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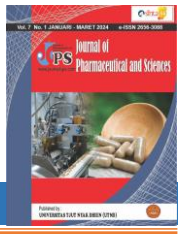

Incidence of Drug-Related Problems in Inpatients with Diabetes Mellitus Based on PCNE Criteria: A Literature Review

Kejadian *Drug-Related Problems* Pada Pasien Rawat Inap dengan Diabetes Melitus Berdasarkan Kriteria PCNE : Literatur Review

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Abstract

Non-communicable chronic diseases such as diabetes mellitus (DM) are a significant health burden worldwide. In the treatment of DM patients, long-term drug use is inevitable and increases the risk of Drug-Related Problems (DRPs). The presence of DRPs can affect the effectiveness of therapy and the risk of side effects in hospitalized DM patients. This review aims to evaluate various studies conducted on DRPs in hospitalized DM patients based on the Pharmaceutical Care Network Europe (PCNE) classification. A systematic search of relevant articles in the last 10 years through the SpringerLink, ScienceDirect, Scopus, and PubMed databases. Irrelevant studies, review articles, and no data on DRP classification using PCNE or outpatients will be excluded. The review found four articles discussing DRP classification using PCNE in hospitalized DM patients. The number of DRPs varied, ranging from 253 to 873 cases. The proportion of patients experiencing at least one DRP was also relatively high, ranging from 48.1% to 84.5%. The most common problem was treatment ineffectiveness (P1.2), which accounted for more than half of the DRPs in the three studies reviewed, namely 62.0%, 79.6%, and 52.7%. The most common cause of DRPs came from the patient-related domain (C7.1) at 71.85%. Other domains that caused DRPs were the Drug use domain (C6.1) at 62.0%, other domains (C9) at 40.9%, the drug selection domain (C1.6) at 26%, and the dose selection domain (C3.5) at 25.9%. The occurrence of DRPs is a significant problem in the management of diabetes mellitus, especially in the hospital environment. The ineffectiveness of therapy is the main problem of DRPs. The high number of DRPs from other domains indicates that many causes of DRPs are not classified explicitly in the PCNE category.

Keywords: *Diabetes Mellitus; Drug-Related Problems; Hospitalized; PCNE*

Abstrak

Penyakit kronis tidak menular seperti diabetes melitus (DM) menjadi beban kesehatan utama di seluruh dunia. Dalam pengobatan pasien DM, penggunaan obat jangka panjang menjadi tak terhindarkan dan meningkatkan risiko terjadinya Drug-Related Problems (DRPs). Adanya DRP dapat mempengaruhi efektivitas terapi dan risiko efek samping pada pasien DM rawat inap. Tujuan dari review ini adalah untuk mengevaluasi berbagai studi yang telah dilakukan mengenai DRPs pada pasien dengan DM rawat inap berdasarkan klasifikasi Pharmaceutical Care Network Europe (PCNE). Penelusuran artikel yang relevan secara sistematis dalam 10 tahun terakhir melalui database SpringerLink, ScienceDirect, Scopus, dan PubMed. Studi yang tidak relevan, review artikel, tidak memiliki data terkait klasifikasi DRP menggunakan PCNE, atau pasienrawat jalan akan dieksklusi. Hasil review menemukan 4 artikel yang membahas klasifikasi DRP menggunakan PCNE pada pasien DM rawat inap. Jumlah DRP bervariasi, mulai dari 253 hingga 873 kasus. Proporsi pasien yang mengalami setidaknya satu DRP juga relatif tinggi, antara 48,1% dan 84,5%. Masalah yang paling sering muncul adalah ketidakefektifan pengobatan (P1.2), yang mencapai lebih dari separuh

