

Analysis of Prescribing Patterns of Drugs Used in Osteoarthritis in Tertiary Care Center

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Abstract

Background: Osteoarthritis (O.A.) is a common degenerative lesion of the articular cartilage that corresponds to hypertrophy deterioration of bone structure is osteoarthritis. The treatment is mainly focused on the management of pain.

Methods: An Observational study was conducted among 163 patients visiting Orthopedics Out Patient Department at GMC Hospital. The duration of study was for 6 months from Jan 2024-Jun 2024. The analysis of collected data was done by SPSS version Software. Descriptive Statistics tools like frequency, Percentage were used to express the findings.

Results: We found that female was (68.7%) in comparison to male (31.3%). Oral route (79%) was most commonly preferred route of drugs administration than topical route (21%). Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) (41.78%), Vitamins and minerals (22.5%), Antulcers (19.5%), Symptomatic Slow-acting Drugs in Osteoarthritis (SYSODA) (6.82%), Muscle Relaxants (5.02%) and Others (4.07%) were Prescribed groups of drugs. Diclofenac (19.52%) was most commonly prescribed Non-Steroidal Anti-Inflammatory Drugs followed by Aceclofenac (11.37%). Average no. of drugs prescribed was 5.12, % of drugs Prescribed from National List of Essential Medicine (NLEM) was 79.88%, % of drugs prescribed by generic name was 0% and Average dispensing time was 225.13 sec.

Conclusion: Osteoarthritis (O.A) was mostly common in female than male. Lumbar was most commonly affected site of Osteoarthritis. Non-Steroidal Anti-Inflammatory Drugs was most commonly prescribed groups of drugs.

Keywords: Osteoarthritis, Prescribing Pattern, Non-Steroidal Anti-Inflammatory Drugs, Diclofenac, Symptomatic Slow-acting Drugs in Osteoarthritis.

INTRODUCTION:

A common degenerative lesion of the articular cartilage that corresponds to hypertrophy deterioration of bone structure is osteoarthritis. Genetics, feminine sex, stressful past events, advancing age, or obese all are indicators of risk ¹. The concept of Osteoarthritis (O.A.) can be classified as primary (idiopathic) or secondary emerged with the discovery that both clinical and radiological hallmarks of the condition might appear following nearly every documented joint ailment. As is generally accepted that a variety of disorders can result in secondary OA ². Osteoarthritis is a disease affecting the entire joint. It is caused by a dysregulation of various pathophysiological processes, including growth hormones, prostaglandins, neuropeptides, cartilage matrix fragments, reactive oxygen intermediates, proteolytic enzymes, and protease inhibitors. When these variables are dysregulated, a cycle of degradation of the bone, cartilage, ligaments, and synovium begins, which is followed by an inflammatory response and sensitization

of the peripheral and central nervous systems³. If gout, pseudo gout, inflammatory arthritis, or joint infection is considered, the synovial fluid assessment is suggested; a white-cell measure within the synovial fluid of fewer than 1000 per millimeter of volume is associated with osteoarthritis, as higher counts demonstrate inflammation-related arthritis⁴. In the case of obese patients, weight loss, lifestyle modifications, and rigorous exercise regimens may be the first steps in the management of osteoarthritis. In addition to pharmaceutical interventions, treatment includes patient education and physical therapy ⁵. It has been demonstrated that in vitro proteoglycan synthesis from articular cartilage can be stimulated by Non-Steroidal Anti-Inflammatory Drugs (NSAIDS) such as aspirin and diclofenac, and dietary supplements glucosamine and chondroitin. Usually, these drugs are recommended to lessen symptoms ⁶. Initial assessments of rational drug use practices in healthcare settings are conducted using the World Health Organization's (WHO) core drug use indicators ⁷. Increasingly, developing countries must

evaluate drug use patterns in accordance with World Health Organization's (WHO) principles in order to promote responsible drug use⁸. In order to continue the fight to promote Rationale Use of Drug (RUD), we therefore tried to conduct this study, which had the following goals: to assess patient education about drug use and drug dispensing practices among medical outpatients; to identify and assess issues related to drug prescribing and dispensing⁹.

RESEARCH METHODOLOGY

Research Design: An observational study was designed to analyze the prescribing Patterns of drugs used in Osteoarthritis in Tertiary Care Center.

Study site and duration:

This study was conducted for 6 months at Gandaki Medical College Teaching Hospital and Research Centre Kaski, Nepal from Jan 2024-Jun 2024 by obtaining Research Approval letter from GMC IRC (Registration No. 24/080/081)

Study population: Patients who are visiting the Orthopedics department and has been diagnosed with Osteoarthritis.

