Issues with Medication for Cardiovascular Disease Patients Admitted to the Medical Ward

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Abstract: Background: Cardiovascular diseases (CVD) remain a significant public health concern globally, with medications playing a critical role in their management. However, drug therapy problems (DTPs) pose a substantial challenge, leading to adverse patient outcomes, increased healthcare costs, and preventable hospitalizations. Limited studies have comprehensively explored DTPs among hospitalized CVD patients, emphasizing the need for further research.

Methods: A prospective observational study was conducted on 242 CVD patients admitted to a medical ward . Data were collected through patient interviews and review of medical and laboratory records. DTPs were identified and classified using Cipolle's framework. Logistic regression analysis was employed to identify predictors of DTPs, with a p-value < 0.05 considered statistically significant.

Results: A total of 177 DTPs were identified, affecting 52.7% of patients, with a mean of 1.4 DTPs per patient. The most common DTPs were the need for additional drug therapy (32.4%), ineffective drug therapy (14%), and unnecessary drug therapy (13.1%). Frequently implicated medications included beta blockers (19.4%), antithrombotics (14.4%), and statins (13%). Older age (AOR: 3.97; 95% CI: 1.68–9.36) and polypharmacy (AOR: 2.68; 95% CI: 1.47–5.11) were significant predictors of DTPs.

Conclusion: More than half of the hospitalized CVD patients experienced DTPs, predominantly due to suboptimal medication management. Older age and polypharmacy were identified as significant contributors to DTPs. Interventions such as medication reconciliation and adherence to standardized clinical guidelines are

essential to reduce DTPs, improve patient outcomes, and optimize CVD management.

Keywords: Cardiovascular Diseases (CVD), Drug Therapy Problems (DTPs), Medication Management in Hospitalized Patients.

1. Introduction

Cardiovascular disease (CVD) poses a significant global public health challenge, affecting approximately 523 million individuals worldwide (1, 2). It is the leading cause of death globally, responsible for over 17.9 million fatalities annually, with projections suggesting this figure could exceed 23.6 million by 2030 (3). In many regions, particularly in developing nations, CVD accounts for a substantial portion of non-communicable disease-related mortality, contributing to 13% of total deaths and 38% of deaths from non-communicable diseases (4, 5). Similarly, the burden of CVD has been increasing steadily, making it a predominant cause of death in certain regions (6). According to data from the Global Burden of Disease Study (1990–2017), age-standardized prevalence, disability-adjusted life years, and mortality rates for CVD were reported as 5534, 3549.6, and 182.63 per 100,000 population, respectively (7).

Despite advancements in pharmacological treatments for CVD in recent years (8), these diseases continue to lead in terms of both morbidity and mortality (9). While medications play a crucial role in managing CVD and other illnesses, their misuse or improper utilization can result in adverse outcomes (10, 11). Clinical management of CVD remains complex, complicated by factors such as intricate drug regimens, the availability of diverse therapeutic options, multiple comorbidities, polypharmacy, aging populations, and inconsistent application of evidence-based guidelines (11–14).

A drug therapy problem (DTP) is any undesirable event that interferes with achieving the therapeutic goals of a drug regimen, either currently or potentially (15). These issues can arise at any stage of the medication use process, from prescribing to ongoing treatment monitoring (16). Cipolle's classification identifies seven primary categories of DTPs: unnecessary drug therapy, need for additional drug therapy, ineffective drug therapy, too low a dosage, too high a dosage, adverse drug reactions, and non-adherence (15, 17). Globally, DTPs have profound social, economic, and humanistic consequences (18–24). On a societal level, they can erode trust in healthcare systems and professionals, discouraging individuals from seeking care when needed (19, 20, 23). Economically, DTPs drive up healthcare expenses through hospital readmissions, extended treatment durations, productivity losses, and legal costs (21, 22, 25). On a personal level, they can lead to physical harm, emotional suffering, and even loss of life, deeply affecting patients and their families (23, 24).

