

How well are we prescribing medications to our children?

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ABSTRACT

Introduction: Prescription errors are common and every step in the process of writing a prescription has the potential for error. These errors can be broadly attributed to the lack of knowledge or lack of skill. Poor legibility, inaccuracy in writing, incomplete prescriptions, omissions, and use of abbreviations are the most common type of errors. **Objectives:** The primary objective of our study was to assess the completeness and legibility of the prescriptions. This is to estimate the rates of skill-based errors. Secondary objective of this study was to assess the appropriateness of the prescriptions using the pediatrics: Omission of Prescriptions and Inappropriate prescriptions (POPI) tool. **Methods:** This was a cross-sectional study, conducted in the pediatric outpatient department of a tertiary teaching hospital in New Delhi, India. Prescriptions received by outpatients attending both the general and special pediatric clinics were collected and evaluated using the World Health Organization Guide to Good Prescribing and the Medical Council of India guidelines. **Results:** A total of 343 prescriptions were assessed, in which 753 drugs were prescribed. A total of 1709 errors were uncovered pertaining to the completeness of the prescription. A majority of the prescriptions were written by postgraduates trainees (206), followed by senior residents (61), consultants (42), and junior residents (20). Abbreviations were used while mentioning the drug names in 53.64% prescriptions. The mean legibility score of all prescriptions was 3.35. Forty (11.66%) prescriptions were found inappropriate as per the International POPI tool. **Conclusion:** The legibility and completeness are largely overlooked yet crucial to the “Art of Prescription Writing.” They deserve as much awareness and education as the appropriateness of the drugs prescribed. The international POPI tool is a promising tool to analyze the appropriateness of pediatric prescriptions.

Key words: Prescription errors, Children, Legible, Pediatrics: Omission of Prescriptions and Inappropriate prescriptions

The Institute of Medicine’s report “*To Err Is Human*,” published in 1999 in the United States, led to a fundamental change in our perception of patient safety [1]. It revealed that in any given year, more deaths were caused due to medication errors than road traffic accidents, breast cancer, or Acquired Immunodeficiency Syndrome — although receiving far less attention. Medication errors have since been brought to the scientific spotlight as a major health concern, with studies in the US approximating that 1.5% of all hospitalized patients per year are harmed as a direct result of such errors.


Every step in the process of writing a prescription has the potential for error. These errors can be broadly attributed to either lack of knowledge or lack of skill. Knowledge-based errors occur while planning the treatment (mistakes), whereas skill-based errors occur in the execution of a correctly planned treatment (Slips and Lapses) [2].

A deeper look into the etiology of such errors by Velo *et al.* revealed that inappropriate prescribing most often derives from a

wrong medical decision, which is further due to lack of knowledge or inadequate training. Skill-based errors, on the other hand, were attributed to poor legibility, inaccuracy in writing, incomplete prescriptions, omissions, and use of abbreviations [3].

A study conducted by Dean *et al.* further quantified the errors and revealed that 39% of the prescribing errors originated in the prescribing decision and 61% in medication order writing [4].

The above trends are further magnified in the pediatric population, but remain largely uncharted [5-7]. It has been described as an “evidence-based desert,” despite studies concluding that pediatric prescribing errors are 3 times more likely to cause harm than adult prescribing errors [8]. There exists no international guide or educational tool for ideal pediatric prescribing, as compared to its widely popular adult counterpart – the World Health Organization (WHO) Guide to Good Prescribing. As the pediatric age group has a higher susceptibility to adverse drug reactions, they require separate studies with an emphasis on weight-based dosing, strength, and formulation — all of which can adversely affect the outcome [9].

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In 2014, a tool to identify inappropriate pediatric prescriptions was developed by Prot-Labarthe *et al.* in France and has since gained much traction [10]. The first of its kind, it was named the POPI tool (Pediatrics: Omission of Prescriptions and Inappropriate prescriptions) and has been validated by an international consensus of 12 countries in 2020 to give rise to the International POPI tool [11]. The International POPI tool identifies inappropriate pediatric prescriptions using a predefined set of 73 crucial omissions and inaccuracies that if present, would deem the prescription unfit per standard treatment guidelines.

The primary goal of our study was to evaluate the prescriptions' completeness and legibility. The secondary goal was to use the POPI tool to assess the appropriateness of the prescriptions. The purpose of this is to estimate the rates of knowledge-based errors.

