai
80.000	-	-	-	-	-	80.000	Transfer Bank	Lunas	-	-	-
120.000	Asam Mefenamat	5.500	500 mg	Apotek Kimia Farma	Jln. Pahlawan No. 8	125.500	Kartu Kredit	Lunas	RS002A	Budi	Selesai
40.000	-	-	-	-	-	40.000	E-Wallet	Lunas	-	-	-
120.000	Amlodipine	8.000	10 mg	Apotek Century	Jln. Gatot Subroto No. 5	128.000	QRIS	Lunas	RS003A	Ilham	Selesai
100.000	Antasida	18.000	1 strip	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	118.000	Transfer Bank	Pending	-	-	Pending
80.000	Forumen	38.000	10 ml	Apotek Kimia Farma	Jln. Pahlawan No. 8	118.000	E-Wallet	Lunas	RS007A	Andi	Selesai
80.000	Tempra	75.000	60 ml	Apotek Century	Jln. Gatot Subroto No. 5	155.000	Transfer Bank	Lunas	RS008A	Rizky	Selesai

Figure 2.3 Dataset Overview (Rows 1-9, Columns 12-23)

80.000	Insto	16.000	7,5 ml	Apotek Kimia Farma	Jln. Pahlawan No. 8	96.000	QRIS	Lunas	RS009A	Reza	Selesai
120.000	Atorvastatin	15.000	20 mg	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	135.000	Kartu Kredit	Lunas	RS010A	Ali	Selesai
80.000	Procold	6.300	2 strip	Apotek Century	Jln. Gatot Subroto No. 5	86.300	E-Wallet	Lunas	RS011A	Dede	Selesai
80.000	Miconazole	7.200	10 gram	Apotek Kimia Farma	Jln. Pahlawan No. 8	87.200	E-Wallet	Lunas	RS012A	Usman	Selesai
40.000	Listerin	33.300	80 ml	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	73.300	Transfer Bank	Lunas	RS013A	Hidayat	Selesai
120.000	Ester C	58.900	500 mg	Apotek Century	Jln. Gatot Subroto No. 5	178.900	QRIS	Lunas	RS014A	Bayu	Selesai
120.000	Hemaviton	22.500	1 strip	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	142.500	E-Wallet	Lunas	RS015A	Fikri	Selesai
80.000	Breathy	49.500	60 ml	Apotek Century	Jln. Gatot Subroto No. 5	129.500	Kartu Kredit	Lunas	RS016A	Fahri	Selesai
80.000	Paracetamol	6.000	500 mg	Apotek Century	Jln. Gatot Subroto No. 5	86.000	QRIS	Lunas	RS017A	Robi	Selesai
80.000	Ester C	58.900	500 mg	Apotek Kimia Farma	Jln. Pahlawan No. 8	138.900	Transfer Bank	Lunas	RS018A	Malik	Selesai
80.000	Asam Mefenamat	5.500	500 mg	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	85.500	E-Wallet	Lunas	RS019A	Rafi	Selesai
80.000	Acnes	25.000	12 gram	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	105.000	QRIS	Lunas	RS020A	Reyhan	Selesai
120.000	Amlodipine	8.000	5 mg	Apotek Kimia Farma	Jln. Pahlawan No. 8	128.000	QRIS	Lunas	RS021A	Yanto	Selesai
80.000	Procold	6.300	1 strip	Apotek Kimia Farma	Jln. Pahlawan No. 8	86.300	E-Wallet	Lunas	RS022A	Dodo	Selesai
80.000	Breathy	49.500	60 ml	Apotek Kimia Farma	Jln. Pahlawan No. 8	129.500	Kartu Kredit	Lunas	RS023A	Dika	Selesai
120.000	Tempra	75.000	60 ml	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	195.000	Transfer Bank	Lunas	RS024A	Radit	Selesai
40.000	Insto	16.000	7,5 ml	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	56.000	QRIS	Lunas	RS025A	Alfi	Selesai
40.000	Procold	6.300	1 strip	Apotek Century	Jln. Gatot Subroto No. 5	46.300	QRIS	Lunas	RS031A	Raihan	Selesai
120.000	Atorvastatin	15.000	10 mg	Apotek Century	Jln. Gatot Subroto No. 5	135.000	E-Wallet	Lunas	RS026A	Rasya	Selesai
80.000	Procold	6.300	1 strip	Apotek Kimia Farma	Jln. Pahlawan No. 8	86.300	E-Wallet	Lunas	RS027A	Yuda	Selesai
80.000	Miconazole	7.200	10 gram	Apotek Century	Jln. Gatot Subroto No. 5	87.200	Transfer Bank	Lunas	RS028A	Ahmad	Selesai
40.000	Listerin	33.300	80 ml	Apotek Century	Jln. Gatot Subroto No. 5	73.300	E-Wallet	Lunas	RS029A	Budi	Selesai

Figure 2.4 Dataset Overview (Rows 10-31, Columns 12-23)

80.000	Ester C	58.900	500 mg	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	138.900	QRIS	Lunas	RS030A	Hidayat	Selesai
80.000	Listerin	33.300	80 ml	Apotek Kimia Farma	Jln. Pahlawan No. 8	113.300	QRIS	Lunas	RS032A	Putra	Selesai
120.000	Paracetamol	6.000	500 mg	Apotek Century	Jln. Gatot Subroto No. 5	126.000	Transfer Bank	Lunas	RS033A	Bara	Selesai
120.000	CDR (Calcium D Redoxon)	53.000	10 tablet	Apotek Century	Jln. Gatot Subroto No. 5	173.000	Transfer Bank	Lunas	RS034A	Putra	Selesai

Figure 2.5 Dataset Overview (Rows 32-35, Columns 12-23)

B. Data Description

1. Customer Information

   The Customer Information section consists of two main fields designed to identify and describe each customer within the telemedicine system. The **IDCustomer** field serves as a unique identifier assigned to every customer, allowing the system to track individuals consistently across consultations and transactions without exposing sensitive personal data. Complementing this, the **IdentitasCustomer** field contains detailed personal information such as the customer's full name, gender, date of birth, address, email, and phone number.

2. Doctor Information

   The Doctor Information section provides essential details about the healthcare professionals involved in each consultation. The **SpesialisasiDokter** field identifies the medical specialty of the doctor, such as Umum, Anak, Jantung, Kulit, Gigi, THT, or Tulang allowing the system to categorize consultations based on clinical expertise. The **NamaDokter** field records the full name of the doctor, enabling the platform to determine which customers were handled by each doctor and to ensure that the consultation aligns with the doctor's assigned specialty. In addition, the **NamaRumahSakit** field specifies the hospital or medical institution with which each doctor is affiliated

3. Transaction Information

   The Transaction section summarizes all essential details related to each consultation conducted on the platform. **IDTransaksi** functions as a unique identifier that links every financial, medical, and administrative activity to a specific consultation event. **TanggalTransaksi** indicates the exact date when the consultation

took place, while **Layanan** describes the type of service received, whether it was a consultation only or a consultation combined with medication. **WaktuMulaiKonsultasi** records the start time of the consultation session, and **WaktuSelesaiKonsultasi** marks the time when the session ended. Meanwhile, **DurasiKonsultasi** contains the length of the consultation recorded explicitly, allowing it to be directly used for analyzing service duration and doctor workload. **BiayaKonsultasi** represents the fee charged for the consultation service alone. At the same time, **MetodeBayar** and **StatusBayar** provide information about the payment method chosen by the customer and the payment status, whether it has been completed or is still pending. Finally, **TotalBiaya** reflects the total amount charged for the transaction by combining the consultation fee with any medication costs (if applicable), providing a complete financial overview of each service interaction.

4. Pharmacy Information

   The Pharmacy section records information about the partner pharmacies involved in fulfilling medication orders linked to consultation transactions. **NamaApotek** identifies the pharmacy responsible for supplying the prescribed medication, ensuring that each medication-related service can be traced to a specific and accountable provider. This field is only relevant for transactions in which the doctor issues a prescription and the customer opts to purchase the medication through the platform. **AlamatApotek** provides the complete physical address of the partner pharmacy, enabling the system to support logistical coordination, verify the pharmacy's operational location, and analyze the geographic distribution of pharmacy partners across different regions.

5. Medication Information

   The Medication section presents detailed information about the medicines prescribed during a consultation. The **NamaObat** field records the name of the medication given to the patient. The **HargaObat** field notes the price per unit of the medication. The **Kuantitas** field describes the amount or dosage provided, using formats that may vary depending on the medication type, such as milligrams, milliliters, or unit counts to represent what the patient receives accurately.

6. Shipping Information

   The Delivery section outlines essential details related to the distribution of prescribed medication. The **NomorResi** field records the shipment tracking number, allowing the progress of each delivery to be monitored from dispatch until arrival.

The **IdentitasDriver** field provides the name of the driver responsible for delivering the medication, ensuring clear accountability throughout the delivery process. The **StatusPengiriman** field indicates the current stage of the delivery, showing whether it has been completed or is still pending.

CHAPTER 3
DATA PROBLEMS AND FUNCTIONAL DEPENDENCIES

A. Data Problems

1. Inconsistent Format

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat email, no hp)
C001	Budi Suryanto, M, 15 Sept 1990, Jln. Mawar 5, budi@mail.com, 0812-3456-7890
C002	Ayu L. , F, 20/5/1995, Jln. Sudirman 10, ayu@mail.com, 0857-1234-5678

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)
C003	Jaka Pratama H., M, 3/11/1988, Jln. Merpati 7, jaka@mail.com, 081398765432
C004	Sita Lianti Wirawan, F, 28/7/2000, Jln. Pelita 12, sita@mail.com, 0878-5432-1098

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)
C005	Toni Kurniawan, M, 10/3/1975, Jln. Kenanga 22, toni@mail.com, 82187654321
C006	nia r., F, 14-Feb-1993, Jln. Gajah Mada 9, nia@mail.com, 0896-2109-8765

Figure 3.1 Inconsistent Values

One of the key data problems identified is inconsistency, which appears in several fields and disrupts uniformity across the dataset. For example, the **IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)** field shows variations in capitalization, where some names are written entirely in lowercase. In contrast, others use proper title case or full uppercase. Date of birth is also inconsistent, with some records using a numeric format such as *date/month/year*, while others use month names written in text, creating variation in readability and sorting. The phone number contains multiple formatting styles, some numbers are written with hyphens, others appear as a continuous string of digits, some begin with a leading zero, and others start directly with the digit 8. These differences make validation, searching, and standardization more difficult, highlighting the need for uniform formatting rules across all customer-related information.

2. Missing Values

NamaObat	HargaObat	Kuantitas	NamaApotek	AlamatApotek	TotalBiaya	MetodeBayar	StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
Paracetamol	6.000	500 mg	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	86.000	QRIS	Lunas	RS001A	Ahmad	Selesai
-	-	-	-	-	80.000	Transfer Bank	Lunas	-	-	-
Asam Mefenamat	5.500	500 mg	Apotek Kimia Farma	Jln. Pahlawan No. 8	125.500	Kartu Kredit	Lunas	RS002A	Budi	Selesai
-	-	-	-	-	40.000	E-Wallet	Lunas	-	-	-
Amlodipine	8.000	10 mg	Apotek Century	Jln. Gatot Subroto No. 5	128.000	QRIS	Lunas	RS003A	Ilham	Selesai
Antasida	18.000	1 strip	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	118.000	Transfer Bank	Pending	-	-	Pending

Figure 3.2 Missing Values

Another key data problem is the presence of missing values, which appear in various fields and represent unavailable or not applicable information. These missing entries are especially common in transactions

without medication, where fields such as **NamaObat, HargaObat, Kuantitas, NamaApotek, AlamatApotek, NomorResi, IdentitasDriver,** and **StatusPengiriman** contain missing values because the system did not capture any data related to medication, pharmacies, or delivery. Missing values also occur in delivery-related fields in row 6, such as **NomorResi** and **IdentitasDriver**. This is because the payment status is still pending, so the delivery process has not yet been initiated and no delivery information has been recorded. Although some missing values may be logically expected, they still create challenges for analysis because they prevent accurate type conversion, affect summary statistics, and may lead to misinterpretation if not handled properly. Recognizing and treating these unknown values as true missing data is essential to ensure clean preprocessing, reliable analysis, and consistent interpretation across the dataset.

3. Redundancy

   a. Patient Data Redundancy

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)	SpesialisasiDokter	NamaDokter	NamaRumahSakit	IDTransaksi
C025	wira mariadi, M, 11/4/1999, Jln. Anggrek 1, wira@mail.com, 0857-8901-2345	Mata	Dr. Lia P.	RS Citra Husada	T025
		Umum	Dr. Rina K.	RS Sehat Sentosa	T031

Figure 3.3 Redundancy in Patient Data

This redundancy occurs when patient identity information, such as name, gender, date of birth, address, email, and phone number is repeatedly recorded in every transaction involving the same patient. Because the same data is copied across multiple rows, any change to an attribute (for example, a new phone number or updated address) can lead to inconsistencies if it is not updated in all related rows.

   b. Doctor and Hospital Data Redundancy

IDTransaksi	NamaDokter	SpesialisasiDokter	NamaRumahSakit
T001	Dr. Rina K.	Umum	RS Sehat Sentosa
T002	Dr. Tono W.	Anak	RS Medika Utama
T003	Dr. Santi D.	Gigi	RS Bina Karya
T004	Dr. Mira S.	Kulit	RS Permata Harapan
T005	Dr. Agung B.	Jantung	RS Asri Medistra
T006	Dr. Rina K.	Umum	RS Sehat Sentosa

Figure 3.4 Redundancy in Doctor and Hospital Data

This redundancy appears when doctor information, including the doctor's name, specialization, and the hospital where the doctor practices, is repeated in every transaction involving that doctor. When the doctor's data changes, all rows containing the same information must be updated, increasing the risk of inconsistencies between rows and consuming more storage space.

c. Medication and Pharmacy Data Redundancy

IDTransaksi	NamaObat	HargaObat	Kuantitas	NamaApotek	AlamatApotek
T017	Paracetamol	6.000	500 mg	Apotek Century	Jln. Gatot Subroto No. 5
T033	Paracetamol	6.000	500 mg	Apotek Century	Jln. Gatot Subroto No. 5

Figure 3.5 Redundancy in Medication and Pharmacy Data

This redundancy occurs when the pharmacy name, pharmacy address, and medication price are repeatedly recorded in every transaction involving the same medication. Such repetition not only increases the amount of stored data but also creates potential inconsistencies, especially in medication prices or pharmacy details, if there are differences in how the information is recorded across rows.

