Pharmacist Led Assessment of Medication Inappropriateness in a Medicine Department of a Tertiary Care Hospital

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ABSTRACT

Background and Introduction: Inappropriate use of drugs is a major problem which contributes towards morbidity, mortality and increased length of hospital stay among patient population. Prescription inappropriateness is significant contributor for adverse health and economic outcome and retard quality use of medication among patient population. **Objectives:** To assess appropriateness of medication prescribed among study population by applying Medication Appropriateness Index (MAI). **Methods:** A prospective observational study was carried out in medicine department [emergency and general] of a teaching hospital. Patient pertinent and prescription medicine information were reviewed and assessed using medication appropriateness index to intercept medication inappropriateness. **Results:** Around 1863 drugs were prescribed of which appropriate drugs are found to be 1639 (87.97%) and inappropriate drugs were found to be 424 (22.76%) based on MAI scoring. Out of 424 Inappropriate drugs, 276 (65.17%) were marginally inappropriate, 44 (10.26%) were inappropriate and 104 (24.55%) drugs were with maximal inappropriateness. Polypharmacy was identified as the major factor contributing towards medication inappropriateness 107 (43.145%). **Conclusion:** The study shows that drug therapy is not consistent on prescribing principles of medicine appropriateness scale and notices the importance and scope of prescriber and patient education. Clinical pharmacist led review of drug therapy assessment can enhance prescribing quality.

Key words: Medication appropriateness index, Inappropriate prescribing, Likert 3-point scale, Drug-drug interaction, Clinical pharmacist, Polypharmacy.

INTRODUCTION

Prescription Inappropriateness is termed as failing to attain the maximum quality of drug use. It is also outlined as the prescription that introduced an important menace of adverse drug associated incident while there is a scope for an equally or more effective substitute medication.[1] Literature had showed that the inappropriate medicines practice is very common in general teaching hospital in most part of the developing and developed world.[1] Universally it is observed that 50% of the patients fails to take their medications correctly due to inappropriate prescribing, dispensing and usage, while other half of the patients fail to follow up the therapy.[2]

The Medication Appropriateness Index (MAI) has many benefits for assessing Inappropriate Prescribing (IP) when compared to that of medications preference among patient population. It is well-defined and hypothetically delicate to distinguish significant IP, or disease; it explains multiple factors of prescribing appropriateness, so this can be applied on the basis of patient's medical history. MAI can be tested in both inpatient and ambulatory care. An additional improvement in its rationality and consistency and in-detailed information was also updated in the recent version.[3,4] The MAI is intended to agree to rating of ten explicit criteria to establish whether a given medication is appropriate for an individual.

The ten criteria of the MAI, worded as questions, relate to the individual patient and drug in question. These criteria are: An indication for the drug; drug effectiveness for the patient's condition; correct dosage and directions; practical directions; drug-drug interaction; drug-disease interaction; unnecessary duplication with other drugs; duration of therapy and cost-effectiveness. Each criterion for the appropriateness of prescribing is rated on a three-point Likert scale, depending on whether the drug is appropriate, marginally appropriate or not appropriate.

The pharmacist's role has advanced considerably from bench side to bed side with the delivery of pharmaceutical care to enhance appropriate medication use and minimizing actual and potential medication related problems. Medication appropriateness coalesce varied fundamentals of evidence-based practice with professional judgment when evidence is incomplete. Pharmaceutical care activities performed by clinical pharmacists as a part of multidisciplinary health care team promotes medication use optimization and improve treatment outcomes in different clinical settings, including hospital wards, intensive care units and in community. However, the literature is inadequate in reporting studies regarding models of practice that involve clinical pharmacists.

The Emergency Department (ED) are usually a busy environment in teaching hospitals and pose challenge for optimum delivery of care. The risk of suboptimal medication use varies in inpatients to ambulatory setting but higher in ED patients. Detection and interception of these inappropriate prescribing highlight the need for pharmacist led deliverance of pharmaceutical care services in these setting and could be the next step practice model for advance pharmacy practice in health care institution. Therefore, the present study is an attempt to apply the MAI by a clinical pharmacist to identify issues of inappropriate prescribing amongst patients admitted to ED and medicine ward.[5]

MATERIALS AND METHODS

A prospective observational study was conducted over a six-month period in a tertiary care hospital in Bijapur city of north Karnataka. All patients aged 18 years and over, taking one or more medicines, who presented at the emergency and general medicine ward during the study period under the care of participating consultant physicians team were included in the study. The six-month time frame allowed sensible time duration to study a meaningful sample size. The study was approved by the Ethics Committee and confidentiality of the subjects was maintained. This study involved a cluster

sampling method of patients admitted under participating consultant's team.

