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Original Article

Pharmacist's Evaluation of Medication Related Problems with Cancer: An Individualized Medication Assessment and Planning (iMAP) Approach

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ABSTRACT

Background: Improving outcomes for cancer patients, particularly older adults with complex health requirements, necessitates optimizing drug therapy. The Individualized Medication Assessment and Planning (iMAP) program, a pharmacist-led intervention, was developed to address Medication-Related Problems (MRPs) in this population. This study aims to evaluate the effectiveness of the iMAP program in reducing MRPs, improving treatment compliance and enhancing the quality of life in elderly cancer patients. **Materials and Methods:** A randomized controlled trial was conducted involving 238 older cancer patients, with 137 participants receiving the iMAP intervention. Participants were randomized into intervention and control groups using computer-generated basic randomization. Data on MRPs, chemotherapeutic compliance and quality of life were collected using standardized forms and questionnaires. Statistical analysis, including chi-square tests, was performed to evaluate the intervention's effectiveness. **Results:** The mean age of participants in the iMAP intervention group was 79.1 years (SD=8.10). The iMAP intervention significantly reduced the mean number of MRPs from baseline to the 30- and 60-day follow-ups ($p<0.05$). The intervention identified and addressed specific MRPs related to suboptimal drug usage, under treatment and non-adherence. **Conclusion:** The pharmacist-led iMAP intervention effectively reduces MRPs in elderly cancer patients. The results highlight the importance of further research and the implementation of pharmacist-led interventions to improve medication management practices and outcomes in cancer care settings.

Keywords: Elderly cancer patients, Pharmacist-led intervention, Individualized Medication Assessment and Planning (iMAP), Medication-Related Problems (MRPs), Randomized Controlled Trial (RCT), Chemotherapeutic compliance, Quality of life (QoL), Drug therapy optimization, Cancer treatment outcomes.

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INTRODUCTION

Medication Therapy Management (MTM) programs play a pivotal role in ensuring optimal patient care, particularly among older adults and individuals with complex health needs such as cancer patients. Ten crucial processes are included in the patient-centered Medication Therapy Management (MTM) project called Individualized Medication Assessment and Planning (iMAP), which aims to improve the safety and efficacy of medications. While initially designed for those aged 65 and above, its relevance extends to diverse patient populations grappling with multiple comorbidities and medication regimens.[1] Assessing medication appropriateness in cancer patients involves navigating various risk factors, including adverse effects, drug interactions and disease-specific considerations. Established criteria standards like Beers Criteria and the Medication Appropriateness Index (MAI) provide frameworks for evaluating medication suitability, encompassing aspects such as indications, dosing and potential interactions.[2]

Polypharmacy, a common phenomenon in older adults, poses significant challenges in cancer care. Limited attention has been directed towards polypharmacy in older cancer patients, with research indicating substantial medication burdens among this demographic. Studies have highlighted a prevalence of potentially inappropriate medications and drug interactions, further compounded by the complexities of cancer treatment.[3] In epidemiological terms, the prevalence of polypharmacy among older cancer patients is notable. Studies, such as the one conducted in Denmark, reveal that a considerable proportion of elderly cancer patients are prescribed multiple medications, often escalating with disease progression. Interestingly, the onset

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of polypharmacy can precede the cancer diagnosis, potentially indicating early symptoms prompting medication initiation.[4]

Pharmacists play a critical role in optimizing medication use for cancer patients, not only in the technical aspects of dispensing but also in providing clinical expertise. While the technical roles of pharmacists in chemotherapy preparation are well-defined, their clinical responsibilities vary across regions, leading to inconsistencies in patient care quality. A standardized script mirrored the strategy used during the first in-person visit and directed the delivery of the iMAP intervention at the 30- and 60-day follow-up intervals (Figure 1). We called each patient at the primary or backup number that they had supplied. At every follow-up session, there were up to five efforts to get in touch with the patient, caregiver, or proxy. The patient/caregiver report was given priority over pharmacy data in the event of any discrepancy.[5] If any new Medication-Related Problems (MRPs) were found during these follow-up visits, the clinical pharmacist would either provide the patient advice directly or direct instructions to follow up with their prescribing physician or office. An adaptable version of the iMAP classification tool served as the foundation for the MRP assessment, enabling the methodical classification and prioritizing of issues that were found. This approach ensures continuity of care beyond the initial intervention, allowing for ongoing monitoring, identification and resolution of MRPs, thereby optimizing medication management and patient outcomes.