This is the first study to attempt a comprehensive audit of pediatric prescriptions, ensuring the trifecta of completeness, legibility, and appropriateness.

METHODOLOGY

This cross-sectional study was conducted in the pediatric outpatient department of a tertiary care, teaching hospital in New Delhi, India. The population studied were children aged 0–12 years. Prescriptions received by outpatients attending both the general and special pediatric clinics were collected. The prescribers included junior residents, postgraduate (PG) trainees, senior residents, and consultants. All the prescriptions were handwritten. Prescribers were blinded to the study to avoid changes in behavior. Digital copies of the prescriptions were made and stored for further data analysis. All the prescriptions were mainly assessed under following headings:

Completeness of the Prescription

The prescriptions were evaluated using the WHO Guide to Good Prescribing and the Medical Council of India guidelines [12]. No such guidelines exist for the pediatric age group; hence, certain additional criteria such as the weight of the patient and allergy status were mandated essential to the pediatric prescription in accordance with hospital guidelines. Furthermore, the misuse of non-standard abbreviations was evaluated both in the drug names and instructions. The 17 criteria analyzed were, weight of the patient, diagnosis, formulation, generic name, strength of the preparation, dosage, route of administration, frequency of dosage, duration of administration, allergy status, follow-up advice, non-standard abbreviations in the drug name, abbreviations in drug instructions and details of prescriber like, signature, name, qualification, and registration number.

Each prescription was given a score under each criterion. The completeness score of the prescription was then derived as the average of all the criterion scores. Each variable thus contributes equal weightage to the completeness score of the prescription.

When encountered with multiple errors within a single criterion (for instance, multiple brand names within a single

prescription), an “All or None” method was implemented, and the prescription was judged erroneous under that criterion.

Legibility of the Prescription

Each prescription was graded by two independent reviewers to assess its legibility.

The legibility of drug names, dosage patterns, and instructions was assessed. A four-point Likert scale was structured, similar to the previous studies [13].

- Grade 1 – Not legible requires further clarification from the prescriber.
- Grade 2 – Barely legible has considerable potential for misinterpretation.
- Grade 3 – Moderately legible has some potential for misinterpretation.
- Grade 4 – Completely legible; with minimal potential for misinterpretation.

Each reviewer gave a score independently and in case of a non-agreement, a final score was decided on by a consensus of both reviewers and the researcher.

The usage of uppercase letters was also evaluated only in the drug names.

Appropriateness of the Prescription

The prescription was assessed using the POPI international tool to detect potentially inappropriate medicines (PIMs) and potentially prescribing omissions (PPOs). Being a tertiary care institute, dermatological, psychiatric, and Ear, Nose and Throat concerns are promptly referred to their respective clinics and, thus, were included in the study although being a part of the POPI tool.

RESULTS

A total of 343 prescriptions were assessed, in which 753 drugs were prescribed. A total of 1709 errors were uncovered pertaining to the completeness of the prescription. Forty-two errors were uncovered pertaining to the appropriateness of the prescription.

A majority of the prescriptions were written by PG trainees (206), followed by senior residents (61), consultants (42), and junior residents (20). Fourteen prescriptions had no professional grade mentioned.

Our study revealed that none of the prescription contains allergy status of the patient, while abbreviations use in drug instructions was a commonly made error. Patient's weight (100%), right dose of drug (92.4%), right route (99.13%), frequency (96.5%), and follow-up advise (90.6%) was mentioned in most of the prescription (Table 1).

Abbreviations were used while mentioning the drug names in 53.64% (184/343) of all prescriptions assessed. Again, a few prescriptions contained multiple abbreviations and an individual count revealed a total of 210 abbreviations in the 753 drugs prescribed. Among these 210 abbreviations, paracetamol was used

most frequently, followed by multivitamin and oral rehydration solution (ORS) (Table 2).

Legibility of the Prescription

The mean legibility score of all prescriptions was 3.35.

Fig. 1 shows the percentage distribution of the legibility score of all prescriptions. About 9.04% (31/343) of prescriptions were unanimously scored Grade 1. About 25 (7.28%) of prescriptions had all the drug names written in the uppercase letters. Twenty-four out of these 25 prescriptions had a full legibility score of 4.

Appropriateness of the Prescription

Forty prescriptions were found inappropriate as per the international POPI tool out of the 343 prescriptions (11.66%). A total of 42 errors were uncovered in total. These consisted of 29 PIMs and 13 PPOs (Table 3).

