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Original research article

Assessing the cost and quantity of unused medications in continuous ambulatory peritoneal dialysis patients: a home visit study in Thasala Hospital, Thailand

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ABSTRACT

Medication waste among continuous ambulatory peritoneal dialysis (CAPD) patients represents a critical but often overlooked challenge, contributing to unnecessary healthcare costs and potential treatment non-adherence. This study aimed to quantify the cost and volume of unused medications in CAPD patients at Thasala Hospital, Thailand, to inform strategies for reducing waste and optimizing resource allocation. We conducted a cross-sectional survey with 25 CAPD patients through home visits to document unused medications and calculate their associated costs using hospital pharmacy unit prices. A total of 58 unused medications were identified, resulting in a cumulative cost of 24,335 baht (973 baht per patient). The most frequently unused medication was sennoside (7.5 mg), while premixed insulin accounted for the highest financial waste. These findings highlight the substantial economic burden of medication waste and the need for targeted interventions to improve medication management. Enhanced patient education, proactive side effect management, and optimized prescribing practices are essential for reducing waste and improving medication adherence. This study provides actionable insights for improving chronic disease management, reducing healthcare costs, and optimizing patient outcomes in CAPD care.

Keywords: medication waste, continuous ambulatory peritoneal dialysis, cost analysis, medication adherence, chronic disease management

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1. Introduction

Medication waste is an increasingly recognized issue within healthcare, especially among patients with chronic, complex treatment needs.[1-3] Continuous ambulatory peritoneal dialysis (CAPD) patients represent a particularly vulnerable population, requiring multiple medications to manage end-stage renal disease (ESRD) and associated comorbidities, including hypertension, diabetes, and cardiovascular conditions.[4,5] Given the substantial number of prescriptions often necessary in CAPD, these patients are at a heightened risk for medication overstock and waste, which not only leads to financial loss but may also reflect adherence issues.[6]

The implications of medication waste extend beyond financial loss. Unused medications can indicate non-adherence, which jeopardizes treatment efficacy, complicates disease management, and can contribute to poor health outcomes.[7] Non-adherence, particularly in chronic diseases, is associated with higher hospitalization rates, disease progression, and increased healthcare costs.[5] CAPD patients, who typically manage multiple medications daily, are at risk of discontinuing treatments due to adverse effects, perceived lack of need, or confusion about complex regimens, all of which contribute to medication waste.[7]

In Thailand, several studies have examined medication waste in general and chronic disease management, particularly in diseases such as hypertension and diabetes, highlighting inefficiencies in drug use and the resulting financial burden on the healthcare system.[8]

Despite the known challenges of medication adherence in CAPD and other chronic conditions, limited research explicitly addresses medication waste within this unique patient group.[9] Understanding the types and costs of unused medications in CAPD patients can inform targeted strategies to improve medication adherence and reduce waste, ultimately enhancing health outcomes and supporting efficient resource allocation within healthcare systems.[10,11]

This study aims to quantify the cost and quantity of unused medications among CAPD patients at Thasala Hospital, Thailand. By analyzing the patterns of medication overstock and the economic impact of unused drugs, we seek to provide actionable insights for policy improvements and clinical interventions that can mitigate waste and optimize resource use in chronic care.

2. Materials and Methods

2.1 Study design and setting

This study utilized a cross-sectional descriptive design conducted through home visits to assess medication waste in CAPD patients at Thasala Hospital, Nakhon Si Thammarat Province, Thailand. Home visits directly provided a comprehensive medication usage review in the patients' care environments, enhancing data accuracy on medication stock and usage.

2.2 Participant selection

Eligible participants were adults (≥18 years) diagnosed with end-stage renal disease (ESRD) who had been undergoing continuous ambulatory peritoneal dialysis (CAPD) under the care of Thasala Hospital for at least six months. Patients were required to communicate adequately, independently or through a caregiver, and provide informed consent to participate in in-home assessments. Exclusion criteria included refusal to participate and recent CAPD initiation (<6 months), as these factors could impact medication stock patterns. A total of 25 patients meeting these criteria consented to participate in the study.