The proper use of cardiovascular medications is essential for reducing the health impacts of CVD. However, the benefits of these treatments are often compromised by DTPs (10, 26). Among CVD patients, the prevalence of DTPs has been reported to range from 29.8% to 91% (10, 11, 27, 28). Research indicates that DTPs contribute to 28% of all emergency ward admissions, with 70–90% being potentially preventable (11). Hospitalized patients with CVD are particularly vulnerable to DTPs due to factors such as advanced age, polypharmacy, and the presence of multiple comorbid conditions (13, 28, 29).

Despite the critical importance of addressing DTPs in CVD management, limited comprehensive studies have been conducted to investigate and document these problems in hospitalized CVD patients. There is an urgent need for research to identify, quantify, and analyze these issues to better understand their magnitude and contributing factors. Such studies

would provide invaluable insights, highlight gaps in current healthcare practices, and help raise awareness among healthcare providers and decision-makers. By addressing these issues, efforts can be directed toward minimizing and preventing DTPs, ultimately improving patient outcomes. Consequently, this study aims to assess the extent of DTPs and the factors contributing to their occurrence in CVD management.

2. Materials and Methods

This study was conducted involving hospitalized patients diagnosed with cardiovascular disease (CVD) in a specialized hospital. The hospital serves as a teaching and referral center, catering to a large population within its catchment area.

The study included adult patients aged 18 years or older who were admitted to the medical ward with a confirmed diagnosis of CVD. Patients with incomplete medical records or those who declined to provide informed consent were excluded.

Participants were recruited using a simple random sampling technique upon admission to the medical ward and were followed daily until discharge. Data collection included daily patient reviews to capture any changes in treatment. Written informed consent was obtained after providing a detailed explanation of the study's objectives. Information was gathered through patient interviews and a thorough review of medical, medication, and laboratory records. Data collection was conducted by trained final-year clinical pharmacy students who had undergone preparation on the study's objectives and data collection methods.

Assessment and Identification of Drug Therapy Problems

Drug therapy problems were identified and classified using Cipolle's framework (15), followed by a review and validation process conducted by a panel of clinical pharmacists and medical specialists. The method was refined to suit the specific study context, integrating treatment guidelines and evidence from the literature (32–34). Detailed assessments of drug therapy included evaluating the appropriateness of medications, recommended dosage regimens (dose, frequency, and duration), potential drug interactions, and adverse drug events based on established treatment guidelines (33–41).

- Polypharmacy: Concurrent use of five or more medications (32).
- Drug therapy problem (DTP): Any unfavorable occurrence that hinders the achievement of desired treatment outcomes through drug therapy, either actually or potentially (15).
- Classification of DTPs: Based on Cipolle's method, DTPs are categorized into seven major classes: unnecessary drug therapy, need for additional drug therapy, ineffective drug therapy, dosage too low, dosage too high, adverse drug reaction, and non-compliance (15).

Data Analysis

Data were entered into EpiData (version 4.2.0) and exported to SPSS (version 22.0) for statistical analysis. Descriptive statistics were used to summarize categorical variables and calculate the mean and standard deviation of continuous variables. Multicollinearity among predictor variables was assessed using variance inflation factor (VIF), with no significant collinearity observed. Univariable logistic regression analysis was performed to evaluate the association of independent variables with DTPs. Variables with $p < 0.25$ in univariable analysis were included in a multivariable binary logistic regression model to identify predictors of DTPs. A p-value less than 0.05 was considered statistically significant.

3. Results

A total of 242 patients were included in the study. The mean age of the patients was 56.45 years, with a standard deviation of 17.76. Among the participants, 50.5% were male, 57.2% lived in urban areas, 69.4% were married, and 32.4% reported being unable to read and write (Table 1).

