Research Article

การใช้ยาหลายชนิดและการใช้ยาที่อาจไม่เหมาะสมในผู้ป่วยสูงอายุโรคมะเร็งในโรงพยาบาลตติยภูมิ

ทิพาวรรณ หิรัญมาพร[1], รัชชาเกียรติ์ ศรีสุระพล[2], ธัญญารัตน์ อริยเมธปรีชา[2], มานิตย์ แซ่เตียว[3], ปิยกาญจน์ วัชเรนทรวงศ์[4], สุธาร จันทะวงศ์[3*]

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บทคัดย่อ

การใช้ยาหลายชนิดและการใช้ยาที่อาจไม่เหมาะสมในผู้ป่วยสูงอายุโรคมะเร็งในโรงพยาบาลตติยภูมิ

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ว. เภสัชศาสตร์อีสาน 2569;22(1):44-55

รับบทความ: 2 มีนาคม 2569 **แก้ไขบทความ:** 8 พฤษภาคม 2569 **ตอบรับ:** 11 พฤษภาคม 2569

การใช้ยาหลายชนิด (Polypharmacy: PP) ในผู้ป่วยสูงอายุโรคมะเร็งที่ได้รับยาเคมีบำบัด อาจส่งผลให้เกิดความเสี่ยงในการใช้ยาที่อาจไม่เหมาะสม (Potential Inappropriate Medications: PIMs) ซึ่งเพิ่มความเสี่ยงต่อเหตุการณ์ไม่พึงประสงค์ เช่น อาการสับสน การหกล้ม และการเลื่อนรอบการรักษาหรือหยุดการรักษา ดังนั้น การประเมินการใช้ยาและวิเคราะห์ปัจจัยที่เกี่ยวข้องจึงมีความจำเป็นอย่างยิ่ง เพื่อ ป้องกันการใช้ยาที่อาจไม่เหมาะสม สร้างความตระหนักและเพิ่มความปลอดภัยในการใช้ยา **วัตถุประสงค์:** เพื่อศึกษาความชุกของการใช้ยาหลายชนิด (PP) และการใช้ยาที่อาจไม่เหมาะสม (PIMs) ในผู้ป่วยสูงอายุโรคมะเร็ง ณ หอผู้ป่วยเคมีบำบัด โรงพยาบาลศรีนครินทร์ โดยใช้เกณฑ์ Beers Criteria (ฉบับปี 2023) ร่วมกับเกณฑ์ START/STOPP Criteria (ฉบับปี 2023) พร้อมทั้งประเมินปัจจัยที่มีความสัมพันธ์กับการได้รับยาที่อาจไม่เหมาะสม (PIMs) เพื่อเป็นแนวทางในการส่งเสริมความปลอดภัยในการใช้ยา **วิธีการศึกษา:** ศึกษาเชิงพรรณนาแบบตัดขวางย้อนหลัง (Retrospective cross-sectional study) ในผู้ป่วยสูงอายุโรคมะเร็ง (อายุ 65 ปีขึ้นไป) ที่เข้ารับการรักษาแบบผู้ป่วยใน ณ หอผู้ป่วยเคมีบำบัด โรงพยาบาลศรีนครินทร์ ระหว่างวันที่ 1 มกราคม พ.