

Assessment of Prescription Quality in Cardiovascular Patients Using the Prescription Quality Index Tool: A Prospective Study

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ABSTRACT

Introduction: The Prescription Quality Index (PQI) is a tool consisting of 22 questions designed to assess the quality of prescriptions. A good prescription should be evidence-based, rational, complete, and precise, ultimately improving treatment outcomes. PQI includes 22 parameters and has been hailed as the perfect instrument for use across a broad range of drugs and clinical problems.

Aim: The study aimed to evaluate the prescription quality of patients with cardiovascular disorders admitted to the Intensive Cardiac Care Unit (ICCU).

Materials and Methods: The present prospective study was conducted in the ICCU of Shri B M Patil Medical college, Hospital and Research Centre, Vijayapura, Karnataka, India, from July 2023 to 2024. It included 151 patients admitted to the ICCU. The medications provided to cardiovascular patients were assessed using the PQI questionnaire. Each of the 22 questions has an answer for each of the medications specified in a single prescription. PQI answers range from 0-4 for very significant criteria, 0-2 for essential criteria, and 0-1 for less critical criteria.

Spearman's correlation coefficient was employed to assess the relationship between each variable and the total PQI score, establishing a threshold for statistical significance at a p-value of less than 0.05.

Results: Out of 151 cases, it was found that 146 prescriptions (96.7%) did not include the least expensive drug available. There was only one documented case (0.7%) of drug-drug interactions. Furthermore, only 1 (0.7%) prescription was written using generic names. The legibility of prescriptions was deemed adequate in 66 (44%) cases. Prescriber and patient information were provided appropriately in 59 (39%) cases. Overall, the PQI scores suggested that all prescriptions demonstrated a high level of quality.

Conclusion: This study demonstrates that high-quality prescriptions can be achieved through the diligent care doctors take while prescribing, in the intensive cardiac care setting of a tertiary care hospital. This quality is ensured by adhering to the key principles of good prescription writing, which have to be followed by all practitioners, to avoid unnecessary complications and burden.

Keywords: Dosage, Drug interaction, Drug safety, Efficacy, Prescription

INTRODUCTION

Prescriptions constitute the essential communication of medication plans from prescribing physicians to pharmacists and finally to patients. The following details should be legibly stated on a complete prescription: the date, the patient's name, age, gender, weight, registration numbers, the medicine name, dose, method of delivery, treatment approach, reason for use, along with the name and signature of the prescribing physician [1]. Drugs play an important role in improving human health and promoting well-being. However, to produce the desired effect, they have to be safe, efficacious and used rationally [2]. An effective prescription is grounded in evidence, logical, thorough, and accurate. It has the potential to enhance treatment results.

Inappropriate prescribing includes incorrect dose or duration, prescriptions causing significant drug interactions, duplication of drugs, and under-use of beneficial medications. This poses more risk than benefit, particularly where safer alternatives exist [3]. Prescription errors are relatively common and may result from a lack of knowledge about the disease [4] or the pharmacological properties of the prescribed medications [5]. Such errors have been identified even in tertiary care hospitals [6,7]. Various tools have been created to evaluate the quality of prescriptions. They rely on the expert opinions of healthcare professionals [7,8] without any information on the psychometric properties of the instruments. No single method can capture all facets of prescription quality.

In 2010, Hassan NB et al., developed the PQI, which includes 22 parameters in the form of questions and has been hailed as the perfect instrument for use across a broad range of drugs and clinical problems in various contexts with little data [9].

The prevalence of cardiovascular disease has increased as a result of industrialisation, urbanisation, and related lifestyle changes [10]. Patients who are admitted will need a variety of medications, and they run the risk of drug-drug interactions. To prevent the use of inappropriate medications, it is important to maintain the quality of prescriptions for patients with cardiovascular disease [11]. In this context, this study aimed to evaluate the prescription quality of patients with cardiovascular disorders admitted to a tertiary care hospital, using the PQI tool.