2.3 Data collection procedure

Home visits were conducted between January and March 2018, allowing for comprehensive, on-site data collection. Each visit included a structured survey and an inventory of medications, conducted in the patient's presence and with caregiver input when available. The survey gathered

demographic information (age, gender, comorbidities), continuous ambulatory peritoneal dialysis (CAPD) duration, and specific medication details, including drug name, dosage, form, and quantity. Medications were categorized as "currently used", "partially used", or "unused". Unused medications were defined as those left wholly or partially unused based on direct confirmation from the patient or caregiver. This approach ensured accurate documentation of medication usage and facilitated insights into adherence patterns.

2.4 Outcome measures

The primary outcomes of this study were as follows: (1) Quantity of Unused Medications: the total number of unused medication units (e.g., tablets, vials) per patient was recorded, as well as the aggregate total for the entire sample. This measure helped identify patterns in overstock and waste across different medication types. To ensure accuracy, an inventory of medications was conducted during home visits, with input from both patients and caregivers. These steps, combined with clinical record cross-referencing from the Hospital, helped ensure the accurate identification of unused medications and provided a clearer understanding of medication adherence patterns. (2) Cost of Unused Medications: the financial waste of unused medications was calculated using the hospital pharmacy's unit costs for each drug. The total cost of unused medications and the average cost per patient was reported to quantify the economic burden of medication waste. We used the drug prices from 2018 for this study because these prices reflect the actual expenditures at the time of data collection. Although drug prices have increased over time, we chose to retain the 2018 prices to maintain consistency with the original dataset and to accurately represent the cost of medications during the study period.

Secondary outcomes included: (1) Identification of Most Frequently Unused Medications: this outcome identified the most commonly left unused medications among the patient sample. This data was essential for highlighting specific drugs or classes of medications that may require targeted management interventions. (2) Analysis of Underlying Reasons for Non-Use: the study also aimed to determine the reasons behind medication non-use, such as adverse side effects, perceived symptom improvement, or changes in treatment plans. These factors were assessed through patient interviews during home visits, providing insight into the behavioral and clinical factors contributing to medication waste.

In our study, unused medications encompass all medications that remained unconsumed, whether due to physician orders, patient self-discontinuation, or changes in treatment plans. This includes instances of non-compliance, which we define as the failure to take medications as prescribed, such as missed doses or self-modification of treatment without consulting healthcare providers. By considering both aspects, our verification methods ensure an accurate representation of unused medications.

Comorbidity burden was assessed using the Charlson Comorbidity Index (CCI), a validated method that predicts 10-year survival in patients with multiple comorbid conditions. The CCI assigns weighted scores to various chronic diseases such as cardiovascular disease, diabetes, and renal disease, with higher scores indicating greater disease burden and mortality risk.[12]

2.5 Statistical analysis

Data were entered into Microsoft Excel and then imported into SPSS version 23 for analysis. Descriptive statistics were used to summarize demographic data and medication data. Continuous variables, such as age and the cost of unused medications, were reported as means with standard deviations (SD). In contrast, categorical variables, including gender, education level, and comorbidities, were summarized as frequencies and percentages.

Independent t-tests assessed differences in the average cost of unused medications by gender. Assumptions of normality and homogeneity of variances were checked before conducting the t-tests. When assumptions were violated, non-parametric alternatives were considered.

Chi-square tests examined associations between medication categories (e.g., antihypertensives, diuretics) and non-use rates. For categories with small sample sizes, Fisher's exact test was applied to ensure the reliability of results.

One-way ANOVA was employed to investigate differences in costs associated with unused medications across age groups or among specific comorbidities (e.g., hypertension, diabetes). Where significant differences were observed, post-hoc analyses with Bonferroni correction were conducted to control for multiple comparisons.

A p-value of <0.05 was considered statistically significant for all tests. SPSS enabled precise calculations and detailed modeling, which were essential for identifying trends in medication non-use and guiding potential interventions for better medication management in CAPD patients.

2.6 Ethical considerations

Ethical approval was obtained from the Ethics Committee in Human Research, Walailak University, Nakhon Si Thammarat, Thailand (Approval Number: WUEC-18-135-01), and all procedures adhered to institutional and ethical guidelines for research involving human subjects.