4. Derived Attributes

WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	DurasiKonsultasi
9:00	9:20	20 min
14:30	14:45	15 min
11:00	11:25	25 min
18:45	18:55	10 min
8:30	9:00	30 min

BiayaKonsultasi	HargaObat	TotalBiaya
80.000	6.000	86.000
80.000	-	80.000
120.000	5.500	125.500
40.000	-	40.000
120.000	8.000	128.000

Figure 3.6 Derived Attributes

Another important data issue involves the presence of derived attributes that do not need to be stored directly. For example, **DurasiKonsultasi** is simply the result of subtracting **WaktuMulaiKonsultasi** from **WaktuSelesaiKonsultasi**, so keeping it as an additional column introduces the possibility of conflicting information if the related timestamps are changed.

A similar situation occurs with **TotalBiaya**, which is obtained by summing **BiayaKonsultasi** and **HargaObat**. Because this value depends

entirely on other fields, storing it directly can create unnecessary redundancy and increase the risk of inconsistencies when any of the components are updated. These issues are typically addressed during normalization, ensuring the table keeps only essential attributes.

5. Anomalies

   a. Insert Anomaly

TransactionHeader						
IDTransaksi	TanggalTransaksi	BiayaKonsultasi	StatusBayar	IDDokter	IDCustomer	NamaCustomer
NULL	NULL	NULL	NULL	NULL	C001	Budi Suryanto
NULL	NULL	NULL	NULL	NULL	C003	Jaka Pratama H.
NULL	NULL	NULL	NULL	NULL	C005	Toni Kurniawan
NULL	NULL	NULL	NULL	NULL	C007	Riko Januar
NULL	NULL	NULL	NULL	NULL	C008	Maya Dian

Figure 3.7 Insert Anomalies

Insert anomalies only occur in the columns that describe independent entities such as doctor, hospital, and pharmacy information. In the current table design, these entities cannot be stored independently. They only appear when a transaction is recorded. This means a new doctor cannot be added to the system unless there is already a consultation involving that doctor. Other columns, like timestamps, service fees, or medication details, do not experience insert anomalies because they are logically dependent on the existence of a transaction.

   b. Update Anomaly

SpesialisasiDokter	NamaDokter	NamaRumahSakit
Umum	Dr. Rina K.	RS Sehat Sentosa
Anak	Dr. Tono W.	RS Medika Utama
Gigi	Dr. Santi D.	RS Bina Karya
Kulit	Dr. Mira S.	RS Permata Harapan
Jantung	Dr. Agung B.	RS Asri Medistra
Umum	Dr. Rina K.	RS Sehat Sentosa
THT	Dr. Heru S.	RS Mitra Sejahtera
Anak	Dr. Tono W.	RS Medika Utama
Mata	Dr. Lia P.	RS Citra Husada
Jantung	Dr. Agung B.	RS Asri Medistra
Umum	Dr. Rina K.	RS Sehat Sentosa
Kulit	Dr. Mira S.	RS Permata Harapan

SpesialisasiDokter	NamaDokter	NamaRumahSakit
Umum	Dr. Rina K.	RS Sehat Sentosa Indah
Anak	Dr. Tono W.	RS Medika Utama
Gigi	Dr. Santi D.	RS Bina Karya
Kulit	Dr. Mira S.	RS Permata Harapan
Jantung	Dr. Agung B.	RS Asri Medistra
Umum	Dr. Rina K.	RS Sehat Sentosa
THT	Dr. Heru S.	RS Mitra Sejahtera
Anak	Dr. Tono W.	RS Medika Utama
Mata	Dr. Lia P.	RS Citra Husada
Jantung	Dr. Agung B.	RS Asri Medistra
Umum	Dr. Rina K.	RS Sehat Sentosa Indah
Kulit	Dr. Mira S.	RS Permata Harapan

NamaApotek	AlamatApotek
Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
-	-
Apotek Kimia Farma	Jln. Pahlawan No. 8
-	-
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
Apotek Kimia Farma	Jln. Pahlawan No. 8
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Kimia Farma	Jln. Pahlawan No. 8
Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Kimia Farma	Jln. Pahlawan No. 8

NamaApotek	AlamatApotek
Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
-	-
Apotek Kimia Farma	Jln. Pahlawan No. 88
-	-
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
Apotek Kimia Farma	Jln. Pahlawan No. 8
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Kimia Farma	Jln. Pahlawan No. 88
Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Kimia Farma	Jln. Pahlawan No. 88

Figure 3.8 Update Anomalies

The update anomaly in this dataset appears only in columns that store identity-related information. Doctor information, hospital names, and pharmacy details, which also appear repeatedly whenever those parties are involved in a consultation or medication order. Because these pieces of information are copied from row to row, any change must be updated in every record. If even one row is left unchanged, the dataset becomes inconsistent. Other columns, especially those that describe transaction events such as consultation time, medication quantity, or delivery status, do not experience update anomalies because their values are specific to each record and are not intended to remain consistent across different rows.

c. Delete Anomaly

Before Deleting the **IDTransaksi** Column

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)	IDTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	DurasiKonsultasi
C033	Kevin Hartanto, M, 12-Apr-1992, Jln. Melati 18, kevin.h92@mail.com, 0813-5521-7788	T034	Konsultasi & Obat	16:15	16:45	30 min

TotalBiaya	MetodeBayar	StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
173.000	Transfer Bank	Lunas	RS034A	Putra	Selesai

BiayaKonsultasi	NamaObat	HargaObat	Kuantitas	NamaApotek	AlamatApotek
120.000	CDR (Calcium D Redoxon)	53.000	10 tablet	Apotek Century	Jln. Gatot Subroto No. 5

Figure 3.9 Data Before Deleting the IDTransaksi Column

After Deleting the **IDTransaksi** Column

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)	IDTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	DurasiKonsultasi
NULL	NULL	NULL	NULL	NULL	NULL	NULL

BiayaKonsultasi	NamaObat	HargaObat	Kuantitas	NamaApotek	AlamatApotek
NULL	NULL	NULL	NULL	NULL	NULL

TotalBiaya	MetodeBayar	StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
NULL	NULL	NULL	NULL	NULL	NULL

Figure 3.10 Data After Deleting the IDTransaksi Column

Delete anomalies appear only in columns that store identity or entity information, such as customer, doctor, hospital, pharmacy, and delivery details. Since all of this information is placed in the same row as the transaction, removing that row also removes the data about the people or organizations involved. This creates a risk where deleting a single transaction could erase all stored information about a customer, a doctor, or a pharmacy that still exists in real operations. Columns that are tied purely to the transaction are not affected by this issue, because their values are expected to be removed when the related transaction no longer exists.

B. Functional Dependencies

A functional dependency describes how one attribute determines another. After the data is arranged into 1NF and identifiers such as **IDDokter, IDRumahSakit, IDObat**, and **IDApotek** become visible, the dependency patterns also become clear. **IDDokter** determines **NamaDokter** and **SpesialisasiDokter**, **IDRumahSakit** determines **NamaRumahSakit, IDObat** determines **NamaObat** and **HargaObat**, and **IDApotek** determines **NamaApotek** and **AlamatApotek**. These relationships show which groups of attributes consistently follow each identifier.

When this structured version of the data is compared with the dependency requirements for 2NF, several issues appear. Doctor attributes that depend on **IDDokter** are still stored together with transaction attributes that rely on **IDTransaksi**. Medication and pharmacy attributes that depend on **IDObat** and **IDApotek** also appear inside transaction rows, even though they rely on different keys. These misplaced dependencies indicate that some attributes are attached to a key that does not actually determine them, which creates the dependency conflicts relevant for evaluating the data against 2NF.

CHAPTER 4
IMPLEMENTATION OF NORMALIZATION

A. UNF to 1NF

1. Ensure Atomic Values in Every Attribute

One of the requirements of 1NF is that each cell should only have one value (atomic value), no cell should hold multiple values. In the CareConnect UNF form, the **IdentitasCustomer** column stores several pieces of information together, including nama (name), gender, tanggal lahir (date of birth), alamat (address), email, and no hp (phone number). Having these multiple values in a single cell makes the data harder to manage and maintain, and querying becomes more difficult. Therefore, values in IdentitasCustomer need to be separated into individual columns, with each column containing only one piece of information.

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)	SpesialisasiDokter
C008	maya dian, F, 1980-12-25, Jln. Permai 1A, maya@mail.com ,0856-4321-0987	Anak multi-values
C009	Fajar Gunawan, M, 19/4/1991, Jln. Anggrek 6, fajar@mail.com, 0811-3098-7654	Mata
C010	Gina M. , F, 6 Juni 1970, Jln. Melati 17, gina@mail.com, 0877 6543 2109	Jantung

Figure 4.1 Multi-values in UNF

IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP
C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987
C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654
C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	087765432109

Figure 4.2 Multi-values become atomic values in 1NF

2. Validate Type Consistency for All Values in Each Attribute

In 1NF, all values within a column must share the same data type. This requirement ensures data consistency, supports efficient data processing, and enables reliable querying and analysis. In the CareConnect UNF form, every

column already follows this rule. For instance, all values in the **NamaApotek** column use the same data type, which is a string, and there are no mixed types such as integers, floats, etc. The same applies to other columns, such as **TanggalTransaksi**, where all values are stored as valid date data. Because each column is consistent in its data type, this 1NF requirement has been fully satisfied.

NamaApotek
Apotek Sehat Utama
Apotek Kimia Farma
Apotek Century
Apotek Kimia Farma
Apotek Century
Apotek Kimia Farma
Apotek Sehat Utama

Figure 4.3 NamaApotek with string data type

TanggalTransaksi
1/9/2025
2/9/2025
3/9/2025
4/9/2025
4/9/2025
5/9/2025
5/9/2025
6/9/2025
6/9/2025
7/9/2025
7/9/2025

Figure 4.4 TanggalTransaksi with date data type

3. Ensure Unique Attribute Names

Each Attribute in 1NF must have a unique name to avoid confusion when retrieving, updating, or adding data. This requirement is already fulfilled in CareConnect UNF form because each attribute in the table is named distinctly. Even attributes that represent a "name" are clearly differentiated based on the entity they belong to, such as **NamaCustomer**, **NamaDokter**, **NamaRumahSakit, NamaObat**, and **NamaApotek**. This clear separation helps avoid ambiguity and ensures that the meaning of each attribute is immediately understandable. With these distinctions, the requirement for unique attribute names in 1NF is fully met.

NamaCustomer	NamaDokter	NamaRumahSakit	NamaObat	NamaApotek

Figure 4.5 Unique Attribute Names

4. Defining a Unique Row Identifier

A relation (table) is said to be in First Normal Form (1NF) if each row (record) is unique. This is necessary to ensure data integrity and avoid ambiguity when referencing records. To ensure row uniqueness, a unique identifier such as primary key is needed. In the CareConnect dataset, each consultation is assigned a unique ID, represented by **IDTransaksi**. This distinct IDTransaksi allows every row to be uniquely identified, making it suitable to serve as the **primary key** in 1NF. We cannot use IDCustomer as the primary key because a single customer may have multiple transactions, which means IDCustomer cannot uniquely identify each row.

IDTransaksi	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDDokter	NamaDokter
T001 Primary Key	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	D001	Dr. Rina K.
T003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432	D003	Dr. Santi D.
T005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	D005	Dr. Agung B.
T007	C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081976543210	D006	Dr. Heru S.
T008	C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987	D002	Dr. Tono W.
T009	C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654	D007	Dr. Lia P.
T010	C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	087765432109	D005	Dr. Agung B.

Figure 4.6 IDTransaksi as unique row identifier

We also add several ID in 1NF form, like IDDokter, IDRumahSakit, IDObat, and IDApotek. These IDs are included to make the next normalization (2NF and 3NF) easier, where attributes will be separated into their corresponding entities.

Table 4.1 UNF to 1NF (Adding ID for several entities)

SpesialisasiDokter	NamaDokter
Anak	Dr. Tono W.
Mata	Dr. Lia P.

Before (UNF)

IDDokter	NamaDokter	SpesialisasiDokter
D002	Dr. Tono W.	Anak
D007	Dr. Lia P.	Mata

After (1NF)

NamaRumahSakit
RS Medika Utama
RS Citra Husada

IDRumahSakit	NamaRumahSakit
MEU-229	RS Medika Utama
CIH-158	RS Citra Husada

Before (UNF) | After (1NF)

NamaObat	HargaObat	Kuantitas
Tempra	75.000	60 ml
Insto	16.000	7,5 ml

IDObat	NamaObat	HargaObat	Kuantitas
TM079	Tempra	75.000	60 ml
IN010	Insto	16.000	7,5 ml

Before (UNF) | After (1NF)

NamaApotek	AlamatApotek
Apotek Century	Jln. Gatot Subroto No. 5
Apotek Kimia Farma	Jln. Pahlawan No. 8

IDApotek	NamaApotek	AlamatApotek
A002	Apotek Century	Jln. Gatot Subroto No. 5
A003	Apotek Kimia Farma	Jln. Pahlawan No. 8

Before (UNF) | After (1NF)

5. Removed Derived Attributes

In the CareConnect dataset, there are two derived attributes, which are **DurasiKonsultasi** and **TotalBiaya**. These attributes are considered derived because their values are calculated from other existing fields in the dataset. Since these values can always be recalculated whenever needed, keeping them in the 1NF table is unnecessary and may even cause inconsistencies if the original data is updated while the derived values remain unchanged. For this reason, both attributes should be removed in the 1NF structure to maintain

data integrity, reduce redundancy, and ensure that all computed values stay accurate and consistent throughout the dataset.

