Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Identification of *Drug-Related Problems* (DRPs) in Type 2 Diabetes Mellitus Patients with *Chronic Kidney Disease* (CKD) Stage I-III in the Inpatient Ward of Hospital X, Bandar Lampung

M. Iqbal Farqi[1*], Nurul Irna Windari[1], Dirga[1]
[1] *Pharmacy Study Program, Faculty of Sains, Institut Teknologi Sumatera, Lampung Selatan 35365, Indonesia*

**Corresponding author:* *iqbafarqi@gmail.com*

***Received** : Maret, 13rd, 2025 ; **Accepted** : April, 21st, 2025*

ABSTRACT
Type 2 Diabetes Mellitus (T2DM) with chronic kidney disease (CKD) stage I–III is characterized by elevated blood glucose and mild to moderate kidney function decline. Patients with this comorbidity are at risk of Drug-Related Problems (DRPs). This study aimed to identify the characteristics and incidence of DRPs in T2DM patients with CKD stage I–III at the inpatient ward of Hospital X, Bandar Lampung, between January and March 2023. This retrospective, descriptive study analyzed 36 medical records met the inclusion criteria. DRPs were identified using Cipolle's method (2021). Most patients were aged >60 years (75.00%), male (52.78%), had BMI <25 kg/m^2 (55.56%), diabetes duration <5 years (77.78%), comorbidities (75.00%), and were treated with a combination of oral antidiabetic drugs and insulin (41.68%). DRPs were observed in 27 patients (75.00%) with 41 total incidents, including unnecessary drug therapy (7.31%), need for additional therapy (12.19%), ineffective drugs (4.87%), insufficient dosage (24.39%), excessive dosage (46.37%), and adverse drug reactions (4.87%). The most frequent DRPs were dosing problems. Regular DRP identification is crucial to optimize therapy safety and effectiveness in T2DM patients with CKD.

Keywords: Chronic Kidney Disease (CKD); Cipolle Method; Drug-Related Problems (DRPs); Inpatient; Type 2 Diabetes Mellitus (T2DM)

INTRODUCTION
Diabetes Mellitus (DM) is a chronic disease characterized by hyperglycemia and is classified as a metabolic disorder. The disease is categorized into type 1 diabetes, type 2 diabetes, gestational diabetes, and diabetes due to other causes. Several etiologies of type 2 diabetes mellitus include impaired insulin secretion, impaired insulin function, or both (1, 2). The development of diabetes can be accelerated by various risk factors, the most common being unhealthy lifestyle habits (3, 4).

Prolonged hyperglycemia in type 2 diabetes patients can lead to the progression of complications, long-term damage, and failure of various organs, including the kidneys (5). Globally, diabetes affects approximately 425 million people (6). In Indonesia, the prevalence of DM is 6.2%, equivalent to 10.8 million individuals, and continues to rise annually (7). In Lampung Province, the prevalence reaches 1.37%, and in Bandar Lampung, up to 2.25% (8). Diabetes mellitus is the leading cause of chronic kidney disease (CKD) (9).

DM patients frequently develop kidney disorders, with about 20–30% of type 2 DM patients experience diabetic nephropathy, which, if uncontrolled, may progress to kidney failure (5, 10). DM with CKD is commonly referred to as Diabetic Kidney Disease (DKD). DKD is characterized by albuminuria and decreased Glomerular Filtration Rate (GFR), both of which are independent risk factors for end-stage renal disease and are associated with

complications such as cardiovascular events and mortality (11-13). DKD is the most common cause of CKD and the leading cause of death in DM patients worldwide (9, 14).

The increasing global incidence and prevalence of CKD are largely attributed to the rising number of diabetes cases. Appropriate pharmacological therapy plays a significant role in achieving treatment goals (1). Maximizing therapeutic benefit with minimal side effects is a key responsibility of pharmacists in pharmaceutical care. Another critical role is identifying Drug-Related Problems (DRPs), which can negatively affect patient outcomes and hinder the achievement of therapeutic targets (15).

METHODS

Tool

This study used a structured data collection form validated through expert review by clinical pharmacists and hospital formulary. Guidelines from PERKENI 2021, American Diabetes Association (ADA) 2023, KDIGO 2022, Pharmacotherapy Handbook 11th edition (16) and the Drug Information Handbook (DIH), as well as digital drug information platforms like Drugs.com and Medscape were employed to assist in classification and clinical judgment of DRPs. The Cipolle et al. (2012) classification system was used to identify and categorize DRPs (17).

Materials

Secondary data were collected from the medical records of Type 2 Diabetes Mellitus (T2DM) patients diagnosed with chronic kidney disease (CKD) stages I-III who were admitted to the inpatient ward of Hospital X, Bandar Lampung, between January and March 2023. A total of 170 medical records were initially reviewed. From this initial pool, 36 medical records met the following inclusion criteria: patients aged ≥18 years and complete medical record data necessary for Drug-Related Problem (DRP) identification.

Procedure

This study employed an observational method with a descriptive design and a retrospective approach. Samples were collected using a total sampling technique from T2DM patients with CKD stage I–III who were undergoing treatment in the inpatient ward of Hospital X in Bandar Lampung. Identification of Drug-Related Problems (DRPs) was conducted based on the CIPOLLE 2021 classification, taking into consideration treatment guidelines from the hospital formulary, PERKENI 2021, the American Diabetes Association (ADA) 2023, KDIGO 2022, Pharmacotherapy Handbook 11th edition. The data source for this study was inpatient medical records from the period of January to March 2023. Data was analyzed using univariate analysis to describe the characteristics of the studied variables.

RESULT AND DISCUSSION

A total of 36 out of 170 inpatients with T2DM and CKD stage I–III during the period of January to March 2023 met the predetermined inclusion criteria. This number meets the minimum sample size requirement of 30 samples, as suggested by Sugiyono (2014) and Kerlinger and Lee (2000) (18, 19). The characteristics of these 36 samples were analyzed based on the predefined research variables, namely age, sex, Body Mass Index (BMI), duration of diabetes, comorbidities, types of medications used, and the occurrence of Drug-Related Problems (DRPs).