The sample size was estimated from previous studies which used the MAI. Taking a level of confidence of 95% and margin of error of 10, the sample population was estimated to be that of 210 patients. Following the medical assessment after admission at selected wards the patient pertinent clinical and demographic information, medication treatment chart, patient case notes from files were reviewed by the pharmacist. Treatment review of both acute and chronic medication a patients was on were performed afterward rounds to detect medication inappropriateness and the necessary data was documented on a standard data collection form. Every medication in the treatment chart of the study subject were evaluated and verified for its appropriateness using MAI.

RESULTS

A total of 210 [male 56.6% and female 43.3%] subjects were finally reviewed in the study of which 110 (52.3%) patients were enrolled from ED and 100 (47.6%) from medicine ward. The minimum and maximum age of the enrolled subjects ranged from 18 to 80 years and above. Majority of the subjects were elderly 64 (58.18%) and were from ED followed by other younger age groups as presented in Table 1.

A total of 1863 drugs were prescribed in all 210[8.88 drugs per patient]. The majority of the drug prescribed class was of cardiovascular category (26.15%) followed by other major classes as illustrated [Figure 1].

Around 424 (22.76%) prescribed drug were found to be inappropriate based on MAI scoring. Out of 424

Table 1: Summary characteristics of study population.

Characteristics	N
Total	210
Enrolled from Emergency ward	110
Enrolled from Medicine ward	100
Gender	Male (119)
	Female (91)
Age range	18-85 years
Age Group (nos)	18-39 (25)
	40-59 (74)
	60-79 (94)
	≥80 (17)
Diagnosis and Co-morbidities	544
Total drugs prescribed	1863
Range of drug	1-20
Average drug per patient	8.8

Inappropriate drugs, 276 (65.17%) were marginally inappropriate, 44 (10.26%) were inappropriate and 104 (24.55%) drugs were found to be with maximal inappropriateness [Table 2]. Drug-drug interaction (50%), drug therapy duration (16.99%), duplication (7.31%) and drug indication (8.01%) are some of the major MAI criterion categories identified with inappropriateness [Table 3 and Figure 2]. An additional beer criterion-based drug inappropriateness assessment in elderly patient only revealed 5.80% drugs as inappropriate [Table 4].
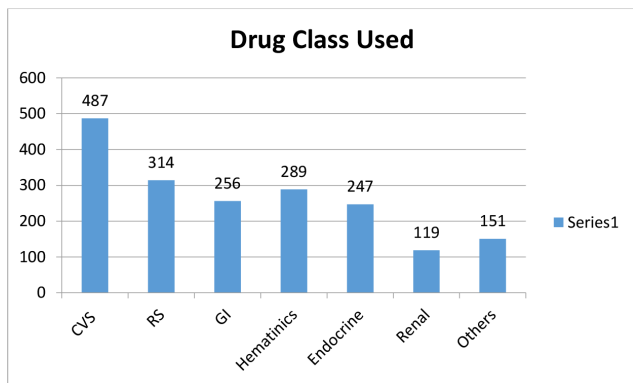

Figure 1: Distribution of Drug classes used among study population.

CVS: Cardiovascular system, RS: Respiratory system, GI: gastro-intestinal
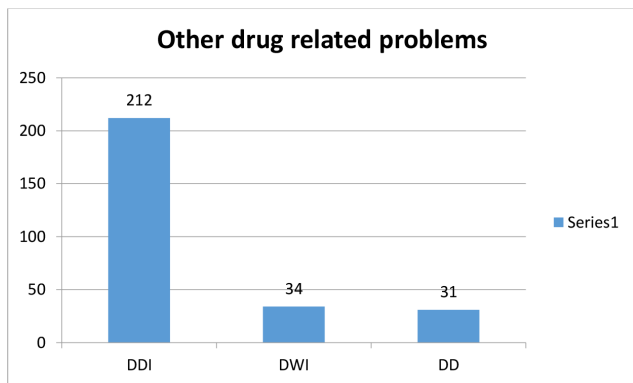

Figure 2: Other drug related problems reported.