The completeness and appropriateness across various professional grades were studied. Fourteen prescriptions were

omitted for this purpose, as the professional grade was unspecified (Fig. 2).

DISCUSSION

The study concludes that more attention needs to be paid to prescription writing practices. A single prescription, on average, had a completeness of only 70.69%. The appropriateness and legibility, on the other hand, fared much better.

Similar studies in pediatric populations are scarce. In adult medicine, a recent study from a government hospital in New Delhi, India evaluated the completeness of outpatient prescriptions and revealed a total of 879 errors in 1000 prescriptions [14]. However, only six elements were used as variables to define an error. Our study has revealed 1079 errors in 343 prescriptions using 17 elements as variables. A study from Eritrea, again in adult outpatient prescriptions, used 13 similar variables and revealed an average completeness score of 78.63%, as compared to the 70.69% score derived from our study [13].

About 15.67% (118/753) of all drugs were prescribed using brand names – notably higher when compared to the 9.80% in

Table 1: Completeness score of all 343 prescriptions across the 17 criteria analyzed

Variable	Completeness frequency (n)	Completeness score (%)
Pt. Weight	343	100
Diagnosis	181	53.06
Formulation	338	98.54
Generic name	244	71.14
Strength	235	68.51
Dosage	317	92.42
Route	340	99.13
Frequency	331	96.50
Duration	288	83.97
Allergy status	0	0
Follow-up advise	311	90.67
Non-standard abbreviations in drug name	184	53.64
Abbreviations in drug instructions	5	1.45
Details of prescriber:		
Name	319	93.00
Qualification	322	93.88
Signature	334	97.38
Reg. No.	54	15.74

Table 2: Distribution of abbreviations used in prescription

Abbreviation used in prescription	Frequency (n)	Percentage (%)
PCM	123	58.57
MV	50	23.80
ORS	22	10.47
FA	9	4.28
BC	4	1.90
LCZ	2	0.09

PCM: Paracetamol; MV: Multivitamin; ORS: Oral rehydration solution; FA: Folic acid; BC: B-complex; LCZ: Levocetizine

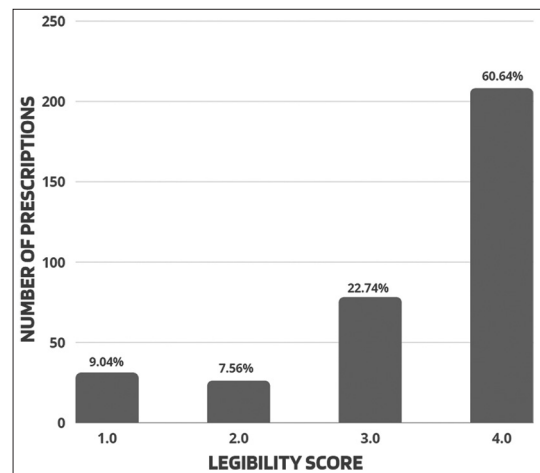


Figure 1: Distribution of prescriptions across legibility score (n=343)

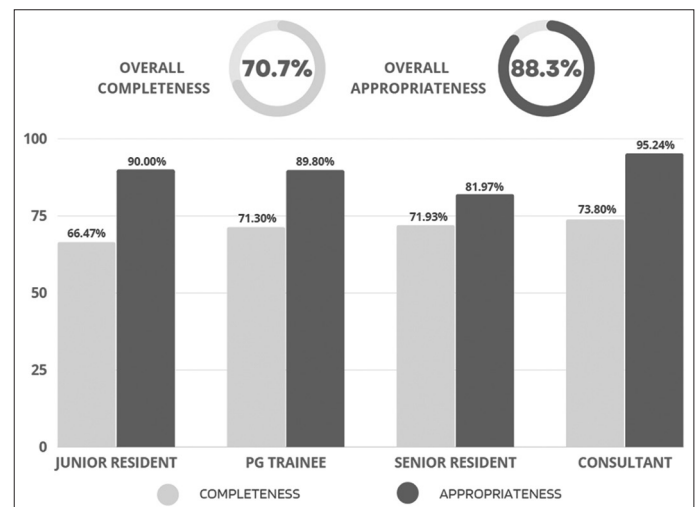


Figure 2: Completeness and appropriateness of prescriptions across professional grades (PG: Postgraduate)

