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RESEARCH ARTICLE

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Polypharmacy and potentially inappropriate medicine use in older adults with cancer: a multicenter cross-sectional study in Northwest Ethiopia oncologic centers

Samuel Agegnew Wondm [a], Tilaye Arega Moges [b], Samuel Berihun Dagnew [b], Fisseha Nigussie Dagnew[b], Tirsit Ketsela Zeleke [a], Rahel Belete Abebe [c], Endalamaw Aschale Mihrete[d] and Fasil Bayafers Tamene [a]

[a]Department of Pharmacy, College of Health Sciences, Debre Markos University, Debre Markos, Ethiopia; [b]Department of Pharmacy, College of Health Sciences, Debre Tabor University, Debre Tabor, Ethiopia; [c]Department of Clinical Pharmacy, School of Pharmacy, College of Medicine and Health Sciences, University of Gondar, Gondar, Ethiopia; [d]Department of Pharmacy, College of Medicine and Health Sciences, Bahir Dar University, Bahir Dar, Ethiopia

ABSTRACT

Background: Most patients with cancer have comorbid conditions that necessitate advanced medical treatment. Polypharmacy (PP) and potentially inappropriate medicine (PIM) use is common among older adult patients with cancer. Not much research has been conducted on PP and PIM use among older adult patients with cancer in Ethiopian oncology centers. Therefore, this study aimed to evaluate the prevalence and determinants of PP and PIM use among older adults with cancer in Northwest Ethiopia oncology centers using the American Geriatrics Society (AGS) 2019 updated Beers criteria.

Methods: This multicenter cross-sectional study was conducted among older adult patients with cancer from July 15–December 30, 2023 in Northwest Ethiopian oncology centers. The use of at least one drug included in the 2019 Beers criteria revisions was classified as potentially inappropriate medication use. To identify the factors influencing PP and PIM use, logistic regression analysis was performed.

Results: Of the 310 samples aproched, 305(98.4% response rate) participated in the study. The prevalence of PP and PIM use were 70.2% (95% CI 64.9–75.1) and 63.0% (95% CI 57.4–68.8) respectively. Being female AOR:3.6; 95% CI:1.7–7.8; p = 0. 001, advanced age [(70–74 years) AOR:3.9; 95% CI:1.2–6.7; p = 0.046 and ≥75

CONTACT Samuel Agegnew Wondm samiagegnew@gmail.com; samuelagegnew@dmu.edu.et
Department of Pharmacy, College of Health Sciences, Debre Markos University, P.O. Box 269, Debre Markos, Ethiopia

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years AOR:3.8; 95% CI:1.7–8.4; p = 0.0028], abnormal body weight (underweight AOR:5.5; 95% CI:1.5–9.6; p = 0.019, overweight AOR:5.1; 95% CI:1.5–7.3; p = 0.01 and obese AOR:5.6; 95% CI:1.5–9.3; p = 0.021) and comorbidities AOR:3.5; 95% CI:1.7–8.3; p = 0.0032 were statistically significant factors for PP. Advanced age [(70–74 years) AOR:5.5; 95% CI:1.4–9.8; p = 0.015 and ≥75 years AOR:3.3; 95% CI:1.5–7.1; p = 0.002)] and polypharmacy; AOR:7; 95% CI:3.4–9.4; p = 0.001 were statistically significant factors for PIM use.

Conclusion: Polypharmacy and potentially inappropriate medicine use were prevalent among older adult patients with cancer. Ensuring safe medicines prescription practices for older patients with cancer requires understanding the issue, stopping unwarranted treatment, and replacing it with less toxic, age-appropriate medicines.

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KEYWORDS Cancer; older adults; polypharmacy; inappropriateness of medicine use; determinants; 2019 Beers criteria

Background

The American Geriatrics Society (AGS) provides a list of medicines that are harmful or inappropriate for older patients (Fick et al., 2019). The 2019 Beers criteria provide five categories: medicines considered potentially inappropriate, potentially inappropriate in patients with certain diseases or syndromes, medicines used in caution, potentially inappropriate drug–drug interactions, and medicines that require dose adjustment based on kidney functions. Polypharmacy, the simultaneous use of several medicines, is prevalent among older persons with cancer (Sharma et al., 2016). Prescription of inappropriate medicines is associated with polypharmacy (Maddison et al., 2011; Vyas et al., 2020). Older patients with cancer frequently experience polypharmacy (Sharma et al., 2016), which is associated with several unfavourable outcomes. Due to age-associated multimorbidity (Nightingale et al., 2015), frailty, and other geriatric syndromes (Maggiore et al., 2010), older adults are more likely to be prescribed multiple medicines. PP and PIM use are associated with functional decline (Davies et al., 2020), falls (Dhalwani et al., 2017), hospitalisation (Jensen et al., 2001), and mortality (Davies et al., 2020) in older adults. PP and PIM use may put older persons with cancer at a heightened risk of adverse outcomes because they are more likely to experience frailty, disability, and geriatric syndromes than older patients without cancer (Mohile et al., 2009). The use of potentially inappropriate medicines affects outcomes, including physical function (Mohamed et al., 2021), and reduces tolerance to cancer therapy (Jørgensen & Herrstedt, 2020). The probability of clinically significant drug–drug interactions (DDIs) and drug-cancer treatment interactions (DCIs) is elevated in cancer patients undergoing therapy because ofPP and PIM use (Ramsdale et al., 2022). The incidence of polypharmacy among older

persons can reach up to 37% in outpatient context (Buck et al., 2009; Steinman et al., 2006) and up to 92% in hospitalised older patients (Hajjar et al., 2005; Rothberg et al., 2008). A previous study reported that 11% – 96% of older patients with cancer had polypharmacy (Sharma et al., 2016).

The American Geriatrics Society (AGS) Beer's criteria, the Screening Tool of Older People's Potentially Inappropriate Prescriptions criteria, and the Screening Tool to Alert Doctors to Right Treatment criteria (STOPP/START) (Abegaz et al., 2018; Getachew et al., 2016) are the two widely used tools to assess PIM use in older adult patients. The AGS Beers criteria are the most frequently used and validated explicit process measure for PIM use (Fick et al., 2019). Moreover, the AGS Beers criteria have been the most commonly used tool in geriatric oncology (Al-Azayzih et al., 2024; Bandidwattanawong et al., 2023; Buck et al., 2009; Noronha et al., 2021; Ramsdale et al., 2022; Reis et al., 2017; Steinman et al., 2006). Furthermore, they are suitable for Ethiopian formulary (Food, 2013).

Prior research has examined the degree of PIM use in older patients with cardiovascular disease using the old version of the Beers criteria and the START/STOPP criteria (Abegaz et al., 2018; Geresu et al., 2017; Getachew et al., 2016; Mekonnen & Bhagavathula, 2023; Tefera et al., 2020; Teka et al., 2016). Furthermore, a recent systematic review and meta-analysis in Ethiopia revealed that 37% of older patients use PIM (Bhagavathula et al., 2022). However, no prior assessments have been conducted in Ethiopia on the prevalence and determinants of PP and PIM use in older adult patients with cancer. This study aimed to assess the prevalence and determinants of polypharmacy and potentially inappropriate medicine use using the revised AGS Beers criteria 2019 among older adult patients with cancer visiting Northwest Ethiopian oncology centers.