ศ. 2566 ถึง 31 ธันวาคม พ.ศ. 2566 (ระยะเวลา 12 เดือน) สำหรับการประเมิน PIMs ทำโดยใช้เกณฑ์ Beers Criteria (ฉบับปี 2023) ร่วมกับเกณฑ์ START/STOPP Criteria (ฉบับปี 2023) **ผลการศึกษา:** จากการประเมินผู้ป่วย 390 ราย พบว่าเพศชายร้อยละ 57.9 มีค่ามัธยฐานอายุ 69 ปี (IQR: 67-73) พบความชุกของการใช้ยาหลายชนิด (PP) สูงถึงร้อยละ 91.0 แบ่งเป็นการใช้ยาตั้งแต่ 5-9 รายการร้อยละ 65.4 และการใช้ยาตั้งแต่ 10 รายการขึ้นไป (Excessive Polypharmacy) ร้อยละ 25.6 สำหรับความชุกของ PIMs ทั้งหมดพบร้อยละ 71.0 โดยเมื่อแบ่งเกณฑ์ Beers Criteria (ฉบับปี 2023) พบ PIMs ร้อยละ 65.9 และ เกณฑ์ START/STOPP Criteria (ฉบับปี 2023) พบ PIMs ร้อยละ 53.8 รายการยาที่พบบ่อยได้แก่ยากลุ่ม benzodiazepines และ prokinetic agents ปัจจัยที่มีความสัมพันธ์กับการเกิด PIMs อย่างมีนัยสำคัญทางสถิติ ได้แก่ จำนวนรายการยา ($p<0.001$) และจำนวนโรคประจำตัว ($p=0.031$) นอกจากนี้การวิเคราะห์พหุตัวแปรพบว่าโรคเบาหวาน (AOR=1.78, 95%CI:1.05-3.03, $p=0.032$), การใช้ยามากกว่า 10 รายการ (AOR=9.27, 95%CI:3.78-22.73, $p<0.001$) และการวินิจฉัยโรคมะเร็งปอด (AOR=8.58, 95%CI:1.09-67.59, $p=0.041$) เป็นปัจจัยเสี่ยงสำคัญที่ทำให้เกิด PIMs **สรุปผลการวิจัย:** ผู้ป่วยสูงอายุโรคมะเร็งส่วนใหญ่มีการใช้ยาหลายชนิดร่วมกัน การประเมินโดยใช้เกณฑ์ Beers Criteria (ฉบับปี 2023) ร่วมกับเกณฑ์ START/STOPP Criteria (ฉบับปี 2023) ร่วมกันช่วยเพิ่มอัตราการตรวจพบการใช้ยาที่อาจไม่เหมาะสม (PIMs) ได้ครอบคลุมมากขึ้น เมื่อเปรียบเทียบกับการใช้เกณฑ์ใดเกณฑ์หนึ่งเพียงอย่างเดียว และเกณฑ์ START/STOPP ช่วยเพิ่มความละเอียดในการประเมินรายบุคคล ทั้งนี้จำนวนรายการยาและจำนวนโรคประจำตัวเป็นปัจจัยที่มีความสัมพันธ์กับการเกิด PIMs