MATERIALS AND METHODS

The present prospective study was conducted in the ICCU of Shri B M Patil Medical College, Hospital and Research Centre, Vijayapura, Karnataka, India from July 2023 to June 2024. Ethical approval was obtained from the Institutional Ethics Committee {BLDE(DU)/IEC/862/2022-23}. Informed consent was taken from patients before the study.

Inclusion and Exclusion criteria: Patients above the age of 18 years of any gender admitted to the ICCU with any cardiovascular disease were included in the study. Only pregnant ladies were excluded.

Sample size calculation: With a 95% confidence level and margin of error of ± 8 , and utilising the equation, $n = \{z^2 p(1-p)\}/d^2$, where $Z=z$ statistic at a 5 % level of significance is the margin of error or z-score corresponding to a 95% confidence level (which is 1.96),

'p' is the maximum prevalence of 50% in anticipated cases, which can be considered for an observational study.

d is the margin of error ($\pm 8\% \rightarrow 0.08$).

The total sample was 151.

Study Procedure

The medications provided to cardiovascular patients were assessed using the PQI questionnaire [9]. Each of the 22 questions had an answer for each of the medications specified in a single prescription. All of the question responses were noted with the matching numbers. For each question, the minimum score was taken as the response to that question, and if no information was available for a question, then that question was given a score of zero. PQI answers range from 0-4 for very significant criteria, 0-2 for essential criteria, and 0-1 for less critical criteria [9].

According to the PQI tool scoring, prescriptions with a PQI total score of 31 were considered low quality, 32-33 as medium quality, and 34-43 as high quality prescriptions [9]. To evaluate different items in the questionnaire, standard references or publications were used. The primary references were PQI manual, pharmacology texts, evidence-based medical reviews, national list of essential medicines of India 2022, articles on Medline, PubMed and 'Micromedex' software [12]. For the cost of the drugs, a drug available at the hospital pharmacy was compared with similar drugs of different brands from the same pharmacy. Drug-drug interactions were checked with 'Micromedex' software.

STATISTICAL ANALYSIS

Data were analysed using Statistical Package for Social Sciences (SPSS) (Version 27.0) software. All characteristics were summarised descriptively. Descriptive statistics were given by mean $\pm$ SD. Spearman's correlation coefficient and Spearman's correlation test were used to assess the correlation between each variable and the total PQI score. A p-value of <0.05 was considered statistically significant. All statistical tests were performed two-tailed.

RESULTS

Of the total 151 patients admitted to the ICCU, 78 (51.7%) were in the age group of 60 to 69 years, followed by 54 (35.8%) patients in the age group of 50 to 59 years. Also, there was a male predominance of 123 (81.5%) patients in cardiovascular diseases in this tertiary care centre and female patients about 28 (18.5%) [Table/Fig-1]. While considering the co-morbidities, hypertension was commonly seen in 74 (49%) patients, followed by 16 (10.6%) patients having both diabetes mellitus and hypertension as co-morbidities [Table/Fig-1].

The total PQI score of each prescription showed that 151 (100%) prescriptions were of high quality, where the score ranged between 34 to 43 as all the other parameters contributed better scores [Table/Fig-2]. A total of 150 (99%) of the prescriptions were not prescribed in generic names, though most of the drugs in each prescription had generic names, but it could not be considered according to the PQI tool. Only 1 (0.7%) prescription was completely prescribed in generic names. The medications were clearly written and legible on 66 (44%) prescriptions and marginally clear in 85 (57%) cases. The information on patient and prescriber, mentioned in the prescription, was inadequate in 92 (61%) prescriptions and adequate in 59 (39%) prescriptions. The total mean of all the cases is 37.4 ± 1.27 , which is more than score 34, from the total PQI score range, implying the mean of all cases gives a high-quality prescription.

Many criteria in the questionnaire did not correlate with the total PQI score, like unnecessary duplication and formulary/essential

Demographic details	Parameters	Frequency	Percentage (%)
Age (in years)	<40 years	1	0.7
	40-49 years	17	11.3
	50-59 years	54	35.8
	60-69 years	78	51.7
	≥ 70 years	1	0.7
Gender	Male	123	81.5
	Female	28	18.5
Co-morbidities	Hypertension	74	49
	Type 2 Diabetes Mellitus	14	9.3
	Type 2 Diabetes Mellitus and Hypertension	16	10.6
	No co-morbidities	47	31

[Table/Fig-1]: Distribution of age, gender, and co-morbidities among ICCU patients with cardiovascular diseases.