Table 1. Sociodemographic Characteristics of Patients with CVD (n = 242)

Variables	n	%
Gender		
Male	122	50.5
Female	120	49.5
Age in years		
15–35	42	17.4
36–65	116	47.9
>65	84	34.7
Residence		
Urban	138	57.2
Rural	104	42.8
Educational level		
Unable to write/read	60	24.8
Primary education	27	11.2
Secondary education	95	39.3
College and above	60	24.8
Marital status		
Married	168	69.4
Single	45	18.6
Divorced	13	5.4
Widowed	16	6.6
Cigarette smoking		
No	221	91.3
Yes	21	8.7
Coffee consumption		
No	48	19.8
Yes	194	80.2

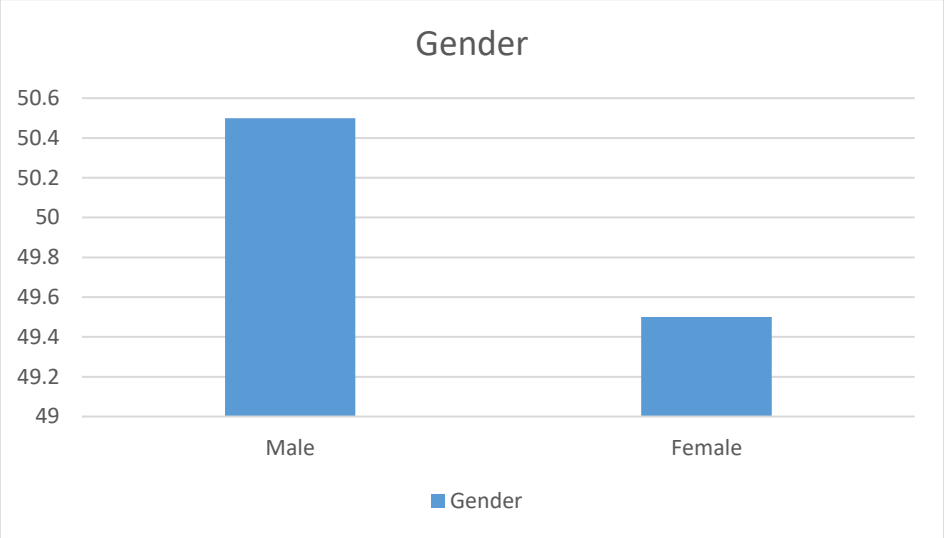

Fig 1: Gender

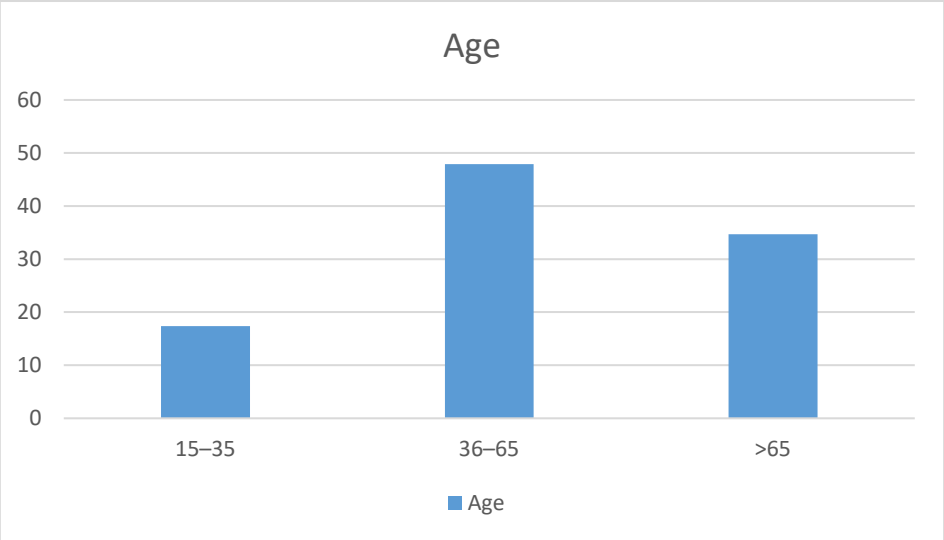

Fig 2: Age

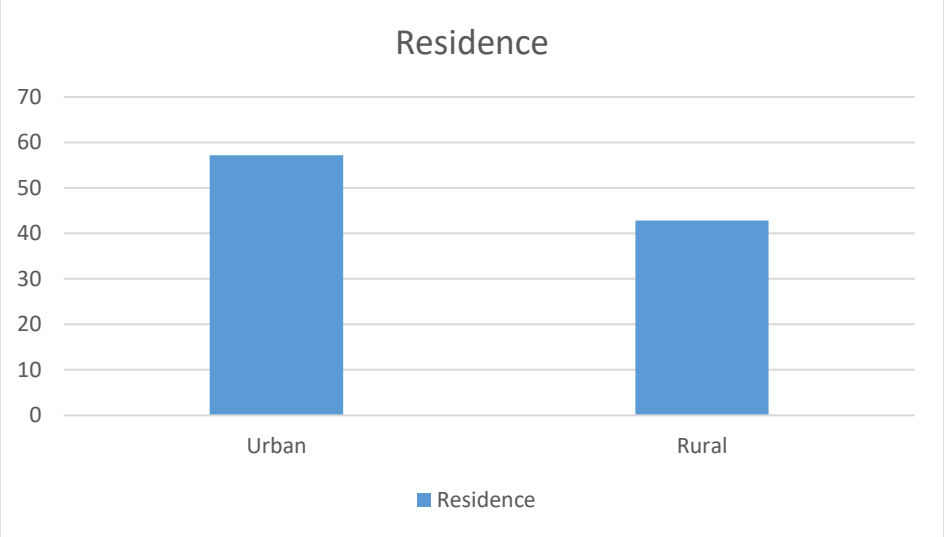

Fig 3: Residence

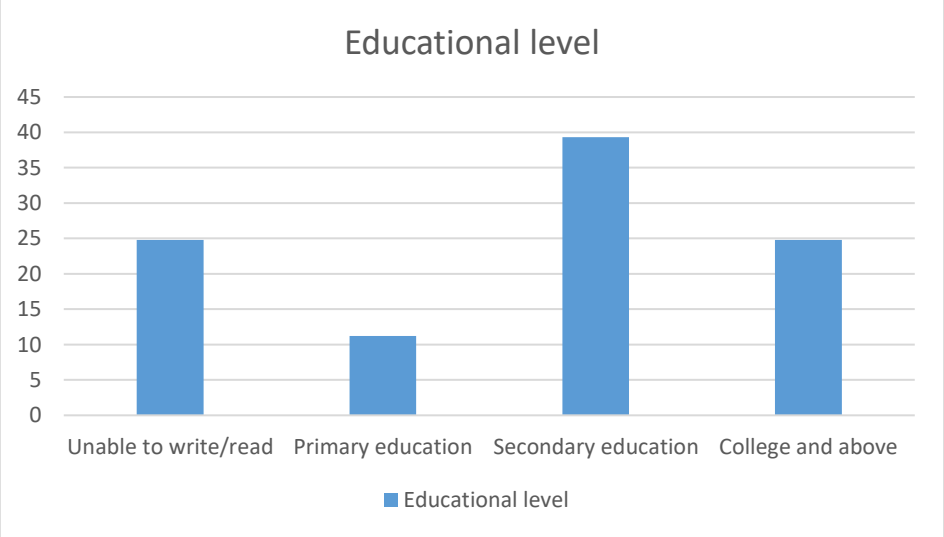

Fig 4: Educational level

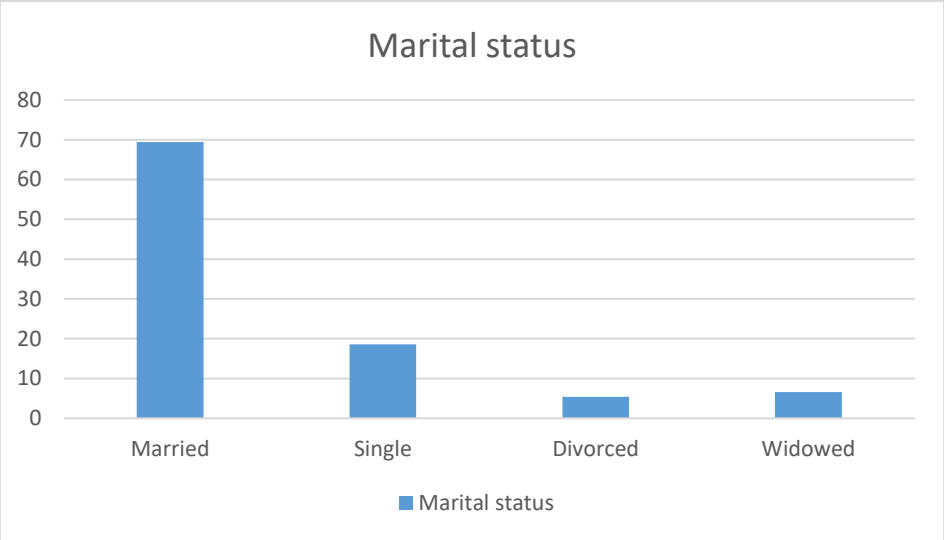

Fig 5: Marital status

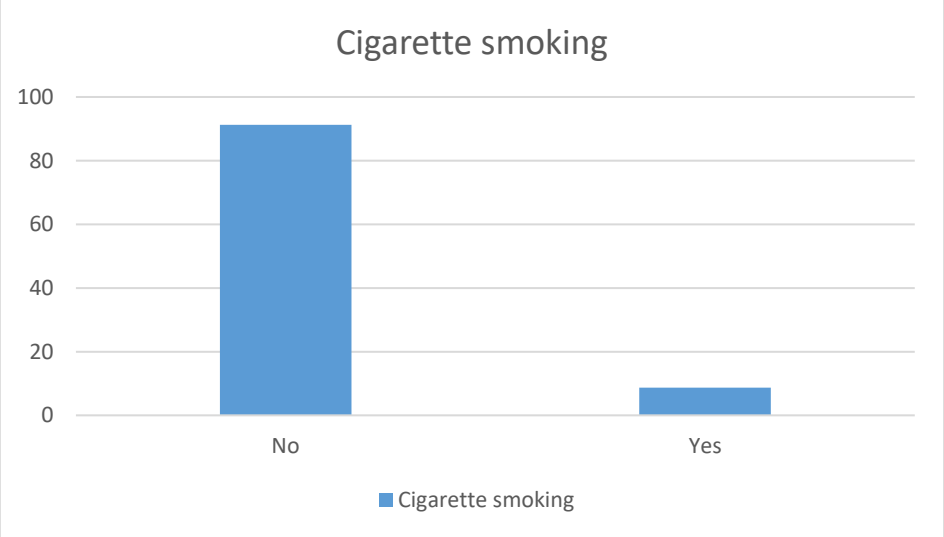

Fig 6: Cigarette smoking

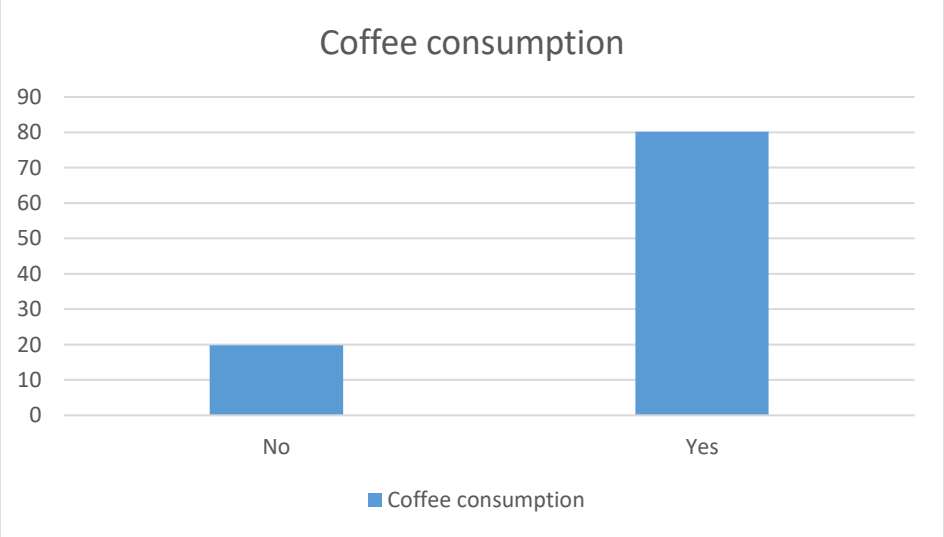

Fig 7: Coffee consumption

Clinical Characteristics

Approximately 25% of the patients had one or more comorbidity. The mean (standard deviation) duration of hospital stay was 11.5 (10.2) days, and more than half (58%) of the