คำสำคัญ: การใช้ยาหลายชนิด (Polypharmacy), ยาที่อาจไม่เหมาะสม (PIMs), เกณฑ์ Beers, เกณฑ์ START/STOPP, ผู้ป่วยสูงอายุโรคมะเร็ง

Polypharmacy and Potentially Inappropriate Medication Use among Elderly Patients with Cancer in a Tertiary Care Hospital

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Abstract

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IJPS, 2026;22(1):44-55

Received: 2 March 2026 **Revised:** 8 May 2026 **Accepted:** 11 May 2026

Polypharmacy (PP) in elderly cancer patients undergoing chemotherapy may lead to an increased odds of potentially inappropriate medications (PIMs), increasing the risk of adverse events such as confusion, falls, and delayed treatment. Therefore, evaluating medication use and analyzing associated factors is essential to avoid inappropriate medications, raise awareness, and improve medication safety for elderly cancer patients. **Objective:** This study aimed to determine the prevalence of PP and PIMs among elderly cancer patients at the chemotherapy unit of Srinagarind Hospital, using the 2023 AGS Beers Criteria and 2023 START/STOPP Criteria version 3. We also identify factors associated with PIMs in this patient population for improving medication safety. **Method:** A retrospective cross-sectional study was conducted in elderly cancer patients (Age ≥ 65 years old) at the chemotherapy unit of Srinagarind Hospital between January 1, 2023, and December 31, 2023 (12 months). **Results:** A total of 390 elderly cancer patients were evaluated, with a male predominance (58.0%) and a median age of 69 years (IQR:67-73). The overall prevalence of PP was 91.0% (n=355), sub-classified into PP (5-9 medications) at 65.4% and excessive polypharmacy (≥10 medications) at 25.6%. The overall prevalence of PIMs was 71.0%. When assessed separately, PIMs were identified by the 2023 Beers criteria in 65.9% of patients and by the 2023 START/STOPP Criteria in 53.8% of patients. Commonly identified PIMs included benzodiazepines and prokinetic agents. In univariate analysis, the number of medications ($p<0.001$) and the number of comorbidities ($p<0.001$) were significantly associated with PIMs. Multivariate analysis revealed that diabetes mellitus (AOR=1.78, 95%CI:1.05-3.03, $p=0.032$), excessive polypharmacy (AOR=9.27, 95%CI:3.78-22.73, $p<0.001$), and a lung cancer diagnosis (AOR=8.58, 95%CI:1.09-67.59, $p=0.041$) were significant factors for PIMs. **Conclusion:** Most elderly cancer patients were treated with polypharmacy. The combined use of 2023 Beers Criteria and 2023 START/STOPP Criteria provides a more comprehensive detection of PIMs compared to using either criteria alone. The START/STOPP criteria provide superior efficacy in patient-specific clinical assessment. The number of prescribed medications and the number of comorbidities were factors associated with the occurrence of PIMs.

Keywords: Polypharmacy; potentially inappropriate medications; Beers Criteria; START/STOPP Criteria; elderly cancer patients.

Introduction

Currently, the world's population is expected to live longer while the population growth rate decreases. As a result, the proportion of the elderly (age ≥65 years) continues to increase which is expected to double within 2054 from 17.0% of global population in 2024 (World Population Prospects, 2024). Cancer is considered one of the main non-communicable diseases and the 2nd leading cause of death in the world (World Health Organization, 2023) and the leading cause of death in Thailand in Thailand (International Agency for Research on Cancer, 2024). The incidence of cancer is significantly higher in the elderly. In 2022, cancer patients aged 65 years and older accounted for 53.0% of all cancer cases globally, and it is expected that the number of new patients worldwide will increase to 35 million by 2050 (American Geriatrics Society, 2023; Bray *et al.*, 2024). The treatment of cancer and its associated symptoms is often complex and requires multiple medications. Therefore, conducive to the occurrence of polypharmacy (PP) and potentially inappropriate medications (PIMs) (Oliveira *et al.*, 2024). Elderly cancer patients are highly vulnerable because physiological changes according to age affect the pharmacokinetics and pharmacodynamics of the medications (Mangoni & Jackson, 2004; Shi *et al.*, 2008). Cancer treatment and associated side effects lead to the use of PP, which means use of 5 or more medications (Masnoon *et al.*, 2017; Sharma *et al.*, 2016). PP is an important factor that increases the odds of drug-drug interactions, adverse reactions and PIMs (Nightingale *et al.*, 2015; Sharma *et al.*, 2016). PIMs in elderly cancer patients are associated with the risk of falls, fractures, brain confusion and may affect the cancer treatment plan (Ramsdale *et al.*, 2022; Nightingale *et al.*, 2015).

International studies highlight the high prevalence of these issues. For example, a study by Nightingale *et al.* reported PP and PIM prevalence rates of 40.0% and 38.0%, respectively, in elderly cancer patients (Nightingale *et al.*, 2015). Key factors associated with PIMs include polypharmacy and the number of comorbidities (Al-Azayzih *et al.*, 2024; Nightingale *et al.*, 2015). Moreover, cognitive impairment further elevates this risk (Redston *et al.*, 2018). Pharmacist-led interventions, such as medication assessments and deprescribing, are crucial strategies for improving medication safety (Whitman *et al.*, 2018). To facilitate these interventions, internationally recognized screening tools such as the 2023 American Geriatrics Society (AGS) Beers Criteria® (American Geriatrics Society, 2023) and the 2023 START/STOPP Criteria version 3 (O'Mahony *et al.*, 2023) are widely used. Comparative studies have consistently shown that the combined use of both tools is more effective for detecting PIMs than using either tool alone (van Loveren *et al.*, 2021).

