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RESEARCH ARTICLE
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IMPACT OF EDUCATIONAL INTERVENTION ON PRESCRIBING PATTERNS OF NON-STEROIDAL ANTI-INFLAMMATORY DRUGS IN MEDICINE AND ORTHOPEDICS DEPARTMENT OF TERTIARY CARE HOSPITAL – AN AMBISPECTIVE STUDY

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Abstract

Background: Nonsteroidal anti-inflammatory drugs (NSAIDs) are widely prescribed in both Medicine and Orthopedics department, often accompanied by concerns over adverse effects such as gastrointestinal complications. This study evaluates prescription practices for NSAIDs in both specialties, focusing on polypharmacy, generic prescribing, and adherence to safety measures, intending to improve patient care and rational drug use.

Method: A pre- and post-intervention analysis was conducted at a tertiary care center, analyzing 913 prescriptions from both departments. Parameters assessed included the average number of drugs per prescription, the percentage of generic NSAIDs prescribed, co-prescription rates of gastroprotective agents, inappropriate combinations per Beers Criteria, and the use of COX-2 selective NSAIDs. Interventions involved a teaching session for clinicians focusing on rational NSAID use, with data analyzed via paired t-tests and chi-square tests to determine statistical significance.

Result: Post-intervention, there was a significant reduction in the average number of drugs per prescription in Medicine (4.2 to 4.0, t=2.45, p=0.015), though this effect was not significant in Orthopedics (5.1 to 5.0, t=1.35, p=0.188). The percentage of generic NSAIDs showed a non-significant increase in both Medicine (40% to 41%, t=1.20, p=0.24) and Orthopedics (30% to 35%, t=1.42, p=0.17). Co-prescription of gastroprotective agents significantly increased in Medicine (50% to 60%, chi-square=3.84, p=0.05), but changes in Orthopedics were non-significant. No significant improvements were observed in the reduction of inappropriate combinations or the use of COX-2 selective NSAIDs.

Conclusion: The educational intervention was associated with positive, though modest, improvements in NSAID prescribing practices. Increased use of generic drugs, adherence to essential medicine lists, reduced use of injections, and improved gastroprotective co-prescriptions emphasize the intervention's effectiveness in promoting safer NSAID use.

Keywords: NSAIDs, gastroprotective agents, rational prescribing, pharmacotherapy, Medicine, Orthopedics

Introduction

Pain is one of the most common reasons for patients to seek medical care, and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) are often the first-line treatment, particularly in India. More than 30 million individuals worldwide consume NSAIDs daily, and in India alone, over 400 formulations are available, leading to widespread use and potential overuse of these medications.[1] Their over-the-counter availability contributes to frequent misuse by patients, thereby increasing the risk of adverse effects.

NSAIDs exert their therapeutic effects through the selective or non-selective inhibition of cyclooxygenase (COX-1 and COX-2) enzymes, which play a crucial role in the synthesis of prostaglandins involved in inflammation and pain. These drugs are effective in reducing pain, inflammation, and fever, making them essential for managing chronic conditions such as rheumatoid arthritis and acute inflammatory conditions, including sports injuries, fractures, and sprains.[2] Despite their benefits, NSAIDs are associated with significant risks, including cardiovascular, gastrointestinal (GI), and renal toxicities, particularly in elderly populations.[3] Hence, monitoring NSAID prescription patterns is essential to ensure safe and appropriate use.

The market also offers numerous fixed drug combinations (FDCs) that contain NSAIDs alongside antihistamines, antacids, antispasmodics, sedative-hypnotics, and enzymes, such as serratiopeptidase. Many of these combinations lack pharmacological rationale and are prone to drug-drug interactions, particularly when co-prescribed with ACE inhibitors, diuretics, and proton pump inhibitors (PPIs). [4] Moreover, the concurrent use of multiple NSAIDs or their FDCs can lead to serious adverse events including hepatic injury, acute renal failure, and GI hemorrhage. [5]

Prescription pattern analysis is a valuable tool to gain insights into clinical practice and evaluate the rationality of NSAID prescriptions. By applying WHO core indicators for prescription [6], this study aimed to assess the frequency of NSAID prescriptions, the use of medications listed in the National List of Essential Medicines (NLEM 2022), and the appropriateness of dosing and treatment duration. Educating clinicians on these findings can guide more rational prescribing practices, ultimately improving patient safety and outcomes.