Table 3: Frequency of PIMs and PPOs identified by POPI tool

Error code	Error description	Frequency
PIMs (n=29)		
II-7	H1-antagonists with sedative or atropine-like effects before 30 months of age.	22
EI-4	The combined use of proton pump inhibitors and NSAIDs, for a short period of time, in patients without risk factors.	4
BI-4	Antibiotic prophylaxis in the case of asymptomatic bacterial infection (except in the case of uropathy).	2
EI-2	Domperidone	1
PPOs (n=13)		
EO-1	Oral rehydration solution in the event of vomiting	7
FO-1	Oral rehydration solution in the event of diarrhea.	6

PIMs: Potentially inappropriate medicines, PPOs: Potentially prescribing omissions, POPI: Pediatrics: Omission of Prescriptions and Inappropriate prescriptions

the above-mentioned study from India. This is a troubling finding in a government institution that adheres to a uniform national Emergency Medicine List and is not in accordance with the recommendations of the World Health Organization. Furthermore, the rampant use of non-standard abbreviations (53.64% in drug names and 98.54% in drug instructions) is of particular concern. Although not prohibited by regulatory councils, this is a practice that has been proven to cause considerable misinterpretation [15]. The Latin abbreviations liberally used in the instructions are hardly in common parlance and further distances the patient from the caregiver.

Despite the urgings of the National Medical Council and hospital guidelines, the registration number of the prescriber was mentioned in a mere 15.74% (54/343) of prescriptions. Not a single prescription analyzed had the allergy status of the child mentioned. A major contributor to adverse drug events, this is an area for further improvement and auditing [16-18].

These “skill-based errors,” being the most numerous, have significant potential to lead to adverse events; yet, sufficient scientific data are lacking – more so in the pediatric population. A novel strategy to reduce such skill-based errors was evaluated in Canada in 2005 [19]. Pre-printed structured forms were introduced which led to a significant reduction in the errors of omission. This could be of immense importance to developing nations where interventions such as the computerized provider order entry (CPOE) systems are in their nascent stages. These efficient yet economical options need further studies in India.

About 9.04% (31/343) of prescriptions were completely illegible (Grade 1), prompting further clarification from the prescriber. This is notably higher compared to the above-mentioned study from India, where 2.20% (22/1000) of prescriptions were judged completely illegible. Interestingly, 96% (24/25) of drug names that were written in the uppercase letters had a full legibility score (grade 4). This remarkably simple strategy to improve legibility was previously highlighted by a study in the National Health Services [20]. CPOE systems

could also significantly improve legibility, although more data are required to draw its cost-effectiveness analysis in India.

About 52.38% (22/42) of all inappropriate prescriptions were due to the use of H1-antagonists with sedative effects (Promethazine) before 30 months of age. All 13 POPs detected using the tool involved the erroneous omission of ORS in the event of vomiting or diarrhea. A cardinal step in the prevention of dehydration, this issue requires prompt addressal. Studies that evaluate the appropriateness of pediatric prescriptions are severely lacking [21]. The POPI tool, due to its recent conception, has been applied in only two studies to date.

A study by Berthe-Aucejo *et al.* in France revealed 12.30% of PIMs and 6.12% of PPOs among prescriptions in the community [22]. Our study revealed 8.45% of PIMs and 3.79% of PPOs. A point to note is that the study in France used the first POPI tool having 105 criteria, while we used the International POPI tool having 73 criteria. The second study, published in 2022, used the International POPI tool in the age group of <18 years in Oman [23]. Both inpatient and outpatient settings were included and revealed a 20.4% prevalence of inappropriate prescriptions.

The major strength of our study is good sample size and use of POPI tool, which has not been evaluated in Indian population so far. Another strength is the comprehensive assessment of prescriptions for not only for their completeness but also for legibility and appropriateness. The limitation of our study is that it is a single-center study, and thus, results may not be a true depiction of real picture.

CONCLUSION

Legibility and completeness are largely overlooked yet crucial to the “Art of Prescription Writing.” They deserve as much awareness and education as the appropriateness of the drugs prescribed. The use of abbreviations is one of the most common errors, while 11.6% prescriptions were inappropriate. Skill-based errors are much more common than knowledge based errors, indicating lack of awareness. The International POPI tool is a promising tool to analyze the appropriateness of pediatric prescriptions.

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