Characteristics of Research Samples Based on Age and Gender

Table 1 shows that most patients in this study were aged ≥60 years, totaling 27 individuals (75.00%), while patients aged <60 years accounted for 9 individuals (25.00%). Similar findings were reported in other studies, which also showed a predominance of patients aged ≥60 years, such as at Fatmawati Central General Hospital

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

(93%), Yogyakarta City Regional Hospital (61.7%), Sewon 1 Bantul Health Center in 2017 (65.71%), and Pahoman Health Center in Bandar Lampung (57.2%) (20, 21, 22, 23). Several studies have indicated that T2DM with CKD is commonly found in the early elderly stage, particularly among those aged 60–69 years. A decline in kidney function typically begins at the age of 40–45 years, with a reduction of approximately ±8 mL/min/1.73 m^2, and this decline progresses with increasing age (1, 24, 25, 26). In elderly patients, cellular to organ-level changes lead to reduced insulin secretion, diminished physiological function in blood glucose regulation, decreased tissue sensitivity to glucose uptake, and lowered blood glucose levels (27, 28, 29, 30).

Table 1. Distribution of research samples by age and gender

Variable		Frequency (n)	Percentage (%)
Age	<60 years	9	25.00
	≥60 years	27	75.00
Total		**36**	**100.00**
Gender	Male	19	52.78
	Female	17	47.22
Total		**36**	**100.00**

Among hospitalized T2DM patients with CKD stage I–III at Hospital Similar results have also been reported in other studies conducted at hospitals and primary healthcare centers, such as Bhayangkara TK II Sartika Hospital in Bandung (51.32%), the University of Medan Hospital in North Sumatra in 2021 (53.33%), and Rangkah Public Health Center in 2017 (52%) (31, 32, 33). Both males and females have an equal risk of developing T2DM with CKD (1, 32, 34). However, men may experience a greater risk due to the tendency of abdominal fat accumulation, which can trigger metabolic disorders and increase the risk of diabetes. A higher risk of CKD in men is also associated with low testosterone levels in those with hypogonadism, reduced estrogen levels as a protective factor for renal blood vessels, protein intake-related factors, and higher smoking prevalence. Moreover, the decline in estimated glomerular filtration rate (eGFR) tends to be faster in men than in women (35, 36,37, 38).

Sample Characteristics Based on BMI

Obesity (BMI ≥ 25 kg/m^2) is a known risk factor for type 2 diabetes. The BMI characteristics of the study sample are presented in Table 2. In this study, 44.44% of hospitalized T2DM patients with CKD stage I–III were classified as obese, while 55.56% were non-obese. These findings indicate that the majority of patients fell into the non-obese BMI category. However, previous studies conducted at PKU Hospital Yogyakarta (53.5%), Dr. H. Abdoel Moeloek General Hospital Lampung in 2014 (69.6%), and in 2023 (96.30%) reported that the majority of patients were obese (39, 40, 41).

Table 2. Distribution of research samples based on BMI

Variabel		Frequency (n)	Percentage (%)
BMI (*Body Mass Index*)	Obesity	16	44.44
	Not Obese	20	55.56

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Variabel	Frequency (n)	Percentage (%)
Total	**36**	**100.00**

BMI-related risk factors for diabetes include reduced physical activity and excessive intake of carbohydrates, protein, and fat. These conditions can lead to increased fatty acids in cells, potentially causing insulin resistance if BMI increases significantly (1, 25, 42,43, 44, 45). Diabetic patients experience insulin deficiency that disrupts protein and fat metabolism. T2DM patients with CKD are more likely to experience muscle protein breakdown and fat mass loss, which can lead to more rapid weight loss compared to T2DM patients without CKD (46, 47).

Characteristics of Research Samples Based on Duration of Diabetes Mellitus (DM)

The characteristics of the research samples based on the duration of DM are presented in Table 3. The majority of patients (77.78%) had T2DM for less than 5 years, while 22.22% of patients had DM for 5 years or more. These findings align with studies conducted at Dr. Moewardi Hospital Surakarta (52.94%) and at Andalas and Pauh Public Health Centers in Padang City (92.9%) (48, 49). The duration of diabetes is counted from the time of diagnosis. It is closely related to the risk of various complications. The main contributing factors to diabetes-related complications are the severity of the disease and how long it has been present (50). Persistent hyperglycemia in type 2 diabetes patients can cause thickening of blood vessel walls, leading to increased blood pressure, which over time may damage capillaries and nerve fibers. This condition increases the risk of nerve cell damage, particularly in the kidneys (51, 52, 53). In this study, most patients with type 2 DM and CKD stages I–III had a disease duration of less than 5 years. This may be since the stages of CKD being studied were early stages (I–III). Several reports indicate that patients with CKD stages 3a and 3b may progress to stage 4 or 5 over an average period of 10 years, regardless of the underlying disease, with varying outcomes (54, 55).

Table 3. Distribution of research samples based on duration of DM

Variable		Frequency (n)	Percentage (%)
Duration DM	< 5 tahun	28	77.78
	≥ 5 tahun	8	22.22
Total		**36**	**100.00**

Characteristics of Research Samples Based on Comorbidities

Based on the data in Table 4, the distribution of research samples based on comorbidities showed that 25.00% of hospitalized type 2 DM patients with CKD stages I–III at Hospital X Bandar Lampung had no comorbidities, while 75.00% had comorbidities. These findings are consistent with studies conducted at Fatmawati Central General Hospital (54%), PKU Muhammadiyah Hospital Yogyakarta (88%), and Dr. H. Abdoel Moeloek Regional Hospital Lampung in 2023 (96.30%) (27; 56). The presence of comorbid conditions significantly complicates the treatment of type 2 DM patients with CKD stages I–III, necessitating proper adjustments to therapy, especially medications aimed at controlling the progression of other coexisting diseases (57).

Table 4. Distribution of research samples based on comorbidities

Variable		Frequency (n)	Percentage (%)
Comorbidity	None	9	25.00
	Present	27	75.00
Total		**36**	**100.00**

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Table 5. Distribution of comorbidity types among research samples

Variable	Comorbidity Type	Frequency (n)	Percentage (%)
Comorbidity	Hypertension (HT)	8	19.04
	PresentDyspepsia	5	11.90
	Anemia	4	9.52
	Chronic Obstructive Pulmonary Disease (COPD)	3	7.14
	Heart Failure	3	7.14
	Pulmonary Edema	3	7.14
	Hyperuricemia	2	4.76
	Atrial Fibrillation	2	4.76
	Unstable Angina	1	2.38
	Pleural Effusion	1	2.38
	Diabetic Ulcer	1	2.38
	Myocardial Infection	1	2.38
	Urinary Tract Infection (UTI)	1	2.38
	Hypovolemia	1	2.38
	Hypokalemia	1	2.38
	Atrial Flutter	1	2.38
	Dyspnea	1	2.38
	Community-Acquired Pneumonia (CAP)	1	2.38
	Hyperthyroidism	1	2.38
	Dyslipidemia	1	2.38
Total		**42**	**100.00**

*Note: *Data is presented based on comorbidity types, thus one patient may have more than one comorbid condition*.

