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Original Article

Impact of Pharmacist-Led Medication Optimization on Treatment Adherence and Quality of Life in Elderly Cancer Patients

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ABSTRACT

Background: Elderly cancer patients often face challenges related to polypharmacy, Medication-Related Problems (MRPs), and comorbidities, which can compromise treatment adherence and Quality of Life (QoL). Pharmacist-led interventions, such as the Integrated Medication Assessment and Planning (iMAP) program, have shown promise in addressing these issues. To assess the effect of the iMAP program on QoL, MRPs, and medication adherence among elderly cancer patients. **Materials and Methods:** A randomized controlled trial was carried out at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre in Belagavi, India over the period from January 2022 to December 2023. A total of 238 elderly cancer patients (aged 65 years and above) were randomly assigned to either the intervention (iMAP) group (n=119) or the control group (n=119). The iMAP program involved a pharmacist-led comprehensive medication review, identification of MRPs, and development of a personalized medication plan, with follow-ups at 30 and 60 days. Outcomes included QoL (assessed with the SF-36 questionnaire), medication adherence (measured by the Medication Adherence Rating Scale [MARS]), and the number of MRPs. Statistical analysis utilized paired t-tests and chi-square tests, with p<0.05 considered significant. **Results:** In our study, SF-36 scores showed significant improvement across all domains over 60 days. Vitality, physical functioning, and mental health notably increased (p<0.001). Age, gender, education, cancer type, and stage were significant predictors of HRQOL. Medication adherence significantly improved in the intervention group, increasing a mean MARS score from 5.52±1.48 at baseline to 6.56.1±1.47 at 60 days (p<0.001). The intervention group also experienced a substantial reduction in MRPs, from 3.8±1.4 to 1.5±1.1 (p<0.001), with high-resolution rates for suboptimal drug use (72%) and non-adherence (85%). Additionally, healthcare utilization decreased, with lower hospital readmission rates (12% vs. 22%, p<0.05) and fewer emergency department visits (18% reduction, p<0.01) in the intervention group. **Conclusion:** The iMAP program significantly improved medication adherence, reduced MRPs, and enhanced QoL in elderly cancer patients. These findings support the integration of pharmacist-led interventions into oncology care to optimize patient outcomes and reduce healthcare utilization.

Keywords: Pharmacist-led intervention, Elderly cancer patients, Medication adherence, Quality of life, iMAP, Medication-related problems, Randomized controlled trial.

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INTRODUCTION

Elderly cancer patients face a multitude of challenges, including the burden of polypharmacy, a high prevalence of Medication-Related Problems (MRPs), and complex comorbidities. These factors can significantly compromise treatment adherence, efficacy, and overall Quality of Life (QoL). Poor medication adherence among this population has been associated with suboptimal treatment outcomes, increased healthcare utilization, and reduced survival rates (Greer *et al*., 2016-Mohile *et al*., 2020).

Pharmacist-led interventions have emerged as an effective strategy to address these challenges. Programs like the Integrated Medication Assessment and Planning (iMAP) focus on optimizing medication regimens by conducting comprehensive medication reviews, resolving MRPs, and improving communication between patients and healthcare teams (Rudolph *et al*., 2018). Studies have demonstrated that such interventions can enhance adherence, reduce MRPs, and improve QoL in elderly patients with chronic conditions, including cancer (Van Campen *et al*., 2022).

Despite encouraging preliminary evidence, there remains a scarcity of research investigating the effectiveness of structured,

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pharmacist-led initiatives in oncology care, particularly for older adults. This study seeks to assess the influence of the iMAP program on medication adherence and QoL in elderly cancer patients. By resolving MRPs and customizing treatment plans to meet individual requirements, we propose that this intervention will significantly enhance both adherence and QoL outcomes. The current study is panned to assess the effect of the iMAP program on QoL, MRPs, and medication adherence among elderly cancer patients.

MATERIALS AND METHODS

Study Design

It was a randomized controlled trial which was carried out over the period of 2 years from January 2022 to December 2023.

Study Site and Participants

The study was carried out at a KLES Dr. Prabhakar Kore Hospital and Medical Research Centre in Belagavi, India. The selected population was the older cancer patients from in patients admitted to the Oncology Inpatient Department. A total of 238 cancer patients aged 65 years and older were enrolled in the study.

Sample Size Estimation

A total of 238 individuals (119 in each group) were calculated by power (80%) and significance level (5%).