patients were hospitalized for seven days or longer. The most commonly diagnosed CVD was heart failure (45.3%), followed by hypertension (29%) and ischemic heart disease (26.12%) (Table 2).

Table 2. Clinical Characteristics of Patients with CVD (n = 242)

Characteristics	n	%
Duration of hospital stay		
≤7 days	101	41.7
>7 days	141	58.3
Comorbidity		
No	180	74.4
Yes	62	25.6
Commonly diagnosed CVDs		
Heart failure	110	45.5
Hypertension	70	28.9
Ischemic heart disease	63	26.0
Stroke	44	18.2
Atrial fibrillation	38	15.7
Valvular heart disease	33	13.6

The mean (standard deviation) number of medications per patient was 3.43 (1.68), and one-third of the patients took five or more medications. The commonly prescribed medications included furosemide (43.7%), statins (36.9%), antiplatelets (33.3%), angiotensin-converting enzyme inhibitors (27.5%), and beta blockers (23.9%)

A total of 242 participants were evaluated for drug therapy problems, and a total of 177 DTPs were identified, with a mean of 1.4 (±0.7) DTPs per patient. Over half of the patients (52.7%) experienced one or more DTPs. The most frequently identified DTP was the need for additional drug therapy (32.4%), followed by ineffective drug therapy (14%) and unnecessary drug therapy (13.1%).

The study identified the most frequently implicated drugs in DTPs. The drugs most commonly associated with DTPs were beta blockers (19.4%), followed by antithrombotics (14.4%), statins (13%), and angiotensin-converting enzyme inhibitors (9%). These medications were frequently associated with the need for additional drug therapy. Moreover, beta blockers were commonly linked with ineffective drug therapy. Conversely, medications such as calcium channel blockers, diuretics, and digoxin were often involved in unnecessary drug therapy.

Univariable logistic regression analysis revealed that older age (Crude odds ratio [COR]: 3.44, 95% confidence interval [CI]: 1.52–7.74) and having five or more medications (COR: 2.66, 95% CI: 1.48–4.79) were significantly associated with the presence of DTPs. Variables with a p-value less than 0.25 in the univariable analyses were included in the multivariable logistic regression model. The overall model, which included all predictors, showed statistical significance (Chi-square = 33.585, degrees of freedom = 7, $p < 0.001$). In the multivariate analysis, both older age (adjusted odds ratio [AOR]: 3.97, 95% CI: 1.68–9.36) and having five or more medications (AOR: 2.68, 95% CI: 1.47–5.11) remained significantly associated with DTPs.

4. Discussion

Although many drug therapy problems (DTPs) are preventable, they continue to pose significant challenges in clinical practice (11, 32). When not promptly addressed, DTPs can lead to increased morbidity, diminished quality of life, elevated healthcare costs, and even death (32). Therefore, it is crucial to assess DTPs and understand the factors that contribute to their occurrence in patients with cardiovascular diseases (CVDs) in order to develop more effective

intervention programs. The goal of our study was to investigate DTPs and their contributing factors among hospitalized CVD patients.