As shown in Table 5, the three most common comorbidities in patients with type 2 DM and CKD stages I–III were hypertension (19.04%), dyspepsia (11.90%), and anemia (9.52%). These findings are in line with studies conducted at Esnawan Antariksa Air Force Hospital in 2021 and PKU Muhammadiyah Hospital in 2016, which also found hypertension to be the most frequent comorbidity among patients with type 2 DM and CKD, with respective prevalence rates of 54.61% and 87.3% (58; 59). Diabetes and hypertension are closely related to kidney health. Elevated blood pressure can trigger kidney failure and vice versa. Increased intraglomerular pressure in hypertension can lead to structural damage, functional impairment in glomerular tissues, and afferent arteriole constriction. Hypertension also increases cardiac workload and damages kidney blood vessels, resulting in impaired filtration and worsening hypertension severity (58; 59; 60).

Pattern of Antidiabetic Drug Use

The use of antidiabetic therapy among T2DM patients with stage I–III CKD in this study is presented in Table 6. Based on data, the majority of patients (41.68%) received combination therapy of oral antidiabetic drugs (OAD) and insulin. This was followed by insulin monotherapy (36.11%), OAD monotherapy (19.44%), and 2.77% of

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

patients who did not receive any antidiabetic medication. These findings are consistent with previous studies conducted in Pontianak City (39.13%) and RSUD Dr. Soehadi Prijonegoro Sragen (61.22%) 61, 62).

Table 6. Distribution of antidiabetic drug types used

Variable	Frequency (n)	Percentage (%)
Without Antidiabetic	1	2.77
Oral Antidiabetic Drugs (OAD)	7	19.44
Insulin	13	36.11
Combination of OAD and Insulin	14	41.68
Total	**36**	**100.00**

Table 7. Distribution of OAD and insulin combination regimens

Combination Type	Drugs	Frequency		Total	
		n	%	n	%
Two-Drug Combination					
Two OADs	Metformin 500mg + Glimepiride 3mg	1	3.03	7	24.24
	Metformin 500mg + Gliclazide 60mg	2	6.06		
	Vildagliptin 50mg + Gliclazide 60mg	2	6.06		
	Gliclazide 60mg + Pioglitazone 30mg	1	3.03		
	Gliquidone 30mg + Pioglitazone 3omg	1	3.03		
OAD + Insulin	Vildagliptin 50mg + Levemir 18U	1	3.03	1	3.03
Two Insulins	Apidra 8U + Apidra 12U	1	3.03	19	54.54
	Apidra 6U + Lantus 10U	1	3.03		
	Apidra 10U + Lantus 10U	1	3.03		
	Apidra 10U + Lantus 16U	1	3.03		
	Apidra 12U + Lantus 20U	2	6.06		
	Apidra 6 U + Levemir 10U	1	3.03		
	Novorapid 6U + Ezelin 10U	1	3.03		
	Novorapid 6U + Ezelin 14U	1	3.03		
	Novorapid 10U + Ezelin 8U	1	3.03		
	Novorapid 10U + Ezelin 14U	1	3.03		
	Novorapid 4U + Lantus 10U	2	6.06		
	Novorapid 5U + Lantus 18U	1	3.03		
	Novorapid 8U + Lantus 12U	1	3.03		
	Novorapid 8U + Lantus 22U	1	3.03		
	Novorapid 7U + Levemir 12U	1	3.03		
	Novorapid 7U + Levemir 10U	1	3.03		
	Novorapid 12U + Levemir 21U	1	3.03		
		Total combination		**27**	**81.81**
Three Drugs Combination					

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Combination Type	Drugs	Frequency		Total	
		n	%	n	%
Three OADs	Metformin 500mg + Vildagliptin 50mg + Pioglitazone 30mg	1	3.03	1	3.03
Two Insulins + OAD	Metformin 500mg + Apidra 10U + Lantus 8U	1	3.03	4	12.12
	Sitagliptin 100mg + Novorapid 10U + Ezelin 8U	1	3.03		
	Sitagliptin 100mg + Apidra 10U + Lantus 10U	1	3.03		
	Sitagliptin 100mg + Apidra 6U + Lantus 10U	1	3.03		
		Total combination		**5**	**15,15**
Four Drugs Combination					
Two OADs + Two Insulins	Gliquidone 30mg + Pioglitazone 15mg + Apidra 5U + Lantus 16U	1	3.03	1	3.04
		Total combination		**1**	**3.04**
	Total	**33***	**100.00**	**33**	**100.00**

**Note: Data presentation is based on regimen type; a single patient may receive more than one type of combination.*

As shown in Table 7, two-drug combinations were the most used regimen (81.81%), followed by three-drug combinations (15.15%) and four-drug combinations (3.04%). These findings align with studies conducted at Dr. H. Abdoel Moeloek Hospital (64.26%), Bogor District Hospital (54%), and Puskesmas X in Palembang City (66.7%) (39, 63, 64). Among the two-drug combinations, the dual insulin regimen (basal and prandial) was the most widely used, accounting for 54.54% or 19 cases out of the 27 two-drug therapies administered. Fasting blood glucose levels or preprandial glycemic control can be effectively managed through a combination of long-acting and rapid-acting insulins, or long-acting insulin therapy alone. Insulin administration, particularly the combination of basal and rapid-acting insulins, can reduce the impact of fasting glucose levels on postprandial blood glucose. Moreover, this combination mimics the body's physiological insulin profile more closely, as it provides both a quicker onset and a longer duration of action (65, 66).

Identification of DRP Incidents in the Research Sample

Based on the data in Table 8, a total of 27 patients, equivalent to 75.00% of the 36 patients experienced DRPs, while the remaining 9 patients, or 25.00%, did not experience DRPs. This indicates that nearly all hospitalized type 2 DM patients with CKD stage I–III at Hospital X in Bandar Lampung during the period of January to March 2023 experienced DRPs. Consistent with findings from Hospital X in Yogyakarta, which reported 51.35%, and at Toto Kabila Regional Hospital, with 67.16% (23, 67).

Table 8. Distribution of patient codes with DRP incidents

Variable			Frequency (n)	Percentage (%)
DRP Incidents	With DRPs	1, 2, 3, 4, 5, 6, 8, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21,	27	75.00

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Variable			Frequency (n)	Percentage (%)
		22, 27, 29, 30, 31, 32, 33, 34, 35		
	Without DRPs	7, 9, 10, 23, 24, 25, 26, 28, 36	9	25.00
Total			**36**	**100.00**

DRPs are categorized into seven types: unnecessary drug therapy, need for additional drug therapy, ineffective drug, insufficient dosage, excessive dosage, adverse drug reaction, and patient non-compliance. DRPs can also be caused by several other factors such as age, polypharmacy, comorbidities, decreased renal function, and others (66, 68). The distribution of DRP categories is presented in Table 9.