3. Results

3.1 Participant demographics

A total of 25 CAPD patients participated, with an average age of 51.5 ± 11.1 years. Gender distribution was nearly equal (52% male, 48% female). The primary comorbidities were hypertension (92%), diabetes (60%), and hyperlipidemia (36%). Low educational attainment was expected, with 56% of participants having completed only primary school, potentially impacting adherence. Occupations included farming (36%), homemaking (32%), and other roles (32%) indicated in Table 1.

Table 1. Participant demographics and characteristics (n = 25).

Characteristic	N (%)
Gender	
Male	13 (52.0)
Female	12 (48.0)
Age Range	
1-20 years	1 (4.0)
21-40 years	1 (4.0)
41-60 years	19 (76.0)
Over 60 years	4 (16.0)
Comorbidities	
Hypertension	23 (92.0)
Diabetes	14 (60.0)
Dyslipidemia	9 (36.0)
Myocardial Ischemia	1 (4.0)
Stroke	1 (4.0)
Gout	1 (4.0)
Autoimmune Disease	1 (4.0)
No Comorbidities	1 (4.0)
CCI Score (mean ± SD)	4.5 ± 1.1

Table 1. (Cont.)

Characteristic	N (%)
Education Level	
Primary Education	14 (56.0)
Lower Secondary Education	2 (8.0)
Upper Secondary Education	2 (8.0)
Vocational - Diploma	4 (16.0)
Bachelor's Degree	2 (8.0)
Lower Primary Education	1 (4.0)
Occupation	
Agriculture	9 (36.0)
Homemaker	8 (32.0)
Trade	3 (12.0)
Retired	5 (20.0)
Caregiver Status	
Spouse	10 (40.0)
Child	7 (28.0)
Parent	1 (4.0)
Grandchild	1 (4.0)
VHV	3 (12.0)
Self-Care	3 (12.0)
Co-residency with Caregiver	
Yes	21 (84.0)
No	1 (4.0)
Unspecified	3 (12.0)
Duration of CAPD	
≤ 1 year	5 (20.0)
1-5 years	15 (60.0)
≥ 5 years	5 (20.0)

Abbreviations:
N, number of patients; Unspecified, No Information Available; CCI Score, Average Charlson Comorbidity Index Score; VHV, Village Health Volunteer.

3.2 Quantity and cost of unused medications

Across all participants, 58 unique medications were recorded, with 24 classified as unused. The total cost of unused medications was 24,335 baht, with a mean cost per patient of 973 ± 759 baht (Tables 2 and 3). An independent t-test was conducted to assess differences in medication costs by gender, but the results showed no statistically significant difference ($p > 0.05$). Sennoside (7.5 mg) had the highest unused quantity, with 1,252 tablets accounting for 12.94% of all unused items. Premixed insulin accounted for the highest individual medication cost, totaling 4,982 baht (20.47% of the total cost of unused medications).

3.3 Analysis of medication types and non-use patterns

In this study, chi-square tests were employed to examine the association between medication classes and non-use rates, identifying which types of medications were most likely to be left unused. The analysis revealed a significant relationship between the class of antihypertensive drugs and higher rates of non-use ($p < 0.05$). Within the category of antihypertensives, diuretics emerged as a notable subset, comprising 15% of all unused medications. This suggests that while diuretics

are commonly prescribed, they are frequently not used by patients, potentially due to side effects, perceived lack of necessity, or other factors affecting adherence (Table 4).

Table 2 Ten most frequently unused medications by quantity (Total: 9,676 tablets or vials).

Medication	Quantity (tablets or vials)*
Sennoside (7.5 mg)	1,252 (12.9%)
Hydralazine (50 mg)	997 (10.3%)
Ferrous fumarate (200 mg)	750 (7.8%)
Furosemide (500 mg)	678 (7.0%)
Calcium carbonate (600 mg)	553 (5.7%)
Potassium chloride (500 mg)	511 (5.3%)
Manidipine (20 mg)	429 (4.4%)
Spironolactone (25 mg)	362 (3.7%)
Simvastatin (40 mg)	326 (3.4%)
Isosorbide mononitrate (20 mg)	314 (3.3%)

* All medications are available in tablet form, except for premixed insulin, which is available in vial form.