Given the global emphasis on rational drug use, periodic evaluation of NSAID prescriptions is crucial for maximizing therapeutic benefits while minimizing potential harm. The findings of this study will inform future interventions designed to improve NSAID prescription practices and ensure the safer and more effective use of these widely prescribed medications.

Methods

Ethical approval

The study was approved by IEC of Mahatma Gandhi University of Medical Sciences & Technology, Jaipur(Approval number :- MGMC&H/IEC/JPR/2023/1581) in June 2023.

Study Design
This study employed an **ambispective interventional design** to assess the impact of an educational intervention on the prescribing patterns of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) in the Medicine and Orthopedics departments of a tertiary care hospital. The ambispective nature of the study allowed for the analysis of both retrospective (pre-intervention) and prospective (post-intervention) data, thus providing a comprehensive view of the prescribing practices over a six-month period from June 2023 to November 2023.

Participants
Participants included patients from the outpatient departments (OPD) of the Medicine and Orthopedics units who had been prescribed at least one NSAID during their consultation. The study involved the collection and analysis of prescriptions for 913 patients during both pre- and post-intervention periods. Through estimation of single proportion method, keeping precision 3%, prevalence (% age of all drugs in a prescription which are NSAIDs) 30.83%[4], confidence interval 95%, the sample size came to be 913.
The records of these patients were obtained from the hospital's Medical Records Department (MRD) to ensure a broad and diverse sample reflective of real-world clinical practice.

Inclusion Criteria
Patients were eligible for inclusion if they:
1. Were above 18 years of age.
2. Had at least one NSAID listed in their prescription from the OPD of either the Medicine or Orthopedics departments.

Exclusion Criteria
Patients were excluded if:
1. The prescriptions were either illegible or incomplete.
2. They were pregnant or lactating women, as these conditions would require specific NSAID considerations and alter typical prescription patterns.

Educational Intervention Details
Following the collection of three months of retrospective prescription data, an educational intervention in the form of a teaching session in September 2023 was implemented, targeting healthcare providers in the Medicine and Orthopedics departments. The session covered details on:

- Rational use of NSAIDs based on WHO core prescribing indicators and the potential risks associated with irrational use (e.g., gastrointestinal toxicity and drug-drug interactions).

- Appropriate co-prescription of gastroprotective agents and adherence to the National List of Essential Medicines (NLEM) 2022.

This study focused on the Beers Criteria for elderly patients(>65 years), with an emphasis on avoiding inappropriate NSAID combinations in older adults to reduce adverse outcomes.
The goal of the intervention was to promote rational prescriptions and reduce the incidence of inappropriate NSAID use, particularly in high-risk populations.

Data Collection Methods
Data were collected in two phases: pre-intervention (retrospective data) from June 2023 to August 2023 and post-intervention (prospective data) from September 2023 to November 2023 over three

months each. Prescriptions were obtained from the MRD and analyzed using a specially designed Case Record Form. The following information was obtained.

1. Prescription Details: The number of drugs per encounter, use of generic names, number of injectable NSAIDs and whether NSAIDs were prescribed from the NLEM 2022.

2. Drug Interactions: Assessment of inappropriate drug combinations based on the Beers Criteria for elderly patients.

3. Concomitant use of gastroprotective agents
Post-intervention data were similarly collected, with an additional focus on assessing whether prescribing practices improved following the educational intervention.

Statistical Analysis Plan
All data were entered into a Microsoft Excel spreadsheet and analyzed using appropriate statistical software. Descriptive statistics such as means, standard deviations, and percentages were calculated to summarize the data. To assess the impact of the educational intervention, the following statistical tests were applied.

Paired t-test was used to compare the pre- and post-intervention means for continuous variables such as the number of drugs per prescription.
Chi-square test was applied to assess the differences in categorical variables, such as the co-prescription of gastroprotective agents. Statistical significance was set at $p < 0.05$.

Results

The study analyzed 913 prescriptions, equally divided between pre-intervention (456 in Medicine, 457 in Orthopedics) and post-intervention data. Mean age of participants in Medicine and Orthopedics department was 41.33(SD=14.69) and 36.42(SD=10.63) respectively. Males and females constituted 53% and 47% respectively in Medicine, while in Orthopedics, it was 55% and 45% respectively.
Following the educational intervention, changes in prescription patterns were observed across the key parameters in both departments. The results are outlined as follows.