Methods

Study design, periods, and setting

Institutional-based cross-sectional research was conducted from July 15, 2023, to December 30, 2023, at the University of Gondar Comprehensive and Specialized Hospital (UOGCSH), Felegehiwot Comprehensive and Specialized Hospital (FHCSH), and Tibebe-Ghion Comprehensive and Specialized Hospital (TGCSH). The University of Gondar Comprehensive and Specialized Hospital is a teaching hospital in Gondar, Northwest Ethiopia. Gondar is 748 km from Addis Ababa, the capital city of Ethiopia. The oncologic centr was established in January 2015. Felegehiwot Comprehensive and Specialized Hospital and Tibebe-Ghion Comprehensive and Specialized Hospital are located in Bahir Dar city, which is approximately 578 km from Addis Ababa. The oncology treatment centers for FHCSH and TGCSH were established in 2017 and 2021, respectively.

Study population, inclusion, and exclusion criteria

The study population consisted of all older adult patients who were admitted to the oncology ward or on follow-up in Northwest Ethiopian oncology centers during the data collection period, whereas the source population consisted of all older adult patients (≥65) with a histologically confirmed cancer diagnosis who were on follow-up or admission to the oncology ward at those centers. The study included patients who provided informed consent and received at least one medicine. The exclusion criteria were patients who were incapable of providing informed consent, had inadequate laboratory values pertinent to judging the presence of PIM use, incomplete medical records, or were seriously unwell.

Sample size calculation and sampling technique

The sample size (n) was calculated using a single population proportion formula by considering the 50% prevalence rate(p) of PP and PIM use among older adult patients with cancer. We also assumed that 5% margin of error(d) for the two-tailed type-I error ($Z\alpha = 1.96$); two-sided 95% confidence interval. Thus, $n = \frac{(Z\alpha/2)^2 \times p(1-p)}{d^2}$. $n = 1.96^2 * 0.5(1-0.5)/0.05^2 = 384$. We used the correction formula because the research source population was fewer than 10,000. Thus, the final sample size(nf) = $n/1 + n/N = 384/1 + 384/1050 = 282$, where N is the source population. The 10% contingency was considered for potential non-response and missing medical records. Finally, 310 research participants were recruited. The total number of older patients with cancer in the UOGCSH, FHCSH, and TGCSH was 400, 350, and 300, respectively, based on the previous 4-month hospital statistics. The final sample size was proportionally allocated to the hospitals. Consequently,118, 103, and 89 eligible participants were selected for UOGCSH, FHCSH, and TGCSH, respectively. A systematic random sampling technique for every 3 intervals was employed to select participants until the desired sample size was maintained.

Data collection instruments

The content of the structured questionnaire reviewed by senior experts who have published research on PP and PIM use . The tool was adopted from validated standard criteria, which were last updated by the 2019 team of experts. The 2019 updated AGS Beers criteria have been approved for international use for the assessment of PIM use in all ambulatory, acute, and institutionalised settings of care, except hospice and end-of-life care settings (Fick et al., 2019). A comprehensive medicines evaluation involved documenting all

prescribed and over-the-counter medicines and complementary and alternative medicine (CAM). Each participant's comorbidity count and the Charleson comorbidity index were determined using comorbidities from medical records and self-reported data collected at the time of study entrance. A quantitative assessment of each patient's comorbidity severity was performed using the Charlson Comorbidity Index (CCI) score (Charlson et al., 1987). Three categories of patients were created: mild, denoted by a CCI score of 1–2; moderate, denoted by a CCI score of 3–4; and severe, denoted by a CCI score of > 5 (Bhagavathula et al., 2021). An electronic scale was used to measure the body weight (kg), and a stadiometer was used to measure the standing height. Body body mass index (BMI) was measured in kilograms per square meter(kg/m^2) and participants were classified into BMI categories underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9), and obese (≥30) according to the World Health Organization definition (Organisation, 2010). The Cockroft-Gault equation was used to estimate the glomerular filtration rate (Cockcroft & Gault, 1976).

Functional health status was assessed using the Katz index of independence in Activity of Daily Living (ADL) (Shelkey & Wallace, 2012). This validated tool has been used to assess the functional health status of indivisuals, ranking adequacy of performance in six functions (eating, dressing, bathing, transferring, continence and toileting). Each rank is assigned a score of 0 or 1, and the overall patient ranking is as follows: Katz score of 6 = independent (full function), 3–5 = partially dependent (moderate impairment) and ≤2 = dependent (sever functional impairment) (Database, 2024; Shelkey & Wallace, 2012). The Geriatric Depression Scale-15 (GDS-15) is validated tool to assess geriatric psychological and emotional status (Yesavage & Sheikh, 2008). Scores≥5 were cut-off points for the potential existence of depression (Anbesaw & Fekadu, 2022). Using a numerical scale provided by the patients, the degree of pain was evaluated. A rating of 1–4 corresponds to mild pain, a rating of 5–6 to moderate pain, and a rating of 7–10 to severe pain, depending on the degree of interference with the cancer patient's function (Serlin et al., 1995). Supportive care medicines are administered before, after, or during the occurrence of adverse drug reactions due to cancer chemotherapy. PP was defined as taking five or more medicines at the same time for at least one day (Organization, 2019), excluding chemotherapy. PP status was dichotomised as yes or no category. The English version of the questionnaire is uploaded (Supplemental Material).

Potentially inappropriate assessment of medicines

The 2019 AGS Beers criteria were used to classify PIM use (yes/no) (Fick et al., 2019). From all eligible patients, data collectors established a list of medicines

taken by the patients during follow-up and hospital admission. Two data collectors, clinical pharamcist from each hospital, were selected. One clinical pharmacist reviewed the patient's medical records, and the other, who had better experience, cross-verified the data filled by the first data collector. Finally, all data collected by the data collectors were cross-verified by authors who are clinical pharmacists and lecturers. Any medicines found to have moderate to strong recommendations to be avoided in older patients were considered PIM. The prevalence of PIM use was calculated as the number of patients who used at least one PIM divided by the total number of participants.

Study variables

Dependent variables: PIM use and PP were outcome variables that needed to be examined.
Independent variables: The patients' sociodemographic, clinical, and medication-related characteristics were the independent variables of the study.

Data quality assurance

To ensure the data quality, brief training was provided to data collectors regarding the objective of the study, data collection tools, data collection procedure, and ethical considerations. Before beginning the data gathering process, the data collection instrument was tested on 15 subjects at UOGCSH to check the reliability of the checklist for most items. The questionnaire were modified for Amharic translation and then back-translated into English to ensure that the original intent was maintained. The principal investigator reviewed the completed questionnaire daily to ensure its accuracy.

Data processing and analysis

The completed questionnaire was manually checked for completeness. The data were coded and entered into Epi Data version 4.6.2 and exported to STATA version 17 for further analysis. Frequencies and percentages were used to characterize clinical, medicine-related, and sociodemographic data. The chi-square test was used to evaluate the statistical significance of group associations for outcome varaibles.

The model of fitness was checked by Hosmer and Lemeshow goodness and a p-value less than 0.05 was considered statistically significant. Multicollinearity was checked, and the maximum variance inflation factor was less than 5.Logistic regression model was used to identify the predictors of PP and PIM use. Variables with a P-value less than 0.25 in the bivariable regression analysis were included in the multivariable

regression analysis. In the multivariable logistic regression analysis, adjusted odds ratio with a 95% confidence interval was computed along with the corresponding P-value (P<0.05) as the cutoff point for determining statistical significance.

Results

Sociodemographic characteristics of the participants

A total of 305 older patients with cancer were included in the final analysis, with a response rate of 98.4% (305/310). Nearly two-thirds of the patients 184 (60.3%) were female. More than half of the patients161(52.8%) were ≥75 years old. More than two-thirds of the patients 214 (70.2%) received insurance payments. Nearly two-thirds of the patients 183(60%) had a normal body mass index (Table 1).