Modified version of the Individualized Medication Assessment and Planning (iMAP) Intervension

Medication-Related Problems (MRPs) are categorized by the iMAP software using the American Society of Health-System Pharmacists (ASHP) categorization system. Numerous criteria are covered by this categorization system, such as monitoring requirements, non-adherence, under treatment and suboptimal medication usage, dosage, duration, frequency and administration. (Figure 2).[6,7] By employing this classification system, the iMAP program ensures a structured approach to identify and address MRPs systematically. Each category allows for a comprehensive assessment of medication-related issues, facilitating tailored interventions to optimize medication therapy and improve patient outcomes. Utilizing the ASHP classification system enhances the consistency and effectiveness of the iMAP program, aligning with established standards in pharmacy practice. This approach promotes patient-centred care by addressing a wide range of medication-related concerns, ultimately contributing to safer and more effective medication use.

This article explores the landscape of medication-related issues in cancer care, emphasizing the need for standardized clinical services provided by pharmacists to ensure safe, effective and economical use of cancer drugs. By elucidating the challenges and opportunities in medication management for cancer patients, this study aims to contribute to the advancement of patient-centered care in oncology settings.

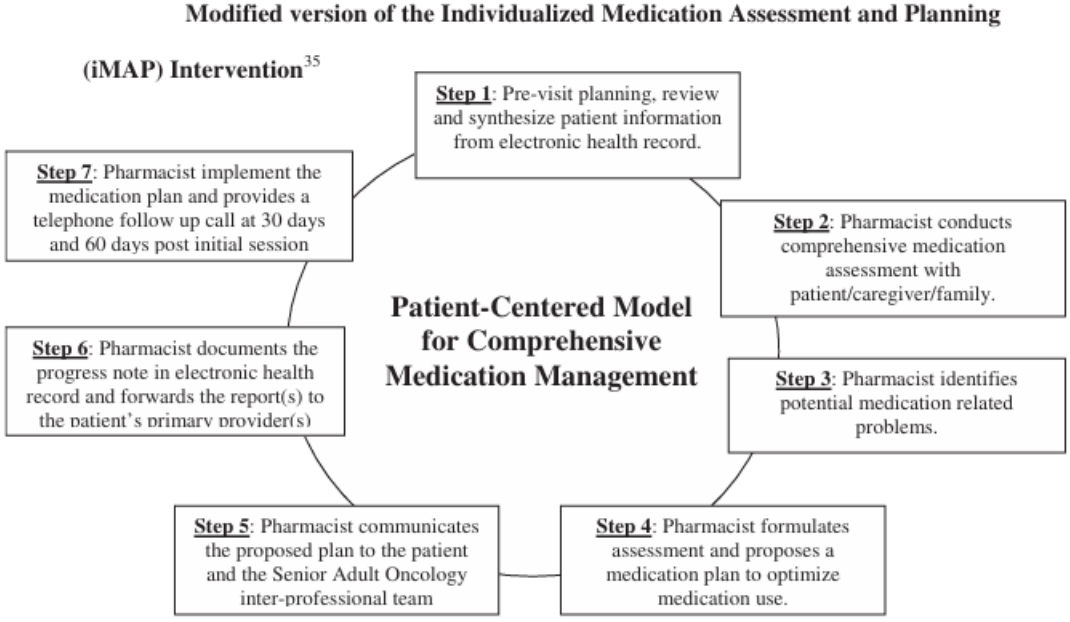

Fig. 1. Modified version of the Individualized Medication Assessment and Planning (iMAP) Intervention [35].

Figure 1: iMAP Intervention in a modified version.[5]

Table 1
Medication related problems classification system [35,37].