Table 4.2 UNF to 1NF (Removed Derived Attributes)

Remove DurasiKonsultasi in 1NF

WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	DurasiKonsultasi	BiayaKonsultasi
15:00	15:20	20 min	80.000
9:30	9:47	17 min	80.000

Before (UNF)

WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi
15:00	15:20	80.000
9:30	9:47	80.000

After (1NF)

Remove TotalBiaya in 1NF

AlamatApotek	TotalBiaya	MetodeBayar
Jln. Gatot Subroto No. 5	155.000	Transfer Bank
Jln. Pahlawan No. 8	96.000	QRIS

Before (UNF)

AlamatApotek	MetodeBayar
Jln. Gatot Subroto No. 5	Transfer Bank
Jln. Pahlawan No. 8	QRIS

After (1NF)

From UNF to 1NF, we also perform data cleaning, particularly to address inconsistent format and missing values. For inconsistent format in IdentitasCustomer, specifically in **nama**, we standardized the names by applying proper capitalization, where each word begins with an uppercase letter. For example, “maya dian” was corrected to “Maya Dian”. Another inconsistency occurred in **tanggal lahir**, which appeared in multiple date formats. In 1NF, we standardized all dates into the dd/mm/yyyy format, such as converting *6 Juni 1970* into *06/06/1970*. Similar issues were found in **NoHP**, where phone numbers had different styles. These were standardized to always start with *08* and be written as one continuous string without spaces, hyphens, or other separators. For missing values, we handled them by

removing rows that contained incomplete data to ensure that the 1NF table remained clean, consistent, and reliable for further normalization steps.

Table 4.3 UNF to 1NF (Inconsistent Format)

Inconsistent Format (One of the example)	
maya dian, F, 1980-12-25, Jln. Permai 1A, maya@mail.com ,0856-4321-0987	Maya Dian
	25/12/1980
	085643210987
Before (UNF)	After (1NF)

Missing Values

IDCustomer	IdentitasCustomer (nama, gender, tanggal lahir, alamat, email, no hp)	SpesialisasiDokter	NamaDokter	NamaRumahSakit	IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	DurasiKonsultasi	BiayaKonsultasi
C001	Budi Suryanto, M, 15 Sept 1990, Jln. Mawar 5, budi@mail.com, 0812-3456-7890	Umum	Dr. Rina K.	RS Sehat Sentosa	T001	1/9/2025	Konsultasi & Obat	9:00	9:20	20 min	80.000
C002	Ayu L. , F, 20/5/1995, Jln. Sudirman 10, ayu@mail.com, 0857-1234-5678	Anak	Dr. Tono W.	RS Medika Utama	T002	1/9/2025	Konsultasi	14:30	14:45	15 min	80.000
C003	Jaka Pratama H., M, 3/11/1988, Jln. Merpati 7, jaka@mail.com, 081398765432	Gigi	Dr. Santi D.	RS Bina Karya	T003	2/9/2025	Konsultasi & Obat	11:00	11:25	25 min	120.000
C004	Sita Lianti Wirawan, F, 28/7/2000, Jln. Pelita 12, sita@mail.com, 0878-5432-1098	Kulit	Dr. Mira S.	RS Permata Harapan	T004	2/9/2025	Konsultasi	18:45	18:55	10 min	40.000
C005	Toni Kurniawan, M, 10/3/1975, Jln. Kenanga 22, toni@mail.com, 82187654321	Jantung	Dr. Agung B.	RS Asri Medistra	T005	3/9/2025	Konsultasi & Obat	8:30	9:00	30 min	120.000

NamaObat	HargaObat	Kuantitas	NamaApotek	AlamatApotek	TotalBiaya	MetodeBayar	StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
Paracetamol	6.000	500 mg	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	86.000	QRIS	Lunas	RS001A	Ahmad	Selesai
-	-	-	-	-	80.000	Transfer Bank	Lunas	-	-	-
Asam Mefenamat	5.500	500 mg	Apotek Kimia Farma	Jln. Pahlawan No. 8	125.500	Kartu Kredit	Lunas	RS002A	Budi	Selesai
-	-	-	-	-	40.000	E-Wallet	Lunas	-	-	-
Amlodipine	8.000	10 mg	Apotek Century	Jln. Gatot Subroto No. 5	128.000	QRIS	Lunas	RS003A	Ilham	Selesai

Figure 4.7 Before remove row with missing values (UNF)

IDTransaksi	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDDokter	NamaDokter	SpesialisasiDokter	IDRumahSakit	NamaRumahSakit
T001	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	D001	Dr. Rina K.	Umum	SES-814	RS Sehat Sentosa
T003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432	D003	Dr. Santi D.	Gigi	BKA-503	RS Bina Karya
T005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	D005	Dr. Agung B.	Jantung	ASM-940	RS Asri Medistra
T007	C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081976543210	D006	Dr. Heru S.	THT	MIS-374	RS Mitra Sejahtera
T008	C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987	D002	Dr. Tono W.	Anak	MEU-229	RS Medika Utama

TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	IDObat	NamaObat	HargaObat	Kuantitas	IDApotek	NamaApotek	AlamatApotek	MetodeBayar
1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	PA055	Paracetamol	6.000	500 mg	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	QRIS
2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	AM013	Asam Mefenamat	5.500	500 mg	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	Kartu Kredit
3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	AD022	Amlodipine	8.000	10 mg	A002	Apotek Century	Jln. Gatot Subroto No. 5	QRIS
4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	FR028	Forumen	38.000	10 ml	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	E-Wallet
4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	TM079	Tempra	75.000	60 ml	A002	Apotek Century	Jln. Gatot Subroto No. 5	Transfer Bank

StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
Lunas	RS001A	Ahmad	Selesai
Lunas	RS002A	Budi	Selesai
Lunas	RS003A	Ilham	Selesai
Lunas	RS007A	Andi	Selesai
Lunas	RS008A	Rizky	Selesai

Figure 4.8 After remove row with missing values (1NF)

1NF Table

IDTransaksi	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDDokter	NamaDokter	SpesialisasiDokter	IDRumahSakit	NamaRumahSakit	TanggalTransaksi	Layanan
T001	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	D001	Dr. Rina K.	Umum	SES-814	RS Sehat Sentosa	1/9/2025	Konsultasi & Obat
T003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432	D003	Dr. Santi D.	Gigi	BKA-503	RS Bina Karya	2/9/2025	Konsultasi & Obat
T005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	D005	Dr. Agung B.	Jantung	ASM-940	RS Asri Medistra	3/9/2025	Konsultasi & Obat
T007	C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081976543210	D006	Dr. Heru S.	THT	MIS-374	RS Mitra Sejahtera	4/9/2025	Konsultasi & Obat
T008	C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987	D002	Dr. Tono W.	Anak	MEU-229	RS Medika Utama	4/9/2025	Konsultasi & Obat
T009	C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654	D007	Dr. Lia P.	Mata	CIH-158	RS Citra Husada	5/9/2025	Konsultasi & Obat
T010	C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	087765432109	D005	Dr. Agung B.	Jantung	ASM-940	RS Asri Medistra	5/9/2025	Konsultasi & Obat
T011	C011	Dika Mikhail Gunawan	M	29/10/1996	Jln. Cemara 4	dika@mail.com	085890123456	D001	Dr. Rina K.	Umum	SES-814	RS Sehat Sentosa	6/9/2025	Konsultasi & Obat
T012	C012	Elsa Putri Setiawan	F	23/01/2009	Jln. Kamboja 11	elsa@mail.com	081245678901	D004	Dr. Mira S.	Kulit	PEH-667	RS Permata Harapan	6/9/2025	Konsultasi & Obat
T013	C013	Hadi L.	M	18/05/1982	Jln. Siliwangi 2	hadi@mail.com	081356789012	D003	Dr. Santi D.	Gigi	BKA-503	RS Bina Karya	7/9/2025	Konsultasi & Obat
T014	C014	Indah Sari Permata	F	04/09/1999	Jln. Kartini 15	indah@mail.com	085723456789	D001	Dr. Rina K.	Umum	SES-814	RS Sehat Sentosa	7/9/2025	Konsultasi & Obat
T015	C015	Kevin P.	M	09/02/1998	Jln. Veteran 33	kevin@mail.com	089687654321	D005	Dr. Agung B.	Jantung	ASM-940	RS Asri Medistra	8/9/2025	Konsultasi & Obat

WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	IDObat	NamaObat	HargaObat	Kuantitas	IDApotek	NamaApotek	AlamatApotek	MetodeBayar	StatusBayar	NomorResi	IdentitasDriver	StatusPengiriman
9:00	9:20	80.000	PA055	Paracetamol	6.000	500 mg	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	QRIS	Lunas	RS001A	Ahmad	Selesai
11:00	11:25	120.000	AM013	Asam Mefenamat	5.500	500 mg	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	Kartu Kredit	Lunas	RS002A	Budi	Selesai
8:30	9:00	120.000	AD022	Amlodipine	8.000	10 mg	A002	Apotek Century	Jln. Gatot Subroto No. 5	QRIS	Lunas	RS003A	Ilham	Selesai
10:45	10:57	80.000	FR028	Forumen	38.000	10 ml	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	E-Wallet	Lunas	RS007A	Andi	Selesai
15:00	15:20	80.000	TM079	Tempra	75.000	60 ml	A002	Apotek Century	Jln. Gatot Subroto No. 5	Transfer Bank	Lunas	RS008A	Rizky	Selesai
9:30	9:47	80.000	IN010	Insto	16.000	7,5 ml	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	QRIS	Lunas	RS009A	Reza	Selesai
13:45	14:13	120.000	AV039	Atorvastatin	15.000	20 mg	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	Kartu Kredit	Lunas	RS010A	Ali	Selesai
17:00	17:15	80.000	PR015	Procold	6.000	1 strip	A002	Apotek Century	Jln. Gatot Subroto No. 5	E-Wallet	Lunas	RS011A	Dede	Selesai
10:10	10:30	80.000	MZ033	Miconazole	8.950	10 gram	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	E-Wallet	Lunas	RS012A	Usman	Selesai
12:00	12:10	40.000	LS092	Listerin	33.300	80 ml	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	Transfer Bank	Lunas	RS013A	Hidayat	Selesai
14:40	15:02	120.000	EC005	Ester C	47.300	500 mg	A002	Apotek Century	Jln. Gatot Subroto No. 5	QRIS	Lunas	RS014A	Bayu	Selesai
11:30	11:55	120.000	HV097	Hemaviton	22.500	1 strip	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	E-Wallet	Lunas	RS015A	Fikri	Selesai

B. 1NF to 2NF

In the First Normal Form (1NF), all attributes are stored in a single table with IDTransaksi as the primary key. Although the table already satisfies atomicity, it still contains attributes that are not fully dependent on IDTransaksi. Several attributes in the table are determined by other identifiers such as IDObat and IDDokter, rather than by the transaction itself. For example, medicine-related attributes depend on IDObat, while doctor and hospital attributes depend on IDDokter. Storing these attributes in the same table leads to dependency violations, which may cause data redundancy and update anomalies.

The Second Normal Form (2NF) requires that all non-key attributes must be fully functionally dependent on the primary key. Therefore, attributes that do not depend fully on IDTransaksi must be separated into their own tables based on their actual functional dependencies.

By decomposing the 1NF table into multiple tables according to these dependencies, the database structure satisfies 2NF, reduces redundancy, and improves overall data consistency.

1. Forming the Transaction Header Table

   Attributes that are fully dependent on IDTransaksi are grouped into the TransactionHeader table.In the given dataset, each transaction involves multiple related entities, which together define the transaction context.

   Transaction related attributes such as **TanggalTransaksi, Layanan, WaktuMulaiKonsultasi, WaktuSelesaiKonsultasi, BiayaKonsultasi, MetodeBayar**, and **StatusBayar** depend directly on the transaction. Customer attributes (**NamaCustomer, Gender, TanggalLahir, Alamat, Email, NoHP**) are also dependent on **IDTransaksi**, since each transaction records a single customer.

   Similarly, pharmacy related attributes (**IDApotek, NamaApotek, AlamatApotek**) are determined by IDTransaksi, as the selected pharmacy is recorded per transaction. Delivery information (**NomorResi, IdentitasDriver, StatusPengiriman**) is also transaction-specific.

   For this reason, all of these attributes are placed in the TransactionHeader table with IDTransaksi as the primary key, ensuring that all non-key attributes are fully functionally dependent on the primary key and that the table satisfies Second Normal Form (2NF).

TRANSACTION HEADER																						
IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDApotek	NamaApotek	AlamatApotek	NomorResi	IdentitasDriver	StatusPengiriman
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS001A	Ahmad	Selesai
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS002A	Budi	Selesai
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS003A	Ilham	Selesai
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081978543210	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS007A	Andi	Selesai
T009	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	Maya Dian	F	25/12/1993	Jln. Permai 1A	maya@mail.com	08564321098?	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS008A	Rizky	Selesai
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 8	fajar@mail.com	081130987654	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS009A	Reza	Selesai
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	Gina M.	F	09/06/1970	Jln. Melati 17	gina@mail.com	087765432109	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS010A	Ali	Selesai
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	Dika Mikhail Gunawan	M	28/10/1996	Jln. Cemara 4	dika@mail.com	085890123456	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS011A	Dede	Selesai
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	Elisa Putri Setiawan	F	23/01/2000	Jln. Kamboja 11	elisa@mail.com	081245678901	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS012A	Usman	Selesai
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	Hadi L.	M	19/05/1982	Jln. Siliwangi 2	hadi@mail.com	081356789012	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS013A	Hidayat	Selesai
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	Indah Sari Permata	F	04/09/1999	Jln. Kartini 15	indah@mail.com	085723456789	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS014A	Bayu	Selesai
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	Kevin P.	M	09/02/1998	Jln. Veteran 33	kevin@mail.com	08986765432?	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS015A	Fikri	Selesai
T016	8/9/2025	Konsultasi & Obat	16:30	16:45	80.000	Kartu Kredit	Lunas	D006	C016	Laila Mariana D.	F	20/11/1994	Jln. Diponegoro	laila@mail.com	082132109876	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS016A	Fahri	Selesai
T017	9/9/2025	Konsultasi & Obat	9:15	9:32	80.000	QRIS	Lunas	D001	C017	Muhammad Miko	M	12/12/2002	Jln. Mawar 20	miko@mail.com	087810987654	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS017A	Rizki	Selesai
T018	9/9/2025	Konsultasi & Obat	14:00	14:18	80.000	Transfer Bank	Lunas	D002	C018	Nanda Kartanegara	F	10/10/1989	Jln. Sudirman 3	nanda@mail.com	081985432106	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS018A	Malik	Selesai
T019	10/9/2025	Konsultasi & Obat	11:45	12:05	80.000	E-Wallet	Lunas	D003	C019	Muhammad Okky	M	21/07/1972	Jln. Merpati 11	okk@mail.com	085609876543	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS019A	Rafi	Selesai
T020	10/9/2025	Konsultasi & Obat	19:15	19:30	80.000	QRIS	Lunas	D004	C020	Putri Gianti	F	02/04/2001	Jln. Pelita 25	putri@mail.com	081176543210	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS020A	Reyhan	Selesai
T021	11/9/2025	Konsultasi & Obat	8:45	9:15	120.000	QRIS	Lunas	D005	C021	Rian H.	M	17/06/1978	Jln. Kenanga 30	rian@mail.com	087732109876	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS021A	Yanto	Selesai
T022	11/9/2025	Konsultasi & Obat	16:00	16:20	80.000	E-Wallet	Lunas	D001	C022	Siska Jessiyn K.	F	20/01/1997	Jln. Gajah Mada	siska@mail.com	085698765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS022A	Dodo	Selesai
T023	12/9/2025	Konsultasi & Obat	10:30	10:45	80.000	Kartu Kredit	Lunas	D006	C023	Umar K.	M	22/08/1992	Jln. Dahlia 8	umar@mail.com	081209876543	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS023A	Dika	Selesai
T024	12/9/2025	Konsultasi & Obat	15:30	15:55	120.000	Transfer Bank	Lunas	D002	C024	Vina Shania F.	F	08/12/1981	Jln. Permai 5B	vina@mail.com	081321098765	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS024A	Radit	Selesai
T025	13/9/2025	Konsultasi & Obat	9:45	9:55	40.000	QRIS	Lunas	D007	C025	Wira Manggala	M	11/04/1999	Jln. Angsana 1	wira@mail.com	085789012345	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS025A	Alfi	Selesai

Figure 4.9 TransactionHeader Table

2. Forming the MsObat Table

In the original 1NF table, medicine attributes such as IDObat, NamaObat, and HargaObat are repeated across multiple transactions whenever the same medicine is prescribed. Attributes such as **NamaObat** and **HargaObat** are functionally dependent on **IDObat**, not on IDTransaksi, because each medication has a fixed name and price that remain consistent across different transactions. A single transaction may include different medications, but the details of each medication are determined solely by its **IDObat**.