Clinical characteristics of older patients with cancer

The study included patients with solid and hematologic cancers. The most common solid cancers were breast cancer 94 (30.8%), colorectal cancer 57 (18.7%), and cervical cancer 44 (14.4%). The most common hematologic cancers were non-Hodgkin lymphoma18 (5.9%) and Hodgkin lymphoma 10 (3.3%), followed by acute lymphoblastic leukemia 9 (3%). More than one-third of patients 104 (34.1%) had comorbidities. The most common comorbidities were psychiatric disorders 54 (17.7%), hypercholesterolemia 34 (11.1%), and osteoporosis 28 (9.2%). More than half of the patients 157 (51.5%) had a mild CCI. More than one-third of patients 113 (37%) received palliative treatment. Less than half of patients 138 (45.3%) had a partially dependent functional health status. More than half of the patients 179 (58.7%) were hospitalized. More than two-thirds of patients 214 (70.2%) had polypharmacy. Nearly half of the patients 149 (48.9%) used over-the-counter (OTC) medicines. Less than half of the patients 141 (46.2%) got ≥5 supportive care medicines (Table 2).

Potentially inappropriate use of medicines

The most commonly prescribed PIM in older patients with cancer were antiemetics 72 (24.1%), nonsteroidal anti-inflammatory drugs (NSAIDs) 53 (17.7%), proton pump inhibitors (PPIs) 35 (11.7%), benzodiazepines 28 (9.4%), and tricyclic antidepressants (TCAs) 23 (7.7%). Drug–drug interactions were found in 33 (11 %) participants (Table 3).

Table 1. Sociodemographic characteristics of older patients with cancer in Northwest Ethiopian oncologic centers (n = 305).

Variable	Category	Total (%)	PP (n = 214)	No PP (n = 91)	P-Value	PIM Use (n = 192)	No PIM use (n = 113)	P-value
Gender	Male	121 (39.7)	59(27.6)	62 (68.1)	0.0001*	51(26.6)	70 (62)	0.0001*
	Female	184 (60.3)	155(72.4)	29(31.9)		141(73.4)	43(38)	
Age	65–69	120 (39.3)	58 (27.1)	62(68.1)	0.002*	40 (20.8)	80(70.8)	0.011*
	70–74	24 (7.9)	20(9.35)	4(4.4)		20(10.4)	4(3.5)	
	≥75	161(52.8)	136(63.55)	25(27.5)		132(68.8)	29(25.7)	
Residence	Rural	189(62)	141(65.9)	48 (52.7)	0.031*	141(65.9)	48 (52.8)	0.003*
	Urban	116 (38)	73(34.11)	43 (47.3)		73 (34.1)	43(47.2)	
Marital status	Single	15(4.9)	10 (4.7)	5(5.5)	0.76	8 (4.2)	7(6.2)	0.73
	Married	240(78.7)	171(79.9)	69 (75.8)		151(78.6)	89 (78.8)	
	Divorced	23(7.5)	14(6.5)	9(9.9)		14(7.3)	9(8)	
	Widowed	27 (8.9)	19(8.9)	8(8.8)		19 (9.9)	8(7)	
Educational status	Unable to read and write	197(64.6)	150(70.1)	47(51.7)	0.004*	129 (67.2)	68 (60.1)	0.086
	Can read and write	61(20)	36(16.8)	25 (27.5)		39 (20.3)	22(19.5)	
	Primary	34 (11.1)	23 (10.8)	11(12)		20(10.4)	14 (12.4)	
	Secondary and above	13 (4.3)	5(2.3)	8 (8.8)		4(2.1)	9(8)	
Religion	Orthodox	236 (77.4)	165 (77.1)	71(78)	0.26	140(72.9)	96(85)	0.46
	Muslim	49 (16)	42(19.6)	7(7.7)		36(18.8)	13 (11.5)	
	Protestant	20 (6.6)	7(3.3)	13(14.3)		16 (8.3)	4 (3.5)	
Source of payment	Insurance	214 (70.2)	151(70.6)	63(69.2)	0.82	140(72.92)	74 (65.49)	0.17
	Self	91 (29.8)	63(29.4)	28 (30.8)		52(27.08)	39 (34.51)	
BMI(kg/m^2)	Underweight	38 (12.5)	34 (15.89)	4(4.4)	0.0021*	26(13.6)	12 (10.6)	0.01*
	Normal	183(60)	106 (49.53)	77(84.6)		98 (51)	85(75.2)	
	Overweight	45 (14.8)	41 (19.16)	4 (4.4)		39 (20.3)	6(5.3)	
	Obesity	39 (12.8)	33 (15.42)	6(6.6)		29(15.1)	10 (8.9)	
CAM use	Yes	48 (15.7)	39 (18.2)	9 (9.9)	0.067	36 (18.8)	12 (10.6)	0.06
	No	257 (84.3)	175 (81.8)	82(90.1)		156 (81.2)	101(89.4)	
Substance use	Yes	46 (15.1)	35(16.4)	11(12.1)	0.34	28(14.6)	18 (15.9)	0.75
	No	259 (84.9)	179 (83.6)	80 (87.9)		164 (85.4)	95 (84.1)	

*Chi square test P-value<0.05

Abbreviations: BMI: Body Mass Index, CAM: Complementary and alternative medicine, PP: polypharmacy, PIM: potentially inappropriate medicine

Table 2. Clinical characteristics of older adult patients with cancer in Northwest Ethiopia oncologic centers (n = 305).

Variable	Category	Total (%)	PP	No PP	P-Value	PIM use (n = 192)	No PIM use (n = 113)	P-value
Solid cancer(n = 259)	Breast cancer	94(30.8)	63 (34.81)	31 (39.74)	0.26	62(37.6)	32 (34)	0.56
	Cervical cancer	44(14.4)	37(20.44)	7(8.97)		34(20.6)	10(10.6)	
	ovarian cancer	24(7.9)	15(8.29)	9 (11.54)		14(8.5)	10(10.6)	
	colorectal cancer	57(18.7)	44 (24.31)	13(16.67)		35(21.2)	22(23.4)	
	lung cancer	18(5.9)	9(4.97)	9(11.54)		10(6.1)	8(8.6)	
	GTN	19(6.2)	10 (5.52)	9 (11.54)		7(4.2)	12 (12.8)	
	Others[¥]	3(1)	3(1.66)	0(0)		3(1.8)	0(0)	
Hematologic cancer(n = 46)	Acute lymphoblastic leukemia	9(3)	6(18.18)	3 (23.08)	0.86	5(18.52)	4(21)	0.52
	Non-Hodgkin's lymphoma	18(5.9)	14 (42.42)	4 (30.77)		12(44.44)	6(31.6)	
	Acute myelogenous leukemia	4(1.3)	2 (6.06)	2 (15.38)		1 (3.70)	3(15.8)	
	Chronic lymphocytic leukemia	3(1)	1(6.06)	2 (7.69)		2(7.41)	1(5.3)	
	Hodgkin lymphoma	10(3.3)	7(21.21)	3(23.08)		5(18.52)	5(26.3)	
	Chronic myelogenous leukemia	2(0.6)	2(6.06)	0(0)		2 (7.41)	0(0)	
Cancer stage	I	46 (15.1)	27 (12.6)	19(20.9)	0.001*	20(10.4)	26(23)	0.01*
	II	147 (48.2)	92(43)	55(60.4)		82(42.7)	65(57.5)	
	III	46(15.1)	38(17.8)	8(8.8)		37(19.3)	9(8)	
	IV	23 (7.5)	18(8.4)	5(5.5)		16(8.3)	7(6.2)	
	Other stage	43 (14.1)	39 (18.2)	4(4.4)		37(19.3)	6(5.3)	
ECOGPS	0	87 (28.5)	51(23.8)	36(39.5)	0.024*	49(25.5)	38(33.6)	0.012*
	I	66 (21.6)	48(22.5)	18(19.8)		42(21.9)	24(21.2)	
	II	63 (20.7)	45(21)	18 (19.8)		37(19.3)	26(23)	
	III	72 (23.6)	54(25.2)	18 (19.8)		49(25.5)	23 (20.4)	
	IV	17 (5.6)	16 (7.5)	1(1.1)		15(7.8)	2(1.8)	
Comorbidity	Yes	104(34.1)	87(40.7)	17(18.7)	0.0001*	70(36.5)	34(30.1)	0.26
	No	201(65.9)	127(59.3)	74(81.3)		122(63.5)	79 (69.9)	
Types of comorbidities	Psychiatric disorder	54(17.7)	33(25)	21(30.4)	0.92	31(24.8)	23(30.26)	0.92
	Hypercholesterolemia	34(11.1)	24(18.2)	10(14.5)		23(18.4)	11(14.47)	
	Osteoporosis	28(9.2)	21(15.9)	7(10.1)		19(15.2)	9(11.84)	
	Anemia	23(7.5)	15(11.4)	8(11.6)		14(11.2)	9(11.84)	
	Arthritis	18(5.9)	11(8.3)	7(10.1)		13(10.4)	5(6.58)	