Table 3 Ten highest-cost unused medications (Total: 24,335 Thai Baht).

Medication	Quantity (tablets or vials)*	Cost (Thai Baht)
Premixed insulin (70% NPH/30% RI)	47	4,982 (20.5%)
Hydralazine (50 mg)	997	2,243 (9.2%)
Sennoside (7.5 mg)	1,252	2,191 (9.0%)
Furosemide (500 mg)	678	1,865 (7.7%)
Manidipine (20 mg)	429	1,716 (7.1%)
Clopidogrel (75 mg)	79	1,027 (4.2%)
Potassium chloride (500 mg)	511	767 (3.2%)
Carvedilol (12.5 mg)	106	636 (2.6%)
Sodium valproate (500 mg)	37	611 (2.5%)
Sitagliptin (50 mg)	19	589 (2.4%)

* All medications are available in tablet form, except for premixed insulin, which is available in vial form.

Additionally, supplements and analgesics were commonly left unused, indicating potential over-prescription or low patient motivation to adhere to these therapies. Interestingly, although premixed insulin was less frequently found among unused medications, it accounted for a disproportionately high share of the total cost, showing that even a small quantity of unused high-cost medications can have a considerable economic impact, highlighting the importance of addressing non-adherence in this category.

3.4 Reasons for non-use of medications

During home visits, patients provided insights into why they were not using certain medications. The primary reasons documented were: (1) Prescription Changes (48%): Adverse effects often led physicians to alter or discontinue medications, leaving patients unused stock. This finding implies a need for more proactive management of potential side effects to reduce

waste. (2) Symptom Improvement (28%): Some patients stopped taking medications after they perceived an improvement in their symptoms, suggesting a lack of understanding regarding the importance of continuing treatment as prescribed, especially for chronic conditions. (3) Patient-initiated Discontinuation (24%): This category includes patients who discontinued medications due to confusion over dosages or a belief that the medication was unnecessary, points to gaps in patient education and communication, indicating that more precise guidance on dosage and the purpose of each medication could enhance adherence (Table 5).

Table 4 Quantity and cost of unused medications classified by pharmacological group.

Medication	Number of patients receiving each medication	Quantity of unused medications (%)	Cost of unused medications (%)
Antihypertensive drugs and Diuretics	109*	3,620 (37.4)	9,197 (35.9)
Gastrointestinal agents	58	2,165 (20.3)	3,410 (14.0)
Electrolytes balance agents	30	1,416 (14.6)	1,743 (7.2)
Anti-anemic agents	37	998 (10.3)	499 (2.1)
Lipid-lowering agents	21	348 (3.6)	785 (3.2)
Vitamins & Minerals	9	248 (2.6)	327 (1.4)
Anticoagulants, Antiplatelets	13	189 (2.0)	1,082 (4.5)
Bronchodilators	4	107 (1.1)	378 (1.6)
Antidiabetic agents	12	92 (1.0)	5,610 (23.1)
Antipsychotic, Antidepressant	5	76 (0.78)	288 (1.2)
Anticonvulsant	2	72 (0.74)	776 (3.2)
Antigout agents	5	57 (0.59)	57 (0.23)
Anxiolytics, Antivertigo	8	38 (0.39)	52.5 (0.21)
Anti-allergic agents	3	26 (0.27)	13 (0.05)
Miscellaneous	10	424 (4.4)	590 (2.4)
Total	**326**	**9,876**	**24,335**

* Chi-square test among pharmacological group statistically significant (p = 0.002).

Table 5 Reasons for non-use of medications.

Reason for Non-Use	N (%)	Quantity (tablets or vials)	Cost of unused medications (Baht)	Mean cost ± SD (Baht)	p-value*
Prescription Changes	12 (48)	4,645	9,734	11,829 ± 372	0.032
Symptom Improvement	7 (28)	2,709	6,814	6,496 ± 348	
Patient-initiated Discontinuation	6 (24)	2,322	5,841	5,737 ± 323	

* The One-Way ANOVA test was conducted to compare the mean cost of unused medications among the three reasons for non-use. A p-value < 0.05 indicates a statistically significant difference in the cost distribution across the groups.