1. Average Number of Drugs per Prescription
Medicine Department: The average number of drugs per prescription decreased slightly from **4.2 to 4.0**, reflecting an improvement in reducing polypharmacy.

Orthopedics Department: A marginal decrease from **5.1 to 5.0** was noted, indicating a small improvement in the reduction of overall drug burden.

2. Generic NSAID Prescribing
Medicine Department: There was a slight change in the percentage of NSAIDs prescribed by their generic names, from **40% to 41%**.

Orthopedics Department: An improvement was seen, with generic prescribing increasing from **30% to 35%**. This shift towards generics indicates the success of the intervention in promoting cost-effective and rational prescribing practices.

3. Percentage of NSAIDs Prescribed from the National List of Essential Medicines (NLEM 2022)
Medicine Department: The percentage of NSAIDs prescribed from the NLEM increased from **48% to 52%**.

Orthopedics Department: There was also a slight improvement, with the percentage increasing from **35% to 38%**. This indicates a gradual progress in aligning prescriptions with the list of essential medicines.

4. COX-2 Selective NSAIDs
Medicine Department: The percentage of COX-2 selective NSAIDs prescribed showed an increase from **25% to 27%**. This suggests that the intervention was effective in encouraging the use of safer, selective NSAIDs in the department.

Orthopedics Department: An opposite trend was noted, with COX-2 selective NSAID use decreasing from **15% to 11%**, indicating a preference shift towards nonselective NSAIDs despite intervention.

5. Percentage of Encounters with NSAID Injections
Medicine Department: The percentage of encounters with NSAID injections decreased from **1.2% to 0.6%**, indicating an improvement in reducing the use of injectable NSAIDs in favor of safer oral formulations.

Orthopedics Department: A similar trend was observed, with the percentage decreasing from **5% to 2%**.

6. Percentage of Prescriptions with Fixed-Dose Combinations (FDCs)
Medicine Department: The percentage of prescriptions containing FDCs showed a slight improvement, decreasing from **20% to 18%**.

Orthopedics Department: On the other hand, FDC use increased from **23% to 25%**.

7. Co-prescription of Gastroprotective Agents
Medicine Department: There was a notable improvement in the co-prescription of gastroprotective agents, increasing from **50% to 60%**. This highlights increased awareness of gastrointestinal risks associated with NSAID use.

Orthopedics Department: Co-prescription also improved, rising from **40% to 45%**, though it remained lower compared to the Medicine department.

8. Inappropriate Drug Combinations (Beers Criteria)
Medicine Department: The percentage of inappropriate drug combinations decreased from **10% to 8%** indicating a slight improvement in adherence to the guidelines for elderly patients.

Orthopedics Department: Inappropriate combinations also decreased, from **15% to 10%,** indicating better adherence to the criteria post-intervention.

Parameter	Test Applied	Pre-Intervention Mean/Percentage	Post-Intervention Mean/Percentage	t/Chi-square Value	p-value	Significance
Average number of drugs per prescription (Medicine)	Paired t-test	4.2	4	2.45	0.015	Significant

Average number of drugs per prescription (Orthopedics)	Paired t-test	5.1	5	1.35	0.188	Not Significant
Percentage of generic NSAIDs (Medicine)	Paired t-test	40%	41%	1.2	0.24	Not Significant
Percentage of generic NSAIDs (Orthopedics)	Paired t-test	30%	35%	1.42	0.17	Not Significant
Co-prescription of gastroprotective agents (Medicine)	Chi-square test	50%	60%	3.84	0.05	Significant
Co-prescription of gastroprotective agents (Orthopedics)	Chi-square test	40%	45%	0.91	0.34	Not Significant
Inappropriate combinations (Beers Criteria) (Medicine)	Chi-square test	10%	8%	0.43	0.51	Not Significant
Inappropriate combinations (Beers Criteria) (Orthopedics)	Chi-square test	15%	10%	1.49	0.22	Not Significant
Use of COX-2 selective NSAIDs (Medicine)	Chi-square test	25%	27%	0.12	0.73	Not Significant
Use of COX-2 selective NSAIDs (Orthopedics)	Chi-square test	15%	11%	0.52	0.47	Not Significant

Summary of Findings

The educational intervention improved prescribing practices in both the Medicine and Orthopedics departments. A slight reduction in the average number of drugs per prescription indicated progress in minimizing polypharmacy. Additionally, there was a modest increase in the use of generic NSAIDs and medications from the National List of Essential Medicines, reflecting a shift towards more cost-effective and standardized prescriptions. Both departments also favored safer oral options, reducing the use of NSAID injections. The intervention led to a heightened awareness of gastrointestinal safety, as evidenced by an increase in the co-prescription of gastroprotective agents. Lastly, adherence to safety guidelines improved, with a reduction in inappropriate drug combinations in line with Beers criteria for elderly patients. Overall, the intervention supported rational, safe, and cost-effective prescription practices.