(*Continued*)

Table 2. Continued.

Variable	Category	Total (%)	PP	No PP	P-Value	PIM use (n = 192)	No PIM use (n = 113)	P-value
	Hypertension	15(4.9)	11(8.3)	4(5.8)		9(7.2)	6(7.89)	
	DM	12(3.9)	6(4.6)	6(8.7)		7 (5.6)	5(6.58)	
	Airway disease	8(2.6)	5(3.8)	4(4.4)		4 (3.2)	4(5.26)	
	Acute infection	6(2)	4 (3)	2(2.9)		4 (3.2)	2(2.63)	
	Others[a]	3(1.3)	2(1.5)	1(1.5)		1(0.8)	2(2.63)	
Distress score	<5	182 (60)	123(57.5)	59(64.8)	0.23	107(55.7)	75(66.4)	0.067
	≥5	123(40)	91(42.5)	32(35.2)		85(44.3)	38(33.6)	
History of falls	0	249(81.6)	176 (82.2)	73(80.2)	0.67	158(82.3)	91(80.5)	0.7
	≥1	56 (18.4)	38(17.8)	18 (19.8)		34(17.7)	22(19.5)	
Pain score	Mild	141(46.2)	89 (41.6)	52(57.1)	0.26	79(41.1)	62(54.9)	0.002*
	Moderate	128 (42)	95 (44.4)	33(36.3)		95(49.5)	33(29.2)	
	Severe	36 (11.8)	30(14)	6(6.6)		18(9.4)	18(15.9)	
Family history of cancer	Yes	44 (14.4)	29(13.5)	15(16.5)	0.5	26 (13.5)	18(15.9)	0.57
	No	261(85.6)	185(86.5)	76(83.5)		166(86.5	95(84.1)	
CCI	Mild	157(51.5)	103(48.1)	54 (59.3)	0.018*	90(46.9)	67(59.3)	0.1
	Moderate	123(40.3)	93 (43.5)	30(33)		84(43.7)	39(34.5)	
	Severe	25(8.2)	18 (8.4)	7(7.7)		18(9.4)	7(6.2)	
Treatment goals for cancer	Palliative	113 (37)	80(37.4)	33(36.2)	0.98	79(41.2)	39(30.1)	0.27
	Curative	82 (26.9)	57(26.6)	25(27.5)		47(24.5)	35(31)	
	Adjuvant	63 (20.7)	45 (21)	18 (19.8)		37(19.3)	26(23)	
	Neoadjuvant	47 (15.4)	32 (15)	15(16.5)		29(15)	18 (15.9)	
Functional health status	Dependent	137(44.9)	87(40.7)	50 (55)	0.009*	84(43.8)	53(46.9)	0.033*
	Partially dependent	138(45.3)	138(50.9)	29(31.8)		92(47.9)	46(40.7)	
	Independent	30 (9.8)	18(8.4)	12(13.2)		30(8.3)	14(12.4)	
Hospitalisation status	Ambulatory	126(41.3)	77(36)	49(53.9)	0.04*	75(39.1)	51(45.1)	0.29
	Hospitalized	179(58.7)	137(64)	42(46.1)		117(60.9)	62(54.9)	
Supportive care medicines	1–4	164 (53.8)	113(52.8)	51(56)	0.6	105(54.7)	59 (52.2)	0.68
	≥5	141 (46.2)	101(47.2)	40 (44)		87(45.3)	54(47.8)	
OTC medicines	Yes	149(48.9)	105(49.1)	44 (48.4)	0.91	99(51.6)	50(44.2)	0.21
	No	156 (51.1)	109(50.9)	47(51.6)		93(48.4)	63(55.8)	
Patient-level polypharamcy	Yes	214 (70.2)	214(100)	0(0)	0.0001*	171(89.1)	43(38)	0.0001*
	No	91(29.8)	0(0)	91(100)		21(10.9)	70(62)	

[a]thyroid disorder, renal disorder ¥ is pancreatic cancer, soft tissue sarcoma, and esophageal carcinoma, *Chi-square test P-value<0.05

Abbreviations: CAM, complementary alternative medicine: Charlson Comorbidity Index, DM: diabetes mellitus, ECOGPS: Eastern Cooperative Oncology Group Performance Status, OTC: Over-the-Counter, PP: Polypharmacy, PIM: potentially inappropriate medicine

Table 3. PIM use among older adult cancer patients who recieved scheduled treatment according to the 2019 AGS Beers criteria (tolal number of PIM use = 299).

Category	n (%)	Medicines	n (%)	Recommendation	QOE	SOR
TCAs	23(7.7)	Amitriptyline	13(4.4)	Avoid	High	Strong
		Clomipramine	10(3.3)	Avoid	High	Strong
PPIs	35(11.7)	Omeprazole	23(7.7)	avoid scheduled use for >8 weeks	High	strong
		Pantoprazolet	12(4)	Avoid if CrCl less than 15 mL/min	High	Strong
NSAIDs	53(17.7)	Indomethacin	14(4.7)	Avoid	Moderate	Strong
		Ibuprofen	21(7)	Avoid	Moderate	Strong
		Diclofenac	12(4)	Avoid	Moderate	Strong
		Meloxicam	6(2)	Avoid	Moderate	Strong
First-generation antihistamines	12(4)	Diphenhydramine	8(2.7)	Avoid	Moderate	Strong
		Promethazine	4(1.3)	Avoid	Moderate	Strong
Sulfonyl urea	8(2.7)	Glibenclamide	8(2.7)	Avoid	High	strong
Anti-infective drugs	18(6)	Cotrimoxazole	18(6)	Reduce dose if CrCl is less than 15–29 mL/min	Moderate	Strong
Benzodiazepine	28(9.4)	Diazepam	28(9.4)	Avoid	Moderate	Strong
Drug-drug interactions	33(11)	Diazepam + Morphine	14(4.7)	Avoid	Moderate	Strong
		Warfarin + Cotrimoxazole	4(1.3)	Avoid	Moderate	Strong
		Hydrocortisone + Diclofenac	15(5)	Avoid	Moderate	Strong
Antiemetics	72(24.1)	Metoclopramide	72(24.1)	Avoid	Moderate	Strong
H2 receptor antagonist	17(5.7)	Cimetidine	17(5.7)	Avoid	Low	Strong

Abbreviations: NSAIDS: Non-Steroidal Anti-Inflammatory Drugs, PPIs, Proton pump inhibitors, QOE: quality of evidence, TCAs: tricyclic antidepressants, SOR: strength of recommendation

Prevalence of PIM use and polypharmacy

The overall prevalence of polypharmacy was 70.2% (95% CI 64.9–75.1). The overall prevalence of potentially inappropriate medicine use was 63.0% (95% CI 57.4–68.8). The prevalence of polypharmacy (44.6%) and PIM use (43.3%) was highest among patients with age ≥75 years (Figure 1).