kasus DRPs dalam tiga studi yang dikaji, yakni sebesar 62,0%, 79,6%, dan 52,7%. Penyebab DRP paling banyak berasal dari domain patient related (C7.1) sebesar 71,85%. Domain lainnya yang menyebabkan DRP seperti domain Drug use (C6.1) sebesar 62,0%, domain lainnya (C9) sebesar 40,9%, domain drug selection (C1.6) sebesar 26%., dan domain dose selection (C3.5) sebesar 25,9%. Kejadian DRP merupakan masalah yang signifikan dalam pengelolaan diabetes melitus, terutama di lingkungan rumah sakit. Ketidakefektifan terapi merupakan masalah utama dari DRP. Tingginya DRP dari domain lainnya menunjukkan masih banyak penyebab DRP yang tidak diklasifikasikan dalam kategori PCNE secara spesifik.

Kata Kunci: *Diabetes Mellitus, Drug-Related Problems, DRP, Pharmaceutical Care Network Europe, PCNE*

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Introduction

Non-communicable chronic diseases such as type 2 diabetes mellitus (T2DM) are a significant health burden worldwide, including Indonesia. Based on data from the IDF in 2019, around 537 million adults (20–79 years) in the world live with diabetes, and this number is expected to increase to 643 million by 2030 [1]. In Indonesia itself, according to Riskesdas 2021, the prevalence of T2DM reached 10.9% and around 60-80% of diabetes patients also have hypertension, increasing the complexity of therapy and patient management. In the treatment of T2DM patients, long-term drug use becomes inevitable. [2]. This increases the risk of Drug-Related Problems (DRPs), which are any events involving drug therapy and can actually or potentially interfere with patient health outcomes. DRPs include various categories such as inappropriate drug selection, inappropriate dosage, drug interactions, adverse side effects, and patient non-compliance with therapy. Several studies show that the prevalence of DRPs in patients with type 2 diabetes mellitus ranges from 40% to 77.7%. The most common types of DRPs found include inappropriate drug selection (up to 48.6%)[3], adverse drug reactions (up to 77.7%) [4], drug interactions (up to 40%) [5], and unnecessary drug therapy (up to 90.24%) [6]. The World Health Organization (WHO) notes that medication errors are one of the leading causes of adverse events in health services. Through the "Medication Without Harm" initiative, WHO targets a 50% reduction in preventable adverse drug events in the next five years. In the context of type 2 diabetes mellitus treatment, DRPs have a significant impact on the effectiveness of therapy. A study showed that approximately 84.5% of type 2 diabetes patients experienced at least one DRP, which can hinder the achievement of optimal glycemic control. [7].

Therefore, this literature review aims to evaluate the various studies conducted on DRPs in patients with type 2 diabetes mellitus (T2DM). The primary focus includes the types of DRPs that most often occur, the classification of DRPs used, especially the Pharmaceutical Care Network Europe (PCNE), which is considered superior because it is more comprehensive, systematic, and continuously updated compared to other classification systems, and the risk factors that contribute to the occurrence of DRPs [8]. In addition, this study also examines various prevention strategies identified in previous studies. This comprehensive understanding is expected to be the basis for designing a safer, more effective, and more rational therapeutic approach to improving clinical outcomes in patients with this comorbidity.

Methods

This review was conducted systematically to evaluate research on DRPs in hospitalized patients with diabetes mellitus. A comprehensive literature search was performed using four major internationally

recognized databases: PubMed, Scopus, ScienceDirect, and SpringerLink. Keywords used in the search included: "Drug-Related Problems," "Diabetes Mellitus," "Hospitalization," and "PCNE Classification." The search was limited to open-access articles published between 2015 and 2025 to ensure up-to-dateness and open access to information. Strict inclusion criteria were set to ensure the homogeneity and validity of the analysis results, namely: (1) original articles with an observational design (cross-sectional or cohort), (2) involving adult patients (≥18 years) hospitalized with a diagnosis of diabetes mellitus, (3) using the PCNE DRP classification system, and (4) available in full text in Indonesian or English. Articles were excluded if they were literature reviews, outpatient studies, or did not contain relevant data related to DRPs. The selection process was conducted in two stages: (1) an initial screening based on title and abstract to assess initial relevance, and (2) a comprehensive review of the full text to assess methodological appropriateness.