In Thailand, there is still a limited study on the prevalence of PIMs in elderly cancer patients that uses the latest version 2023 of both tools together. While a study by Bandidwattanawong *et al.* (2023) reported a high PIMs prevalence of 50.8% among elderly outpatients using the STOPP criteria version 2. However, most existing research in Thailand has focused on the general elderly population, with very limited data available for the specific subgroup of elderly cancer patients, who represent a uniquely vulnerable population due to their complex medication regimens and high-risk status.

Therefore, this study is important to provide insight into the most common PIMs in the context of cancer treatment including supportive care such as antiemesis, which is guided by specific oncology guidelines (National Comprehensive Cancer Network, 2024) to be a database for the further development of evaluation models for elderly cancer patients in clinical pharmacy.

Objectives

This study aimed to determine the prevalence of PP and PIMs among elderly cancer patients at the chemotherapy unit of Srinagarind Hospital, using the 2023 AGS Beers Criteria and 2023 START/STOPP Criteria version 3.

We also identify factors associated with PIMs in this patient population for improving medication safety.

Materials and Methods

Study Design and Data Collection

This research study is a retrospective cross-sectional study about the use of PP and PIMs in elderly cancer patients at a tertiary hospital. The study was ethically approved by the Human Research Ethics Committee of Khon Kaen University (Approval No. HE671719). This study performs by collecting data from the hospital information system database and inpatient medical records for elderly cancer patients admitted to Srinagarind Hospital, Khon Kaen University between January 1, 2023 to December 31, 2023.

PIMs Assessment

Divide the evaluation details into 2 parts as follows:

Separate Assessment: Initially, PIMs were identified separately using two validated tools, the 2023 American Geriatrics Society (AGS) Beers Criteria and the 2023 START/STOPP Criteria version 3. The prevalence of PIMs according to each individual criteria were calculated.

Combined PIMs Assessment: To assess the overall burden of inappropriate prescribing and the added value of using both tools. A patient was considered to have a PIM if they had at least one medication flagged by either the 2023 Beers Criteria or the 2023 START/STOPP criteria. This approach was used to determine the overall prevalence and to enhance the efficacy of the analysis of associated factors based on a more comprehensive PIMs definition.

Operational Definition:

Polypharmacy (PP): Defined as the concurrent use of five or more medications (Masnoon *et al.*, 2017).

Excessive Polypharmacy: Defined as the concurrent use of ten or more medications (Masnoon *et al.*, 2017).

Potentially Inappropriate Medications (PIMs): In this study, PIMs were identified by at least one of the following two criteria:

1. The 2023 American Geriatrics Society (AGS) Beers Criteria: This tool identifies medications that should generally be avoided or used with caution in older adults aged 65 years and older due to their potential for harm outweighing their benefits (American Geriatrics Society, 2023).

2. The 2023 START/STOPP Criteria (version 3): This tool consists of two parts: STOPP (Screening Tool of Older People's Prescriptions) to identify potentially inappropriate prescribing (error of commission), and START (Screening Tool to Alert to Right Treatment) to identify potential prescribing omissions (error of omission) (O'Mahony *et al.*, 2023).

Population and sample

Population: Inpatients who are elderly patients (≥65 years), have been diagnosed with cancer, and treated with systemic chemotherapy at chemotherapy unit, Srinagarind Hospital (N = 4,152 cases).

Sample calculation

The sample size was determined using the Taro Yamane formula, assuming a 95% confidence level and a 5% margin of error. As the exact prevalence of PIMs in this specific population was unknown, a proportion (p) of 0.5 was used to yield the most conservative (largest) sample size, resulting in a required sample of 365 participants.

Sampling technique

A random sample of elderly cancer patients admitted to the chemotherapy unit of Srinagarind Hospital was conducted between January 1, 2023 until December 31, 2023. Randomly selected 32 patients each month, resulting in a total sample size of 384. A total of 390 eligible patients met the inclusion criteria.