To remove partial dependency and reduce duplication, medicine information is moved into a master table called MsObat, where IDObat serves as the primary key. This table stores each medicine only once, ensuring consistency and simplifying maintenance of medicine data.

MsObat		
IDObat	NamaObat	HargaObat
PA055	Paracetamol	6.000
AM013	Asam Mefenamat	5.500
AD022	Amlodipine	8.000
FR028	Forumen	38.000
TM079	Tempra	75.000
IN010	Insto	16.000
AV039	Atorvastatin	15.000
PR015	Procold	6.000
MZ033	Miconazole	8.950
LS092	Listerin	33.300
EC005	Ester C	47.300
HV097	Hemaviton	22.500
BR060	Breathy	43.260
AC001	Acnes	25.000
CR022	CDR (Calcium D Redoxon)	53.000

Figure 4.10 MsObat Table

3. Forming the Dokter - Rumah Sakit Table

Doctor and hospital related attributes such as **NamaDokter, SpesialisasiDokter, IDRumahSakit,** and **NamaRumahSakit** do not have a direct relationship with **IDTransaksi** because a transaction can occur multiple times for the same doctor. These attributes are inherent to the doctor entity and remain constant across transactions. Therefore, they are functionally dependent on **IDDokter**, not on **IDTransaksi**.

Keeping this information in the transaction table causes repeated storage of the same doctor and hospital details for every transaction handled by the same doctor. To eliminate this redundancy, these attributes are separated into a table named Dokter - Rumah Sakit, with IDDokter as the primary key. This table ensures that doctor and hospital data are stored only once and can be referenced efficiently by transactions.

TABEL DOKTER - RUMAH SAKIT				
IDDokter	NamaDokter	SpesialisasiDokter	IDRumahSakit	NamaRumahSakit
D001	Dr. Rina K.	Umum	SES-814	RS Sehat Sentosa
D002	Dr. Tono W.	Anak	MEU-229	RS Medika Utama
D003	Dr. Santi D.	Gigi	BKA-503	RS Bina Karya
D004	Dr. Mira S.	Kulit	PEH-667	RS Permata Harapan
D005	Dr. Agung B.	Jantung	ASM-940	RS Asri Medistra
D006	Dr. Heru S.	THT	MIS-374	RS Mitra Sejahtera
D007	Dr. Lia P.	Mata	CIH-158	RS Citra Husada
D008	Dr. Vito B.	Tulang	HRK-254	RS Harapan Kami

Figure 4.11 Dokter - Rumah Sakit Table

4. Forming the PrescriptionDetail Table

After removing attributes with partial dependencies, Kuantitas remains because it is fully dependent on the combination of IDTransaksi and IDObat, not on either attribute alone. The quantity of a medicine can only be defined for a specific medicine within a specific transaction.

To satisfy Second Normal Form (2NF), these attributes are placed in a separate table named **Prescription Detail**, where a composite primary key (**IDTransaksi, IDObat**) ensures that **Kuantitas** is fully functionally dependent on the entire key. This separation eliminates partial dependencies and results in a more normalized database structure.

PrescriptionDetail		
IDTransaksi	IDObat	Kuantitas
T001	PA055	500 mg
T003	AM013	500 mg
T005	AD022	10 mg
T007	FR028	10 ml
T008	TM079	60 ml
T009	IN010	7,5 ml
T010	AV039	20 mg
T011	PR015	2 strip
T012	MZ033	10 gram
T013	LS092	80 ml
T014	EC005	500 mg
T015	HV097	1 strip
T016	BR060	60 ml
T017	PA055	500 mg
T018	EC005	500 mg
T019	AM013	500 mg
T020	AC001	12 gram
T021	AD022	5 mg
T022	PR015	1 strip
T023	BR060	60 ml
T024	TM079	60 ml
T025	IN010	7,5 ml
T026	PR015	10 mg
T027	AV039	1 strip
T028	PR015	10 gram
T029	MZ033	80 ml
T030	LS092	500 mg
T031	EC005	1 strip
T032	LS092	80 ml
T033	PA055	500 mg
T034	CR022	10 tablet

Figure 4.12 PrescriptionDetail Table

C. 2NF to 3NF

In order to transform 2NF into 3NF, transitive dependency must be removed. Transitive dependency is a type of dependency when any attribute can be determined using another non-primary attribute.

1. Normalizing Customer Information

   In 2NF stage, the Transaction Header still holds the entire Customer Information such as IDCustomer, NamaCustomer, Gender, TanggalLahir, Alamat, Email, and NoHP. The primary key of Transaction Header is IDTransaksi. However, among all customer attributes, only IDCustomer depends on IDTransaksi. The remaining customer attributes depend on IDCustomer. This results in transitive dependency.

   To solve this problem, a table named MsCustomer is created to store Customer Information. IDCustomer in MsCustomer acts as the **primary key**. The only Customer Information left in Transaction Header is IDCustomer, which acts as **foreign key**.

   Problems solved:

   1. Transitive Dependency

      Customer Information such as NamaCustomer, Gender, TanggalLahir, Alamat, Email, and NoHP now depend directly on IDCustomer.
   2. Insert Anomaly

      A new customer data can be inserted into the database without having a transaction history. Previously, customer data was available only when they made a transaction.
   3. Update Anomaly

      Changes on customer information are updated only in MsCustomer. Normalizing it helps to prevent data inconsistency.
   4. Remove Redundancy

      Returning customer data does not need to be re-entered. This eliminates redundant customer data across transactions.

IDTransaksi determines IDCustomer

IDCustomer determines Customer Information

TRANSACTION HEADER

IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDApotek	NamaApotek	AlamatApotek	NomorResi	IdentitasDriver	StatusPengiriman
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS001A	Ahmad	Selesai
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS002A	Budi	Selesai
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS003A	Ilham	Selesai
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081976543210	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS007A	Andi	Selesai
T008	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS008A	Rizky	Selesai
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS009A	Reza	Selesai
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	087765432109	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS010A	Ali	Selesai
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	Dika Mikhail Gunawan	M	29/10/1990	Jln. Cemara 4	dika@mail.com	085890123456	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS011A	Dede	Selesai
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	Elsa Putri Setiawan	F	23/01/2000	Jln. Kamboja 11	elsa@mail.com	081456789011	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS012A	Usman	Selesai
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	Hadi L.	M	18/05/1992	Jln. Siliwangi 2	hadi@mail.com	081356789012	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS013A	Hidayat	Selesai
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	Indah Sari Permata	F	04/09/1999	Jln. Kartini 15	indah@mail.com	085723456789	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS014A	Bayu	Selesai
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	Kevin P.	M	09/02/1998	Jln. Veteran 33	kevin@mail.com	089987654321	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS015A	Fikri	Selesai
T016	8/9/2025	Konsultasi & Obat	16:30	16:45	80.000	Kartu Kredit	Lunas	D006	C016	Laila Mariana D.	F	20/11/1994	Jln. Diponegoro	laila@mail.com	082132109876	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS016A	Fahri	Selesai
T017	8/9/2025	Konsultasi & Obat	9:15	9:32	80.000	QRIS	Lunas	D001	C017	Muhammad Miko	M	12/12/2002	Jln. Mawar 20	miko@mail.com	087810987654	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS017A	Robi	Selesai
T018	9/9/2025	Konsultasi & Obat	14:00	14:18	80.000	Transfer Bank	Lunas	D002	C018	Nanda Kartanegara	F	10/10/1989	Jln. Sudirman 3	nanda@mail.com	081965432109	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS018A	Malik	Selesai
T019	10/9/2025	Konsultasi & Obat	11:45	12:05	80.000	E-Wallet	Lunas	D003	C019	Muhammad Okky.	M	21/07/1972	Jln. Merpati 11	okk@mail.com	085609876543	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS019A	Rafi	Selesai
T020	10/9/2025	Konsultasi & Obat	19:15	19:30	80.000	QRIS	Lunas	D004	C020	Putri Ganti	F	02/04/2001	Jln. Pelita 25	putri@mail.com	081178543210	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS020A	Reyhan	Selesai
T021	11/9/2025	Konsultasi & Obat	8:45	9:15	120.000	QRIS	Lunas	D005	C021	Nan H.	M	17/06/1978	Jln. Kenanga 30	nan@mail.com	087732109875	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS021A	Yanto	Selesai
T022	11/9/2025	Konsultasi & Obat	16:00	16:20	80.000	E-Wallet	Lunas	D001	C022	Saka Jesslyn K.	F	26/01/1997	Jln. Gajah Mada	saka@mail.com	085890765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS022A	Dedo	Selesai
T023	12/9/2025	Konsultasi & Obat	10:30	10:45	80.000	Kartu Kredit	Lunas	D006	C023	Umar K.	M	22/08/1992	Jln. Dahlia 8	umar@mail.com	081209876543	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS023A	Dika	Selesai
T024	12/9/2025	Konsultasi & Obat	15:30	15:55	120.000	Transfer Bank	Lunas	D002	C024	Vina Shania F.	F	08/12/1981	Jln. Permai 5B	vina@mail.com	081312098765	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS024A	Radit	Selesai

Figure 4.13 Transaction Header before 3NF normalization

TransactionHeader

IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	IDApotek	NomorResi
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	A001	RS001A
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	A003	RS002A
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	A002	RS003A
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	A003	RS007A
T008	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	A002	RS008A
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	A003	RS009A
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	A001	RS010A
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	A002	RS011A
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	A003	RS012A
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	A001	RS013A
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	A002	RS014A
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	A001	RS015A

Figure 4.14 Transaction Header after 3NF normalization

MsCustomer

IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP
C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890
C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432
C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321
C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081976543210
C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987
C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654
C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	087765432109

Figure 4.15 MsCustomer

2. Normalizing Pharmacy Information

Among all Pharmacy Information which are in Transaction Header, IDApotek is the only attribute that depends on IDTransaksi. NamaApotek and AlamatApotek solely depend on IDApotek. This results in transitive dependency.

To solve this problem, a table called MsApotek is created. MsApotek has IDApotek as **primary key**, while NamaApotek and AlamatApotek depend on IDApotek. IDApotek inTransaction Header will act as **foreign key**.

Problem solved:

1. Transitive Dependency

   Pharmacy Information such as NamaApotek and AlamatApotek now depend directly on IDApotek.

2. Insert Anomaly

   A newly partnered pharmacy data can now be added to the database before any transactions related to that pharmacy occur. Previously, pharmacy information was available only when they are included in a transaction.

3. Update Anomaly

   Changes on pharmacy information are updated only in MsApotek. Normalizing it helps to prevent data inconsistency.

4. Remove Redundancy

   Pharmacy data does not need to be re-entered when a new transaction includes an existing pharmacy. This eliminates redundant customer data across transactions.