Variable	Brief description	Data source(s)
Under-treatment	The patient has a medical condition, laboratory abnormality, or risk factors for a disease that would benefit from drug therapy (clear indication), and the patient has no contraindications to the drug, but the drug was not prescribed.	Pharmacist determination from patient interview, chart /lab review
Suboptimal medication use	The patient is taking an appropriate medication but the dose, duration, frequency or administration is not optimal to achieve the desired response or has the potential for harm.	Pharmacist determination from medication review
Med monitoring needed	The individual is receiving a drug, and monitoring is required to assess response to therapy or prevent harm but has not been done *(e.g. angiotensin- converting enzyme inhibitor initiated without appropriate follow-up monitoring of potassium and serum creatinine concentrations)*	Pharmacist determination from medication /laboratory review
Suboptimal drug	The individual is receiving a drug that has no indication, is not effective or is potentially not safe (e.g., risk of using drug outweighs benefit)	Pharmacist determination from patient interview and chart review
Adverse drug reaction present	The patient is experiencing an actual adverse Consequence attributed to a drug or the inappropriate use of a drug.	Pharmacist determination from patient interview and chart / medication review
Non-adherence	The patient has not filled a prescription, is not taking a drug, or is not using a drug as prescribed whether intentional or unintentional using the 8-item Morisky Medication Adherence Scale (MMAS): MMAS 0–5: Low adherence MMAS 6–7: Moderate adherence MMAS 8: High adherence	Pharmacist determination from patient (self-report)
Afford-ability	Does the patient have difficulty paying for prescription medications? [Yes/no]	Pharmacist determination from patient interview and social worker report

Figure 2: Medication related problems classification system.[6,7]

MATERIALS AND METHODS

Study Design

In order to evaluate the impact of a pharmacist-led intervention utilizing iMAP program on MRPs among elderly cancer patients, this study used a randomized controlled design. The influence of the Medication Therapy Management (MTM) model on iMAP is another goal of the study.

Study Site and Population

The study was conducted at KLES Dr. Prabhakar Kore Hospital and Medical Research Centre in Belagavi, India. The target population comprises older cancer patients admitted to the Oncology Inpatient Department.

Sample Size Estimation

The difference in the proportion of cancer patients between the intervention and control groups is used to calculate the sample size. A total sample size of 238 individuals (119 in each group) is calculated using a procedure that accounts for power (80%) and significance level (5%). Of the 238 senior citizens who were assessed for enrolment, 144 qualified patients were able to sign up for the research. 137 cases were subsequently included to the final analysis. Their participation was contingent upon their fulfilment of the 30-day and 60-day telephone follow-up sessions, which guaranteed thorough data gathering and analysis.

Randomization

Participants will be randomly allocated to either the intervention (study) group or the control group using computer-generated simple randomization. Sequentially Numbered, Opaque, Sealed Envelopes (SNOSE) method will be employed for concealment.

Study Procedures

The iMAP program consists of 10 essential steps, which will be implemented in the intervention group. These steps include reviewing medical records, conducting comprehensive medication reviews, identifying MRPs, formulating assessment and optimization plans, communicating with primary care providers, implementing plans, educating patients, documenting in medical records, reconciling medications and providing ongoing follow-up.

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 obtained from all participants.

Data Analysis

Statistical methods such as chi-square tests and other appropriate techniques was utilized to analyse the collected data. The analysis was focused on evaluating the effectiveness of the pharmacist-led intervention in reducing MRP among older cancer patients and its impact on compliance and quality of life.

Materials

The materials utilized in the study includes 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

The primary outcomes include assessing the effectiveness of the pharmacist-led intervention on MRP among older cancer patients and evaluating the impact of the MTM model on individualized medication assessment and planning.

RESULTS

The study included a total of 238 participants, with 137 individuals receiving the iMAP intervention. The mean age of all participants was 77.7 years (SD=8.53), ranging from 65 to 101 years. Among those receiving the iMAP intervention, the mean age was slightly higher at 79.1 years (SD=8.10). The distribution of participants across age ranges showed a predominance of individuals aged 80-89 years in both groups (Table 1). Regarding gender distribution, 53.78% of participants were females and 46.21% were males. This distribution was similar in the iMAP intervention group, with 54.74% females and 45.25% males (Table 1). In terms of education level, the majority of participants had completed at least a technical school education, with 24.78% having attended technical school and 31.93% being college graduates. Similar education distributions were observed in the iMAP intervention group (Table 1). The most common cancer types among participants were solid malignancies, with breast cancer (18.06%) and colorectal cancer (13.02%) being the most prevalent. Hematologic malignancies, including lymphoma (10.50%) and myeloma (8.40%), were also represented. The stage of solid tumour presentation varied, with stage IV being the most common (28.15%) (Table 1).