DDI: drug-drug interaction, DWI: drug without indication, DD: drug duplication

Table 2: Distribution of Inappropriateness *n*=424.

Inappropriateness category	Frequency	%
Marginally inappropriate (5-8)	276	65.17
Inappropriate (9-12)	44	10.26
Maximal inappropriate (13-18)	104	24.55

Table 3: Distribution of Inappropriateness as MAI criterion.

MAI criterion Question	Drugs Inappropriateness *n*=424	
	n	%
Drug indication	34	8.01
Effectiveness	10	2.36
Correct dosage	10	2.36
Correct direction	5	1.18
Practical directions	6	1.41
Drug- Drug Interaction	212	50
Drug - Disease Interaction	12	2.83
Duplication	31	7.31
Duration of Therapy	72	16.99
Expense	32	7.55

Table 4: Inappropriate Drug as per Beers criteria (only in elderly) *n*=108.

Drug	Frequency	%
Nitrates	22	20.37
Alprazolam	19	17.59
Insulin	17	15.74
Aspirin	11	10.15
Sulfonylureas	10	9.25
Zolpidem	06	5.55
Chlorpheniramine	05	4.62
Spironolactone	04	3.70
Diclofenac	03	2.77
Pioglitazone	03	2.77
Pentazocine	02	1.85
Digoxin	02	1.85
Nitroglycerin	02	1.85
Cyproheptadine	01	0.92
Amitryptylline	01	0.95

The most common inappropriate drug classes were Benzodiazepines 108 (25.44%) followed by Antibiotics 68 (16.07%), Anti hypertensive's 45 (10.71%), antidiabetics 44 (10.26%), NSAIDS 40 (9.35%), Diuretics 36 (16.07%), antiemetics 32 (7.58%), opioid analgesics 17 (4.01%) and others 34 (8.03%) [Table 5].

Of the contributing factors possibly reported for medication inappropriateness, Polypharmacy was found to be the major factor 107 (43.145%), followed by duration of therapy 40 (16.12%), personnel errors were 28 (11.29%) etc [Table 6].

Table 5: Most Common Drug class with Inappropriateness, *n*=424.

Drugs	Frequency	Percentage
Benzodiazepines	108	25.44
Antibiotics	68	16.07
Anti-Hypertensive's	45	10.71
Diabetic drugs	44	10.26
NSAIDS	40	9.35
Diuretics	36	8.42
Anti-emetics	32	7.58
Opioid analgesics	17	4.01
Others	34	8.03

Table 6: Contributing Factors for Medication Inappropriateness, *n*=448.

Factor	Frequency	Percentage
Polypharmacy	193	43.15
Duration of therapy	72	16.13
Inappropriate communication	51	11.29
Dosage form errors	47	10.48
Inappropriate therapy	40	8.87
Therapeutic duplication	31	6.85
Other factors	14	3.22

DISCUSSION

MAI is implicit tool criteria for the use in elderly patients initially. However, it can be utilized in all age groups as no statistical difference was observed with reliability of result in different age groups. A total of 210 subjects were finally reviewed and included in the study, among them 119 (56.6%) were male and 91 (43.3%) were female. Majority of the patients were elderly with higher admission pattern observed both in ED and medicine ward against non-elderly suggestive of their susceptibility to disease chronicity and ageing process and are more likely to utilized ED level of services.[6]

A total of 1863 drugs were prescribed in 210 study subjects. The inappropriate drugs were found to be 424 (22.76%) based on MAI scoring and 1439 (77.24%) appropriate drugs, Among the appropriate, drugs with score 0 were 45.57%, drugs with score 1 were 11.10%, drugs with score 2 were 18.05%, with score 3 (16.71%) and score 4 were 8.54% based on MAI scale.

Among 424 Inappropriate drugs 65.1% were marginally inappropriate, 10.26% were inappropriate and 24.55% drugs were found to be with maximal inappropriateness based on the MAI scoring.