IDTransaksi determines IDApotek

IDApotek determines Pharmacy Information

TRANSACTION HEADER

IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDApotek	NamaApotek	AlamatApotek	NomorResi	IdentitasDriver	StatusPengiriman
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS001A	Ahmad	Selesai
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	08139876543 2	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS002A	Budi	Selesai
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS003A	Ilham	Selesai
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	Riko Januar	M	01/08/1998	Jln. Dahlia 3	riko@mail.com	081978543210	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS007A	Andi	Selesai
T008	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS008A	Rizky	Selesai
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS009A	Reza	Selesai
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	08776543210 9	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS010A	Ali	Selesai
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	Dika Mikhail Gunawan	M	29/10/1998	Jln. Cemara 4	dika@mail.com	085690123456	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS011A	Dede	Selesai
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	Elsa Putri Setiawan	F	23/01/2000	Jln. Kamboja 11	elsa@mail.com	081245678901	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS012A	Usman	Selesai
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	Hadi L.	M	19/05/1982	Jln. Siliwangi 2	hadi@mail.com	081356789012	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS013A	Hidayat	Selesai
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	Indah Sari Permata	F	04/09/1999	Jln. Kartini 15	indah@mail.com	085723456789	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS014A	Bayu	Selesai
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	Kevin P.	M	09/02/1998	Jln. Veteran 33	kevin@mail.com	089687654321	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS015A	Fikri	Selesai
T016	8/9/2025	Konsultasi & Obat	16:30	16:45	80.000	Kartu Kredit	Lunas	D006	C016	Laila Mariana D.	F	20/11/1994	Jln. Diponegoro	laila@mail.com	082132109876	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS016A	Fahri	Selesai
T017	9/9/2025	Konsultasi & Obat	9:15	9:32	80.000	QRIS	Lunas	D001	C017	Muhammad Miko	M	12/12/2002	Jln. Mawar 20	miko@mail.com	087810987654	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS017A	Robi	Selesai
T018	9/9/2025	Konsultasi & Obat	14:00	14:18	80.000	Transfer Bank	Lunas	D002	C018	Nanda Kertanegara	F	10/10/1989	Jln. Sudirman 3	nanda@mail.com	081965432109	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS018A	Malik	Selesai
T019	10/9/2025	Konsultasi & Obat	11:45	12:05	80.000	E-Wallet	Lunas	D003	C019	Muhammad Okky	M	21/07/1972	Jln. Merpati 11	okk@mail.com	085509876543	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS019A	Rafi	Selesai
T020	10/9/2025	Konsultasi & Obat	19:15	19:30	80.000	QRIS	Lunas	D004	C020	Putri Giant	F	02/04/2001	Jln. Pelita 25	putri@mail.com	081176543210	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS020A	Reyhan	Selesai
T021	11/9/2025	Konsultasi & Obat	8:45	9:15	120.000	QRIS	Lunas	D005	C021	Rian H.	M	17/06/1976	Jln. Kenanga 30	rian@mail.com	08773210987 8	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS021A	Yanto	Selesai
T022	11/9/2025	Konsultasi & Obat	16:00	16:20	80.000	E-Wallet	Lunas	D001	C022	Siska Jessiyn K.	F	26/01/1997	Jln. Gajah Mada	siska@mail.com	085698765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS022A	Dodo	Selesai
T023	12/9/2025	Konsultasi & Obat	10:30	10:45	80.000	Kartu Kredit	Lunas	D006	C023	Umar K.	M	22/08/1992	Jln. Dahlia 8	umar@mail.com	081209876543	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS023A	Dika	Selesai
T024	12/9/2025	Konsultasi & Obat	15:30	15:55	120.000	Transfer Bank	Lunas	D002	C024	Vina Shania F.	F	08/12/1981	Jln. Permai 5B	vina@mail.com	081321098765	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS024A	Radit	Selesai

Figure 4.16 Transaction Header before 3NF normalization

TransactionHeader

IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	IDApotek	NomorResi
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	A001	RS001A
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	A003	RS002A
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	A002	RS003A
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	A003	RS007A
T008	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	A002	RS008A
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	A003	RS009A
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	A001	RS010A
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	A002	RS011A
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	A003	RS012A
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	A001	RS013A
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	A002	RS014A
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	A001	RS015A

Figure 4.17 Transaction Header after 3NF normalization

MsApotek

IDApotek	NamaApotek	AlamatApotek
A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
A002	Apotek Century	Jln. Gatot Subroto No. 5
A003	Apotek Kimia Farma	Jln. Pahlawan No. 8

Figure 4.18 MsApotek

3. Normalizing Shipping Information

Shipping Information consists of NomorResi, IdentitasDriver, and StatusPengiriman. The only attribute in Shipping Information that depends on IDTransaksi is NomorResi. IdentitasDriver and StatusPengiriman depend on NomorResi. Placing all three attributes in Transaction Header creates a transitive dependency.

To remove this problem, a separate table named MsPengiriman is created. In MsPengiriman, NomorResi becomes the **primary key** to determine IdentitasDriver and StatusPengiriman. NomorResi in Transaction Header becomes a **foreign key** referring to MsPengiriman.

Problem solved:

1. Transitive Dependency

   Shipping Information such as IdentitasDriver and StatusPengiriman now depend directly on NomorResi.

IDTransaksi determines NomorResi

NomorResi determines Shipping Information

TRANSACTION HEADER

IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP	IDApotek	NamaApotek	AlamatApotek	NomorResi	IdentitasDriver	StatusPengiriman
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	Budi Suryanto	M	15/09/1990	Jln. Mawar 5	budi@mail.com	081234567890	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS001A	Ahmad	Selesai
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	Jaka Pratama H.	M	03/11/1988	Jln. Merpati 7	jaka@mail.com	081398765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS002A	Budi	Selesai
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	Toni Kurniawan	M	10/03/1975	Jln. Kenanga 22	toni@mail.com	082187654321	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS003A	Iham	Selesai
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	Riko Januar	M	01/05/1996	Jln. Dahlia 3	riko@mail.com	081976543210	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS007A	Andi	Selesai
T008	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	Maya Dian	F	25/12/1980	Jln. Permai 1A	maya@mail.com	085643210987	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS008A	Rizky	Selesai
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	Fajar Gunawan	M	19/04/1991	Jln. Anggrek 6	fajar@mail.com	081130987654	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS009A	Reza	Selesai
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	Gina M.	F	06/06/1970	Jln. Melati 17	gina@mail.com	087765432109	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS010A	Ali	Selesai
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	Dika Mikhail Gunar	M	29/10/1995	Jln. Cemara 4	dika@mail.com	085990123456	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS011A	Dede	Selesai
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	Elsa Putri Setiawa	F	23/01/2000	Jln. Kamboja 11	elsa@mail.com	081245678901	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS012A	Usman	Selesai
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	Hadi L.	M	19/05/1982	Jln. Siliwangi 2	hadi@mail.com	081356789012	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS013A	Hidayat	Selesai
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	Indah Sari Permata	F	04/08/1998	Jln. Kartini 15	indah@mail.com	085723456789	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS014A	Bayu	Selesai
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	Kevin P.	M	09/02/1996	Jln. Veteran 33	kevin@mail.com	089687654321	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS015A	Fikri	Selesai
T016	8/9/2025	Konsultasi & Obat	16:30	16:45	80.000	Kartu Kredit	Lunas	D006	C016	Laila Mariana D.	F	20/11/1994	Jln. Diponegoro	laila@mail.com	082132109876	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS016A	Fahri	Selesai
T017	9/9/2025	Konsultasi & Obat	9:15	9:32	80.000	QRIS	Lunas	D001	C017	Muhammad Miko	M	12/12/2002	Jln. Mawar 20	miko@mail.com	087910987654	A002	Apotek Century	Jln. Gatot Subroto No. 5	RS017A	Yobi	Selesai
T018	9/9/2025	Konsultasi & Obat	14:00	14:18	80.000	Transfer Bank	Lunas	D002	C018	Nanda Kartanegara	F	10/10/1988	Jln. Sudirman 3	nanda@mail.com	081965432109	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS018A	Aqlik	Selesai
T019	10/9/2025	Konsultasi & Obat	11:45	12:05	80.000	E-Wallet	Lunas	D003	C019	Muhammad Okky	M	21/07/1972	Jln. Merpati 11	okk@mail.com	085690876543	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS019A	Yafi	Selesai
T020	10/9/2025	Konsultasi & Obat	19:15	19:30	80.000	QRIS	Lunas	D004	C020	Putri Ganti	F	02/04/2001	Jln. Pelita 25	putri@mail.com	081178543210	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS020A	Rayhan	Selesai
T021	11/9/2025	Konsultasi & Obat	8:45	9:15	120.000	QRIS	Lunas	D005	C021	Rian H.	M	17/06/1976	Jln. Kenanga 30	rian@mail.com	087732109876	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS021A	Yanto	Selesai
T022	11/9/2025	Konsultasi & Obat	16:00	16:20	80.000	E-Wallet	Lunas	D001	C022	Siska Jesslyn K.	F	28/01/1997	Jln. Gajah Mada	siska@mail.com	085698765432	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS022A	Dodo	Selesai
T023	12/9/2025	Konsultasi & Obat	10:30	10:45	80.000	Kartu Kredit	Lunas	D006	C023	Umar K.	M	22/08/1992	Jln. Dahlia 8	umar@mail.com	081209876543	A003	Apotek Kimia Farma	Jln. Pahlawan No. 8	RS023A	Dika	Selesai
T024	12/9/2025	Konsultasi & Obat	15:30	15:55	120.000	Transfer Bank	Lunas	D002	C024	Vina Shania F.	F	09/12/1991	Jln. Permai 58	vina@mail.com	081321098765	A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1	RS024A	Tedit	Selesai

Figure 4.19 Transaction Header before 3NF normalization

TransactionHeader

IDTransaksi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar	IDDokter	IDCustomer	IDApotek	NomorResi
T001	1/9/2025	Konsultasi & Obat	9:00	9:20	80.000	QRIS	Lunas	D001	C001	A001	RS001A
T003	2/9/2025	Konsultasi & Obat	11:00	11:25	120.000	Kartu Kredit	Lunas	D003	C003	A003	RS002A
T005	3/9/2025	Konsultasi & Obat	8:30	9:00	120.000	QRIS	Lunas	D005	C005	A002	RS003A
T007	4/9/2025	Konsultasi & Obat	10:45	10:57	80.000	E-Wallet	Lunas	D006	C007	A003	RS007A
T008	4/9/2025	Konsultasi & Obat	15:00	15:20	80.000	Transfer Bank	Lunas	D002	C008	A002	RS008A
T009	5/9/2025	Konsultasi & Obat	9:30	9:47	80.000	QRIS	Lunas	D007	C009	A003	RS009A
T010	5/9/2025	Konsultasi & Obat	13:45	14:13	120.000	Kartu Kredit	Lunas	D005	C010	A001	RS010A
T011	6/9/2025	Konsultasi & Obat	17:00	17:15	80.000	E-Wallet	Lunas	D001	C011	A002	RS011A
T012	6/9/2025	Konsultasi & Obat	10:10	10:30	80.000	E-Wallet	Lunas	D004	C012	A003	RS012A
T013	7/9/2025	Konsultasi & Obat	12:00	12:10	40.000	Transfer Bank	Lunas	D003	C013	A001	RS013A
T014	7/9/2025	Konsultasi & Obat	14:40	15:02	120.000	QRIS	Lunas	D001	C014	A002	RS014A
T015	8/9/2025	Konsultasi & Obat	11:30	11:55	120.000	E-Wallet	Lunas	D005	C015	A001	RS015A

Figure 4.20 Transaction Header after 3NF normalization

MsPengiriman		
NomorResi	IdentitasDriver	StatusPengiriman
RS001A	Ahmad	Selesai
RS002A	Budi	Selesai
RS003A	Ilham	Selesai
RS007A	Andi	Selesai
RS008A	Rizky	Selesai
RS009A	Reza	Selesai
RS010A	Ali	Selesai
RS011A	Dede	Selesai
RS012A	Usman	Selesai
RS013A	Hidayat	Selesai
RS014A	Bayu	Selesai
RS015A	Fikri	Selesai

Figure 4.21 MsPengiriman

4. Normalizing Dokter - Rumah Sakit Table

   NamaRumahSakit in Dokter - Rumah Sakit Table does not depend on IDDokter. Instead, it depends on IDRumahSakit, which depends on IDDokter. This creates a transitive dependency.

   To solve this problem, a separate table called MsRumahSakit is created. In MsRumahSakit there are IDRumahSakit as primary key and NamaRumahSakit that depends on it. After removing NamaRumahSakit, the table is left with only Doctor Information. Hence, the table is renamed to MsDokter. IDRumahSakit in MsDokter refers to IDRumahSakit in MsRumahSakit.

   Problem solved:

   1. Transitive Dependency

      NamaRumahsakit now depends directly on IDRumahSakit.

IDDokter determines IDRumahSakit

IDRumahSakit determines NamaRumahSakit

TABEL DOKTER - RUMAH SAKIT				
IDDokter	NamaDokter	SpesialisasiDokter	IDRumahSakit	NamaRumahSakit
D001	Dr. Rina K.	Umum	SES-814	RS Sehat Sentosa
D002	Dr. Tono W.	Anak	MEU-229	RS Medika Utama
D003	Dr. Santi D.	Gigi	BKA-503	RS Bina Karya
D004	Dr. Mira S.	Kulit	PEH-667	RS Permata Harapan
D005	Dr. Agung B.	Jantung	ASM-940	RS Asri Medistra
D006	Dr. Heru S.	THT	MIS-374	RS Mitra Sejahtera
D007	Dr. Lia P.	Mata	CIH-158	RS Citra Husada

Figure 4.22 Dokter - Rumah Sakit Table before 3NF normalization

MsDokter			
IDDokter	NamaDokter	SpesialisasiDokter	IDRumahSakit
D001	Dr. Rina K.	Umum	SES-814
D002	Dr. Tono W.	Anak	MEU-229
D003	Dr. Santi D.	Gigi	BKA-503
D004	Dr. Mira S.	Kulit	PEH-667
D005	Dr. Agung B.	Jantung	ASM-940
D006	Dr. Heru S.	THT	MIS-374
D007	Dr. Lia P.	Mata	CIH-158
D008	Dr. Vito B.	Tulang	HRK-254

Figure 4.23 MsDokter

MsRumahSakit	
IDRumahSakit	NamaRumahSakit
SES-814	RS Sehat Sentosa
MEU-229	RS Medika Utama
BKA-503	RS Bina Karya
PEH-667	RS Permata Harapan
ASM-940	RS Asri Medistra
MIS-374	RS Mitra Sejahtera
CIH-158	RS Citra Husada
HRK-254	RS Harapan Kami

Figure 4.24 MsRumahSakit

5. Ensure Remaining Tables are in 3NF

   a. MsObat

   There are only two attributes in MsObat, IDObat and NamaObat. IDObat acts as Primary Key and NamaObat depends on IDObat. This already fulfills the criteria for 3NF.

MsObat		
IDObat	NamaObat	HargaObat
PA055	Paracetamol	6.000
AM013	Asam Mefenamat	5.500
AD022	Amlodipine	8.000
FR028	Forumen	38.000
TM079	Tempra	75.000
IN010	Insto	16.000
AV039	Atorvastatin	15.000
PR015	Procold	6.000
MZ033	Miconazole	8.950
LS092	Listerin	33.300
EC005	Ester C	47.300
HV097	Hemaviton	22.500
BR060	Breathy	43.260
AC001	Acnes	25.000
CR022	CDR (Calcium D Redoxon)	53.000

Figure 4.25 MsObat

b. PrescriptionDetail

To determine the quantity/dose of a medicine from some transaction, IDTransaksi and IDObat are required. IDTransaksi and IDObat become composite key.