Inclusion criteria

Cancer patients aged 65 years or older who have been treated with Systemic Chemotherapy between January 1, 2023 until December 31, 2023

Exclusion criteria

Patients who do not come to receive medication according to the treatment plan and patients with lost

treatment history or cannot search for treatment history from the electronic database of Srinagarind Hospital.

Data collection and evaluation

The researcher collected data from the electronic database of Srinagarind Hospital by using a case record form that has been evaluated for the correctness of the content from 3 experts (doctors, pharmacists, and nurses).

The data collected includes:

Demographic Data: gender, age, renal function, comorbidities, type and stage of cancer

Treatment information: A list of all medications received during treatment with Systemic Chemotherapy (excluding chemotherapy, OTC medications and dietary supplements).

Study tools:

1. Electronic Medical Database of Srinagarind Hospital.

2. Case record form, validated for content appropriateness by three oncology specialists (a physician, a nurse, and a pharmacist) consisted of the following sections.

Part 1: General information, included patient code, age, sex, weight, height, laboratory, primary diagnosis, comorbidities, and history of drug allergy.

Part 2: Medical data, including indications, dosage forms, strengths, dosages, administration dates.

Outcome:

Primary outcome: Prevalence of PP and PIM use in elderly cancer patients at Srinagarind Hospital.

Secondary outcomes: Factors associated with combined PIMs use among these patients.

Statistical Analysis

Demographic data and prevalence are presented using descriptive statistics, by using frequency and percentages. For data with non-normal distribution will be shown with median and interval between quartiles (IQR). Univariate logistic regression was performed to identify potential factors associated with PIMs. Variables with a p-value < 0.20 in the univariate analysis were then included in a multivariate logistic regression model using a backward stepwise method to identify independent factors associated with PIMs. Statistical significance was p-value < 0.05.

Results

From 390 patients who participated in the study, the median age was 69 years (IQR: 67,73). Most of them were male (57.9%). The most common type of cancer was colorectal cancer (40.0%) and most of them were non-metastatic (55.9%). The median of comorbidities was 1 disease (IQR: 0,2). The most common comorbidities were hypertension 160 cases (41.0%). The most common stage of impaired kidney function is CKD stage 2, 183 cases (48.2%). The median of the number of medications items received was 7 items (IQR: 5,10), as shown in Table 1.

Table 1 Demographic and Clinical characteristics of cancer patient (n=390)

Patient characteristics	Number (%age)
Gender	
Male	226 (57.9)
Female	164 (42.1)
Age (years) (Median (IQR))	69 (67-73)
Cancer type	
Colorectal	156 (40.0)
Cholangiocarcinoma	49 (12.6)
Hepatocarcinoma	28 (7.2)

Patient characteristics	Number (%age)
Pancreas	25 (6.4)
Hematology	22 (5.6)
Lung	21 (5.4)
Bladder	20 (5.1)
Head and Neck	19 (4.9)
Gynecology	18 (4.6)
Stomach	16 (4.1)
Other	13 (3.3)
Breast	2 (0.5)
Prostate	1 (0.3)
Cancer Stage	
Non-metastatic	218 (55.9)
Metastatic	172 (44.1)
Number of Comorbidities (Median (IQR))	1 (0-2)
Patients have Comorbidities	251 (64.4)
Hypertension	160 (41.0)
Diabetes Mellitus	105 (26.9)
Dyslipidemia	51 (13.1)
Others	81 (20.8)
Renal function	
CKD stage 1	125 (32.0)
CKD stage 2	188 (48.2)
CKD stage 3a	57 (14.6)
CKD stage 3b	10 (2.6)
CKD stage 4	0 (0.0)
CKD stage 5	10 (2.6)
Number of medications (Median (IQR)	7 (5, 10)

A study on the prevalence of PP and PIMs found that 355 patients (91.0%) were divided into polypharmacy, using 5 - 9 medications, 255 cases (65.4%) and excessive polypharmacy (using ≥ 10 medications) 100 cases (25.6%). Overall prevalence of combined PIMs 277 patients (71.0%). Also found patients with PIMs according to 2023 Beers criteria 257 cases (65.9%) and from START/STOPP criteria, a total of 210 cases (53.8%) as shown in Table 2