Table 9. Distribution of DRP categories

No	DRP Categiry	Frequency (n*)	Percentage (%)
1	Unnecesary Drug Therapy	3	7.31
2	Need for Additional Drug Therapy	5	12.19
3	Ineffective Drug	2	4.87
4	Insufficient Dosage	10	24.39
5	Excessive Dosage	19	46.37
6	Adverse Drug Reaction	2	4.87
	Total	41	**100.00**

Note: Data is presented based on DRP incidents; hence, one patient may have more than one DRP.

A total of 27 patients who experienced DRPs were further analyzed based on DRP categories in Table 9. The results of this study show a total of 41 DRP cases from 27 patients, indicating that one patient may experience more than one type of DRP. The categories of DRPs in descending order based on frequency are excessive dosage (46.37%), insufficient dosage (24.39%), need for additional drug therapy (12.19%), unnecessary drug therapy (7.31%), ineffective drug (4.87%), and adverse drug reaction (4.87%). A similar study at Kendari Regional Hospital reported 40.1%, and in Thailand, 39.31% of total DRPs were due to high dosages (69, 70).

Unnecessary Drug Therapy

Unnecessary drug therapy is one of the DRP (Drug-Related Problems) categories where a patient receives drug therapy that is not needed for their current condition or without a clear medical indication. The causes of unnecessary drug therapy in this study were therapeutic duplication, where the patient only required monotherapy, and the use of medications without a clear medical indication (17, 71). The details of unnecessary drug therapy DRPs are shown in Table 10.

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Table 10. Details of unnecessary drug therapy DRP incidents

Case Code	DRPs Cause	Antidiabetic Therapy Administered	DRP Details
12	Drug therapy given without indication	Vildagliptin 50mg dan Gliclazide 60mg	Newly diagnosed patients with HbA1c 6.2 should receive OAD monotherapy
20		Lantus 15U	Newly diagnosed DM patient with RBG <300 does not require insulin
31		Gliquidone 30mg	RBG 91 mg/dL, OAD not necessary

In this study, there were 3 cases of unnecessary drug therapy DRPs, accounting for 8.44% of the total patient sample. These cases were found in patients with case codes 12, 20, and 31. This result is consistent with a study conducted at Toto Kabila Regional Hospital, where unnecessary drug therapy ranked fourth, accounting for 4.57% of total DRPs (57). The use of insulin and ADO should follow proper principles and only be administered when blood glucose levels are uncontrolled. Inappropriate use of insulin and ADO contrary to the recommended treatment algorithm can result in hypoglycemic side effects (1).

Need for Additional Drug Therapy

The next DRP category is the need for additional drug therapy, which is defined as situations where type 2 DM patients with CKD stage I–III require an additional drug therapy to prevent worsening of their condition. This type of DRP is caused by the need to initiate therapy to manage the patient's medical condition (17, 71). The details are shown in Table 11.

Table 11. Details of additional drug therapy DRP incidents

Case Code	DRPs Cause	Antidiabetic Therapy Given	DRPs Description
5	Indication present without therapy	No antidiabetic given on first day	Antidiabetic therapy initiation needed
6		Lantus 10U on day 3, no antidiabetic on day 4	RBG ≥ 300 mg/dL requires antidiabetic therapy
14		No antidiabetic given on day 2 and 3	Antidiabetic therapy initiation needed
31		No antidiabetic therapy on days 1–3	Antidiabetic therapy initiation needed
33		Lantus 12U	Prandial insulin required

The study identified 5 cases of DRPs related to the need for additional drug therapy, accounting for 13.88% of the total patient sample. These DRPs were found in patients with case codes 5, 6, 14, 31, and 33. This finding is consistent with a study conducted at Dr. Sitanala General Hospital Tangerang, which reported 13.16% of total DRPs in this category (72). The administration of antidiabetic therapy is aimed at controlling blood glucose levels

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

and preventing the worsening of comorbid conditions. According to the PERKENI 2021 guidelines, insulin therapy can be initiated if RBG >300 mg/dL or HbA1c >9%, with basal insulin therapy initiated with or without ADO (1, 73).

Ineffective Drug Therapy

Ineffective drug therapy as a DRP is defined as when type 2 DM patients with CKD stage I–III receive antidiabetic therapy that is not effective in achieving the desired therapeutic outcome. The details of this DRP category are shown in Table 12.

Table 12. Details of ineffective drug therapy DRP incidents

Case Code	DRPs Cause	Antidiabetic Therapy Given	DRPs Description
19	More effective drug therapy was available	Lantus 20U and Apidra 12U	Despite dual insulin therapy, RBG continued to increase
32		Metformin 500mg dan Fonylin MR 60mg	RBG >300 mg/dL, insulin should have been given

Two cases were identified of ineffective drug therapy DRPs, accounting for 5.55% of the total patient sample, found in patients with case codes 19 and 32. This finding is consistent with a study at Hospital X in Samarinda, which also reported 2 cases of ineffective drug therapy DRPs, representing 4.12% of total DRPs (Helmidanora et al., 2018). According to the PERKENI 2021 guidelines, insulin therapy can be optimized by adding ADOs up to the maximum dose, and newly diagnosed type 2 DM patients with RBG ≥ 300 mg/dL or HbA1c ≥ 9% should be treated with a combination of three agents, namely two ADOs and insulin (1, 73).

Insufficient Dosage

This study found 10 cases of DRPs related to drug dosages being too low, which accounts for 27.77% of the total patient sample. These cases were identified in patients with case codes 1, 11, 12, 14, 15, 17, 18, 21, 27, and 30. The findings are consistent with a 2024 study conducted at a hospital in Jakarta, where this DRP category ranked third with a percentage of 17.00% (16). In this study, the administered doses were lower than those recommended based on the patient's body weight. Administering antidiabetic therapy at doses below those recommended in the treatment guidelines will not achieve the desired therapeutic outcomes and may result in uncontrolled blood glucose levels (16, 71). Details of DRPs related to drug dosage being too low are shown in Table 13.