Recurrence of cancer was observed in a significant portion of participants, with metastatic recurrence being reported in 16.80% of cases. Polypharmacy, defined as the concurrent use of multiple medications, was prevalent among participants, with 54.20% of all participants and 43.79% of those in the iMAP intervention group experiencing polypharmacy. Potentially inappropriate medication use was also noted, with 27.31% of all participants and 21.16% of those in the iMAP intervention group receiving potentially inappropriate medications (Table 1). At three different time points-baseline, 30-day follow-up and 60-day follow-up-the efficacy of the iMAP intervention in lowering the number of MRPs was assessed. The mean of MRPs per participant was 3 (±1.91), ranging from 0 to 9. Following the intervention, the mean number of MRPs decreased to 1.9 (±1.58) at the 30-day follow-up and further decreased to 1.63 (±1.46) at the 60-day follow-up, indicating a reduction in MRPs over time (Table 2).

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

Patient demographics	Frequency (*n*=238)	iMAP-intervention
Age: Mean (SD)	77.7(8.53)	79.1(8.10)
Age Group (years)		
15-29	24 (10.1)	15 (12.60%)
30-44	42 (17.6)	24 (20.16%)
45-59	105 (44.1)	56 (47.05%)
60-74	54 (22.7)	29 (24.36%)
>75	13 (5.5)	8 (6.72%)
Sex, N (%)		
Females	128(53.78%)	75(54.74%)
Males	110(46.21%)	62(45.25%)
Education N (%)		
Elementary School	28(11.76%)	14(10.21%)
Highschool	36(15.12%)	15(10.94%)
Technical school	59(24.78%)	39(28.46%)
College Graduate	76(31.93%)	49(35.76%)
Postgraduate	39(16.38%)	20(14.59%)
Cancer type N (%)		
Solid Malignancies		
Breast	43(18.06%)	24(17.51%)

Patient demographics	Frequency (*n*=238)	iMAP-intervention
Colorectal	31(13.02%)	20(14.59%)
Lung	29(12.18%)	21(%)15.32
Pancreatic	26(10.92%)	17(12.40%)
Prostate	24(10.08%)	14(10.21%)
Other	40(16.80%)	20(14.59%)
Hematologic Malignancies		
Lymphoma	25(10.50%)	16(11.67%)
Myeloma	20(8.40%)	5(3.64%)
Solid tumour stage N (%)		
I	34(14.28%)	21(15.32%)
II	30(12.60%)	22(16.05%)
III	46(19.32%)	23(16.78%)
IV	67(28.15%)	21(15.32%)
Recurrence		
Local Recurrence	21(8.82%)	21(15.32%)
Meta static recurrence	40(16.80%)	29(21.16%)
Polypharmacy, N (%)	129(54.20%)	60(43.79%)
Potentially inappropriate medication use, N (%)	65(27.31%)	29(21.16%)

The distribution of MRPs across different categories was assessed at each time point. The most common MRP category at baseline was "Inadequate medication-no indication or therapeutic need," accounting for 33.33% of MRPs. This category remained prevalent at both the 30 and 60-day follow-ups, with percentages decreasing slightly over time (Table 2). "Inadequate drug-safer alternatives accessible," "Under-treatment-untreated clinical condition," and "Inadequate dosing-dose too high" were among other frequent MRP categories. Some of these categories showed declines in prevalence after the intervention, whereas others had varied frequencies over the various time periods. Several specific MRPs were identified within each category, such as the absence of nutritional deficiencies being addressed by multivitamins/supplements, the use of non-steroidal anti-inflammatory drugs without a clear indication and under-treatment of medical conditions requiring immunizations.