The study reveals 22.76% prescribed drugs were inappropriate for one or the other reason. Untoward adverse drug event, deficient or underutilization of health care services, risk of morbidity and mortality are some of the outcomes which are quite common because of inappropriate medication use.[7] Inappropriate prescription reporting using MAI varied from 39.5% to 78.3% at varied level of health care setting possibly because of difference in study design.[8-10] More than 90% of the study subjects had one or more medications rated as inappropriate by MAI tool, as quite similar to reported studies.[8-10] Inadequate prescribing practice has been associated with reduced update on clinical pharmacology and therapeutics. These inadequacies further exaggerated by deficient system design, lack of teamwork and environmental stress impact negatively on prescribing practices.[11]

The major category of inappropriate prescribing was observed with drug- drug interaction which shares 50% of all inappropriateness reported followed by duration of therapy 16.99%, drug indication 8.01% and duplication of therapy 7.31%. These occur possibly with multiple use of medication or polypharmacy. An important component probably is communication among health care professional treating the patient and also communication between health care professional and patient/ patient attendees, if the instruction were not conveyed appropriately might lead to cause drug use error. This might bring in the need of a system or mechanism which encourages writing written instructions and appropriate verbal mode. Duration of therapy 16.99% was the second major inappropriate category observed in the study, there are some plausible clinical situations where the drug therapy duration was not adhered owing to peer pressure based on gathered local evidence and moreover at times when benefit outweighs risk but it was observed that lack of therapeutics update as possible reason for such occurrence. The study reveals around 8.01% of episodes where there was a problem related with the use of drug without any indication in the patients. The issues of drug without indication were attributed to deficient patient medical/medication history assessment and deficient documentation of the findings. Medication with look alike, sound alike and name alike are possible reason for drug without indication problems. These also contribute towards drug duplication. Branded medicines and their substitution during dispensing precipitate drug duplication problem observed among the study population.

The drug like nitrates (20.37%), alprazolam (7.59%), insulin (5.74%), aspirin (10.15%) and sulphonylureas (9.25%) are chiefly involved as inappropriate prescribing

reported through Beers criteria assessment among the elderly subject of the study population [Table 4] also, as reported through MAI, Benzodiazepines (25.4%), Antibiotics (16.07%), anti-Hypertensive's (10.71%) and anti-diabetic drugs (10.26%) were majorly encountered with inappropriate prescribing. The observed therapeutic classes were different from study to study.[8,12,13]

The observation reported of the study are of significance as they provide the need to rationalize and improve the prescribing efficiency by approaches of following guidelines, implementing protocol and safe drug use policies and continued education to all health care professionals involved in the deliverance of patient care. The approaches might reduce the occurrence of medication related injury and could possibly have a cost-effective impact on overall treatment cost. The vigilant role of pharmacist at bed side might help prevent a potential problem from becoming an actual problem and promote safe drug use practice in a clinical setting and might optimize overall treatment outcome

The MAI was applied to detect inappropriate prescriptions; though it's marked utility it does not address issues like adverse drug reactions assessment and medication adherence. However, MAI satisfactorily assisted pharmacists in detection of medication inappropriateness

CONCLUSION

The study reveals the significant role of a clinical pharmacist to monitor drug therapy. Despite the existence of comprehensive guidelines for use and monitoring of appropriate use of drug, these parameters have not been performed accurately. The lack of acquaintance and update of prescribers with the guidelines may be a potential reason for not administering drug appropriately. Most of the subjects with inappropriate administration observed were mostly in geriatrics patients. Use of drug in geriatric patients must be carefully monitored. The study concluded that drug therapy was moderately consistent with clinical principles and perceives the opportunity and significance of prescriber education.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

MAI: Medication Appropriateness Index; **IP:** Inappropriate prescribing; **ED:** Emergency department; **NSAIDs:** Non-steroidal anti-inflammatory drugs.

SUMMARY

Increased morbidity, mortality and extension of hospitalization have also been attributed to inappropriate drug use among patient population and is considerably an important risk factor influencing patient outcomes. The studies approaches to assess prescription appropriateness using Medication Appropriateness Index (MAI) scale and observed significant gaps in prescribing quality though unintentional and are attributed to deficient clinical update and acquaintance to standard therapeutic guidelines. The study notices the importance and scope of prescriber and patient education.

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