PrescriptionDetail		
IDTransaksi	IDObat	Kuantitas
T001	PA055	500 mg
T003	AM013	500 mg
T005	AD022	10 mg
T007	FR028	10 ml
T008	TM079	60 ml
T009	IN010	7,5 ml
T010	AV039	20 mg
T011	PR015	2 strip
T012	MZ033	10 gram
T013	LS092	80 ml
T014	EC005	500 mg
T015	HV097	1 strip
T016	BR060	60 ml
T017	PA055	500 mg
T018	EC005	500 mg
T019	AM013	500 mg
T020	AC001	12 gram
T021	AD022	5 mg
T022	PR015	1 strip
T023	BR060	60 ml
T024	TM079	60 ml
T025	IN010	7,5 ml
T026	PR015	10 mg
T027	AV039	1 strip
T028	PR015	10 gram
T029	MZ033	80 ml
T030	LS092	500 mg
T031	EC005	1 strip
T032	LS092	80 ml
T033	PA055	500 mg
T034	CR022	10 tablet

Figure 4.26 PrescriptionDetail

CHAPTER 5
ENTITY RELATIONSHIP DIAGRAM

A. Entity Relationship Diagram

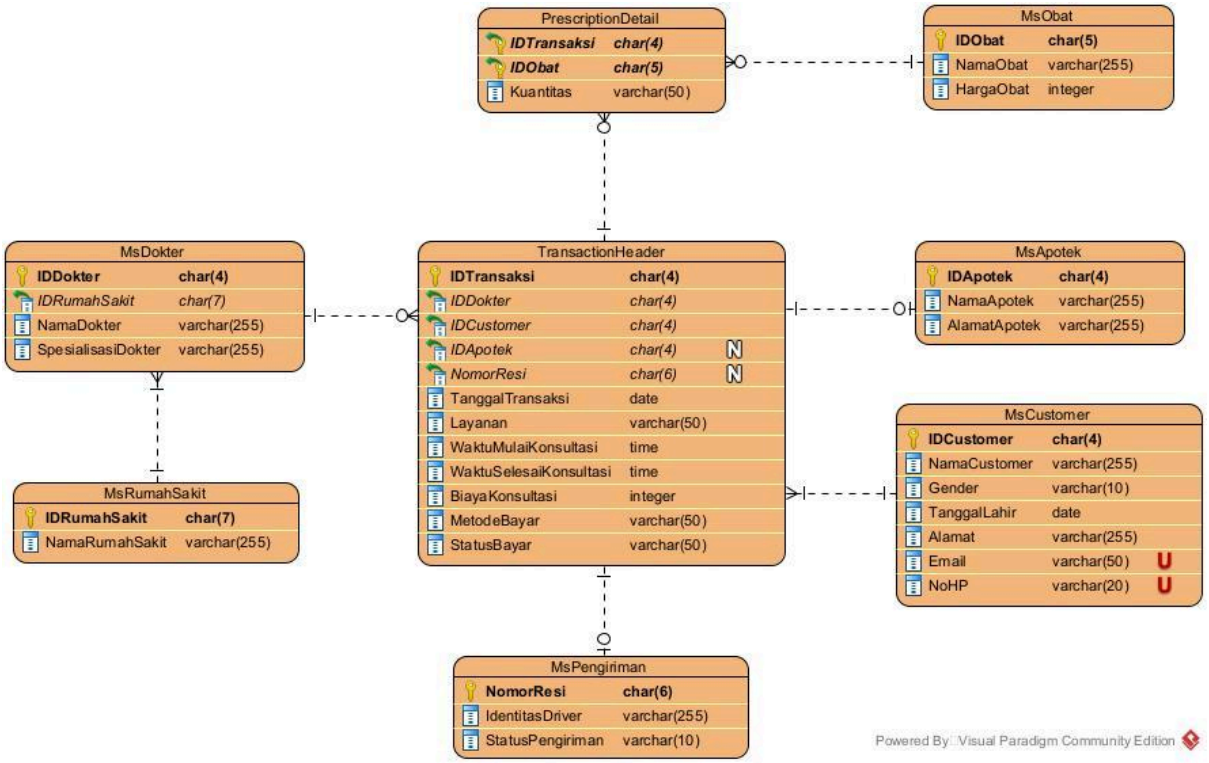

Figure 5.1 Entity Relationship Diagram

B. Tables Description

1. MsCustomer

   The table represents customers who make transactions on the application and their information. The columns are:

Table 5.1 MsCustomer Attributes

Column	Description
IDCustomer: char(4)	A unique identifier assigned to each customer. Serves as the primary key and is used to reference the customer in other tables.
NamaCustomer: varchar(255)	The registered full name of the

	customer.
Gender: varchar(10)	The registered gender of the customer.
TanggalLahir: date	The customer's date of birth. Used for identity verification.
Alamat: varchar(255)	The customer's registered home address.
Email: varchar(50)	The customer's registered email address, used for login, notifications, and communication.
NoHP: varchar(20)	The customer's registered phone number, used as the main contact for verification and communication.

The key and constraints are:

Table 5.2 MsCustomer Constraints

Constraint	**Column**	**Description**
Primary Key	IDCustomer	Ensures each customer has a unique identifier and prevents duplicate records.
Unique	Email, NoHP	Guarantees that no two customers can have the same email address or phone number.
Check	IDCustomer REGEXP '^C[0-9]{3}$'	Ensures that the IDCustomer value follows the required

		format: starts with “C” followed by exactly three digits.
Not Null	NamaCustomer, Gender, TanggalLahir, Alamat, Email, NoHP	Ensures these fields must contain a value and cannot be left empty.

2. MsDokter

   The table represents doctors registered in the application and their professional information. The columns are:

Table 5.3 MsDokter Attributes

Column	**Description**
IDDokter: char(4)	A unique identifier assigned to each doctor. Used as the primary key and to reference the doctor in other related tables.
IDRumahSakit: char(7)	The identifier of the hospital with which the doctor is affiliated. Links each doctor to their associated medical institution.
NamaDokter: varchar(255)	The full registered name of the doctor. Used to identify the healthcare professional handling consultations.
SpesialisasiDokter: varchar(255)	The medical specialty of the doctor.

The key and constraints are:

Table 5.4 MsDokter Constraints

Constraint	Column	Description
Primary Key	IDDokter	Ensures each doctor has a unique identifier and prevents duplicate records.
Foreign Key	IDRumahSakit	References the IDRumahSakit from the MsRumahSakit table.
Check	IDDokter REGEXP '^D[0-9]{3}$'	Validates the IDDokter format.
Not Null	IDRumahSakit, NamaDokter, SpesialisasiDokter	Requires all these fields to contain values, preventing the insertion of incomplete doctor records.

3. MsRumahSakit

   The table represents hospitals registered in the application and their institutional information. The columns are:

Table 5.5 MsRumahSakit Attributes

Column	Description
IDRumahSakit: char(7)	A unique identifier assigned to each hospital. Used as the primary key and referenced by other tables to link doctors to the correct institution.
NamaRumahSakit: varchar(255)	The official registered name of the

	hospital or medical institution.

The key and constraints are:

Table 5.6 MsRumahSakit Constraints

Constraint	Column	Description
Primary Key	IDRumahSakit	Ensures each doctor has a unique identifier and prevents duplicate records.
Check	IDRumahSakit REGEXP '^[A-Z]{3}-[0-9]{3}$'	Ensures that the hospital ID follows the pattern of three uppercase letters, a hyphen, and three digits
Not Null	NamaRumahSakit	Requires all these fields to contain values, preventing the insertion of incomplete doctor records.

4. MsPengiriman

The table represents delivery records stored in the application and their shipping information. The columns are:

Table 5.7 MsPengiriman Attributes

Column	Description
NomorResi: char(6)	A unique tracking number assigned to each delivery. Used to monitor and verify the shipping process from start to completion.

IdentitasDriver: varchar(255)	The identifier or name of the driver responsible for handling the delivery.
StatusPengiriman: varchar(10)	The current delivery status.

The key and constraints are:

Table 5.8 MsPengiriman Constraints

Constraint	Column	Description
Primary Key	NomorResi	Ensures each delivery record has a unique tracking number and prevents duplicate shipment entries
Check	NomorResi REGEXP '^RS[0-9]{3}A$'	Ensures the tracking number follows the required format: starts with RS, followed by three digits, and ends with A.
Not Null	IdentitasDriver, StatusPengiriman	Requires these fields to always contain values, preventing the creation of incomplete delivery records.

5. TransactionHeader

   The table represents the main transaction records made by customers. It stores information about consultations, payments, and medicine delivery. The columns are:

Table 5.9 TransactionHeader Attributes

Column	Description
IDTransaksi: char(4)	A unique identifier assigned to each transaction. Used as the primary key and referenced by other tables to link each record to the correct transaction.
IDDokter: char(4)	The identifier of the doctor responsible for handling the consultation in the transaction. Links the transaction to the specific doctor selected by the customer.
IDCustomer: char(4)	The identifier of the customer who created the transaction. Links the transaction to the customer who received the service.
IDApotek: char(4)	The identifier of the pharmacy associated with the transaction. Links the transaction to the specific pharmacy responsible for providing or preparing the medicines purchased by the customer.
NomorResi: char(6)	The identifier of the shipment receipt associated with the transaction. Links the transaction to the specific delivery record, allowing tracking of the shipping status for the purchased items.
TanggalTransaksi: date	The date on which the transaction occurred.

Layanan: varchar(50)	The type of service.
WaktuMulaiKonsultasi: time	The start time of the consultation session, indicating when the consultation begins.
WaktuSelesaiKonsultasi: time	The end time of the consultation session, indicating when the consultation ends.
BiayaKonsultasi: integer	The charge for the consultation service.
MetodeBayar: varchar(50)	The payment method used by the customer.
StatusBayar: varchar(50)	The payment status (e.g., Paid, Unpaid)

The key and constraints are:

Table 5.10 TransactionHeader Constraints

Constraint	**Column**	**Description**
Primary Key	IDTransaksi	Ensures each transaction has a unique identifier and prevents duplicate records.
Foreign Key	IDDokter, IDCustomer, IDApotek, NomorResi	References IDDokter from MsDokter table, IDCustomer from MsCustomer table, IDApotek from MsApotek table, and

		NomorResi from MsPengiriman table.
Check	IDTransaksi REGEXP '^T[0-9]{3}$'	Validates the IDTransaksi format.
Not Null	IDDokter, IDCustomer, TanggalTransaksi, Layanan, WaktuMulaiKonsultasi, WaktuSelesaiKonsultasi, BiayaKonsultasi, MetodeBayar, StatusBayar	Requires these fields to always contain values, preventing the creation of incomplete transaction records.

6. PrescriptionDetail

   The table represents detailed items within a transaction, specifically the list of medicines purchased by the customer. The columns are:

Table 5.11 PrescriptionDetail Attributes

Column	**Description**
IDTransaksi: char(4)	The identifier of the related transaction. Part of primary key and foreign key referencing TransactionHeader.
IDObat: char(5)	The identifier of the purchased medicine. Part of the primary key and foreign key referencing MsObat.
Kuantitas: varchar(50)	The quantity of the medicine purchased in the transaction.

The key and constraints are:

Table 5.12 PrescriptionDetail Constraints

Constraint	Column	Description
Primary Key	IDTransaksi, IDObat	Composite key ensuring unique medicine entry per transaction.
Foreign Key	IDTransaksi, IDObat	References IDTransaksi from TransactionHeader table and IDObat from MSObat table.
Not Null	Kuantitas	Requires these fields to always contain values, preventing the creation of incomplete detail records.

7. MsObat

   The table represents all medicines available in the application. The columns are:

Table 5.13 MsObat Attributes

Column	Description
IDObat: char(5)	A unique identifier assigned to each medicine. Used as the primary key and referenced by other tables to ensure each record is linked to the correct medicine.
NamaObat: varchar(255)	The name of the medicine provided by the pharmacy.

HargaObat: integer	The price of the medicine.

The key and constraints are:

Table 5.14 MsObat Constraints

Constraint	Column	Description
Primary Key	IDObat	Ensures each medicine has a unique identifier and prevents duplicate medicine records.
Check	IDObat REGEXP '^[A-Z]{2}[0-9]{3}$'	Validates the IDObat formats.
Not Null	NamaObat, HargaObat	Requires these fields to always contain values, preventing the creation of incomplete medicine records.

8. MsApotek

The table represents partner pharmacies that provide medicines for purchase. The columns are:

Table 5.15 MsApotek Attributes

Column	Description
IDApotek: char(4)	A unique identifier assigned to each pharmacy. Used as the primary key and referenced by other tables to ensure proper linkage to the correct pharmacy.

NamaApotek: varchar(255)	The registered name of the pharmacy.
AlamatApotek: varchar(255)	The physical address of the pharmacy.

The key and constraints are:

Table 5.16 MsApotek Contraints

Constraint	Column	Description
Primary Key	IDApotek	Ensures each pharmacy has a unique identifier and prevents duplicate entries.
Check	IDApotek REGEXP '^A[0-9]{3}$'	Ensures that the pharmacy ID follows the required format: the letter "A" followed by three digits.
Not Null	NamaApotek, AlamatApotek	Requires these fields to always contain values, preventing the creation of incomplete pharmacy records.

C. Relationships Between Tables

1. MsCustomer to TransactionHeader (1-1 or Many)

   A single customer may perform multiple transactions over time, where each transaction is tied to one registered customer.

   Primary Key (Reference): MsCustomer.IDCustomer

   Foreign Key: TransactionHeader.IDCustomer

This relationship ensures that every transaction recorded in **TransactionHeader** is linked to a valid customer from **MsCustomer**. A customer can have many transaction records, but each transaction belongs to exactly one customer.

ON UPDATE CASCADE: If IDCustomer in MsCustomer is updated, the corresponding IDCustomer values in TransactionHeader will automatically follow the change.
This prevents foreign key mismatches and maintains data consistency across customer-related transaction history.
ON DELETE RESTRICT: A customer cannot be deleted from MsCustomer if they still have transaction records in TransactionHeader.
This rule protects the integrity of transaction history, ensuring that important financial or operational data is not accidentally removed.

2. MsDokter to TransactionHeader (1-Zero or Many)
   Each transaction is handled or approved by exactly one doctor, while a single doctor may be responsible for many different transaction records over time. The zero indicates that a doctor may temporarily have no transactions linked to them.

   Primary Key (Reference): MsDokter.IDDokter
   Foreign Key: TransactionHeader.IDDokter

   This relationship ensures that every transaction recorded in **TransactionHeader** is tied to a valid doctor from **MsDokter**. A doctor may handle multiple consultations, but each transaction must be associated with one specific doctor to ensure accountability, traceability, and clear ownership of medical actions.