Eligibility criteria

Participants were required to have a confirmed cancer diagnosis, be undergoing active cancer treatment, and be capable of providing informed consent. They were randomly assigned to either the intervention group (iMAP) or the control group. Randomization was conducted using a computer-generated allocation sequence to ensure equal distribution, with 119 participants in each group.

Intervention

The intervention group received the iMAP program, which was designed to optimize medication management. A clinical pharmacist conducted a comprehensive review of each patient's medication regimen, identified MRPs, and created a personalized medication plan. The pharmacist provided patient education, adjusted medications as necessary, and communicated with the healthcare team to address MRPs. Follow-up assessments were conducted at 30 and 60 days to evaluate adherence, QoL, and MRPs.

The control group received standard care, which included routine clinical management without pharmacist-led interventions.

Data Collection

Data was collected using well-designed data collection forms, informed consent forms, patient ID cards, patient information leaflets, and questionnaires. The study assessed medication-related problems, compliance with chemotherapy, and quality of life of cancer patients. Informed consent was obtained from all participants.

Statistical Analysis

Descriptive statistics were employed to summarize the baseline characteristics. To assess changes in outcomes from baseline to follow-up, multivariate linear regression was used for the SF-36 questionnaire, while one-way ANOVA tests were applied for medication adherence. A p-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS software (version 27.0).

Materials

The materials utilized in the study include informed consent forms, patient ID cards, data collection forms, patient information leaflets, questionnaires, and quality of life scales. These materials are essential for participant recruitment, data collection, and assessment of study outcomes.

Study outcomes

Medication adherence was assessed using the Medication Adherence Rating Scale (MARS), which evaluates adherence behavior on a scale of 0 to 10. Quality of life is measured using the SF-36 questionnaire, which assesses various domains, including vitality, physical functioning, bodily pain, general and mental health, and physical, emotional, and social role functioning. Number and types of MRPs identified and resolved, including suboptimal drug use, undertreatment, non-adherence, and drug interactions.

RESULTS

Participant Characteristics

Our study included 238 participants, with a mean age of 50.1±13.8 years. The largest proportion of participants fell within the 45-59 years age group (44.1%), followed by those aged 60-74 years (22.7%). Younger participants aged 15-29 years comprised 10.1%, while individuals aged ≥75 years accounted for 5.5%. The study population consisted of a marginally higher percentage of females (53.8%) than males (46.2%). Regarding education, 31.93% were college graduates, 24.78% had completed technical school, and 16.38% held postgraduate degrees. A smaller percentage had elementary school (11.76%) or high school education (15.12%).

Among cancer types, solid malignancies were more common than hematologic malignancies. Breast cancer was the most prevalent (18.06%), followed by colorectal cancer (13.02%), lung cancer (12.18%), and pancreatic cancer (10.92%). Hematologic malignancies included lymphoma (10.50%) and myeloma (8.40%). Regarding cancer stages, stage IV was the most frequent (33.6%), followed by stage III (26.9%), stage II (20.6%), and stage I (18.9%), as detailed in Table 1.

Quality of Life (SF-36)

In our study, SF-36 scores improved across multiple domains over 60 days (Table 2). Vitality increased from 45.9 at baseline to 63.4 at 60 days ($p<0.001$). Physical functioning rose from 44.0 at baseline to 70.2 at 60 days ($p<0.001$). Bodily pain improved from 40.5 to 63.9 ($p=0.011$ at baseline; $p<0.001$ at follow-ups). General health perceptions increased modestly from 66.1 to 67.5 ($p=0.002$). Physical role functioning improved significantly from 41.0 to 65.3 ($p<0.001$), while emotional role functioning increased from 33.0 to 62.1 ($p<0.001$). Social role functioning rose from 62.3 to 82.7 ($p<0.001$), and mental health scores improved from 57.1 to 74.9 ($p<0.001$).

A multivariate regression analysis (Table 3) found that age negatively impacted HRQOL (β = -0.095, $p=0.047$), while male gender (β = 2.012, $p<0.001$) and higher education (β = 1.678, $p=0.021$) were positively associated with HRQOL. Participants with solid malignancies (β = -1.482, $p=0.014$) and stage III tumors (β = -0.953, $p=0.031$) had lower HRQOL scores. These results underscore the influence of demographic and clinical factors on HRQOL outcomes, as shown in Table 3.

Medication Adherence (MARS)

In our study, the mean scores for the interventional group showed a consistent increase over the 60 days, while the control group demonstrated a gradual decline. At baseline, the mean score in the interventional group was 5.52±1.48, compared to 4.20±2.10 in the control group. By the 30th day, the interventional group improved to 6.09±1.49, while the control group slightly declined to 3.95±2.05. At the end of the 60th day, the interventional group further improved to 6.56±1.47, whereas the control group continued to decrease to 3.72±2.00 as shown in Table 4 and Figure 1.