Table 2 Prevalence of PP and PIMs use classified by screening tools (n=390)

PP and PIMs	Number (%age)
PP	
Polypharmacy (5-9 medications)	255 (65.4)

PP and PIMs	Number (%age)
Excessive polypharmacy (≥ 10 medications)	100 (25.6)
PIMs	
Overall PIMs[a]	277 (71.0%)
2023 Beers criteria	257 (65.9)
2023 START/STOPP criteria	210 (53.8)
Both criteria[b]	190 (48.7)

[a] Overall PIMs identified by either Beer or START/STOPP criteria

[b] PIMs detected with Beer and START/STOPP criteria

Assessment with 2023 Beers Criteria found a total of 215 medications items (average PIMs 0.55 items per patient). The list of medications that found the most PIMs is lorazepam (235 patients, 60.3%), which is classified as PIMs according to the 2023 Beers Criteria in the benzodiazepines category, followed by metoclopramide (210 patients, 53.8%) and omeprazole (88 patients, 22.6%). Based on 2023 Beers criteria highlights three critical areas: first, medications that should be avoided such as first-generation antihistamines and benzodiazepines; second, medications to be used with caution, including antidepressants (SSRIs, SNRIs) and antipsychotics; and third, high-risk drug-drug interactions, specifically the concurrent use of opioids with benzodiazepines or gabapentin. Regarding 2023 START/STOPP criteria emphasizes both the cessation of PIMs and the initiation of essential therapies for elderly cancer patients. The top priorities for discontinuation (STOPP) include the concurrent use of two or more medications with anticholinergic properties, the administration of sulfonylureas for type 2 diabetes due to hypoglycemia risks and use of aspirin for primary prevention of cardiovascular disease. Conversely, criteria highlight critical treatments that should be initiated (START), such as prescribing PPIs for high-risk patients on low-dose aspirin, start antihypertensive therapy when blood pressure exceeds 140/90 mmHg, and ensuring the use of beta-blockers for patients with symptomatic coronary artery disease.

Interestingly, the prevalence of PIMs involving Lorazepam showed a marked discrepancy between the two assessment tools, with 235 cases (60.3%) identified by the 2023 Beers Criteria compared to only 63 cases (16.2%) by the 2023 START/STOPP Criteria. This significant difference is attributed to the inherent definitions and clinical focus of each tool. The 2023 Beers Criteria categorizes benzodiazepines as 'potentially inappropriate' in most older adults regardless of specific indications, prioritizing the risk of falls, cognitive impairment, and delirium. Conversely, the 2023 START/STOPP Criteria (specifically STOPP criteria) identifies PIMs based on more stringent clinical contexts, such as prolonged use beyond 4 weeks or use in patients with a history of recurrent falls. In the context of oncology, Lorazepam is frequently prescribed as a protocol premedication for chemotherapy-induced nausea and vomiting (CINV) or for anxiety related to cancer diagnosis. While these indications are clinically necessary in oncology practice, they are still flagged under the broad safety net of the 2023 Beers Criteria, whereas the 2023 START/STOPP criteria may overlook these cases if they do not meet the criteria for ‘prolonged use’ or ‘specific contraindications’ as shown in Table 3

Table 3 Top 10 medications most frequent of PIMs items identified by 2023 Beers criteria and 2023 START/STOPP criteria (n=390)

2023 Beers criteria		2023 START/STOPP criteria		Both criteria	
Medications	Number (%age)	Medications	Number (%age)	Medications	Number (%age)
Lorazepam	235 (60.3)	Lorazepam	63 (16.2)	Lorazepam	149 (38.2)
Metoclopramide	210 (53.8)	Glipizide	49 (12.6)	Metoclopramide	95 (24.4)
Omeprazole	88 (22.6)	cyproheptadine	45 (11.5)	Morphine	56 (14.4)
Morphine	81 (20.8)	Aspirin	37 (9.4)	Glipizide	49 (12.6)
Tramadol	50 (12.8)	Morphine	15 (3.9)	Aspirin	46 (11.8)
Glipizide	49 (12.6)	Carvedilol	6 (1.5)	Omeprazole	45 (11.5)
Aspirin	46 (11.8)	Propranolol	5 (1.3)	Cyproheptadine	44 (11.3)
Olanzapine	45 (11.5)	Tramadol	4 (1.0)	Tramadol	31 (7.9)
Cyproheptadine	44 (11.3)	Nortriptyline	3 (0.8)	Gabapentin	23 (5.9)
Gabapentin	28 (7.2)	Simvastatin	2 (0.5)	Olanzapine	22 (5.6)