   ON UPDATE CASCADE: If IDDokter in MsDokter is changed, all related IDDokter entries in TransactionHeader will update automatically. This ensures seamless consistency between doctor data and transaction history.
   ON DELETE RESTRICT: A doctor cannot be removed from MsDokter if there are still transactions linked to them in TransactionHeader. This prevents

loss of historical transaction data and preserves accurate medical or operational records.

3. MsPengiriman to TransactionHeader (Zero or 1-1)
   Each delivery record corresponds to exactly one transaction, and each transaction can have only one or zero associated delivery. A value of zero indicates that the transaction does not require delivery, as there is no medicine transaction.

   Primary Key (Reference): MsPengiriman.NomorResi
   Foreign Key: TransactionHeader.NomorResi

   This relationship ensures a zero-or-one to one link between **MsPengiriman** and **TransactionHeader**. Once a transaction is created and requires shipping, the system stores delivery information, such as NomorResi, IdentitasDriver, and StatusPengiriman inside **MsPengiriman**, and the transaction links to that record through NomorResi.

   ON UPDATE CASCADE: If NomorResi in MsPengiriman is updated, the corresponding NomorResi in TransactionHeader will automatically update. This keeps the tracking link consistent across both tables.
   ON DELETE RESTRICT: A delivery record in MsPengiriman cannot be deleted if it is still linked to a transaction in TransactionHeader. This protects historical shipping data and prevents broken references in transaction records.

4. MsRumahSakit to MsDokter (1-1 or Many)
   Each doctor is associated with exactly one hospital, while one hospital can employ or manage many doctors.

   Primary Key (Reference): MsRumahSakit.IDRumahSakit
   Foreign Key: MsDokter.IDRumahSakit

   This relationship establishes that each doctor works under one hospital, but a hospital can have multiple doctors on staff.

   ON UPDATE CASCADE: If IDRumahSakit in MsRumahSakit is updated, the linked IDRumahSakit in MsDokter is automatically updated. This prevents inconsistency between hospital data and doctor affiliation.

ON DELETE RESTRICT: A hospital cannot be removed from MsRumahSakit if there is still a doctor record associated with it in MsDokter. This ensures that no doctor is left without a valid hospital reference, maintaining the integrity of staff assignment.

5. TransactionHeader to PrescriptionDetail (1-Zero or Many)
   A single transaction may include multiple purchased medicines, while each detail record belongs to exactly one transaction. The zero indicates that a transaction may not contain any medicine items at all.

   Primary Key (Reference): TransactionHeader.IDTransaksi
   Foreign Key: PrescriptionDetail.IDTransaksi

   The relationship ensures that every medicine listed in **PrescriptionDetail** refers to a valid transaction from **TransactionHeader.** A transaction may contain several medicine items, but each detail entry is tied to exactly one transaction, providing accurate breakdowns of purchases.

   ON UPDATE CASCADE: If IDTransaksi in TransactionHeader changes, all corresponding IDTransaksi values in PrescriptionDetail will automatically be updated. This maintains consistency across the transaction and its associated detail records.
   ON DELETE RESTRICT: A transaction cannot be deleted from TransactionHeader if it still has related records in PrescriptionDetail. This protects purchase history and prevents orphaned detail entries.

6. MsObat to PrescriptionDetail (1-Zero or Many)
   A single medicine product can appear in many prescription details, while each detail entry links to exactly one medicine. The zero indicates that a medicine item may temporarily have no associated prescription details.

   Primary Key (Reference): MsObat.IDObat
   Foreign Key: PrescriptionDetail.IDObat

   The relationship ensures that every medicine item in **PrescriptionDetail** refers to a valid medicine listed in **MsObat**. A medicine may be purchased many

times by different customers, but each detail record points to only one medicine to ensure accurate tracking of product usage and sales history.

ON UPDATE CASCADE: If IDObat in MsObat is updated, all matching IDObat values in PrescriptionDetail will automatically be updated to the new value. This ensures that the link between a medicine and its prescription details remains consistent even when the medicine ID changes.
ON DELETE RESTRICT: A medicine record in MsObat cannot be deleted if it is still referenced by any entry in PrescriptionDetail. This rule protects the integrity of historical prescription data by preventing the removal of a medicine that has been used in past transactions.

7. MsApotek to TransactionHeader (0 or 1-1)
   A single pharmacy (MsApotek) can be associated with at most one transaction record, while each TransactionHeader must refer to exactly one pharmacy. The zero indicates that a pharmacy may not be linked to any transaction at all, but once used, it can be connected to only one transaction record.

   Primary Key (Reference): MsApotek.IDApotek
   Foreign Key: TransactionHeader.IDApotek

   The relationship ensures that every record in **TransactionHeader** refers to a valid pharmacy listed in **MsApotek**. Although a single medicine can be available in multiple pharmacies and a pharmacy can provide many different medicines, the selected pharmacy for a purchase is determined at the transaction level. Therefore, each transaction is fulfilled by exactly one pharmacy, while a pharmacy may not be involved in any transaction at all (zero).

   This design avoids ambiguity that would occur if pharmacies were linked directly to medicines. If the relationship were modeled only between medicines and pharmacies, it would not be possible to clearly identify which pharmacy was chosen in a specific transaction when multiple pharmacies stock the same medicine. By connecting MsApotek directly to TransactionHeader, the system can accurately determine which pharmacy

supplies the medicines for each transaction and ensure correct transaction tracking.

ON UPDATE CASCADE: If IDApotek in MsApotek is updated, all corresponding IDApotek values in TransactionHeader will automatically be updated to match the change. This preserves referential consistency and ensures that the pharmacy-transaction linkage remains accurate after modifications to a pharmacy's identifier.

ON DELETE RESTRICT: A pharmacy record in MsApotek cannot be deleted if it is still referenced by any transaction in TransactionHeader. This rule safeguards transaction integrity and prevents the removal of pharmacy data that has been used to fulfill a customer's order.

Conclusion

In conclusion, the database design for the CareConnect online medical consultation platform is developed based on the dataset and normalized up to Third Normal Form (3NF) to ensure a structured, consistent, and reliable data model. The Entity Relationship Diagram (ERD) reflects the end-to-end healthcare workflow, including customer registration, medical consultations with certified doctors, prescription handling, pharmacy coordination, and medication delivery. This design minimizes data redundancy, enforces referential integrity, and supports accurate tracking of transactions across all involved entities. As a result, the system provides a scalable and efficient foundation for managing digital healthcare services, enabling CareConnect to deliver accessible and dependable medical consultations anytime and anywhere.

SQL IMPLEMENTATION

1. CREATE DATABASE

Tabel 5.17 Create CareConnect Database

```sql
CREATE DATABASE CareConnect;
USE CareConnect;
```

Database
careconnect

We create a database named **CareConnect** to represent the dataset used in the CareConnect online medical consultation platform. This database stores integrated information about customers, doctors, partner hospitals, medicines, pharmacies, and delivery processes. Through these tables and relationships, SQL will help organize the system's operations, from booking consultations, recording medical sessions, managing prescriptions, to tracking medicine delivery. By using this database, we can perform both DDL (Data Definition Language) and DML (Data Manipulation Language) operations to support CareConnect's complete digital healthcare workflow.

2. DDL (DATA DEFINITION LANGUAGE)

The creation of the CareConnect database itself is a DDL operation. DDL (Data Definition Language) is a part of SQL used to define, create, modify, and remove database structures. It focuses on how the database is organized, including tables, columns, constraints, and relationships. In this section, we define the database structures used by the CareConnect system. We begin by creating tables that store fundamental information about medical partners such as pharmacies, hospitals, doctors, and customers. These DDL commands ensure that every entity in the CareConnect platform follows consistent formatting rules, maintains data accuracy, and preserves referential integrity across all transactions.

Tabel 5.18 Create MsApotek Table

```sql
CREATE TABLE MsApotek(
IDApotek CHAR(4) PRIMARY KEY CHECK (IDApotek REGEXP '^A[0-9]{3}$'),
NamaApotek VARCHAR(255) NOT NULL,
AlamatApotek VARCHAR(255) NOT NULL
);
```

	Tables_in_careconnect
▶	msapotek

Field	Type	Null	Key	Default	Extra
IDApotek	char(4)	NO	PRI	NULL	
NamaApotek	varchar(255)	NO		NULL	
AlamatApotek	varchar(255)	NO		NULL	

The **MsApotek** table stores the identity and address of each pharmacy, enabling the system to track where medications are prepared and managed.

Tabel 5.19 Create MsRumahSakit Table

```sql
CREATE TABLE MsRumahSakit(
IDRumahSakit CHAR(7) PRIMARY KEY CHECK (IDRumahSakit REGEXP '^[A-Z]{3}-[0-9]{3}$'),
NamaRumahSakit VARCHAR(255) NOT NULL
);
```

▶	msrumahsakit

Field	Type	Null	Key	Default	Extra
IDRumahSakit	char(7)	NO	PRI	NULL	
NamaRumahSakit	varchar(255)	NO		NULL	

The **MsRumahSakit** table stores the identity and name of each hospital to track doctor affiliations, with ***IDRumahSakit*** as a unique identifier.

Tabel 5.20 Create MsPengiriman Table

```sql
CREATE TABLE MsPengiriman(
NomorResi CHAR(6) PRIMARY KEY CHECK (NomorResi REGEXP '^RS[0-9]{3}A$'),
IdentitasDriver VARCHAR(255) NOT NULL,
StatusPengiriman VARCHAR(10) NOT NULL
);
```

▶	mspengiriman

Field	Type	Null	Key	Default	Extra
NomorResi	char(6)	NO	PRI	NULL	
IdentitasDriver	varchar(255)	NO		NULL	
StatusPengiriman	varchar(10)	NO		NULL	

The **MsPengiriman** table records each delivery, including driver identity and shipment status, enabling real-time monitoring.

Tabel 5.21 Create MsCustomer Table

```
CREATE TABLE MsCustomer(
IDCustomer CHAR(4) PRIMARY KEY CHECK (IDCustomer REGEXP '^C[0-9]{3}$'),
NamaCustomer VARCHAR(255) NOT NULL,
Gender VARCHAR(10) NOT NULL,
TanggalLahir DATE NOT NULL,
Alamat VARCHAR(255) NOT NULL,
Email VARCHAR(50) NOT NULL UNIQUE,
NoHP VARCHAR(20) NOT NULL UNIQUE
);
```

mscustomer

Field	Type	Null	Key	Default	Extra
IDCustomer	char(4)	NO	PRI	NULL	
NamaCustomer	varchar(255)	NO		NULL	
Gender	varchar(10)	NO		NULL	
TanggalLahir	date	NO		NULL	
Alamat	varchar(255)	NO		NULL	
Email	varchar(50)	NO	UNI	NULL	
NoHP	varchar(20)	NO	UNI	NULL	

The **MsCustomer** table stores customer identity and contact information, ensuring uniqueness for email and phone numbers.

Tabel 5.22 Create MsObat Table

```
CREATE TABLE MsObat(
IDObat CHAR(5) PRIMARY KEY CHECK (IDObat REGEXP '^[A-Z]{2}[0-9]{3}$'),
NamaObat VARCHAR(255) NOT NULL,
HargaObat INT NOT NULL
);
```

msobat

Field	Type	Null	Key	Default	Extra
IDObat	char(5)	NO	PRI	NULL	
NamaObat	varchar(255)	NO		NULL	
HargaObat	int	NO		NULL	

The **MsObat** table stores each medication's ID, name, and price, enabling tracking and management of drugs.

Tabel 5.23 Create MsDokter Table

```
CREATE TABLE MsDokter(
IDDokter CHAR(4) PRIMARY KEY CHECK (IDDokter REGEXP '^D[0-9]{3}$'),
IDRumahSakit CHAR(7) NOT NULL,
NamaDokter VARCHAR(255) NOT NULL,
SpesialisasiDokter VARCHAR(255) NOT NULL,
FOREIGN KEY (IDRumahSakit) REFERENCES MsRumahSakit (IDRumahSakit)
    ON DELETE RESTRICT
    ON UPDATE CASCADE
);
```

msdokter

Field	Type	Null	Key	Default	Extra
IDDokter	char(4)	NO	PRI	NULL	
IDRumahSakit	char(7)	NO	MUL	NULL	
NamaDokter	varchar(255)	NO		NULL	
SpesialisasiDokter	varchar(255)	NO		NULL	

The **MsDokter** table stores doctor identity and specialization, linked to hospitals using foreign key constraints.

Tabel 5.24 Create TransactionHeader Table

```
CREATE TABLE TransactionHeader(
IDTransaksi CHAR(4) PRIMARY KEY CHECK (IDTransaksi REGEXP '^T[0-9]{3}$'),
IDDokter CHAR(4) NOT NULL,
IDCustomer CHAR(4) NOT NULL,
IDApotek CHAR(4) DEFAULT NULL,
NomorResi CHAR(6) DEFAULT NULL,
TanggalTransaksi DATE NOT NULL,
Layanan VARCHAR(50) NOT NULL,
WaktuMulaiKonsultasi TIME NOT NULL,
WaktuSelesaiKonsultasi TIME NOT NULL,
BiayaKonsultasi INT NOT NULL,
MetodeBayar VARCHAR(50) NOT NULL,
StatusBayar VARCHAR(50) NOT NULL,
```

```
FOREIGN KEY (IDDokter) REFERENCES MsDokter (IDDokter)
    ON DELETE RESTRICT
    ON UPDATE CASCADE,
FOREIGN KEY (IDCustomer) REFERENCES MsCustomer (IDCustomer)
    ON DELETE RESTRICT
    ON UPDATE CASCADE,
FOREIGN KEY (IDApotek) REFERENCES MsApotek (IDApotek)
    ON DELETE RESTRICT
    ON UPDATE CASCADE,
FOREIGN KEY (NomorResi) REFERENCES MsPengiriman (NomorResi)
    ON DELETE RESTRICT
    ON UPDATE CASCADE
);
```

▶ transactionheader

Field	Type	Null	Key	Default	Extra
IDTransaksi	char(4)	NO	PRI	NULL	
IDDokter	char(4)	NO	MUL	NULL	
IDCustomer	char(4)	NO	MUL	NULL	
IDApotek	char(4)	YES	MUL	NULL	
NomorResi	char(6)	YES	MUL	NULL	
TanggalTransaksi	date	NO		NULL	
Layanan	varchar(50)	NO		NULL	
WaktuMulaiKonsultasi	time	NO		NULL	
WaktuSelesaiKonsultasi	time	NO		NULL	
BiayaKonsultasi	int	NO		NULL	
MetodeBayar	varchar(50)	NO		NULL	
StatusBayar	varchar(50)	NO		NULL	

The **TransactionHeader** table records consultation transactions, including doctors, customers, pharmacy, delivery references, service details, and payment information, enabling the system to manage and track each medical consultation and its associated payment workflow.