Table 13. Details of DRPs: Insufficient Dosage

Type of Medication and Dosage	Patient Code	Body weight (kg)	Guideline-Based Dosage	Dosage in Medical Record	Remarks
Basal Insulin (Levemir, Lantus, Ezelin) Initial dose:10U/0,2U x Kg/BB. Frequency: once daily	12	50 kg	10U	7U	Underdose
	14	78 kg	15-16U	8U	Underdose
	17	65 kg	13U	8U	Underdose
	21	75 kg	15U	12U	Underdose
	27	110 kg	22U	18U	Underdose

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Type of Medication and Dosage	Patient Code	Body weight (kg)	Guideline-Based Dosage	Dosage in Medical Record	Remarks
(PERKENI, 2021)					
Insulin Prandial (Novorapide dan Apidra)	1	71 kg	7-8U	8U once daily	Dose frequency too infrequent
	11	65 kg	6-7U	5U	Underdose
Initial dose: 4U / 0.1 x body weight / 10% of basal dose	15	80 kg	8U	5U	Underdose
	18	66 kg	6-7U	5U	Underdose
Frequency: 3x daily (PERKENI, 2021)	30	84 kg	8-9U	6U	Underdose

Excessive Dose

This study identified 19 cases of excessive dose DRPs, which account for 52.78% of the total patient sample. These DRPs were found in patients with case codes 1, 2, 3, 5, 8, 11, 13, 14, 15, 16, 17, 18, 19, 20, 22, 29, 33, 34, and 35. These results are consistent with a study conducted at Dr. Sardjito Hospital Yogyakarta in 2016, where the excessive dose DRP category ranked first with a percentage of 35.46% among all DRP categories (74). This category is defined as a condition where patients with type 2 DM and CKD stages I–III receive medications that are appropriate based on treatment guidelines but at doses exceeding recommended levels, which can lead to toxicity or undesirable effects (16, 71). In this study, patients who received antidiabetic therapy exceeding usual and maximum recommended doses were at risk of hypoglycemia and worsening of CKD stages (1, 24, 73). Details of DRPs due to excessive dosing are shown in Table 14.

Table 14. Details of DRPs due to excessive dose

Type of Medication and Dosage	Patient Code	Body weight (kg)	Guideline-Based Dosage	Dosage in Medical Record	Remarks
OAD Maximum dose of Vildagliptin 50mg/day	5	68 kg	Maximum dose of Vildagliptin 50mg/day	50mg twice daily	Exceeds Maximum Dose
Maximum dose of Sitagliptin 50mg/day (KDIGO, 2022)	17	65 kg	Maximum dose of Sitagliptin 50mg/day	50mg twice daily	Exceeds Maximum Dose
Basal Insulin (Levemir, Lantus, Ezelin)	1	71 kg	14U	22U	High Dose
	2	50 kg	10U	16U	High Dose
	3	68 kg	13-14U	20U	High Dose
Initial dose: 10U / 0.2U x body weight (kg)	5	68 kg	13-14U	18U	High Dose
	8	51 kg	10-11U	14U	High Dose
	11	65 kg	13U	18U	High Dose
Frekuensi once daily	16	50 kg	10U	12U	High Dose

Research Article
Vol.14 No.1 (2025), 9-25
P-ISSN: 2303-2138 | E-ISSN: 2830-201X

Type of Medication and Dosage	Patient Code	Body weight (kg)	Guideline-Based Dosage	Dosage in Medical Record	Remarks
(PERKENI, 2021)	19	56 kg	11-12U	20U	High Dose
	20	60 kg	12U	15U	High Dose
	29	71 kg	14-15U	21U	High Dose
Insulin Prandial (Novorapide dan Apidra) Initial dose: 4U / 0.1 x body weight (kg) / 10% of basal dose Frequency: 3x daily (PERKENI, 2021)	1	71 kg	7U	8U	High Dose
	3	68 kg	6-7U	8U	High Dose
	8	51 kg	5-6U	10U	High Dose
	13	66 kg	6-7U	12U-8U-12U	High Dose
	14	78 kg	7-8U	10U	High Dose
	15	80 kg	8U	10U	High Dose
	18	66 kg	6-7U	10U	High Dose
	19	56 kg	5-6U	12U	High Dose
	22	50 kg	5U	6U	High Dose
	29	71 kg	7-8U	12U	High Dose
	33	61 kg	6-7U	8U	High Dose
	34	60 kg	6U	7U	High Dose

Adverse Drug Reactions

The overview of DRPs related to adverse drug reactions is presented in Table 15. There were 2 cases (5.56%) of adverse drug reaction-related DRPs identified in cases 1 and 4. These findings are consistent with a study conducted in a Malaysian hospital in 2013, where the adverse drug reaction DRP category ranked fifth with a percentage of 8.0% of total DRP cases (70). Interactions between levofloxacin and other antidiabetics affect glucose homeostasis in pancreatic beta cells, which regulate insulin secretion. This interaction can lead to either hyperglycemia or hypoglycemia, ultimately posing a risk to kidney function (75, 76). Management of this interaction includes strict blood glucose monitoring, especially in elderly patients and those with renal disease, and discontinuing quinolone therapy if hypoglycemia occurs (70).

Table 15. Details of DRPs due to andverse drug reactions

Case code	DRPs cause	Medication Given	DRP Description
1	Drug-drug interaction	Levofloxacin tab 500mg, lantus 22U, and novorapid 8U	Major interaction between • Levofloxacin and Lantus • Levofloxacin and Novorapid

Case code	DRPs cause	Medication Given	DRP Description
4		levofloxacin 500mg dan glimepirid 3mg	Major interaction between Glimepiride dan levofloxacin

CONCLUSION

The characteristics of hospitalized type 2 diabetes mellitus (T2DM) patients with chronic kidney disease (CKD) stage I–III at Hospital X in Bandar Lampung showed that most were over 60 years old (27 patients, 75.00%), with a higher incidence in males (19 patients, 52.78%). Most patients were not obese, with a Body Mass Index (BMI) below 25 kg/m^2 (20 patients, 55.56%), had been diagnosed with DM for less than 5 years (28 patients, 77.78%), and had at least one comorbidity (27 patients, 75.00%). The most frequently used therapy was a combination of oral antidiabetic drugs (ADO) and insulin (14 patients, 41.68%). Drug-Related Problems (DRPs) identified in the study based on the CIPOLLE 2021 classification included unnecessary drug therapy (7.31%), need for additional drug therapy (12.19%), ineffective drug (4.87%), insufficient dosage (24.39%), excessive dosage (46.37%), and adverse drug reactions (4.87%).

ACKNOWLEDGMENT

The authors would like to thank Hospital X in Bandar Lampung and its staff for their permission and support during data collection. Special thanks are also given to the academic supervisor for the valuable guidance, direction, and input throughout the research process. Appreciation is further extended to all parties who participated and contributed to the completion of this study.