DISCUSSION

The findings of this study corroborate previous research highlighting the significant medication-related challenges faced by older cancer patients and underscore the potential of pharmacist-led interventions to mitigate these issues. Polypharmacy, a prevalent phenomenon among older adults with cancer, poses substantial risks, including ADE, drug interactions and compromised treatment efficacy.[8] The observed reduction in the number of MRPs following the iMAP intervention aligns with studies demonstrating the benefits of pharmacist-led medication management programs in improving medication safety and optimizing therapy outcomes.[9,10]

The effectiveness of the iMAP intervention in reducing the number of MRPs over a 60-day period is noteworthy. The observed decrease in the mean number of MRPs from baseline to both the 30-day, 60-day follow-ups suggests that the intervention led to improvements in medication appropriateness and safety among older cancer patients. The reduction in MRPs is particularly promising given the potential adverse effects and drug interactions associated with polypharmacy, which can compromise patient outcomes and quality of life. The persistent prevalence of MRPs related to suboptimal drug use underscores the importance of ongoing medication assessment and optimization in cancer care. Suboptimal prescribing practices, such as the use of medications without clear indications or safer alternatives, represent areas where pharmacist interventions can lead to meaningful improvements in patient care.[11] By leveraging tools like the Beers

Table 2: The iMAP intervention's effectiveness in lowering the frequency of drug-related issues.

Effectiveness of the iMAP intervention on reducing number of medication related problems*	Baseline	30-day	60-day
Average number of drug-related issues±standard deviation	3±1.91[0-9]	1.9±1.58[0-8]	1.63±1.46[0-7]
MRP category	**Baseline**	**30-day**	**60-day**
Inadequate medication-no indication or therapeutic need MV/supplements (no inadequacy in nutrients) Omega-3 fish oil without a prescription (no dyslipidaemia or CVD**) Low dosage aspirin (no risk for PVD***, CVD, or cerebrovascular disease) Use of proton pump inhibitors for GERD† beyond 8 weeks.	54(33.33%)	22(25.28%)	20(26.31%)
Inadequate medicine; a safer replacement is provided Anxiolytics, Sedative hypnotics, 1st generation anti histamines, Non-steroidal anti-inflammatory drugs, Oral long-duration sulfonylureas.	30(18.51%)	16(18.39%)	15(19.73%)
Undertreatment: medical conditions that go untreated Immunizations (i.e. influenza vaccine, pneumococcal vaccine).	29(17.90%)	18(20.68%)	16(21.05%)
Overdose of a dosage or inadequate dosing Oral DM needing renal dosage modification (sitagliptin) Cardiovascular drugs that need to be adjusted for renal dosage (digoxin) Antiplatelet medications (325 mg of aspirin) for primary CVD prevention Analgesics that need to have their renal dosage adjusted, (Gabapentin).	18(11.11%)	9(10.34%)	7(9.21%)
Noncompliance-difficulties in memory Combinations of HTN regimens	4(2.46%)	4(4.59%)	4(5.26%)
Inadequate medication-drug ineffective Oral painkilling protocols that use codeine.	4(2.46%)	2(2.29%)	2(2.63%)
Noncompliance-an additional cause Cost/affordability ratio.	3(1.85%)	3(3.44%)	3(3.94%)
Suboptimal medication-a contraindication to treatment Contraindication depending on laboratory findings (e.g., metform used in individuals with eGFRb of 30 mL/min/1.73 m^2)	3(1.85%)	3(3.44%)	2(2.63%)
Drug interaction potential due to suboptimal dosages Proton pump inhibitors with clopidogrel: both of them could decrease their antiplatelet effects	3(1.85%)	2(2.29%)	1(1.31%)
Undertreatment: further therapy needs to be done Vit D supplements (falls, fracture risk)	3(1.85%)	1(1.14%)	1(1.31%)
Monitoring medications is necessary to evaluate treatment response. Laboratory Parameters (e.g., test results after iron and/or vitamin B supplements) Anti DM (laboratory testing for HBA_{1c}).	2(1.23%)	2(2.29%)	1(1.31%)
Monitoring medication is vital; evaluate potential side effects. Therapeutic medication monitoring for possible toxicity, such as digoxin. Blood pressure monitoring at home to check for hypotension.	2(1.23%)	1(1.14%)	1(1.31%)