All selection stages were conducted systematically and documented, using standardized guidelines, minimizing the potential for selection bias. Four of the 20 articles identified met all criteria and were included in the final analysis because they were methodologically sound and met established quality standards. Due to variations in study design and characteristics, a meta-analytic analysis was not performed. Instead, a descriptive analysis was conducted to evaluate and compare the average prevalence of DRPs and the patterns of DRP types found in each study. This analysis provided a comprehensive overview of the trends and burden of DRPs in the studied population. The entire process was conducted using a transparent, systematic approach and per the principles of evidence-based review, ensuring that the results were free from publication and selection biases. The decision to restrict the publication to indexed and open-access journals was intended to ensure the quality and replicability of the study results.

Result and Discussion

Table 1. Summary of article analysis results

References	Research Methods	Sample (n)	Result
[9]	Prospective cohort study	571	1. A total of 873 DRPs were identified 2. The most frequently identified DRPs were ineffective therapy (72.2%) and adverse events (27.0%)
[10]	Cross-sectional study	182	1. A total of 97 (53.3%) patients had DRP 2. The most commonly identified causes of DRP were patient-related factors (31.5%), drug selection (26.7%), and other causes (24.9%)
[11]	Cross-sectional study	351	1. 253 DRPs were identified, and 169 (48.1%) patients experienced at least 1 DRP. 2. Therapeutic effectiveness 133 (52.6%), therapeutic safety 44.7%, and therapy not required 2.8%
[12]	Hospital-based prospective observational study	330	1. The number of DRPs identified was 455. 2. 279 (84.5%) patients experienced at least 1 DRP. 3. Suboptimal therapeutic effects (52.7%) and untreated indications or symptoms (30.1%) were the most frequently identified DRP problems.

Notes: DRP = Drug Related Problems.

Table 2. Distribution of The Problems of Drug-Related Problems in Hospitalized Diabetes Mellitus Patients Based on PCNE Classification

Primary Domain	Code	Problem	Number (%)
Treatment effectiveness	P1.1	No effect of drug treatment despite correct use	85 (9,7)[1], 0 (0)[2], 16 (3,5)3
	P1.2	The effect of drug treatment is not optimal	541 (62,0)[1], 82 (79,6)[2], 240 (52,7)3
	P1.3	Untreated symptoms or indications	4 (0,5)[1], 137 (30,1)[3]

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Treatment safety	P2.1	Adverse drug event (possibly) occurring	236 (27,0)[1], 0 (0)[2], 42 (9,2)3
Other	P3.1	Treatment issues related to cost-effectiveness	0 (0)[1], 0 (0)[2], 12 (2,6)3
	P3.2	Unnecessary drug-treatment	0 (0)[1], 1 (0,9)[2], 8 (1,8)3
	P3.3	Unclear problem/complaint. Further clarification is necessary (please use as an escape only)	7 (0,8)[1], 20 (19,4)[2]

Sources: [1]Bezerra et al. (2023), [2]Chapagain et al. (2024),[3]Sheleme et al. (2021)

Table 3. Distribution of The Problems of Drug-Related Problems in Hospitalized Diabetes Mellitus Patients Based on PCNE Classification