These findings emphasize that adverse effects are a significant factor in medication non-use. A one-way ANOVA test confirmed this, revealing a statistically significant relationship between prescription changes due to adverse effects and the volume of unused medications ($p = 0.032$). This underlines the importance of monitoring and managing side effects to reduce waste.

3.5 Economic implications

The study also explored the economic impact of unused medications, especially among patients with multiple chronic conditions. An analysis of variance showed that patients with comorbidities, particularly those with both hypertension and diabetes, had significantly higher average costs associated with unused medications ($p < 0.05$). This finding highlights the economic strain associated with poly-pharmacy, which is common in CAPD patients. This group's high cost of unused medicines underscores the need for streamlined prescription practices, particularly for patients with multiple conditions.

3.6 Summary of key findings

The substantial levels of unused medications and the associated costs present an opportunity to improve prescription practices and patient education within this patient population. The findings suggest that targeted interventions could address medication waste by (1) patient education on medication adherence, especially for chronic conditions where symptom relief does not mean the condition is cured; (2) providing more precise instructions on dosage and medication purposes to reduce patient-initiated discontinuation; (3) improving management of adverse effects to prevent prescription changes which often lead to unused medications. These interventions could improve adherence and alleviate the economic burden on patients and healthcare systems, highlighting the importance of addressing medication waste in CAPD management.

4. Discussion

This study highlights a significant issue of medication waste among CAPD patients, underscoring both the economic and clinical implications. The high rate of unused medications and associated costs in this population align with previous research on chronic disease management, particularly among patients requiring complex, long-term pharmacotherapy.[1,7] Addressing medication waste through targeted interventions could reduce the financial strain on healthcare systems and patients, especially in resource-limited settings.[2,10]

Our findings reveal that unused medications in this patient population contributed to a cumulative cost of 24,335 baht, averaging 973 baht per patient. This substantial financial burden is consistent with prior studies indicating that medication waste is a significant economic issue in chronic care populations.[1,7] In the context of CAPD, where patients already face high treatment costs, this waste exacerbates the financial burden and underscores the need for cost-effective medication management strategies.[4,5]

While counting unused medications provides insight into potential medication waste and costs, it is not a robust method for assessing adherence compared to the Medication Possession Ratio (MPR) and the Proportion of Days Covered (PDC). Future studies should consider incorporating these validated adherence measures for a more precise evaluation of medication adherence patterns in CAPD patients. Furthermore, a combination of medication collection, patient surveys, and self-reported adherence assessments can enhance the accuracy of adherence evaluation, as PDC is regarded as the most reliable measure. Integrating these approaches would provide a more comprehensive assessment of both medication waste and adherence behavior.

Regarding barriers to adherence, the primary reasons for medication non-use in this study-adverse effects, patient-initiated

discontinuation, and perceived symptom improvement-are well-documented adherence barriers in chronic disease populations. Previous studies have similarly highlighted that side effects are a common reason for discontinuation, particularly when patients lack adequate support in managing these effects.[4,6] Additionally, symptom improvement leading to medication discontinuation reflects a gap in patient understanding regarding the necessity for chronic treatment.[1,6] These gaps point to the critical need for patient education programs emphasizing the importance of adherence, as demonstrated in similar studies on chronic disease management.[5]

Practical recommendations to improve adherence from this study: (1) Patient Education Programs**:** Tailored education programs are essential to address the necessity of consistent medication use. Research shows that understanding the treatment regimen is pivotal to adherence. Programs emphasizing the importance of sustained medication use, even in the absence of symptoms, can help reduce the risk of self-discontinuation.[1] (2) Side Effect Management: 40% of patients discontinuing medications due to adverse effects highlight the importance of proactive side effect management. Studies show that regular follow-ups addressing side effects can support adherence by empowering patients to manage concerns without discontinuing treatment.[9,13] Integrating these consultations into routine care can prevent unnecessary medication waste while improving patient comfort and outcomes. (3) Optimized Prescribing Practices: Regular prescription reviews are crucial, particularly for CAPD patients with multiple comorbidities. Streamlining prescriptions to reduce unnecessary stockpiling can help optimize medication management.[4,10] Medication reviews help minimize excess stock and improve adherence, reducing waste.