Effectiveness of the iMAP intervention on reducing number of medication related problems*	Baseline	30-day	60-day
Average number of drug-related issues±standard deviation	3±1.91[0-9]	1.9±1.58[0-8]	1.63±1.46[0-7]
MRP category	**Baseline**	**30-day**	**60-day**
Inadequate medication-therapeutic overlap. Combination anticoagulant (warfarin) and antiplatelet (aspirin) without a definite cardiovascular risk-benefit analysis or assessment of the course of therapy. combination treatment using PPI and histamine-2 receptor antagonists (ranitidine) without a need for concurrent usage.	2(1.23%)	1(1.14%)	1(1.31%)
Non-adherence-a fear of adverse effects.	1(0.61%)	1(1.14%)	1(1.31%)
Non-compliance: sensation worse.	1(0.61%)	1(1.14%)	1(1.31%)
Non-compliance: patient is unaware of changes in their medication.	1(0.61%)	0(0%)	0(0%)
Non-adherence: patient abuses prescription drugs.	1(0.61%)	0(0%)	0(0%)
Suboptimal dosage-incorrect frequency of pharmaceutical use.	1(0.61%)	0(0%)	0(0%)
noncompliance-the patient couldn't afford the prescription.	0(0%)	1(1.14%)	0(0%)

*Not the number of participants experiencing medication-related difficulties, but the number of medication-related problems present at each time point is represented by N.
**Cardiovascular disease.
***Peripheral vascular disease.
†Gastroesophageal reflux disease.

Criteria and the MAI, pharmacists can systematically evaluate medication appropriateness and recommend evidence-based alternatives, thereby reducing the risk of adverse drug events and treatment-related complications.[12,13] The distribution of MRPs across different categories provides insights into the specific areas where pharmacist-led interventions can have the most impact. The persistent prevalence of MRPs related to suboptimal drug use underscores the need for ongoing medication assessment and optimization in cancer care. Additionally, the identification of specific MRPs within each category highlights actionable areas for intervention, such as addressing nutritional deficiencies, optimizing dosing regimens and ensuring adherence to evidence-based guidelines. The identification of specific MRPs within each category provides actionable insights for targeted intervention strategies. For example, addressing nutritional deficiencies through appropriate supplementation and optimizing dosing regimens for high-risk medications can help mitigate the risks associated with polypharmacy and improve treatment outcomes.[14,15] Additionally, interventions aimed at improving medication adherence and addressing patient-specific barriers to therapy can further enhance the effectiveness of pharmacist-led medication management programs.[16] The study's findings underscore the critical role of pharmacists in interdisciplinary cancer care teams. Pharmacists possess the clinical expertise necessary to assess medication appropriateness, identify DRP, and collaborate with healthcare providers to optimize therapy regimens.[17] By integrating pharmacist-led interventions like the iMAP program into routine oncology practice, healthcare teams can enhance medication safety, improve treatment adherence and ultimately, enhance the quality of care for older cancer patients.

CONCLUSION

This study provides evidence supporting the effectiveness of pharmacist-led interventions, such as the iMAP program, in reducing MRPs among older cancer patients. The results emphasize the necessity for comprehensive medication management measures by highlighting the frequency of polypharmacy and potentially inappropriate drug usage in this group. By leveraging the expertise of pharmacists and implementing patient-centred interventions such as iMAP, healthcare teams can improve medication safety, optimize therapy outcomes and enhance the quality of care for older adults with cancer. Moving forward, further research and implementation of pharmacist-led interventions are warranted to address the complex medication needs of this vulnerable patient population.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

iMAP: Individualized Medication Assessment and Planning, **MRPs:** Medication-Related Problems, **MTM:** Medication Therapy Management, **ASHP:** American Society of Health-System Pharmacists, **MAI:** Medication Appropriateness Index, **SD:** Standard Deviation, **CVD:** Cardiovascular Disease, **GERD:** Gastroesophageal Reflux Disease, **eGFR:** Estimated Glomerular Filtration Rate, **PVD:** Peripheral Vascular Disease.

ETHICAL STATEMENTS

Ethical clearance for this study was obtained from the Institutional Ethical Committee of 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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