Primary Domain	Code	Cause	Number (%)
1. Drug selection	C1.1	Inappropriate drug according to guidelines/formulary	25 (9,9)[3], 12 (2,3)[4]
	C1.2	Medication according to guidelines, but there are contraindications	6 (0,7)[1], 8 (3,2)[3], 4 (0,8)[4]
	C1.3	No indication for the drug	1 (0,1)[1], 9 (3,6)[3], 8 (1,5)[4]
	C1.4	Inappropriate combination of drugs, or drugs and herbal medications, or drugs and dietary supplements	13 (5,1)[3], 6 (1,1)[4]
	C1.5	Inappropriate duplication of the therapeutic group or active ingredient	18 (7,1)[3], 3 (0,6)[4]
	C1.6	No or incomplete drug treatment despite existing indication	19 (2,2)[1], 137 (26,0)[4]
	C1.7	Too many different drugs/active ingredients are prescribed for the same indication	0 (0)
2. Drug form	C2.1	Inappropriate drug form/formulation (for this patient)	4 (0,5)[1], 2 (0,8)[3]
3. Dose selection	C3.1	Drug dose too low	112 (12,9)[1], 4 (2,9)[2], 7 (2,8)[3], 28 (5,3)[4]
	C3.2	The drug dose of a single active ingredient is too high	19 (2,2)[1], 5 (2,0)[3], 18 (3,4)[4]
	C3.3	The dosage regimen is not frequent enough	83 (9,5)[1], 7 (1,3)[4]
	C3.4	The dosage regimen is too frequent	8 (0,9)[1], 11 (2,1)[4]
	C3.5	Does timing instructions wrong, unclear, or missing	226 (25,9)[1], 3 (1,2)[3], 16 (3,0)[4]
4. Treatment duration	C4.1	Duration of treatment too short	9 (1,7)[4]
	C4.2	The duration of treatment is too long	6 (1,1)[4]
5. Dispensing	C5.1	Prescribed drug not available	10 (1,9)[4]
	C5.2	Necessary information was not provided, or incorrect advice was provided	3 (0,3)[1], 4 (2,9)[2], 35 (6,6)[4]
	C5.3	Wrong drug, strength, or dosage advised (OTC)	0 (0)
	C5.4	Wrong drug or strength dispensed	0 (0)
6. Drug use process	C6.1	Inappropriate timing of administration or dosing intervals by a health professional	541 (62,0)[1], 9 (6,7)[2], 27 (5,1)[4]
	C6.2	Drug under-administered by a health professional	3 (2,2)[2], 8 (3,2)[3], 17 (3,2)[4]
	C6.3	A drug was over-administered by a health professional	4 (2,9)[2], 4 (1,6)[3], 3 (0,6)[4]
	C6.4	The drug was not administered at all by a health professional	1 (0,1)[1], 14 (5,5)[3], 11 (2,1)[4]

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	C6.5	A health professional administered the wrong drug	1 (0,1)[1]
	C6.6	A drug was administered via the wrong route by a health professional	0 (0)
7. Patient-related	C7.1	Patient intentionally uses/takes less of the drug than prescribed or does not take the drug at all for whatever reason	97 (71,85)[2], 65 (25,7)[3], 25 (4,7)[4]
	C7.2	Patient uses/takes more drugs than prescribed	1 (0,74)[2], 10 (4,0)[3], 4 (0,8)[4]
	C7.3	Patient abuses drug (unregulated overuse)	0 (0)
	C7.4	The patient decides to use an unnecessary drug	1 (0,74)[2], 3 (0,6)[4]
	C7.5	The patient takes food that interacts	0 (0)
	C7.6	Patient stores the drug inappropriately	1 (0,74)[2], 71 (13,5)[4]
	C7.7	Inappropriate timing or dosing intervals	4 (2,96)[2], 29 (5,5)[4]
	C7.8	Patient unintentionally administers/uses the drug in the wrong way	6 (4,44)[2], 5 (0,9)[4]
	C7.9	Patient is physically unable to use the drug/form as directed	1 (0,74)[2], 22 (4,2)[4]
	C7.10	Patient is unable to understand instructions properly	6 (2,4)[3]
8. Patient transfer related	C8.1	Medication reconciliation problem	0 (0)
9. Other	C9.1	No or inappropriate outcome monitoring (incl. TDM/ Therapeutic Drug Monitoring)	4 (0,5)[1], 12 (4,7)[3]
	C9.2	Other cause; specify.....	350 (40,2)[1], 25 (9,9)[3]
	C9.3	No obvious cause	34 (3,9)[1], 31 (12,3)[3]