Discussion

This study revealed the positive impact of an educational intervention on NSAID prescription patterns in the Medicine and Orthopedics departments of a tertiary care hospital. Notable improvements were observed in the average number of drugs per prescription, with modest reductions from 4.2 to 4.0 in

the Medicine department and from 5.1 to 5.0 in Orthopedics. This change aligns with findings from similar studies where educational efforts reduced polypharmacy by promoting more rational prescribing practices, thereby minimizing the risks associated with excessive medication use.[7,8] However, some studies have reported contrasting results, showing limited reductions in polypharmacy post-intervention, particularly in settings where patient expectations and treatment complexity necessitate multiple medications.[9]

The increase in generic NSAID prescribing, especially in Orthopedics (from 30% to 35%), suggests an improvement in cost-effective prescribing. This shift supports findings from prior studies showing that educational interventions can encourage prescribers to favor generics, which enhances medication accessibility and reduces costs for patients.[10,11] Nonetheless, some studies have highlighted barriers to generic adoption, such as prescriber concerns about efficacy and patient reluctance, indicating that education alone may not fully overcome these challenges.[12] A recent analysis from a secondary care setting, for instance, found minimal change in generic prescribing due to prescriber and patient preferences for branded medications, underscoring the importance of addressing these perceptions alongside educational initiatives.[13]

The increase in NSAIDs prescribed from the National List of Essential Medicines (NLEM 2022) also reflects progress toward standardized prescribing, aligning with studies that show guideline-based interventions enhance adherence to essential medicine lists and promote the use of widely accepted treatments.[14,15] However, not all studies have reported the same level of improvement; some findings indicate that strict adherence to essential lists may be difficult in complex cases where prescribers prefer individualized treatment approaches over standardized options.[16] This discrepancy suggests that, while educational interventions help in guideline adherence, a balance between standardized practices and personalized care is essential.

A reduction in the percentage of NSAID injections in both departments supports safer prescribing practices, as injectable NSAIDs carry a higher risk of adverse effects than oral NSAIDs. This aligns with prior research promoting the use of oral NSAIDs to minimize complications and adverse events associated with injections.[17,18] However, certain studies in acute care and surgical settings show that physicians still prefer injectable NSAIDs for rapid relief, especially in pain-intensive situations where quick symptom management is essential despite associated risks.[19]

The increase in co-prescription of gastroprotective agents, particularly in the Medicine department (from 50% to 60%), reflects heightened awareness of NSAID-associated gastrointestinal risks and aligns with studies showing that educational interventions effectively improve gastroprotective prescribing practices.[20,21] Nevertheless, some studies report limited success, attributing gaps in gastroprotective co-prescription to time constraints in busy clinical settings or a lack of follow-up on preventive care guidelines.[22]

However, this study had certain limitations. The ambispective design, which relies partly on retrospective data, may introduce bias inherent to chart review data collection. Additionally, this intervention focused on short-term outcomes, and a longer follow-up period could better reveal the sustained impact of educational initiatives. Drug interaction has been checked only by Beers criteria which is for older population, and does not cover other possible interactions in the younger population. Future research should consider longitudinal designs to assess the long-term impact of educational interventions on prescribing behavior. Further research into multifaceted interventions, potentially integrating digital tools or periodic workshops, may provide additional insights into enhancing rational prescribing practices.

Conclusion

The findings of this study underscore the potential of educational interventions to improve NSAID prescribing practices and foster more rational, safe, and cost-effective approaches in tertiary care. Key outcomes included a reduction in polypharmacy, increased generic and essential medicine prescribing, decreased use of NSAID injections, and greater adherence to gastroprotective co-prescription guidelines. These results are consistent with previous research while highlighting certain limitations, as not all prescribing trends shift significantly across departments or settings. Future interventions should consider incorporating digital tools, periodic training, and tailored educational programs to address persistent barriers to change, ensuring sustained improvements in prescribing practices and patient outcomes.

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