REFERENCES

1. Purnamasari, D. Diagnosis dan Klasifikasi Diabetes Melitus. Dalam: Buku Ajar Ilmu Penyakit Dalam Jilid II Edisi VI. Jakarta: Interna Publishing, pp. 2323-2327. 2014
2. PERKENI. (2021). Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2021. Global Initiative for Asthma.
3. Soegondo, S. and Sukardji, K. (2008) Hidup secara mandiri dengan diabetes melitus, kencing manis, sakit gula. Jakarta: Balai Penerbit.
4. Isfandari, S. and Lolong, D. B. (2014) „Analisa Faktor Risiko dan Status Kesehatan Remaja Indonesia pada Dekade Mendatang", Buletin Penelitian Kesehatan, 4(2), pp. 122–130
5. Sari N dan Hasyim B. Hubungan antara diabetes melitus tipe ii dengan kejadian gagal ginjal kronik di rumah sakit pku muhammadiyah yogyakarta periode januari 2011-oktober 2012. JKKI. 2014; 6(1)
6. IDF. 2019. IDF Diabetes Atlas 9th Edition.
7. Yusransyah., Sofi Nurmay S., & Aliffia Nur S. (2022). Hubungan Antara Kepatuhan Minum Obat Pasien Diabtes Melitus dan Support yang Diberikan Keluarga. Jurnal Ilmiah Kesehatan, 4(2); 74-77.
8. Riskesdas. 2019. Laporan Provinsi Lampung Riskesdas 2018. Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan (LPB)
9. Bikbov B, Purcell CA, Levey AS, et al. Global, regional, and national burden of chronic kidney disease, 1990–2017: a systematic analysis for the global burden of disease study 2017. The Lancet 2020; 395:709–33.
10. Hendromartono. Nefropati Diabetik. Dalam: Buku Ajar Ilmu Penyakit Dalam. Edisi VI Jilid II. Jakarta: Pusat Penerbit FKUI. 2014

11. Ninomiya T, Perkovic V, de Galan BE, et al. Albuminuria and kidney function independently predict cardiovascular and renal outcomes in diabetes. JASN 2009;20: 1813–21.
12. Berhane AM, Weil EJ, Knowler WC, et al. Albuminuria and estimated glomerular filtration rate as predictors of diabetic end-stage renal disease and death. Clin J Am Soc Nephrol 2011; 6:2444–51.
13. Kandarini, Yenny. "Type 2 Diabetes Management: Sitagliptin on Renal Impaired T2DM Patients." Jurnal PKB-Trigonum Sudema-Ilmu Penyakit Dalam XXV (2017).
14. Oktaviani E, Indriani L, Kusuma ENP, Futriani. 2021. Kontrol Glikemik dan Profil Serum Kreatinin pada Pasien DM Tipe 2 dengan Gagal Ginjal Kronik.Jurnal Manajemen dan Pelayanan Farmasi. 11(2): 100-113
15. Adiana, S., & Maulina, D. (2022). Klasifikasi Permasalahan Terkait Obat (Drug Related Problem/DRPs): Review. Indonesian Journal of Health Science, 2(2), 54–58. https://doi.org/10.54957/ijhs.v2i2.238
16. Schwinghammer TL, DiPiro JT, Ellingrod VL, DiPiro CV, editors. *Pharmacotherapy handbook*. 11th ed. New York: McGraw Hill; 2022.
17. R. J. Cipolle, L. M. Strand, and P. C. Morley, "Pharmaceutical Care Practice: The Patient-Centered Approach to Medication Management, 3rd Edition," The McGraw-Hill Companies, Inc, vol. 3, pp. 1–30, 2012
18. Sugiyono. 2014. Statistika Untuk Penelitian, Penerbit CV. ALFA BETA Bandung
19. Kerlinger, F. N & Lee, H. B. (2000). Foundation of behavioral research 4th ed. Holt, NY
20. Kemenkes RI. (2019). Riskesdas 2018. Kementrian Kesehatan RI. Badan Penelitian dan Pengembangan Kesehatan
21. Robin Gresti I. dan Nurul Maziiyyah (2016) "Identifikasi Drug Related Problem Potensial Melalui Proses Rekonsulasi Obat Pada Pasien Diabetes Melitus Tipe 2 Di Puskesmas Sewon 1 Bantul". Yogyakarta : Universitas Muhammadiyah Yogyakarta
22. Lathifa Nabila, Sundas Ejaz, and Shalahuddin Al Madury, "Drug-Related Problem (DRPs) in Geriatric Patients With Type 2 Diabetes Mellitus (T2DM) : a Review," Indonesian Journal of Pharmacology and Therapy, vol. 3, no. 2, pp. 91-99, 2022, doi: 10.22146/ijpther.2695.
23. Dirga, A.E., Nugroho and I. D. P. Pramantara., "The Factors Influencing Clinical Outcome of Pain in Patient With Diabetic Neuropathy in Internal Medicine Clinics of Yogyakarta City General Hospital," Jurnal Kefarmasian Indonesia, vol. 2 no. 2, 2022
24. KDIGO 2022 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney International Supplements. 2013;3(1)
25. American Diabetes Association. "Standard of Medical Care in Diabetes," The Journal of Clinical and Applied research and Education, vol,45,no.1, p19, 2022.
26. Casagrande SS, McEwen LN, Herman WH.. Changes in health insurance coverage under the affordable care act: a national sample of U.S. adults with diabetes, 2009 and 2016. Diabetes Care 2018;41:956–962.
27. Samiyah, Miyadah. 2017. IDENTIFIKASI DRUG RELATED PROBLEM (DRO) PADA PASIEN DIABETES MELITUS YANG DISERTAI DENGAN GAGAL GINJAL KRONIK (CHRONIC KIDNEY DISEASE) DI RUMAH SAKIT UMUM PUSAT (RSUP) FATMAWATI. Jakarta :Universitas Islam Negeri Syarif Hidayatullah Jakarta.
28. Febriyanti Alifia P., Ria Ramadhani D. A., Helma Chika O., dan Dhani Wijaya. "Analisis Peresepan Polifarmasi Pada Pasien Geriatri dengan Diabetes Melitus Tipe 2 Berdasarkan Beers Criteria 2023" Jurnal Mandala Pharmacon Indonesia (JMPI), vol. 9, no. 2, pp 613-620
29. Imelda, S. I. (2019). Faktor-Faktor Yang Mempengaruhi Terjadinya diabetes Melitus di Puskesmas Harapan Raya Tahun 2018. Scientia Journal, 8(1), 28–39. https://doi.org/10.35141/scj.v8i1.406.
30. Misnadiarly. (2006). Mengenali Gejala, Menanggulangi, Dan Mencegah Infeksi. Pustaka Populer Obor.