Criteria	Weighted scale	Mean	SD
1. Is there indication for drug?	0-2-4	4	0
2. Is the dosage correct?	0-2-4	4	0
3. Is the medication effective for condition?	0-1-2	2	0
4. Is indication supported by evidence?	0-1-2	2	0
5. Are directions for administration correct?	0-1-2	2	0
6. Are directions for administration practical?	0-1-2	2	0
7. Are there clinically significant drug-drug interactions?	0-1-2	1.9	0.08
8. Are there clinically significant drug-disease interactions?	0-2	2	0
9. Does patient experience any ADR?	0-1-2	2	0
10. Is there unnecessary duplication of drugs?	0-1	1	0
11. Is the duration of therapy acceptable?	0-1-2	2	0
12. Is this drug cheapest compared to alternatives for the same indication?	0-1	0.03	0.18
13. Is the medication available being prescribed by generic name?	0-1	0.01	0.08
14. Is the medication available in the formulary or essential drug list?	0-1	1	0
15. Does the patient comply with the drug treatment?	0-2	2	0
16. Is the medications name on the prescription clearly written?	0-1-2	1.56	0.49
17. Is the prescriber's writing on the prescription legible?	0-1-2	1.56	0.49
18. Is the prescriber's information on the prescription adequate?	0-2	0.79	0.97
19. Is the patient's information on the prescription adequate?	0-1-2	1.39	0.49
20. Is the diagnosis on the prescription clearly written?	0-1-2	2	0
21. Does the prescription fulfil the patient's requirement for drug therapy?	0-1	1	0
22. Has the patient's condition improved with treatment?	0-1-2	1.07	0.25

[Table/Fig-2]: Assessment of prescribing indicators using PQI tool.

drug list, indication, dosage, effectiveness, evidence-based, correct direction, practical direction, drug-disease interaction, adverse drug reaction, duration of therapy, compliance, clearly written diagnosis and treatment fulfilling the patient's requirements ($p > 0.05$) [Table/Fig-3].

DISCUSSION

Among the prescriptions examined, 146 (97%) did not include the least expensive available drugs. In most instances, only one or

PQI	Correlation coefficient	p-value
1. Indication	**Not applicable	>0.05
2. Dosage	**Not applicable	>0.05
3. Effectiveness	**Not applicable	>0.05
4. Evidence-based	**Not applicable	>0.05
5. Correct direction of administration	**Not applicable	>0.05
6. Practical direction of administration	**Not applicable	>0.05
7. Drug-drug interaction	0.127, mild correlation	0.122
8. Drug-disease interaction	**Not applicable	>0.05
9. Adverse drug reaction	**Not applicable	>0.05
10. Unnecessary duplication	**Not applicable	>0.05
11. Duration of therapy	**Not applicable	>0.05
12. Cheaper than alternatives	0.227, mild correlation	<0.005 *
13. Generic prescribing	0.137, mild correlation	0.094
14. In formulary/essential drug list	**Not applicable	>0.05
15. Compliance	**Not applicable	>0.05
16. Medication's name is clear	0.334, mild correlation	0.003 *
17. Legible	0.334, mild correlation	0.003 *
18. Prescriber's information	0.824, moderate correlation	<0.001 *
19. Patient's information	0.748, moderate correlation	<0.001 *
20. Diagnosis clearly written	**Not applicable	>0.05
21. Treatment fulfil patient's requirement	**Not applicable	>0.05
22. Improvement	0.234, mild correlation	0.004 *

[Table/Fig-3]: PQI total score correlation with 22 criteria.

*significant p-value <0.05, **Most of the variables could not be calculated, the variables whose SD value is 0, for that it becomes a binary number and hence r and p-values cannot be calculated.

two drugs fell outside the category of the least expensive options. However, the majority of the prescribed drugs were still among the cheaper alternatives. Unfortunately, the evaluation criteria stipulated that all drugs in the prescriptions must be the most affordable compared to their alternatives, rather than just a selected few [9]. Consequently, most prescriptions received a score of '0' for this evaluation. Only 5 (3%) of the prescriptions were composed entirely of drugs prescribed at their lowest available prices.