Tabel 5.25 Create PrescriptionDetail Table

```
CREATE TABLE PrescriptionDetail(
IDTransaksi CHAR(4),
IDObat CHAR(5),
Kuantitas VARCHAR(50) NOT NULL,
PRIMARY KEY(IDTransaksi, IDObat),
FOREIGN KEY (IDTransaksi) REFERENCES TransactionHeader (IDTransaksi)
    ON DELETE RESTRICT
    ON UPDATE CASCADE,
FOREIGN KEY (IDObat) REFERENCES MsObat (IDObat)
    ON DELETE RESTRICT
    ON UPDATE CASCADE
);
```

▶ prescriptiondetail

Field	Type	Null	Key	Default	Extra
IDTransaksi	char(4)	NO	PRI	NULL	
IDObat	char(5)	NO	PRI	NULL	
Kuantitas	varchar(50)	NO		NULL	

The **PrescriptionDetail** table stores medications prescribed per transaction, with quantities and foreign key constraints, allowing the system to manage prescriptions and link them to the corresponding consultation.

3. DML (Data Manipulation Language)

DML (Data Manipulation Language) is a part of SQL used to insert, update, delete, and retrieve data stored in database tables. In this section, we focus specifically on the insert operations used in the CareConnect system. These insert commands populate the tables with essential initial data, such as information about pharmacies, hospitals, doctors, and customers. By inserting consistent and accurate data into the system, we ensure that the CareConnect platform has a reliable foundation for all its operational processes and transactions.

Tabel 5.26 Insert Values to MsApotek Table

```
INSERT INTO MsApotek VALUES
('A001', 'Apotek Sehat Utama', 'Jln. Kebon Jeruk No. 1'),
('A002', 'Apotek Century', 'Jln. Gatot Subroto No. 5'),
('A003', 'Apotek Kimia Farma', 'Jln. Pahlawan No. 8');
```

IDApotek	NamaApotek	AlamatApotek
A001	Apotek Sehat Utama	Jln. Kebon Jeruk No. 1
A002	Apotek Century	Jln. Gatot Subroto No. 5
A003	Apotek Kimia Farma	Jln. Pahlawan No. 8

The **MsApotek** table stores core information about registered pharmacies in the CareConnect system. In this section, we insert the initial pharmacy records, which include unique IDs, names, and addresses. These entries establish the reference data needed for managing pharmacy related transactions throughout the platform.

Tabel 5.27 Insert Values to MsRumahSakit Table

```sql
INSERT INTO MsRumahSakit VALUES
('SES-814', 'RS Sehat Sentosa'),
('MEU-229', 'RS Medika Utama'),
('BKA-503', 'RS Bina Karya'),
('PEH-667', 'RS Permata Harapan'),
('ASM-940', 'RS Asri Medistra'),
('MIS-374', 'RS Mitra Sejahtera'),
('CIH-158', 'RS Citra Husada'),
('HRK-254', 'RS Harapan Kami');
```

IDRumahSakit	NamaRumahSakit
ASM-940	RS Asri Medistra
BKA-503	RS Bina Karya
CIH-158	RS Citra Husada
HRK-254	RS Harapan Kami
MEU-229	RS Medika Utama
MIS-374	RS Mitra Sejahtera
PEH-667	RS Permata Harapan
SES-814	RS Sehat Sentosa

The **MsRumahSakit** table contains the list of partner hospitals available within the CareConnect network. The data inserted here provides each hospital's identifier and official name. This information allows the system to recognize and associate medical services with the correct hospital entities.

Tabel 5.28 Insert Values to MsPengiriman Table

```sql
INSERT INTO MsPengiriman VALUES
('RS001A', 'Ahmad', 'Selesai'),
('RS002A', 'Budi', 'Selesai'),
('RS003A', 'Ilham', 'Selesai'),
('RS007A', 'Andi', 'Selesai'),
('RS008A', 'Rizky', 'Selesai'),
```

NomorResi	IdentitasDriver	StatusPengiriman
RS001A	Ahmad	Selesai
RS002A	Budi	Selesai
RS003A	Ilham	Selesai
RS007A	Andi	Selesai
RS008A	Rizky	Selesai

The **MsPengiriman** table manages delivery information that supports the system's operational workflow. The inserted records include delivery IDs, courier names, and status details. By establishing these entries, CareConnect

can track and verify delivery activities effectively across completed transactions.

Tabel 5.29 Insert Values to MsCustomer Table

```
INSERT INTO MsCustomer VALUES
('C001', 'Budi Suryanto', 'M', '1990-09-15', 'Jln. Mawar 5', 'budi@mail.com', '081234567890'),
('C003', 'Jaka Pratama H.', 'M', '1988-11-03', 'Jln. Merpati 7', 'jaka@mail.com', '081398765432'),
('C005', 'Toni Kurniawan', 'M', '1975-03-10', 'Jln. Kenanga 22', 'toni@mail.com', '082187654321'),
('C007', 'Riko Januar', 'M', '1998-08-01', 'Jln. Dahlia 3', 'riko@mail.com', '081976543210'),
('C008', 'Maya Dian', 'F', '1980-12-25', 'Jln. Permai 1A', 'maya@mail.com', '085643210987'),
```

IDCustomer	NamaCustomer	Gender	TanggalLahir	Alamat	Email	NoHP
C001	Budi Suryanto	M	1990-09-15	Jln. Mawar 5	budi@mail.com	081234567890
C003	Jaka Pratama H.	M	1988-11-03	Jln. Merpati 7	jaka@mail.com	081398765432
C005	Toni Kurniawan	M	1975-03-10	Jln. Kenanga 22	toni@mail.com	082187654321
C007	Riko Januar	M	1998-08-01	Jln. Dahlia 3	riko@mail.com	081976543210
C008	Maya Dian	F	1980-12-25	Jln. Permai 1A	maya@mail.com	085643210987

The **MsCustomer** table contains detailed records of all customers registered in the CareConnect system. In this section, we insert a comprehensive set of customer information, including personal identifiers, demographic attributes, contact details, and residential addresses. Having complete and accurate customer data enables the platform to support personalized services, verify user identities, and maintain smooth interactions across various system features.

Tabel 5.30 Insert Values to MsObat Table

```
INSERT INTO MsObat VALUES
('AC001', 'Acnes', 25000),
('AD022', 'Amlodipine', 8000),
('AM013', 'Asam Mefenamat', 5500),
('AV039', 'Atorvastatin', 15000),
('BR060', 'Breathy', 43260),
('CR022', 'CDR (Calcium D Redoxon)', 53000),
('EC005', 'Ester C', 47300),
('FR028', 'Forumen', 38000),
('HV097', 'Hemaviton', 22500),
('IN010', 'Insto', 16000),
('LS092', 'Listerin', 33300),
('MZ033', 'Miconazole', 8950),
('PA055', 'Paracetamol', 6000),
('PR015', 'Procold', 6000),
('TM079', 'Tempra', 75000);
```

IDObat	NamaObat	HargaObat
AC001	Acnes	25000
AD022	Amlodipine	8000
AM013	Asam Mefenamat	5500
AV039	Atorvastatin	15000
BR060	Breathy	43260
CR022	CDR (Calcium D Redoxon)	53000
EC005	Ester C	47300
FR028	Forumen	38000
HV097	Hemaviton	22500
IN010	Insto	16000
LS092	Listerin	33300
MZ033	Miconazole	8950
PA055	Paracetamol	6000
PR015	Procold	6000
TM079	Tempra	75000

The **MsObat** table holds the list of medicines available within the CareConnect system. The inserted entries provide each product's unique code, official name, and price, forming a reliable reference set for all medication-related operations. This dataset ensures that prescriptions, transactions, and inventory processes consistently use standardized and correctly identified medicine records.

Tabel 5.31 Insert Values to MsDokter Table

```
INSERT INTO MsDokter VALUES
('D001', 'SES-814', 'Dr. Rina K.', 'Umum'),
('D002', 'MEU-229', 'Dr. Tono W.', 'Anak'),
('D003', 'BKA-503', 'Dr. Santi D.', 'Gigi'),
('D004', 'PEH-667', 'Dr. Mira S.', 'Kulit'),
('D005', 'ASM-940', 'Dr. Agung B.', 'Jantung'),
('D006', 'MIS-374', 'Dr. Heru S.', 'THT'),
('D007', 'CIH-158', 'Dr. Lia P.', 'Mata'),
('D008', 'HRK-254', 'Dr. Vito B.', 'Tulang');
```

IDDokter	IDRumahSakit	NamaDokter	SpesialisasiDokter
D001	SES-814	Dr. Rina K.	Umum
D002	MEU-229	Dr. Tono W.	Anak
D003	BKA-503	Dr. Santi D.	Gigi
D004	PEH-667	Dr. Mira S.	Kulit
D005	ASM-940	Dr. Agung B.	Jantung
D006	MIS-374	Dr. Heru S.	THT
D007	CIH-158	Dr. Lia P.	Mata
D008	HRK-254	Dr. Vito B.	Tulang

The **MsDokter** table stores information about the doctors affiliated with partner hospitals in the CareConnect system. The inserted records include each doctor's identifier, associated hospital code, name, and medical specialization. This dataset provides the system with structured professional

profiles, enabling accurate scheduling, service matching, and identification of medical expertise across the healthcare network.

Tabel 5.32 Insert Values to TransactionHeader Table

```
INSERT INTO TransactionHeader VALUES
('T001', 'D001', 'C001', 'A001', 'RS001A', '2025-09-01', 'Konsultasi & Obat', '09:00', '09:20', 80000, 'QRIS', 'Lunas'),
('T003', 'D003', 'C003', 'A003', 'RS002A', '2025-09-02', 'Konsultasi & Obat', '11:00', '11:25', 120000, 'Kartu Kredit', 'Lunas'),
('T005', 'D005', 'C005', 'A002', 'RS003A', '2025-09-03', 'Konsultasi & Obat', '08:30', '09:00', 120000, 'QRIS', 'Lunas'),
('T007', 'D006', 'C007', 'A003', 'RS007A', '2025-09-04', 'Konsultasi & Obat', '10:45', '10:57', 80000, 'E-Wallet', 'Lunas'),
('T008', 'D002', 'C008', 'A002', 'RS008A', '2025-09-04', 'Konsultasi & Obat', '15:00', '15:20', 80000, 'Transfer Bank', 'Lunas'),
```

IDTransaksi	IDDokter	IDCustomer	IDApotek	NomorResi	TanggalTransaksi	Layanan	WaktuMulaiKonsultasi	WaktuSelesaiKonsultasi	BiayaKonsultasi	MetodeBayar	StatusBayar
T001	D001	C001	A001	RS001A	2025-09-01	Konsultasi & Obat	09:00:00	09:20:00	80000	QRIS	Lunas
T003	D003	C003	A003	RS002A	2025-09-02	Konsultasi & Obat	11:00:00	11:25:00	120000	Kartu Kredit	Lunas
T005	D005	C005	A002	RS003A	2025-09-03	Konsultasi & Obat	08:30:00	09:00:00	120000	QRIS	Lunas
T007	D006	C007	A003	RS007A	2025-09-04	Konsultasi & Obat	10:45:00	10:57:00	80000	E-Wallet	Lunas
T008	D002	C008	A002	RS008A	2025-09-04	Konsultasi & Obat	15:00:00	15:20:00	80000	Transfer Bank	Lunas

The **TransactionHeader** table captures the main details of each patient visit within the CareConnect platform. Each record represents one completed service interaction, linking the doctor, customer, pharmacy, delivery code, consultation date, service type, time details, total charges, payment method, and payment status. This dataset forms the core transactional layer of the system, enabling tracking of service history, billing integrity, and overall utilization patterns across all healthcare facilities.

Tabel 5.33 Insert Values to PrescriptionDetail Table

```
INSERT INTO PrescriptionDetail VALUES
('T001', 'PA055', '500 mg'),
('T003', 'AM013', '500 mg'),
('T005', 'AD022', '10 mg'),
('T007', 'FR028', '10 ml'),
('T008', 'TM079', '60 ml'),
```

IDTransaksi	IDObat	Kuantitas
T001	PA055	500 mg
T003	AM013	500 mg
T005	AD022	10 mg
T007	FR028	10 ml
T008	TM079	60 ml

The **PrescriptionDetail** table expands each medical transaction by listing the specific medications prescribed during a patient's visit. Every entry links a transaction to an individual drug, along with its prescribed dosage or form. This table enriches the system's clinical records by providing item level prescription information, enabling detailed analysis of medication usage, patient treatment patterns, and pharmacy-related operations.

CASE STUDY

Case 1: CareConnect aims to identify the doctor specialty with the highest number of consultations to determine which specialty requires additional doctors. An analysis of consultation counts per specialty is conducted to pinpoint the most frequently used services as a basis for decision-making.

Tabel 5.34 SQL for Case Study 1

```sql
SELECT SpesialisasiDokter, COUNT(*) AS JumlahKonsultasi
FROM MsDokter d
JOIN TransactionHeader t ON d.IDDokter = t.IDDokter
GROUP BY SpesialisasiDokter
ORDER BY JumlahKonsultasi DESC
LIMIT 1;
```

SpesialisasiDokter	JumlahKonsultasi
Umum	9

Case 2: CareConnect wants to identify which pharmacy is most frequently chosen by customers. By analyzing the pharmacies with the highest number of purchases, CareConnect can determine which partners are most preferred by users. These insights will help CareConnect offer partnerships to the best performing pharmacies, ensuring that any collaboration brings maximum value to both sides.

Tabel 5.35 SQL for Case Study 2

```sql
SELECT NamaApotek, COUNT(*) AS TotalPembelian
FROM TransactionHeader th
JOIN MsApotek a ON th.IDApotek = a.IDApotek
GROUP BY NamaApotek
ORDER BY TotalPembelian DESC;
```

NamaApotek	TotalPembelian
Apotek Century	12
Apotek Kimia Farma	10
Apotek Sehat Utama	9

Link sheet UNF to 3NF:

https://docs.google.com/spreadsheets/d/1F7lkuPuILpjPuYcxvPlVsszoc5A1GeTt4DfPpAkKSug/edit?usp=sharing