Moreover, using hospital pharmacy unit costs to assess the financial impact of unused medications could provide a more standardized method for cost analysis. Since cost structures vary between healthcare settings, utilizing hospital-based cost data would improve comparability across different institutions and countries. Future research should consider these cost variations to enhance the generalizability of economic findings.

Although this study offers valuable insights, it is limited by its single-center design and small sample size, which may affect the generalizability of the findings. Future studies should validate these findings across multiple centers with larger, more diverse patient populations. Additionally, qualitative research exploring the behavioral and psychosocial factors influencing non-adherence could offer a more nuanced understanding of patient perspectives in chronic disease management.[5] Intervention-based studies incorporating PDC, MPR, and structured adherence surveys would further refine adherence assessment and help develop evidence-based guidelines for improving medication adherence in CAPD patients and other chronic disease populations.

Table 4 summarizes the total quantity and cost of unused medications classified by pharmacological group. Since patients often receive multiple medications, the total number of medications exceeds the sample size.

The footnotes provide specific details on individual drugs and patient counts.

- Antihypertensive drugs & Diuretics: manidipine (20 mg) in 20 patients, furosemide (500 mg) in 16 patients, hydralazine (50 mg) in 16 patients, losartan (50 mg) in 13 patients, doxazosin (4 mg) in 11 patients, spironolactone (25 mg) in 9 patients, carvedilol (12.5 mg) in 8 patients, methyldopa (250 mg) in 6 patients, furosemide (40 mg) in 5 patients, enalapril (20 mg) in 1 patient, minoxidil (5 mg) in 1 patient, amlodipine (10 mg) in 1 patient, metoprolol (100 mg) in 1 patient, diltiazem (30 mg) in 1 patient.
- Gastrointestinal agents: sennosides (7.5 mg) in 20 patients, lactulose in 14 patients, ranitidine (150 mg) in 8 patients, omeprazole

(20 mg) in 7 patients, aluminium hydroxide (216 mg) in 4 patients, domperidone (10 mg) in 3 patients, hyoscine (10 mg) in 2 patients.

- Electrolyte balance agents: potassium chloride (500 mg) in 11 patients, calcium carbonate (600 mg) in 9 patients, calcium carbonate (1,250 mg) in 7 patients, and sodium bicarbonate (300 mg) in 3 patients.
- Anti-anemic agents: ferrous fumarate (200 mg) in 18 patients, folic acid (5 mg) in 19 patients.
- Lipid-lowering agents: simvastatin (40 mg) in 18 patients, atorvastatin (40 mg) in 3 patients.
- Anticoagulants & Antiplatelets: aspirin (81 mg) in 9 patients, clopidogrel (75 mg) in 4 patients.
- Bronchodilators: theophylline (200 mg) in 3 patients, ipratropium/fenoterol (50/20 mcg) in 1 patient.
- Antidiabetic agents: premixed insulin in 7 patients, pioglitazone (30 mg) in 4 patients, sitagliptin (50 mg) in 1 patient.
- Antipsychotic & Antidepressants: sertraline (50 mg) in 3 patients, flupentixol/melitracen (0.5/10 mg) in 1 patient, chlorpromazine (50 mg) in 1 patient.
- Anticonvulsants: Sodium valproate (500 mg) in 1 patient, Phenytoin (100 mg) in 1 patient.
- Antigout agents: Colchicine (0.6 mg) in 4 patients, Allopurinol (100 mg) in 1 patient.
- Anxiolytics & Antivertigo: Clonazepam (2 mg) in 3 patients, Diazepam (2 mg) in 2 patients, Lorazepam (1 mg) in 2 patients, Flunarizine (5 mg) in 1 patient.
- Anti-allergic agents: Cetirizine (10 mg) in 2 patients, Hydroxyzine (10 mg) in 1 patient.
- Miscellaneous: Isosorbide mononitrate (20 mg) in 4 patients, Prednisolone (5 mg) in 1 patient, Cyproheptadine (4 mg) in 4 patients, Hydroxychloroquine (200 mg) in 1 patient.