The results of the analysis of the relationship between the use of PP and having comorbidities. From the study of the relationship between the number of medications that the patient received and the number of comorbidities, it was found that the number of medications that concurrent use was statistically significantly related to the number of comorbidities ($p < 0.001$). Patients with more comorbidities were clearly more likely to receive PP. In the group of patients without comorbidities (0 diseases), most of them received only 0 – 4 medications (12.4%), while patients with 2 or more comorbidities found that the proportion of medications received at the level of polypharmacy (5 - 9 medications) and excessive polypharmacy (≥ 10 medications) was significantly higher. Especially the group with 3 or more comorbidities, which has a proportion of ≥ 10 medications up to 24.0%. When analyzing the comorbidities, it was found that patients with hypertension (HT), diabetes (DM) and hyperlipidemia (DLD) are more likely to receive multiple medications than those who do not have comorbidities which is statistically significant ($p < 0.001$, $p < 0.001$ and $p = 0.004$, respectively). While hepatitis B and Benign Prostatic Hyperplasia (BPH) did not find a significant difference. In summary, it was found that increasing the number of comorbidities related to polypharmacy and excessive polypharmacy is statistically significant which reflects the complexity of treatment in patients with multiple chronic diseases. From multivariate logistic regression analysis to find the relationship between the variable and the number of PIMs found, patients who use 5 or more medications have a 3.58-fold chance of inappropriate medications compared to those who use only 0-4 medications ($p=0.001$). Patients who use 10 or more medications, there is a 9.27-fold chance of

inappropriate medications compared to those who use only 0-4 medications ($p < 0.001$). There are 1.78-fold chance of PIMs in diabetes patients when compared with non-diabetes. Notably, patients with lung cancer exhibited a 8.58-fold higher odds of PIMs compared to those with other cancers (Adjusted OR = 8.58; 95%CI: 1.09-67.59; p = 0.041) shown in Table 4.

Table 4 Univariate and Multivariate Logistic Regression Analysis of Factors Associated with combined PIMs (n=390)

Factors	Univariate Logistic Regression OR (95%CI)	p-value	Multivariate Logistic Regression Adjusted OR (95% CI)	p-value
Gender				
Male	Ref	Ref	Ref	Ref
Female	0.95 (0.61-1.47)	0.811	-	-
Age	1.03 (0.97-1.08)	0.327	-	-
Number of comorbidities	1.28	0.031	1.12	0.245
Number of medications	1.35	<0.001	1.22	0.005
0-4 medications	Ref.	Ref.	Ref.	Ref.
5-9 medications (Polypharmacy)	3.34 (1.62-6.91)	0.001	3.58 (1.70-7.53)	0.001
≥10 medications (Excessive polypharmacy)	9.21 (3.82-22.24)	<0.001	9.27 (3.78-22.73)	<0.001
Metastatic status				
Non-metastatic	Ref.	Ref.	Ref.	Ref.
Metastatic	0.87(0.56-1.35)	0.542		
Cancer type				
Other Cancer	Ref.	Ref.	Ref.	Ref.
Lung Cancer	8.83 (1.17-66.58)	0.035	8.58 (1.09-67.59)	0.041
No Diabetes	Ref.	Ref.	Ref.	Ref.
Diabetes	2.26 (1.30-3.94)	0.004	1.78 (1.05-3.03)	0.032