Sources: 1 (Bezerra et al., 2023), 2 (Chapagain et al., 2024), 3 (Phoemlap et al., 2024), 4 (Sheleme et al., 2021)

The four studies reviewed used diverse methodological designs, consisting of one prospective cohort study (n=571), two cross-sectional studies (n=182 and n=351), and one prospective hospital-based observational study (n=330) (Table 1). These design differences enriched the analytical perspective but made conducting a comprehensive quantitative synthesis difficult due to heterogeneity in methods, populations, and DRP classification tools (e.g., PCNE in various versions or others).

This literature review shows that Drug-Related Problems (DRPs) are a significant issue in the management of diabetes mellitus, especially in the hospital setting. Based on the analysis of four articles, the number of DRPs found significantly varied, ranging from 253 to 873 cases (Table 1). The proportion of patients experiencing at least one DRP was also relatively high, ranging from 48.1% to 84.5%. Another study found that DRPs in patients with type 2 diabetes mellitus were 80.56%[13]. These data reflect the high risk of DRP incidence in the population of patients with chronic diseases and long-term drug use.

The most common types of DRPs are related to the effectiveness and safety of therapy. One study noted that 72.2% of DRP cases were therapies that did not provide the expected results. [9]. In addition, the incidence of adverse drug events was also recorded at 27.0%. In another study, the effectiveness of therapy was recorded at 52.6%, while problems related to the safety of treatment reached 44.7% [11]. Untreated or untreated symptoms also contributed significantly to DRPs, amounting to 30.1% [12]. A systematic review found that the most frequently identified DRPs were drug-drug interactions, adverse drug reactions, problems with the effectiveness of therapy, and inappropriate use of drugs (Jihadi et al., 2023). A study found that DRP can affect glycemic control in DM patients with neuropathy ($p = 0.005$) [14]. These findings indicate that DRPs in hospitalized DM patients are not only related to drug selection but also to aspects of therapeutic success and long-term safety of use.

Table 2 presents the distribution of problems related to DRPs in patients with diabetes mellitus undergoing treatment in the hospital, with classification based on the PCNE system. The results of the analysis showed that the majority of problems came from the domain of treatment effectiveness (P1), followed by therapy safety (P2) and other categories (P3). The most common problem was treatment ineffectiveness (P1.2),

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which accounted for more than half of the DRPs in the three studies reviewed, namely 62.0%, 79.6%, and 52.7% (Table 2). Causative factors may include the use of drugs in suboptimal doses, inappropriate regimen selection, or lack of monitoring of therapy outcomes. A study by Samanta et al. (2025) observed that most DRPs in hospitalized diabetic patients with hypertension were related to late regimen adjustments and lack of compliance with current therapy guidelines[15]. Another study found that there was a relationship between unnecessary drug therapy DRPs and length of hospitalization ($p = 0.016$) [13]. This condition indicates that even though the patient has received therapy, the expected clinical response has not been achieved. Another prominent issue is untreated indications (P1.3), with a proportion reaching 30.1% [12]. This condition often occurs when some symptoms or diagnoses have not received appropriate pharmacological intervention. Untreated indications can prolong hospitalization and reduce the overall effectiveness of treatment [16]. Another study found that untreated symptoms or indications of 35.6% and length of hospital stay ≥ 5 days significantly increased the risk of DRP (p-value = 0.005) [17].