One-way ANOVA was used to compare the mean scores between the two groups at each time point. At baseline, the between-group difference was statistically significant (F = 32.74, $p=0.000$; Mean Square = 115.32). On the 30th day, the difference remained significant and became more pronounced (F = 47.82, $p=0.000$; Mean Square = 158.45). By the 60th day, the difference further widened, with an F-value of 54.26 and a p-value of 0.000 (Mean Square = 172.36). These results confirm that the intervention had a statistically significant and progressive impact over time as shown in Table 5.

Medication-Related Problems

At baseline, the mean number of MRPs was similar between the intervention group (3.8±1.4) and the control group (3.9±1.3, $p>0.05$).

By the 30-day follow-up, the number of MRPs in the intervention group significantly decreased to 2.1±1.2 ($p<0.01$), whereas the control group exhibited only a minor reduction to 3.7±1.3 ($p=0.08$).

At the 60-day follow-up, the intervention group showed a significant decline in MRPs, reducing to 1.5±1.1 ($p<0.001$). In contrast, the control group experienced minimal change, with MRPs remaining at 3.5±1.2 ($p=0.07$) as shown in Table 6.

Table 1: Demographic and Clinical Characteristics of the Study Population.

Characteristics	Group	Frequency N (%) = 238
Age: Mean±SD	50.1±13.8	-
Age Group (years)	15-29	24 (10.1)
	30-44	42 (17.6)
	45-59	105 (44.1)
	60-74	54 (22.7)
	>75	13 (5.5)
Sex	Female	128 (53.8)
	Male	110 (46.2)
Education	Elementary School	28 (11.76)
	Highschool	36 (15.12)
	Technical school	59 (24.78)
	College Graduate	76 (31.93)
	Postgraduate	39 (16.38)
Cancer Type		
Solid Malignancies	Breast Cancer	43 (18.06)
	Colorectal Cancer	31 (13.02)
	Lung Cancer	29 (12.18)
	Pancreatic Cancer	26 (10.92)
	Prostate Cancer	24 (10.08)
	Others	40 (16.80)
Hematologic Malignancies	Lymphoma	25 (10.50)
	Myeloma	20 (8.40)
Cancer stages	I	45 (18.9)
	II	49 (20.6)
	III	64 (26.9)
	IV	80 (33.6)
Recurrence	Local Recurrence	21 (15.32%)
	Metastatic recurrence	29 (21.16%)

Table 2: SF-36 score trends in the intervention group.

SF-36 scores	Baseline		30 days		60 days	
	Intervention Group	*p*-value	Intervention Group	*p*-value	Intervention Group	*p*-value
Vitality	45.9	0.057*	58.25	<0.001*	63.4	<0.001*
Physical functioning	44.0	0.312	62.3	<0.001*	70.2	<0.001*
Bodily pain	40.5	0.011*	57.6	<0.001*	63.9	<0.001*
General health perceptions	66.1	0.093	66.9	0.002*	67.5	0.002*
Physical role functioning	41.0	0.121	58.4	<0.001*	65.3	<0.001*
Emotional role functioning	33.0	0.015*	55.2	<0.001*	62.1	<0.001*
Social role functioning	62.3	0.013*	74.3	<0.001*	82.7	<0.001*
Mental health	57.1	0.028*	65.9	<0.001*	74.9	<0.001*

* Statistically significant $p<0.05$.SF Scores range from 0-100, Lower scores indicate more disability, higher scores indicate less disability.

Table 3: Multivariate linear regression study of HRQOL-related variables.

Factors	β coefficient	Standard error	*p*-value
Age	-0.095	0.051	0.047*
Gender (male)	2.012	0.598	<0.001*
Education (college graduate)	1.678	0.723	0.021*
Cancer type (solid malignancies)	-1.482	0.6382	0.014*
Tumor stage (III)	-0.953	0.412	0.031*

*Statistically significant $p<0.05$.

Table 4: Mean and Standard Deviation (SD) of MARS Scores in both Groups.

Timepoint	Control Group (Mean±SD)	Interventional Group (Mean±SD)
Baseline (0^{th} day)	4.20±2.10	5.52±1.48
30^{th} day	3.95±2.05	6.09±1.49
60^{th} day	3.72±2.00	6.56±1.47

Types of MRPs Addressed in the Intervention Group

Suboptimal drug use was resolved in 72% of cases, showing a significant improvement from 45% at baseline. Similarly, undertreatment was addressed in 64% of cases, rising from an initial 30%. Non-adherence saw the highest resolution rate, improving from 40% at baseline to 85%. Drug interactions were also effectively managed, with resolution increasing from 25% to 70% of cases as shown in Table 7.