Distribution of PIM use

In total, 299 PIM use were identified among 192 older patients with cancer according to the AGS Beers criteria of 2019. Among the identified PIM use 55.8%, 36.4%, 5.2% and 2.6% of patients were exposed to one, two, three, and four PIM use, respectively (Figure 2).

Predictors of the use of polypharmacy and PIM

Bivariable and multivariable logistic regression analysis were employed to explore the determinants of polypharmacy and PIM use. Being female AOR:3.6; 95% (CI:1.7–7.8); p = 0.001, advanced age [(70–74 years) AOR:3.9; 95%(CI:1.2–6.7); p = 0.046 and ≥75years AOR:3.8; 95% (CI:1.7–8.4); p = 0.0028], abnormal body weight (underweight AOR:5.5; 95% (CI:1.5–9.6); p = 0.019, overweight AOR:5.1; 95% (CI:1.5–7.3); p = 0.01 and obese AOR:5.6; 95% (CI:1.5–9.3); p = 0.021), and comorbidities AOR:3.5; 95% (CI:1.7–8.3); p = 0.0032 were determinants of polypharmacy (Table 4). Advanced age [(70–74 years) AOR:5.5; 95% (CI:1.4–9.8); p = 0.015 and ≥75 years AOR:3.3; 95% (CI:1.5–7.1); p = 0.002] and polypharmacy AOR:7; 95% (CI:3.4–9.4); p = 0.001 were determinants of PIM use (Table 5).

Discussion

To the best of our knowledge, this is the first study to employ the revised 2019 AGS Beers criteria as a screening approach to assess the prevalence of PIM use among older adult patients with cancer in Northwest Ethiopian oncology Centers. The prevalence of PP and PIM use were 63.0% (95% CI 57.4–68.8) and 70.2% (95% CI 64.9–75.1), respectively.

The prevalence of polypharmacy was 70.2%, which was comparable to previous research among older patients with cancer in France (75.4%) (Leger et al., 2018), India (68%) (Noronha et al., 2021), the USA (75.8%) (Ramsdale et al., 2022), Thailand (67.8%) (Bandidwattanawong et al., 2023), and the Netherlands (65%) (Hamaker et al., 2014). However, the polypharmacy prevalence was higher than that of studies conducted on older patients with cancer in the USA (38%) (Elliot et al., 2014), Norway (7.03%) (Nieder et al., 2017), Italy (36%) (Iurlo et al., 2016), and Canada (47%) (Caparrotti et al., 2017). The increased prevalence of PP observed in our study might be the

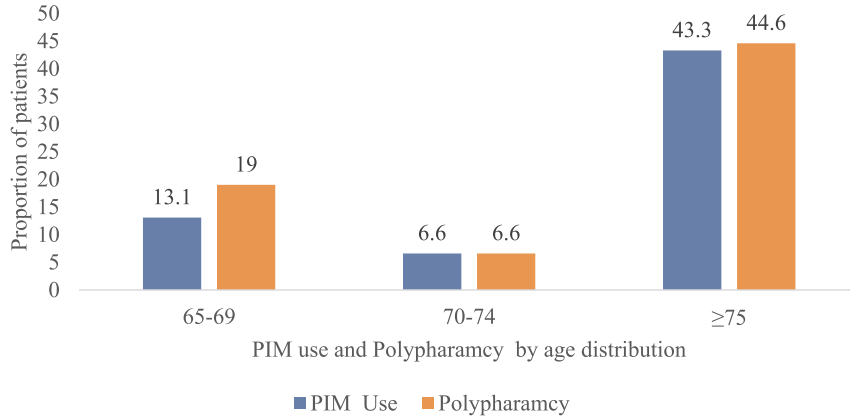

Figure 1. Distribution of PIM use and polypharmacy among older cancer patients (n = 305).

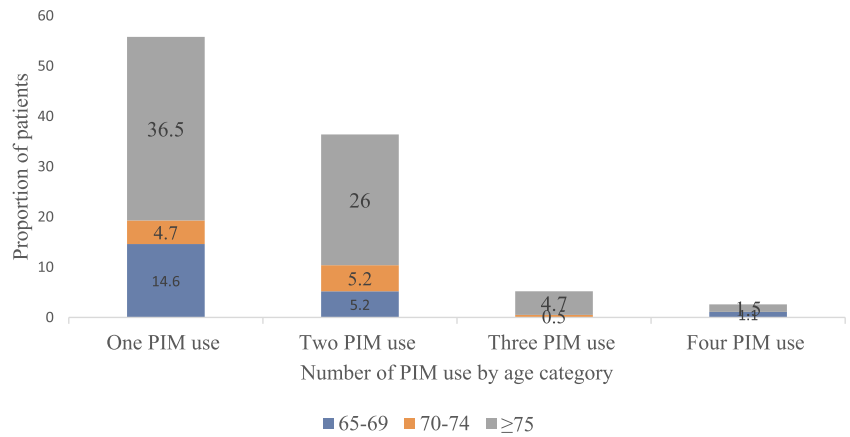

Figure 2. Number of potentially inappropriate medicines by age category (n = 192).

result of earlier studies that used outdated screening methods and/or criteria to define PP in older adults. The higher prevalence of PP in our study compared with previous publications may be also explained by the fact that the majority of these investigations evaluated medicines use based on usual care standards, which were defined by physician- or prescriber-directed medication assessments recorded in medical records and/or medicines databases, whereas our study was conducted by pharmacist-directed comprehensive medicines assessment. Our results showed a lower rate of polypharmacy than research conducted on older patients with cancer in Turkey (94.7%) (Paksoy et al., 2019), Jordan (83%) (Al-Azayzih et al., 2024), and Saudi Arabia (79%) (Alwhaibi et al., 2020). The variation in the prevalence of

Table 4. Bivariable and multivariable logistic regression analysis of determinants for polypharmacy among older patients with cancer in Northwest Ethiopia oncologic centers (n = 305).