In addition, the incidence of adverse drug reactions (P2.1) is also a significant concern. One study showed more than a quarter of patients (27%) experienced adverse effects. [9]. Some drugs that are most likely associated with adverse events include insulin, antihypertensives, or a combination of oral antidiabetic agents. The risk of adverse events increases significantly in patients receiving multiple types of drugs simultaneously (polypharmacy), using insulin, sulfonylureas, and the presence of comorbidities. [18,19]. The combination of angiotensin converting enzyme inhibitors (ACEIs) with sulfonylureas can increase the risk of hypoglycemia. [20]. A study in Ethiopia in patients with diabetes mellitus with comorbid hypertension found that 69 (19%) patients experienced drug side effects such as gastrointestinal disorders 36 (17.7%), dry cough 24 (11.8%), hypoglycaemia 7 (3.4%), and ankle oedema 2 (1%) [21]. Another study found that patients with type 1 diabetes mellitus who used insulin had an increased risk of hypoglycaemia when used with antithrombotic/anticoagulant agents, corticosteroids, opioids, antipsychotics, and antidepressants.[22].

Based on Table 3, the causes of Drug Related Problems (DRP) in hospitalized diabetes mellitus patients are classified according to the PCNE standard and grouped into nine main domains, namely drug selection, drug form, dose selection, treatment duration, dispensing, drug use process, patient-related, patient-transferred-related, and others. PCNE has been widely used in clinical practice for DRP analysis. This is because the PCNE structure is systematic and comprehensive by dividing DRP into primary domains and categories of causes, is flexible and can follow the development of health care practices in various countries, supports measurable clinical interventions, and has international validity and reputation.[23–25].

Drug selection

The most common cause of DRP in hospitalized DM patients from the drug selection domain is C1.6 (treatment not given even though there is an indication) at 26%, followed by C1.1 (treatment not in accordance with guidelines/formulary) at 9.9%, and C1.5 (duplicate therapy) at 7.1%. Drug selection that is not in accordance with guidelines often occurs due to a lack of clinical information updates by health workers or limited access to the latest references [26]. A systematic review states that the factors that most influence prescribing errors are inadequate drug knowledge, skills, and/or experience of the prescriber. [27]. Doctors' involvement in preparing hospital guidelines can influence doctors' decisions in providing patient therapy. [28]. This inconsistency has the potential to cause suboptimal therapy or even endanger patients. Drug duplication increases the risk of drug-drug interactions and the occurrence of side effects. A study stated that there is a relationship between polypharmacy and an increased risk of drug-drug interactions. [29]. Duplication of therapy is an unnecessary and potentially harmful medication error. [30].

Drug Form

The drug form category has a relatively lower proportion, such as C2.1 (drug dosage form does not match the patient) at 0.5%. Inappropriate dosage forms can affect patient compliance with treatment, especially in patients with swallowing disorders or other physical limitations. A systematic review states that the prevalence of difficulty taking medication is relatively high, and the alternative is crushing tablets. [31,32]Although the proportion is small, doctors should consider this when choosing the type of preparation appropriate for the patient so that the potential for errors in drug administration can be avoided.

Dose Selection

The high proportion in category C3.5 (incorrect, unclear, or missing dosage instructions) of 25.9% indicates communication and documentation problems related to incomplete or confusing dosage

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instructions. This is in line with research by Jihadi et al. (2023), which shows that errors in medication administration instructions are a significant cause of DRP in hospitals, especially in patients with chronic diseases such as diabetes[8]. Categories C3.1 (drug dose too low) of 12.9% and C3.2 (drug dose too high) of 3.1% also contribute to the cause of DRP in hospitalized DM patients. Errors in dose adjustment can have a significant impact on the effectiveness of therapy and increase the risk of complications. This is especially important in diabetic patients who have comorbidities such as nephropathy or impaired liver function, where drug metabolism changes significantly [33]. Dosage errors are still a significant problem in treating hospitalized diabetes mellitus patients. Clinical pharmacy interventions such as medication review, interprofessional collaboration, and education of healthcare workers on current therapeutic guidelines are essential to minimize DRPs.