31. Lathifah Nur L. 2017. "Hubungan Durasi Penyakit Kadar Gula Darah dengan Keluhan Subyektif Penderita Diabetes Melitus". Jurnal Berkala Epidemiologi, vol. 5(2), pp 232-239.
32. Sena, A. R., Afifah, A. and Salim, M. F. (2018) 'The Relationship Between Age, Gender, and Complications Neuropathy with Incidence of Diabetes Mellitus in Dr. Sardjito Hospital'
33. Abe, Masanori. Okada, Kazuyoshi & Soma, Masayoshi. 2011. Antidiabetic Agents in Patient with Chronic Kidney Disease and End-Stage Renal Disease on Dialysis : Metabolism and Clinical Practice. University School of Medicine. Hal. 59.
34. Jelantik, Ig. M. G. and Haryati, H. E. (2014) 'Hubungan Faktor Risiko Umur, Jenis Kelamin, Kegemukan Dan Hipertensi Dengan Kejadian Diabetes Mellitus Tipe II Di Wilayah Kerja Puskesmas Mataram', Jurnal Media Bina Ilmiah 39, 8(1).
35. Sugara YR, Acang N, Hakim FA. Prevalensi Gagal Ginjal Kronik pada Pasien Diabetes Melitus Tipe 2 beserta Indikator Usia, Jenis Kelamin dan Laju Filtrasi Glomerulus di RSUD Al Ihsan pada Tahun 2018. Prosiding Pendidikan Dokter. 2020 Jan 27:575-9.
36. Swartling O, Rydell H, Stendahl M, Segelmark M, Lagerros YT, Evans M. CKD progression and mortality among men and women: a nationwide study in Sweden. American Journal of Kidney Diseases. 2021 Aug 1;78(2):190-9
37. Musdalifah and Nugroho, P. S. (2020) 'Hubungan Jenis Kelamin dan Tingkat Ekonomi dengan Kejadian Diabetes Melitus di Wilayah Kerja Puskesmas Palaran Kota Samarinda Tahun 2019', Borneo Student Research, 1(2), pp. 1238–1242. Available at: https://journals.umkt.ac.id/index.php/bsr/article/view/483.\
38. Neugarten, J., & Golestaneh, L. (2013). Gender and the prevalence and progression of renal disease. Advances in Chronic Kidney Disease, 20(5), 390–395. https://doi.org/10.1053/j.ackd.2013.05.004
39. Marvel Ramadhani A., "Hubungan Kejadian Drug Related Problems Dengan Outcome Terapi Pasien Diabetes Melitus Tipe 2 di RSUD Dr. H. Abdul Moeloek Provinsi Lampung" Bandar Lampung : Institut Teknologi Sumatera. 2023.
40. Sari, Nova Nurwida. "Hubungan Obesitas Sentral Dengan Kejadian Diabetes Melitus Tipe II". Jurnal Ilmiah Keperawatan Sai Betik, vol. 14(2). 2018.
41. S. Ruspandi, "Hubungan Drug Related Problems dengan Outcome Terapi Pada Pasien Diabetes Melitus Tipe 2 Rawat Inap di Rumah Sakit PKU Muhammadiyah Yogyakarta," Universitas Gadjah Mada,2015
42. Almatsier, S. (2009) Prinsip Dasar Ilmu Gizi. Jakarta: PT Gramedia Pustaka Utama.
43. Câmara NO, Iseki K, Kramer H, Liu ZH, Sharma K: Kidney disease and obesity: epidemiology, mechanisms and treatment. Nat Rev Nephrol. 2017, 13:181-90. 10.1038/nrneph.2016.191.
44. Schmidt MI, Duncan BB, Mill JG, et al.: Cohort profile: longitudinal study of adult health (ELSA-Brasil) Int J Epidemiol. 2015, 44:68-75. 10.1093/ije/dyu027.
45. Johansen KL, Lee C: Body composition in chronic kidney disease . Curr Opin Nephrol Hypertens. 2015, 24:268-75. 10.1097/MNH.0000000000000120.
46. Tetana Ary S., "Perbedaan Indeks Massa Tubuh (IMT) Pada Pasien Gagal Ginjal Kronik Dengan DM dan Tanpa DM dii RSUD Dr. Moewardi" Universitas Muhammadiyah Surakarta. 2018.
47. B. Purnama Dewi, A. Amin Darussalam, dan Y. Rimbawati "Hubungan Karakteristik Pasien Usia Lanjut Dengan Penyakit Ginjal Kronik (PGK) Yang Disebabkan Diabetes Melitus dan Hipertensi". Jurnal Kesehatan Terapan. Vol. 9 (2), pp 96 – 105. 2022.
48. Mawaddah dan Dwi Widya W. (2024) "Hubungan Lama Menderita Diabetes Melitus Tipe 2 Dengan Kejadian Neuropati Diabetik" Jurnal Ilmu Farmasi dan Kesehatan, vol. 2(1), pp 40-46.