		Polypharmacy					
Variables	Category	Yes(n = 214)	No(n = 91)	COR (95% CI)	P-value	AOR (95% CI)	P-value
Gender	Female	155	29	5.6(3.3–9.6)	0.0001	3.6(1.7–7.8)	0.001*
	Male	59	62	1	Ref	1	Ref
Age	≥75	136	25	5.8(3.3–10.1)	0.004	3.8(1.7–8.4)	0.0028*
	70–74	20	4	5.3(1.7–16.6)	0.0001	3.9(1.2–6.7)	0.046*
	65–69	58	62	1	Ref	1	Ref
Residence	Rural	141	48	1.73(1.1–2.9)	0.031	1.1(0.6–2.2)	0.754
	Urban	73	43	1	Ref	1	Ref
Education	Illiterate	150	47	5.1(1.6–16.3)	0.006	3.4(0.7–16.2)	0.12
	Literate with no formal education	36	25	2.3(0.7–7.8)	0.18	1.4(0.3–6.9)	0.7
	Primary	23	11	3.3(0.9–12.6)	0.075	2.3(0.4–13.3)	0.36
	Secondary and above	5	8	1	Ref	1	Ref
ECOGPS	IV	16	1	11.3(1.5–16.9)	0.021	3.6(0.3–10.6)	0.28
	III	54	18	2.1(1.1–4.2)	0.031	1.4(0.5–3.7)	0.48
	II	45	18	1.8(0.9–4)	0.11	0.9(0.33–2.4)	0.82
	I	48	18	1.9(0.9–3.8)	0.072	1.7(0.6–4.4)	0.28
	0	51	36	1	Ref	1	Ref
BMI(kg/m^2)	Underweight	34	4	6.2(2.1–18.1)	0.001	5.5(1.5–9.6)	0.019*
	Overweight	41	4	7.4(2.6–21.7)	0.0001	5.1(1.5–7.3)	0.01*
	Obese	33	6	4(1.6–10)	0.003	5.6(1.5–9.3)	0.021*
	Normal	106	77	1	Ref	1	Ref
CCI	Severe	18	7	1.34(0.53–3.4)	0.53	0.84(0.22–3.14)	0.8
	Moderate	93	30	1.6(0.9–2.8)	0.071	0.97(0.44–2.1)	0.9
	Mild	103	54	1	Ref	1	Ref

Comorbidities	Yes	87	17	3(1.6–5.4)	0.0001	3.5(1.7–8.3)	0.0032*
	No	127	74	1	Ref	1	Ref
Cancer stage	IV	18	55	2.5(0.8–8)	0.11	0.99(0.22–4.5)	0.074
	III	38	8	3.3(1.3–8.7)	0.014	1.4 (0.4–4.8)	0.6
	II	92	55	1.2(0.6–2.3)	0.64	0.6(0.23–1.5)	0.26
	Other stage	39	4	6.9(2.1–22.4)	0.001	1.6(0.3–7.5)	0.54
	I	27	19	1	Ref	1	Ref
Functional Health status	Dependent	87	50	1.2(−0.5–2.6)	0.72	1.5(0.43–5.2)	0.53
	Partially dependent	109	29	2.5(1.1–5.8)	0.032	3.7(0.95–11.4)	0.058
	Independent	18	12	1	Ref	1	Ref
CAM use	Yes	39	9	2(0.94–4.4)	0.072	0.87(0.31–2.4)	0.81
	No	175	82	1	Ref	1	Ref
Hospitalisation status	Hospitalized	137	42	2.1(1.3–3.4)	0.004	1.3(0.64–2.63)	0.47
	Ambulatory	77	49	1	Ref	1	Ref

1 = Reference group, Ref: reference *Significance P value <0.05

Abbreviations: AOR: adjusted odds ratio, BMI: body mass index, CAM: complementary and alternative medicine, CCI: Charlson comorbidity index, CI: Confidence Interval, COR: crude odds ratio, ECOGPS, eastern cooperative oncology group performance status

Table 5. Bivariable and multivariable logistic regression analysis of determinants for PIM use among older cancer patients in Northwest Ethiopia oncologic centers.

		PIM use					
Variables	Category	Yes(n = 192)	No(n = 113)	COR (95% CI)	P-value	AOR (95% CI)	P-value
Gender	Female	141	43	4.5(2.7–7.4)	0.002	1.6(0.8–3.1)	0.11
	Male	51	70	1	Ref	1	Ref
Age	≥75	132	29	9.1(5.2–15.8)	0.004	3.3(1.5–7.1)	0.002*
	70–74	20	4	10(3.2–31.2)	0.006	5.5(1.4–9.8)	0.015*
	65–69	40	80	1	Ref	1	Ref
Polypharmacy	Yes	171	43	13.2(7–16.9)	0.0001	7(3.4–9.4)	0.001*
	No	21	70	1	Ref	1	Ref
Residence	Rural	131	58	2(1.3–3.3)	0.004	1.4(0.75–2.7)	0.27
	Urban	61	55	1	Ref	1	Ref
ECOGPS	IV	15	2	5.8(1.3–27)	0.025	5.7(0.9–6.3)	0.067
	III	49	23	1.7(0.9–3.2)	0.13	1.2(0.5–2.9)	0.76
	II	37	26	1.1(0.6–2.1)	0.77	1.1(0.5–2.8)	0.82
	I	42	24	1.4(0.7–2.6)	0.36	0.98(0.4–2.4)	0.97
	0	49	38	1	Ref	1	Ref
BMI(kg/m^2)	Underweight	261	2	1.9(0.9–3.9)	0.096	1.1(0.4–2.7)	0.84
	overweight	39	6	5.6(2.3–14)	0.001	4.3(0.92–13.3)	0.072
	Obese	29	10	2.5(1.2–5.5)	0.02	3.1(0.72–9.4)	0.063
	Normal	98	85	1	Ref	1	Ref
CCI	Severe	18	2	1.9(0.76–4.8)	0.17	1.3(0.3–4.8)	0.72
	Moderate	84	39	1.6(0.98–2.6)	0.061	1.2(0.6–2.5)	0.61
	Mild	90	67	1	Ref	1	Ref
Stage of cancer	IV	16	7	2.97(1.1–8.6)	0.045	2.4(0.7–8.9)	0.19
	III	37	9	5.3(2.1–13.6)	0.0001	4.2(0.96–14.4)	0.2
	II	82	65	1.6(0.84–3.2)	0.15	1.1(0.5–2.7)	0.77
	I	20	26	1	Ref	1	Ref

	Other stage	37	6	8.1(2.8–22.7)	0.0009	2.5(0.7–9.3)	0.16
Pain score	Severe	18	18	0.78(0.4–1.6)	0.52	0.5(0.2–1.5)	0.23
	Moderate	95	33	2.26(1.3–3.8)	0.002	0.8(0.4–1.2)	0.069
	Mild	79	62	1	Ref	1	Ref
CAM use	Yes	36	12	1.94(0.96–3.9)	0.063	1.4(0.6–3.7)	0.46
	No	156	101	1	Ref	1	Ref
Functional Health status	Dependent	84	53	1.4(0.6–3.1)	0.42	1.7(0.55–5.6)	0.34
	Partially dependent	92	46	1.75(0.8–3.9)	0.17	1.8(0.6–5.8)	0.28
	independent	16	14	1	Ref	1	Ref

Ref: Reference, *Significance p value <0.05

Abbreviations: AOR: adjusted odds ratio, CAM: complementary and alternative medicine, CCI: charlson comorbidity index, CI: Confidence Interval, COR: crude odds ratio, ECOGPS: eastern cooperative oncology group Performance status, PIM: potentially inappropriate medicine

polypharmacy among different studies on older patients with cancer may be due to variations in the study design, study populations, age groups, study settings, and definition of polypharmacy.

The prevalence of PIM use in our study was comparable to earlier studies among older patients with cancer in Taiwan (62.5%) (Lai et al., 2009) and the USA (67.1%) (Ramsdale et al., 2022). However, compared with other studies on older patients with cancer in Jordan (71.6%) (Al-Azayzih et al., 2024), the Netherlands (78%) (van Loveren et al., 2021) and Thailand (69.4%) (Bandidwattanawong et al., 2023), the prevalence of PIM use was lower in our study. This may be due to variations in patient illness features, physician prescription practices, geographic location, and hospital medication lists.