Healthcare Utilization

The intervention group experienced a reduction in hospital readmissions, with 12% of patients readmitted compared to 22% in the control group ($p<0.05$).

The intervention group experienced a significant 18% reduction in emergency department visits compared to the control group ($p<0.01$).

Satisfaction levels were significantly greater in the intervention group, where 92% of participants expressed satisfaction with pharmacist consultations, compared to 65% in the control group ($p<0.001$).

DISCUSSION

The findings of this study highlight the essential role of pharmacist-led interventions in addressing the challenges faced by elderly cancer patients, particularly with QoL and medication adherence. These results align with and expand upon the growing body of evidence supporting the positive impact of pharmacist involvement in improving patient outcomes.

QoL improvements in the intervention group further underscore the importance of pharmacist-led care. The intervention group demonstrated significant improvements in both general and mental health, bodily pain scores and specific functional domains, including physical, emotional, social, and role functioning ($p<0.001$). These improvements not only reflect better physical

health outcomes but also suggest a reduction in the psychological burden associated with cancer and its treatment. This aligns with findings from Nolazco *et al*., (2018), who reported that supportive care interventions, including pharmacist involvement, resulted in enhanced QoL metrics for cancer patients undergoing treatment. The significant improvements in emotional and social functioning underscore the holistic benefits of addressing MRPs and adherence challenges, demonstrating that pharmacist interventions can positively impact both the physical and psychological well-being of cancer patients.

In terms of medication adherence, the intervention group experienced a significant improvement ($p<0.001$). This finding supports the effectiveness of pharmacist interventions in promoting medication compliance, which has been consistently demonstrated in previous research. For example, a meta-analysis by Mekonnen *et al*., (2016) emphasized the ability of pharmacists to enhance adherence rates through strategies such as medication counseling, education, and follow-ups. In contrast, the control group showed no substantial improvement, suggesting that standard care alone is insufficient in addressing the complex adherence barriers often faced by elderly patients, particularly those undergoing cancer treatment.

The reduction in MRPs observed in the intervention group is another noteworthy finding. The number of MRPs decreased significantly from 3.8 to 1.5 ($p<0.001$), reflecting the effectiveness of pharmacists in optimizing medication regimens. This result is consistent with previous studies, such as the work of Kaboli *et al*., (2006), which highlighted pharmacists' ability to resolve MRPs through medication reconciliation and adjustments. Specifically, the intervention led to a high-resolution rate for specific MRPs, including suboptimal drug use (72%) and non-adherence (85%). These findings further validate the crucial role of pharmacists in enhancing medication safety and efficacy, which ultimately improves patient outcomes. In contrast, the control group showed minimal changes in MRPs, emphasizing the need for proactive pharmacist involvement in addressing these issues.

The findings also highlight the impact of pharmacist-led interventions on healthcare utilization. The intervention group experienced reductions in hospital readmissions (12% vs. 22%, $p<0.05$) and emergency department visits (18% decrease, $p<0.01$), which is consistent with previous research that demonstrated how optimizing medication management can reduce the need for healthcare services. Pellegrin *et al*., (2017) found that pharmacist-led medication management decreased medication-related hospitalizations, which is a significant finding considering the high rate of hospital readmissions and emergency visits among elderly cancer patients. These reductions in healthcare utilization also reflect the broader benefits of effective medication management in improving disease control and preventing adverse events.

Additionally, the higher satisfaction rates among patients in the intervention group (92% vs. 65%, $p<0.001$) further highlight the value of pharmacist-patient interactions in enhancing patient care. Patients who received pharmacist-led interventions expressed greater satisfaction with their treatment, suggesting that these interventions foster trust and improve overall health outcomes. This finding is consistent with Mekonnen *et al*., (2016), who emphasized that pharmacist-patient interactions are integral to building trust and improving adherence, which ultimately leads to better health outcomes.