5. Conclusion

This study demonstrates the substantial economic and clinical impact of medication waste among CAPD patients, with unused medications contributing to significant financial strain and potential non-adherence. Our findings underscore the need for practical, targeted interventions to reduce medication waste and enhance patient adherence in this high-risk population.

We provide actionable insights to inform healthcare policies and clinical practices by identifying the most frequently unused medications and uncovering the underlying reasons for non-use. Tailored patient education, proactive side effect management, and optimized prescribing practices are crucial to improving medication adherence and reducing waste. These strategies could improve patient outcomes and alleviate the financial burden on healthcare systems, particularly in resource-constrained settings.

This research contributes valuable evidence to the growing literature on medication management in chronic disease care. Future studies, especially those involving more considerable and diverse populations, must refine intervention strategies further and explore additional factors influencing medication adherence.

In conclusion, addressing medication waste in CAPD patients is critical in optimizing healthcare resources and improving the long-term management of chronic conditions. The insights gained from this study can inform clinical practice and policy, supporting more efficient and effective care for CAPD patients.

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Conflicts of Interest

All authors have declared no conflict of interest.

References

[1] Law AV, Sakharkar P, Zargarzadeh A, Tai BW, Hess K, Hata M, et al. Taking stock of medication wastage: unused medications in US households. Res Social Adm Pharm. 2015 Jul-Aug;11(4):571-578.

[2] Tong AY, Peake BM, Braund R. Disposal practices for unused medications around the world. Environ Int. 2011 Jan;37(1):292-298.

[3] Bekker CL, Gardarsdottir H, Egberts ACG, Bouvy ML, van den Bemt BJF. Pharmacists' activities to reduce medication waste: an international survey. Pharmacy (Basel). 2018 Aug 29;6(3):94.

[4] Cutler RL, Fernandez-Llimos F, Frommer M, Benrimoj C, Garcia-Cardenas V. Economic impact of medication non-adherence by disease groups: a systematic review. BMJ Open. 2018 Jan 21;8(1):e016982.

[5] Rifkin DE, Laws MB, Rao M, Balakrishnan VS, Sarnak MJ, Wilson IB. Medication adherence behavior and priorities among older adults with CKD: a semistructured interview study. Am J Kidney Dis. 2010 Sep;56(3):439-446.

[6] Denhaerynck K, Manhaeve D, Dobbels F, Garzoni D, Nolte C, De Geest S. Prevalence and consequences of nonadherence to hemodialysis regimens. Am J Crit Care. 2007 May;16(3):222-235.

[7] Dalton K, Byrne S. Role of the pharmacist in reducing healthcare costs: current insights. Integr Pharm Res Pract. 2017 Jan 25;6:37-46.

[8] Srijuntrapun P, Maluangnon K. The management of unused and expired medications in Thai households: influencing factors and prevailing practices. PLoS One. 2024 Aug 27;19(8): e0309266.

[9] Ingersoll KS, Cohen J. The impact of medication regimen factors on adherence to chronic treatment: a review of literature. J Behav Med. 2008 Jun;31(3):213-224.

[10] Alenezi A, Yahyouche A, Paudyal V. Interventions to optimize prescribed medicines and reduce their misuse in chronic non-malignant pain: a systematic review. Eur J Clin Pharmacol. 2021 Apr; 77(4):467-490.

[11] Hein AE, Vrijens B, Hiligsmann M. A digital innovation for the personalized management of adherence: analysis of strengths, weaknesses, opportunities, and threats. Front Med Technol. 2020 Dec 14;2:604183.

[12] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis. 1987; 40(5):373-383.

[13] Mechta Nielsen T, Frøjk Juhl M, Feldt-Rasmussen B, Thomsen T. Adherence to medication in patients with chronic kidney disease: a systematic review of qualitative research. Clin Kidney J. 2018 Aug;11(4): 513-527.