Compared with other studies among older cancer patients in France (34.4%) (Leger et al., 2018), in the USA (51%) (Nightingale et al., 2015), and in Australia (26.5%) (Saarelainen et al., 2014), the prevalence of PIM use in our research was greater. Prescribers must remember that many drugs are situation-specific and not always appropriate for a patients (Steinman et al., 2015). Prescribers need to know the medicines included in the updated AGS 2019 Beers criteria to prevent PIM use (Fick et al., 2019). Moreover, the use of various drugs, which has increased in geriatric oncology in recent years, can be attributed to the increase in PIM use among geriatric patients (Noronha et al., 2021; Prithviraj et al., 2012; Sharma et al., 2016). In our analysis, non-prescription medicines accounted for nearly half of the medicines. Most previous research only included prescription medications, which is possible explanation for the underestimation of PIM use in comparison with our study.

The prevalence of PIM use in our study was higher than earlier Ethiopian studies which have been conducted among older adult patients without cancer (28.6%–47.2%) (Bhagavathula et al., 2021; Getachew et al., 2016; Teka et al., 2016). The reason for the high prevalence of PIM use in our study might be that older patients with cancer are often in extremely poor physical and mental health, and they have a strong inclination to take medicines, including analgesics, sedative-hypnotics, and antitumour agents. Another reason might be that PIM use is strongly associated with unfavourable outcomes in older patients with cancer, and poor clinical outcomes in such patients will intensify the incidence of PIM use (Mohamed et al., 2020).

Our results showed that scheduled use of metoclopramide was the most frequently administered PIM at a rate of 24.1%. One possible reason for this finding is that our participants were receiving cancer chemotherapy, and metoclopramide was commonly prescribed to prevent chemotherapy-induced nausea and vomiting. This finding was in line with the findings of a Jordanian retrospective cross-sectional study, which revealed that

metoclopramide was the most common PIM (Al-Azayzih et al., 2024). In an Indian study, metoclopramide ranked first among PIM with an exceptionally high incidence of prevalence of 54.3% (Jhaveri et al., 2014). Because it may cause extrapyramidal adverse events, metoclopramide is associated with poor health. Furthermore, chronic tardive dyskinesia is a negative side effect of long-term metoclopramide therapy (Marengoni et al., 2011).

NSAIDs were the second most frequently used PIM in this study, with a prevalence rate of 17.7%. When treating moderate-to-severe cancer pain (Mercadante, 2001) arising from surgery, tumour infiltration, metastasis, or chemotherapy-related neuropathy (Looi & Audisio, 2007), NSAIDs can be administered alone or in conjunction with opioids. At diagnosis, >50% of patients with cancer experience moderate to severe pain (Looi & Audisio, 2007). Due to the widespread use of NSAIDs, side effects, such as increased risks of stroke, cardiovascular death, gastrointestinal bleeding, and peptic ulcer disease, must be addressed. These effects are particularly severe in high-risk groups, such as patients $\geq$ 75 years who are on oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents (Pastor Cano et al., 2020). Guidelines from National Comprehensive Cancer Network and AGS recommend the use of the World Health Organization sequential three – step analgesic ladder from non-opioids to weak opioids to strong opioids (Organization, 1996). In addition, psychological support has been demonstrated to modify the subjective perception of pain experiences in older adults (Hachem et al., 2019).

PPIs were the third most implicated PIM in our study with a prevalence rate of 11.7%. PPIs were the most popular medicine class on the PIM list, with a prevalence rate of 33%, according to prospective research conducted in India (Noronha et al., 2021). PPIs were the most common pharmacological class among PIM, with a prevalence rate of 33.3%, according to a cross-sectional study conducted in Brazil (Reis et al., 2017). In older adults, proton pump inhibitors increase the risk of bone loss, fracture, and Clostridium difficile infection (Fick et al., 2019). Although extended therapy for gastroesophageal reflux illnesses is successful, the long-term use of prophylactic proton pump inhibitors may increase the risk of infections, fractures, osteoporosis, hypokalemia, and hypomagnesemia in patients with cancer (Abramowitz et al., 2016). Omeprazole use is associated with hypomagnesemia, bone fractures, and inadequate calcium, iron, and vitamin B12 absorption in studies conducted in Japan (Abramowitz et al., 2016). As a safe substitute for PPIs, histamine-2 receptor antagonists are not recommended for use in patients with delirium according to the Beers criteria because of the risk of worsening their illnesses (Fick et al., 2019).

The fourth most frequently prescribed PIM identified in this study was benzodiazepine (diazepam) (9.4%). This agreed with prior Brazilian research that found benzodiazepines to be among the PIM with a 10.5%

prevalence rate (Reis et al., 2017). International recommendations for anxiety and sleeplessness therapy include the use of benzodiazepines; however, the treatment course should be brief and do not exceed 3 months. A case–control study showing a high risk of Alzheimer's disease among chronic benzodiazepine users (Vaillant-Roussel et al., 2014) highlighted the significant public health concerns associated with the high prevalence and chronic use of benzodiazepines by older adults and the rising incidence of dementia in developing countries. Benzodiazepines increase the risk of fractures, delirium, and cognitive impairment, according to the AGS 2019 Beers criteria. Long-acting drugs are metabolised at a slower rate in older individuals and increase the risk of adverse effects (Marengoni et al., 2011). People who experience anxiety may benefit from buspirone as an alternative (Fick et al., 2019). Nonpharmacological treatments for insomnia include behavioural therapy combined with good sleep hygiene (Hanlon et al., 2015).

The fifth most frequently prescribed PIM in this study were TCAs (7.7%) including amitriptyline (4.4%) and clomipramine (3.3%). Treatment for neuropathic pain, nocturnal sedation, and decreased urination frequency are just a few of the many off-label applications of TCAs. Sometimes, especially when nonsteroidal anti-inflammatory drugs or opioids do not have the desired effect, tricyclic antidepressants are used for cancer pain (Verdu et al., 2008). Anti-convulsant such as pregabalin and gabapentin have better safety profiles than TCA when used as adjuvant treatment for persistent neuropathic pain in older adults (Hachem et al., 2019).

In the multivariable logistic regression analysis, the prevalence of polypharmacy increased by more than three-fold in female patients. This finding is consistent with other studies showing that women are highly susceptible to polypharmacy (Assari & Bazargan, 2019; Johnell et al., 2009). Compared with men, women report more chronic illnesses (Regitz-Zagrosek, 2012). Women are also more likely to seek medical assistance for their disease (Redondo-Sendino et al., 2006). Women generally have higher symptom awareness (Vlahiotis et al., 2010) and better doctor-patient communication (Braybrook et al., 2011).

Advanced age increases the likelihood of polypharmacy by nearly four-fold among older adults with cancer. A nationwide study in Italy found that PP increased with age (Onder et al., 2016). This is because older patients are more likely to have chronic illnesses that require several prescription therapies. These disorders can result in ADEs, poor treatment adherence, and food-drug interactions, among other medicines – related issues (Viktil et al., 2007). Furthermore, elderly patients frequently see several doctors to address complex medical conditions, which increases the possibility of writing several prescriptions for medicines (Gibson et al., 2005). This implies that patients at an advanced age should be closely monitored to prevent polypharmacy, which possibly prevents PIM.