49. Qholfi Anggi Uraini Sahid, "Hubungan Lama Diabetes Melitus Dengan Terjadinya Gagal Ginjal Terminal di Rumah Sakit Dr. Moewardi Surakarta. Naskah Publikasi. Universitas Muhammadiyah Surakarta. 2012
50. Ilmi M, Abdurrahman, Abiyoga A. Hubungan Antara Lama Menderita Diabetes Mellitus Tipe 2 Dengan Kejadian Neuropati Sensorik di Puskesmas Loa Janan. J Keperawatan Wijaya. 2020;1(1).
51. Faiqotunnuriyah, Cahyati W hary. Faktor yang Berhubungan Dengan Kejadian Neuropati Diabetik pada Penderita Diabetes Melitus Tipe 2. Jurnal Kesmas Indonesia. 2021;13(1):64–76.
52. Amelia R, Wahyuni AS, Yunanda Y. Diabetic neuropathy among type 2 diabetes mellitus patients at amplas primary health care in Medan city. Open Access Macedonian Journal of Medical Sciences. 2019;7(20):3400–3.
53. Liu X, Xu Y, An M, Zeng Q. (2019). The risk factors for diabetic peripheral neuropathy: A meta-analysis. PLoS ONE. 2019 Feb 1;14(2).
54. Gosse P, Segalas C, Rubin S, Boulestreau R, Jacqmin-Gadda H, Leffondre K, et al. Long term evolution ofrenal function in essential hypertensive patients with nobaseline proteinuria. J Hum Hypertens. 2020; 34:560-7, http://dx.doi.org/10.1038/s41371-019-0245-4.
55. Baek SD, Baek CH, Kim JS, Kim SM, Kim JH, Kim SB. Does stage III chronic kidney disease always progress to end-stage renal disease? A ten-year follow- up study. Scand J Urol Nephrol. 2012;46:232---8, http://dx.doi.org/10.3109/00365599.2011.649045
56. Veronika, Poppy. (2021). Analisa Drug Related Problems (DRPs) Pada Pasien Chronic Kidney Disease (CKD) Di Instalasi Rawat Inap Klinik Sari Medika Kabupaten Semarang. Jurnal Farmasi & Sains Indonesia, vol 4(1): 1-5.
57. Kuna Moh R., Gunawan Pamudji W., Ismi Rahmawati. 2023. "Identifikasi Potensi DRPs (Drug Related Problems) Diabetes Melitus Tipe 2 dengan Penyakit Komorbid Pasien Rawat Jalan Di RSUD Toto Kabila". Jurnal Media Ilmu Kesehatan, vol 12(1), pp 104-115.
58. Artiany Sara, et al. 2021. "Gambaran Komorbid pada Pasien Hemodialisis di Rumah Sakit Angkatan Udara (RSAU) dr Esnawan Antariksa". Jurnal Keperawatan Cikini, vol. 2(2), pp 01-06.
59. Utami, M. (2016). Komorbiditas dan Kualitas Hidup Pasien Hemodialisa.Yogyakarta: Universitas Muhammadiyah Yogyakarta.
60. M. D. Gultom, and M. K. Sudaryo, "Hubungan Hipertensi dengan Kejadian Gagal Ginjal Kronik di RSUD DR. Djasamen Saragih Kota Pematang Siantar Tahun 2020," Jurnal Epidemiologi Kesehatan Komunitas, vol. 8, no. 1, pp. 40-47, Feb. 2023. https://doi.org/10.14710/jekk.v8i1.11722
61. Madelina Winona, Eka K. U., dan Esy Nansy. "Efek Perseptif Penggunaan Kombinasi Antidiabetes Oral-Insulin pada Pasien Diabetes Melitus Tipe 2 di Kota Pontianak dan Sekitarnya". Jurnal Farmasi Klinik Indonesia, vol. 7(3), pp 209-216.
62. Daffa Dhiya U., Yen Yen A.I., Arief Suryadinata. 2022. "Analisis Efektivitas Biaya Terapi Kombinasi Insulin dengan Obat Antidiabetes Oral pada Pasien Rawat Jalan Penderita Diabetes Melitus Tipe 2 di RSUD dr. Soehadi Prijonegoro Sragen". Jurnal Islamic Pharmacy., vol. 7(2), pp 112-118.
63. Wulandari, Ainun. "Kesesuaian Penggunaan Obat Antidiabetes pada Pasien Diabetes Melitus di Puskesmas X Palembang". Borneo Journal of Pharmascientech. vol 5(2). 2021
64. Kurniawati, Tias. L,Dwintha. Rahayu, Anis Puji. S. F. Ningrum. "Evaluasi Profil Penggunaan Obat Antidiabetes Pada Pasien Diabetes Melitus Tipe2 Rawat Jalan di Salah Satu Rumah Sakit Kabupaten Bogor. Journal of Science, Technology, and Enterpreneurship. vol 3, no 1. 2021
65. Wijaya, IN, Faturrohmah A, Yuda A, Mufarrihah, Soesanto TG, Kartika D, dkk. 2015.ProfilPenggunaan Obat Pada Pasien Diabetes Melitus di Puskesmas Wilayah Surabaya Timur. Surabaya: Departemen Farmasi Komunitas Fakultas Farmasi Universitas Airlangga. Jurnal Farmasi Komunitas. Vol 2 (1):23-28.

66. Sudoyo, Aru W, Dr.dr. 2006.Buku Ajar Ilmu Penyakit Dalam, Jilid III, Edisi IV. Jakarta: Pusat Penerbitan Departemen Ilmu Penyakit Dalam Fakultas Kedokteran Universitas Indonesia.
67. Malihah Dhiyah dan Rida Emelia. 2022. "Pola Pengobatan Antidiabetes Terhadap Pasien Diabetes Tipe II Rawat Jalan di RSAU dr. M. Salamun". Jurnal Delima Harapan, vol. 9 (1), pp 83-94.
68. K. Nazilah., E. Rachmawati., and P. B. Subagijo, "Identifikasi Drug Related Problems (DRPs) Pada Terapi Diabetes Melitus Tipe 2 di Instalasi Rawat Inap RSD. Dr. Soebandi Jember Periode Tahun 2015" e-Journal Pustaka Kesehatan, vol. 5, no. 3., pp 413 – 419.
69. R. Helmidanora., M. Reza., and Y. Sukawaty. "DRPs (Drug Related Problems) Pada Pnederita Diabetes Melitus Dengan Komplikasi Gagal Ginjal di Rumah Sakit Umum Daerah X di Samarinda Periode Oktober - Desember 2016" Jurnal Ilmiah Manuntung, vol.4(2), pp 169 -174. 2018.
70. Huri, Z. H., & Ling, L. C. (2013). Drug-Related Problems In Type 2 Diabetes Mellitus Patients with Dyslipidemia. Bio Med Central Public Health, 13(1), 1-1.
71. Ayele, Y., & Tesfaye, Z. T. (2021). Drug-related problems in Ethiopian public healthcare settings: Systematic review and meta-analysis. SAGE Open Medicine, 9, 205031212110097. https://doi.org/10.1177/20503121211009728
72. Perkumpulan Endokrinologi Indonesia (PERKENI), Pedoman Petunjuk Praktis Terapi Insulin Pada Pasien Diabetes Melitus, Jakarta: PB PERKENI, 2021.
73. S. Megawati, S. Sopiahani, dan N. Fathhonah. (2024). "Identifikasi Drug Related Problems (DRPs) Pada Pasien Gagal Ginjal Kronik di Instalasi Rawat Inap RSUP Dr. Sitanala Tangerang Tahun 2019-2021" Jurnal Ilmiah Medicamento, vo.10(2). 2024
74. Y.D. Arini., F. Rahmawati., and T.M. Andayani. "Faktor Risiko Kejadian Drug Related Problems Pada Pasien Penyakit Kronis Rawat Jalan di Poliklinik Penyakit Dalam" Jurnal Manajemen dan Pelayanan Farmasi, Vol.6(2), pp 83 – 94. 2016.
75. Drugs.com. 2024. "Prescription Drug Information, Interaction & Side Effects" Terdapat di : https://www.drugs.com/drug_interactions.html. [Diakses pada November 22, 2024].
76. Medscape.com, 2024, Drug Interaction Checker, Terdapat di: https://reference.medscape.com/drug-interactionchecker [Diakses pada November 22, 2024].