Overall, the results of this study provide strong evidence for the benefits of pharmacist-led interventions in addressing the

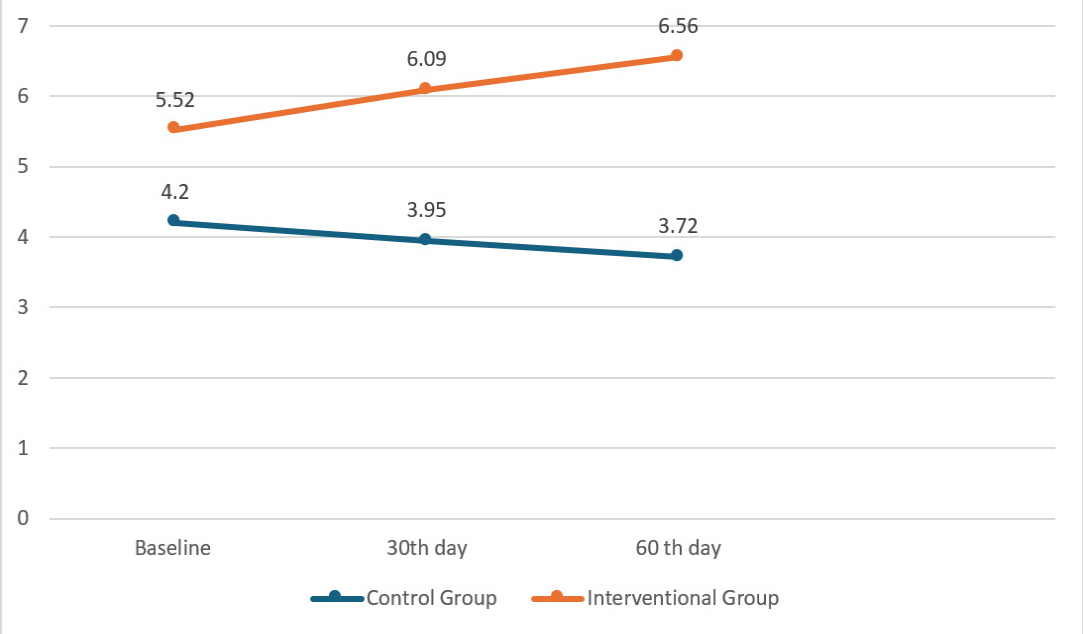

Figure 1: Medication adherence in both groups.

Table 5: Summary of One-Way ANOVA of MARS scores.

Source	Sum of Squares	d_f	Mean Square	F	Sig.
Baseline					
Between-group	115.32	1	115.32	32.74	0.000*
Within group	1042.19	236	4.42		
30 days					
Between-group	158.45	1	158.45	47.82	0.000*
Within group	546.82	165	3.31		
60 days					
Between-group	172.36	1	172.36	54.26	0.000*
Within group	445.78	139	3.21		

*Statistically significant $p<0.05$.

Table 6: Medication-Related Problems (MRPs).

Parameters	Intervention group	Control group
Baseline MRPs	3.8±1.4	3.9± 1.3, $p>0.05$
30-Day Follow-Up	reduced to 2.1±1.2 ($p<0.01$)	Slight reduction to 3.7±1.3 ($p=0.08$)
60-Day Follow-Up	Significant reduction to 1.5±1.1 MRPs ($p<0.001$)	Minimal change to 3.5±1.2 ($p=0.07$)

Statistically Significant $p<0.05$.

Table 7: Types of MRPs Addressed in the Intervention Group.

Types	Baseline	Resolved
Suboptimal Drug Use	45%	72%
Undertreatment	30%	64%
Non-Adherence	40%	85%
Drug Interactions	25%	70%

unique challenges faced by elderly cancer patients. By improving medication adherence, resolving MRPs, enhancing QoL, and reducing healthcare utilization, pharmacists play a critical role in optimizing care for this vulnerable patient population. These findings underscore the importance of integrating pharmacists into the multidisciplinary care teams of elderly cancer patients to improve both the clinical and quality of life outcomes for these patients.

CONCLUSION

This study highlights the effectiveness of pharmacist-led interventions in enhancing medication adherence, reducing MRPs, and improving QoL in elderly cancer patients. The results, which align with previous research, support the inclusion of pharmacists in oncology care teams to improve patient outcomes and minimize healthcare utilization.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

QoL: Quality of Life; **MRP:** Medication-Related Problems; **iMAP:** Integrated Medication Assessment and Planning; **SPSS:** Statistical Package for the Social Sciences; **MARS:** Medication Adherence Rating Scale; **SF-36:** Short form-36 Questionnaire - Core 30; **ED:** Emergency Department.

ETHICAL STATEMENTS

Ethical clearance for this study was obtained from the Institutional Ethical Committee KLE Academy of Higher Education and Research to carry out this research project. IEC Number: KAHER/ EC/20-21/001/9.

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