Abnormal body mass index namely underweight, overweight, and obese, increase the likelihood of polypharmacy by more than fivefold among older adult patients with cancer. Research conducted among older patients with cancer in the United States revealed that overweight was a statistically significant predictor of polypharmacy (Assari et al., 2019). The association between polypharmacy and abnormal BMI might be due to undernutrition and overnutrition. Patients with higher BMI have poorer outcomes from cancer treatment than those with normal body weight. Higher BMI affects both the efficacy and toxicity of systemic cancer therapy including chemotherapy (Petrelli et al., 2021). In addition, overweight and obesity are associated with increased cancer mortality (Petrelli et al., 2021; Spei et al., 2019). Patients with higher BMI are at increased risk of reduced physical activity. Physical inactivity is associated with mortality in patients with cancer (Spei et al., 2019). Therefore, physical activity should be the major target of obesity prevention and treatment, particularly for patients with cancer. In addition, physiological and drug-induced factors are associated with undernutrition, which is correlated with polypharmacy in older cancer patients (Kose et al., 2021). Malnutrition may affect pharmacokinetics and pharmacodynamics, potentiate adverse effects of chemotherapy, and induce or worsen side effects (Kose et al., 2021). Therefore, it is necessary to simultaneously evaluate the development of malnutrition during cancer chemotherapy. Multidisciplinary teams should put forth an effort to recognise and mitigate the potential impact of patients' nutritional status on polypharmacy.

Comorbidities increase the likelihood of polypharmacy by more than three-fold among older adults with cancer. This result was consistent with that of previous studies, which found a substantial correlation between polypharmacy and several number of comorbidities (Morio et al., 2019; Nightingale et al., 2015; Prithviraj et al., 2012). Patients with geriatric oncology experience significant challenges related to comorbidities, impairments, and diseases. Patients also have a higher likelihood of using several drugs and experiencing the adverse effects of medicines (Korc-Grodzicki et al., 2014). Therefore, physicians and other healthcare professionals should pay close attention when prescribing medicines to older patients with cancer and comorbidities.

Advanced age increases the likelihood of PIM by three- to five-fold among older adults with cancer. This finding agrees with prior Chinese retrospective research (Tao et al., 2021), which focused on patients without cancer. One plausible explanation for this finding might be that as an individual's age and illness management progresses, the incidence of comorbidities increases, requiring intense and concurrent medicines use. According to a Spanish study, the use of PIM increased by 14% or 15% for every extra prescription medication (Hudhra et al., 2016).

Polypharmacy increases the likelihood of PIM by seven-fold among older adults with cancer. Our results agreed with those of other studies among older patients with cancer (Nightingale et al., 2015; Prithviraj et al., 2012). Depending on the population analyzed and the definition of polypharmacy, another study on older patients with cancer reported that the prevalence of polypharmacy ranged from 2%–80% (Karuturi et al., 2018). This is expected as patients with cancer are administered several medicines in addition to chemotherapy, such as analgesics, antiemetics, and vitamins. Our findings are consistent with those of other studies showing a strong association between polypharmacy and PIM (Mohamed et al., 2021; Prithviraj et al., 2012; Tao et al., 2021). This implies close monitoring of patients with cancer who are receiving polypharmacy to prevent PIM.

Deprescribing has been successful in reducing PIM use and polypharmacy among elderly individuals (Ammerman et al., 2019; Hansen et al., 2018). Therefore, systematic approaches that reduce improper prescription of unnecessary medicines should be used to limit polypharmacy. Encouraging physicians to weigh the risks and benefits when recommending medicines to older patients, particularly those with polypharmacy, is crucial. To reduce the use of PIM, patient-centered educational programmes for the older adult patients with cancer that focus on medicines use should be established, as well as joint prescriber-pharmacist assessments of medications. It has been reported that clinical pharmacists assist in the care of older adults with cancer undergoing PIM treatment and that this is crucial for conducting a thorough assessment of pharmacotherapy (Nightingale et al., 2015). The aspects of prescription and over-the-counter medicines, geriatric and oncologic pharmacotherapy, and medicine assessments should consider aging-related pharmacokinetic and pharmacodynamic changes. This approach is critical for assessing the care of older cancer patients, improving the efficacy and safety of pharmacotherapy, and lessening the negative effects of PIM on a patient's functioning, autonomy, and quality of life.

Strengths and limitations of this study

It is important to consider the following limitations when interpreting the findings of our study. Our study did not assess the use of PIM from the perspective of the prescriber. Older individuals may not remember all their prescriptions; thus, recall bias may occur. We were unable to pinpoint the exact causal relationship between the predictor variables and PIM use and PP. Therefore, further longitudinal studies are required. Despite these limitations, this is the first study to evaluate the prevalence of PIM and PP in older adults diagnosed with cancer. In addition, this is the first multicenter cross-sectional study to evaluate the association

between PP and PIM use in Northwest Ethiopia oncology centers among older adults with cancer.

Conclusions

Polypharmacy and PIM use are prevalent among older patients with cancer. Female gender, advanced age, abnormal body mass index, and comorbidities were statistically significant determinants of polypharmacy. Polypharmacy and advanced age were significant determinants of PIM use. Ensuring safe medicine prescription practices for older patients with cancer requires understanding the issue, stopping unwarranted treatment, replacing it with a less toxic drug, and administering age-appropriate medicines. Pharmaceutical care that prevents PIM use and PP is crucial for reducing associated burdens. Further research into possible causes and the creation of action plans can enhance healthcare practitioners' compliance with the AGS Beers criteria.

Abbreviations

ADEs: adverse drug events, AGS: American Geriatric Society, AOR: adjusted odds ratio, BMI: body mass index, BSA: body surface area, CCI: charlson comorbidity index, CI: confidence interval, COR: crude odds ratio, DCIs:drug-cancer treatment interactions, DDIs: drug–drug interactions, DM: diabetes mellitus, ECOGPS: eastern cooperative oncology group performance status, FHCSH: Felegehiwot Comprehensive and Specialized Hospital, NSAIDs: nonsteroidal anti-inflammatory drugs, PP: polypharmacy, PIM: potentially inappropriate medicine, OTC: over-the-counter, PPIs: proton pump inhibitors, QOE: quality of evidence, SOR: strength of recommendation, TCAs: tricyclic antidepressants, TGCSH: Tibebe-Ghion Comprehensive and Specialized Hospital, UoGCSH: University of Gondar Comprehensive and Specialized Hospital.

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Author contributions

S.A.W., F.B.T. responsible for writing an original draft, validation, supervision, resources, project administration, methodology, investigation, formal analysis, visualisation, software, data curation, and conceptualisation. **T.A.M.**, **S.B.D.** responsible for writing an original draft, visualisation, supervision, software, resources, methodology, investigation, formal analysis, data curation, and conceptualisation. **F.N.D, T.K.Z., R.B.A.** responsible for writing an original draft, validation, software, project administration, investigation, and formal analysis. **E.AM.** responsible for writing an original draft, software, project administration, investigation, funding

acquisition, and data curation. All authors have read and approved the final version of the manuscript.

Consent to publish the study

All authors provided informed consent for publication.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethics approval and consent to participate

Ethical approval was obtained from the Institutional Review Board of Bahir Dar University (Ref No: 796/2023). Written informed consent was obtained from the participants after explaining the study objective. The confidentiality of patients maintained by omitting patient identifiers and code numbers. All rules and regulations were followed according to the Helsinki Declaration.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

ORCID

Samuel Agegnew Wondm http://orcid.org/0000-0002-0723-6804
Tilaye Arega Moges http://orcid.org/0000-0001-6813-8792
Tirsit Ketsela Zeleke http://orcid.org/0000-0003-3528-0703
Rahel Belete Abebe http://orcid.org/0000-0002-2560-2951
Fasil Bayafers Tamene http://orcid.org/0009-0005-3026-6584
Samuel Berihun Dagnew http://orcid.org/0000-0002-8938-4551

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