While checking for potential drug-drug interactions using Micromedex software, only 1 (0.7%) major interaction was identified, which involved ranolazine and ondansetron. Both of these medications can cause QT prolongation [13]; therefore, they should not be administered concurrently.

Aspirin and bisoprolol were mentioned to have moderate interaction because beta-blockers and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) given together may increase blood pressure [14], which was monitored, but blood pressure was controlled in the present study, and no such interactions were noted. Also, while checking for drug interactions, the antiplatelet drugs and anticoagulant drugs showed interactions like excessive bleeding if given together. But it is not considered so, as most of the emergency cardiac conditions like myocardial infarction require fibrinolytic treatment with several drugs from both of these classes as the initial treatment to counteract the ischaemic state [15]. This usually will not lead to bleeding, as the general treatment recommendations support this [16]. So such drug combinations are not considered significant drug interactions in the study.

According to the National Medical Commission, generic drugs are 30-80% cheaper [17] than branded drugs and using generic names in prescriptions will allow patients to choose the drugs they can afford and reduce their expenditure on healthcare. The present study shows that 99% of the prescriptions were not completely prescribed in generic names. An important factor to be considered is that this result is with respect to the PQI score, where even if one drug of the entire prescription fails to bear the generic name, the

minimum score is counted as zero which resulting in a huge 99% of not having generic names.

A study of prescription databases stated that as age increases, there is a higher risk of complications and more drugs required for treatment [18]. This is in accordance with the current study, also most of the patients in the current study were in the age group of 50-70 years of age who had these cardiovascular events along with two or more co-morbidities and hence more number of drugs.

In a study by Suthar JV and Patel VJ, prescribing quality in terms of PQI score showed 71.6% of prescriptions being of poor quality with PQI score ≤ 31 and claimed that it may be due to factors affecting the quality of prescribing, like patients' illness status, including co-morbidities, number of drugs prescribed, patient flow at health care centre, etc., [18]. It is in contrast to the present study where 100% of the prescriptions were of high quality. An important reason may be that the study was done in a tertiary care centre, where more time for patient care can be provided and the prescriptions can be improved, which can directly affect the care provided, but it is not possible in a primary health centre, where a larger turnover of patients occurs daily.

The study by Hassan NB et al., reported that there was no correlation between the PQI total scores and four criteria, namely unnecessary duplication, formulary/essential drug, legibility, and adequate patient information. Yet retained in the PQI questionnaire for validity, legal and clinical significance [9]. But in the present study, two of these criteria did not correlate with total PQI score in this study, namely, unnecessary duplication and formulary/essential drug list, along with other parameters, as mentioned in the results. This can be due to the severity of conditions that patients presented with, requiring more drugs, which were all adequate.

Bhadiyadara SN et al., in their study, noticed that 80% were of high-quality prescriptions while evaluating prescriptions written for bronchitis [19]. The present study also revealed a similar result of high-quality prescriptions, which was also conducted at a tertiary care teaching hospital. This can be the reason for the overall high PQI score, where prescriptions were written by consultants as well as postgraduate resident doctors, who could provide adequate time for each patient and prescription, resulting in better outcomes.

Limitation(s)

The limitations of the present study include variability in the number and types of drugs prescribed to each patient with cardiovascular diseases. Additionally, the findings are based on a tertiary healthcare facility, so they may not apply to primary or secondary healthcare settings.

CONCLUSION(S)

The PQI tool is a valid tool to evaluate the quality of prescriptions in chronic conditions. It can be used in different clinical situations at different healthcare facilities. The present study demonstrates that high-quality prescriptions can be achieved through the diligent care doctors take while prescribing, in the intensive cardiac care setting of a tertiary care hospital. This quality can be ensured by adhering to the key principles of good prescription writing, which have to be followed by all practitioners, to avoid unnecessary complications and burden.

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