OR = Odds ratio, CI = Confidence interval

Discussion

This study reveals a notably high prevalence of PP among elderly cancer patients in a tertiary care hospital. The prevalence of polypharmacy (≥ 5 medications) in our inpatient cohort reached 91.0%, with a quarter of patients (25.6%) experiencing excessive polypharmacy (≥10 medications). These figures are considerably higher than those recently reported in another Thai study involving elderly cancer outpatients (67.8% and 20.0%, respectively) but are more aligned with findings from European inpatient settings (Bandidwattanawong *et al.*, 2023; van Loveren *et al.*, 2021). This discrepancy likely reflects the acute care nature of our hospitalized cohort, where medications are frequently added to manage complex cancer treatments,

side effects, and acute complications, on top of pre-existing therapies for comorbidities such as hypertension and diabetes, which were prevalent in our sample.

In addition to the high medication burden, the prevalence of Potentially Inappropriate Medications (PIMs) was also substantial. Using the latest 2023 AGS Beers and 2023 STOPP criteria, we identified that 71.0% of patients had at least one PIM. The 2023 Beers criteria identified PIMs in 65.9% of patients, while the 2023 STOPP criteria identified them in 53.8%. A striking finding was the predominance of benzodiazepines, particularly lorazepam, which accounted for 60.3% of PIMs detected. This high usage, while consistent with other inpatient studies (Bandidwattanawong *et al.*, 2023; Ramsdale *et al.*, 2022), highlights a critical tension between oncologic symptom management guidelines (e.g., for anticipatory nausea) and geriatric safety principles that advise against these medications due to risks of falls and delirium (American Geriatrics Society, 2023). Lorazepam is frequently and justifiably used as an adjunctive agent for managing chemotherapy-induced nausea and vomiting (CINV), particularly for breakthrough or anticipatory CINV. The 2023 Beers criteria found risk drug-drug interactions, use of opioids with benzodiazepines or gabapentin often seen in cancer pain management, and significant risk of synergistic CNS depression leading to excessive sedation and increased fall risk. In addition to polypharmacy, our study identified specific patient characteristics as independent risk factors for PIMs. Notably, patients with diabetes mellitus had a 1.78-fold increased odds of having a PIM. This finding is consistent with existing literature, which frequently links an increased number of comorbidities with a higher risk of PP and PIMs.

Limitations

This study has several limitations that should be acknowledged. First, its single-center design limits the generalizability of our findings to other healthcare settings. Second, the cross-sectional nature of the study identifies associations but cannot establish causality. Third, being a retrospective study, our analysis was reliant on the accuracy of existing medical records and may lack data on prescribing rationale. Finally, the exclusion of incomplete records could have introduced selection bias. These limitations highlight the need for future multi-center, prospective studies to confirm our findings.

Future Research Directions

Based on our findings and limitations, future research should focus on the development and validation of an oncology-specific PIM screening tool. Furthermore, interventional studies evaluated the effectiveness of pharmacist-led deprescribing programs in this high-risk vulnerable population.

Conclusion

Polypharmacy and PIMs are highly prevalent among hospitalized elderly patients with cancer in this tertiary care setting. Our study found that 91.0% of patients experienced polypharmacy, and PIMs were identified in 71.0% of patients when using the combined 2023 AGS Beers and START/STOPP criteria. An increasing number of medications was the most significant factor associated with the presence of PIMs. These findings underscore the urgent need for routine, systematic medication reviews and the integration of geriatric- pharmacotherapy principles into standard oncologic care to optimize medication safety in this vulnerable population.

Suggestion

There should be a prospective study and should perform in many centers, including the evaluation of clinical outcomes caused by PIMs (such as falling, confusion, stopping treatment). In addition, there should be an evaluation of the doctor's advice and response of the doctor to the recommendation to reduce the list of medications (deprescribing) from clinical pharmacists in the group of elderly cancer patients.

Acknowledgement

The authors gratefully acknowledge Ms. Benyapha Mounmontree and Ms. Nisakan Sribut, Department of Clinical Pharmacy, Faculty of Pharmacy, Khon Kaen University, for their assistance with research data collection.

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