Treatment Duration

The treatment duration category has a relatively low proportion compared to other causes: 1.7% (C4.1) and 1.1% (C4.2). Inappropriate treatment duration can affect the success of therapy and potentially worsen glycemic control. It often occurs due to a lack of adjustment to the patient's clinical response or applicable protocol. [34].

Dispensing

The most common cause in this domain was the lack of necessary information (C5.2) at 6.4%, followed by the unavailability of prescribed drugs (C5.1) at 1.9%. This shows that drug information and logistics availability in health care facilities are crucial in preventing DRPs. The lack of information on how to use or drug interactions can result in incorrect use. Limited information in drug distribution is a significant factor in the occurrence of drug use errors in hospitals. [35].

Drug Use Process

This is one of the domains with the highest score. C6.1—Incorrect medication administration time or dosage interval contributed 62.0% of the total causes, making it the largest DRP cause in the table. This inaccuracy can be caused by a lack of monitoring of administration time, a non-real-time dose distribution system, or miscommunication between medical and nursing teams. Errors in the medication administration process are a major contributor to DRP, especially in patients undergoing complex therapy such as diabetes mellitus.

Patient Related

Patient-related causes are also significant sources of DRPs. The most prominent are C7.1 (Patients use less or no medication) at 71.85% followed by C7.8 (Patients cannot use medication in the manner or form as directed) at 4.44%, and C7.9 (Patients cannot understand instructions properly) at 4.2%. These problems are often related to low health literacy, physical limitations, advanced age, and the use of large amounts of medication (polypharmacy). A study by Bailey et al. (2013) confirmed that patients' lack of understanding of medication regimens significantly contributes to non-compliance and DRP events. [36]. A study found that non-compliance is associated with adverse drug events, patients are unaware of the importance of compliance, and patients consider medications unnecessary. [37]. Proper medication instructions are essential to achieve desired therapeutic outcomes in DM patients. Therefore, clinical pharmacists can provide counseling or education to patients to minimize DRPs and improve patient compliance.

Others

This category includes C9.2 (Other causes), C9.3 (no apparent reason), and C9.1 (no results of drug monitoring, such as therapeutic drug monitoring). The proportion of C9.2 is relatively high at 40.9%, indicating that many causes of DRP are not specifically classified in the PCNE category. The high proportion in the "other" category indicates the need to update or adjust the PCNE classification to accommodate specific DRP causes in the field. This also emphasizes the importance of the role of clinical pharmacists in documenting and analyzing in-depth the causes of complex DRPs.

Limitations of The Study

The differences in study designs, such as cohort versus cross-sectional, offer diverse perspectives that enrich understanding of DRPs in patients with type 2 diabetes mellitus. However, this methodological

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heterogeneity, along with variations in population characteristics and DRP classification tools (e.g., differences in the use of the PCNE system), poses challenges for conducting a comprehensive and consistent quantitative synthesis. These factors can affect the findings' clinical interpretability, significance, and generalizability. Additionally, discrepancies in sample sizes across studies (ranging from 253 to 873 DRPs) may further influence the weight and comparability of the reported clinical outcomes.

Conclusions

Based on the distribution of DRPs according to the PCNE classification, therapeutic effectiveness remains the main challenge in managing hospitalized patients with diabetes mellitus, followed by issues related to safety and completeness of therapy. These findings highlight the importance of a holistic and proactive therapeutic approach, including individualized treatment regimens based on the patient's clinical status, continuous monitoring of drug response and adverse effects, and the active involvement of clinical pharmacists in the early detection, evaluation, and prevention of DRPs. To strengthen therapeutic outcomes, it is recommended to implement structured medication reconciliation at hospital admission and discharge, enhance patient education regarding medication adherence and side effect awareness, and adopt real-time monitoring systems to facilitate early identification and management of potential drug-related problems.

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No

Authors Contributions

Rizkina Elistya Febriania analyzed and interpreted the data and drafted the manuscript. Hidayah Karuniawati and Anees ur Rahmanc wrote the final draft.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Ethical Consideration

No

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