Our study found that over half (52.7%) of the participants experienced at least one DTP, despite the well-documented association between DTPs and negative outcomes in CVDs (10). Similar results have been reported in previous studies conducted in different regions (11, 42, 43), suggesting that DTPs are a widespread issue rather than one specific to a particular geographical area. However, our study identified a higher incidence of DTPs compared to a study in Spain, where the reported rate was 29.8% (28). This discrepancy may be linked to various factors common in developing countries, such as lower levels of health literacy, lack of clear protocols, skepticism toward modern medicine, suboptimal healthcare systems, and limited availability of essential cardiovascular medications (44–46). Addressing these issues in such settings is vital for improving cardiovascular care and reducing the frequency of DTPs.

The most commonly identified DTP in our study was the need for additional drug therapy, followed by ineffective drug therapy and unnecessary drug therapy. This finding is consistent with earlier studies from other regions (11, 27). The need for additional therapy can stem from various factors, including complex medical conditions that require multiple medications, comorbidities, missed diagnoses, and adverse drug reactions. Socioeconomic factors such as limited access to healthcare, medication non-adherence, individual variations in drug responses, and the progression of disease also play a role. To reduce this DTP, effective communication between healthcare providers and patients, alongside proper patient education and comprehensive healthcare strategies, is essential. Our study also found that ineffective drug therapy and unnecessary drug therapy were commonly identified, similar to findings in other studies (32, 42). In contrast, a study from Cyprus reported adverse drug reactions as the most frequent DTP (47), which could be attributed to differences in the classification of DTPs, healthcare infrastructure, and patient demographics.

In this study, the classes of drugs most commonly involved in DTPs were beta blockers (19.4%), antithrombotics (14.4%), statins (13%), and angiotensin-converting enzyme (ACE) inhibitors (9%). These findings align with a study on hospitalized heart failure patients, where beta blockers (35%), ACE inhibitors (25%), antithrombotics (20%), and statins (16%) were frequently implicated in DTPs (43). Despite the widespread recommendation to use beta blockers, statins, antiplatelets, and ACE inhibitors for all cases of acute coronary syndrome, unless contraindicated (48, 49), many patients in our study did not receive these necessary medications. Additionally, despite evidence supporting the use of beta blockers for all cases of systolic heart failure, heart failure patients in our study were not receiving beta blockers as recommended (50). Furthermore, atenolol, which is not approved for heart failure in clinical trials, was often used instead of recommended beta blockers such as carvedilol, bisoprolol, and metoprolol (50). These issues may stem from the absence of comprehensive treatment guidelines for CVDs, highlighting the need for their development and implementation to ensure appropriate medication selection and improve patient outcomes, thus reducing DTPs.

Polypharmacy is a well-established factor contributing to DTPs (13, 28, 51, 52). Our study found a significant association between the number of medications and DTPs, with patients on five or more drugs being three times more likely to experience DTPs than those with fewer medications. This finding is consistent with local studies (43). Polypharmacy increases the risk of adverse drug reactions, drug interactions, non-adherence, and medication errors (32, 53, 54), making it crucial to regularly review and optimize medication regimens, particularly for elderly patients with multiple chronic conditions (55, 56).

Additionally, age was found to be a significant factor influencing DTPs in our study. Patients over the age of 65 were four times more likely to experience DTPs compared to younger adults (aged 18–35). This result is in line with other studies (29, 32). Older adults often have multiple comorbidities, renal and liver impairments, and are on numerous medications (57, 58), increasing their susceptibility to dosing errors, adverse drug reactions, drug interactions, and

non-compliance (59, 60). Cognitive decline associated with aging can also affect medication adherence and proper usage (61, 62). Therefore, age-related factors should be considered when evaluating drug therapy to ensure the safety and effectiveness of treatment for older patients.

5. Conclusion

Our study indicates that more than half of the patients experienced DTPs, with old age and polypharmacy identified as significant predictors of DTPs. It is essential to focus on patients who are at higher risk for developing DTPs and take steps to mitigate modifiable risk factors. Implementing medication reconciliation processes and standardized clinical practices could be effective strategies for reducing DTPs in the management of cardiovascular diseases.

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