Sampling Size:

The prevalence rate of Osteoarthritis in Western Development Region of Nepal is 12.1 %.¹⁰ So, the estimated Sample size of participants was 163 by using sample size calculation formula for prevalence studies.

Inclusion Criteria:

- ❖ Patient of 18 or above 18 years of age of either sex
- ❖ Patient diagnosed with Osteoarthritis with or without co-morbidities
- ❖ Only patients who have given written informed consent were included

Exclusion Criteria:

- ❖ Patients below 18 years of age
- ❖ Patients who were not willingly to participate in the study
- ❖ Patient having surgical procedures or with mental illness, psychiatric or depressive patient.

Sampling Method: The data was collected by using Non Probability convenient sampling method was taken.

RESULTS

Gender Wise distribution of patients

The Gender Wise distribution of patients is given below:

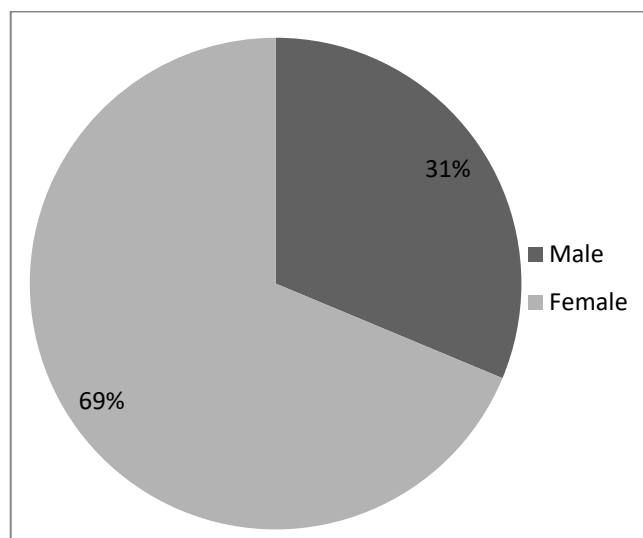


Figure a: Gender Wise distribution of patients

Among the gender Wise distribution of patients, In our research 69% was female and 31% was male.

Age distribution of patients

The age distribution of patients is given below:

Table a: Age wise distribution of patients

S.N.	Age Wise distribution	No. of patients	% of patients
1	30-40	6	3.68
2	40-50	25	15.33
3	50-60	46	28.22
4	60-70	41	25.15
5	70-80	30	18.4
6	80-90	15	9.2
Total		163	100

At our study, most of patients affected by O.A. was from age group 50-60 (28.22%) followed by 60-70 (25.15%).

Others age group were about 40-50 (15.33%), 70-80 (18.4%), 80-90 (9.2%) and least about 30-40 (3.68%).

Habitat wise distribution of patients

The habitat wise distribution of patients is given below:

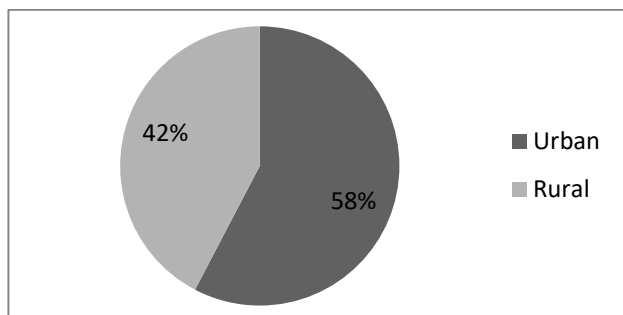


Figure b: Habitat wise distribution of patients

Out of 163 patients, 58% was found to be living in Urban area and 42% was found to be living in Rural area.

Occupation wise distribution of patients

The Occupation wise distribution of patients is shown below:

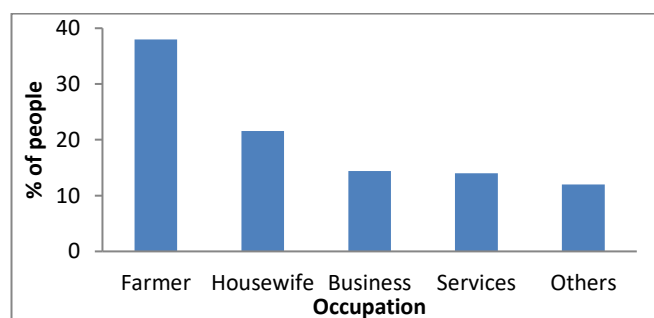


Figure c: Occupation wise distribution of patients

At present Study, most of the O.A. patients were Farmer (38%), followed by Housewife (21.6%), Business (14.4%), Services (14%) and Others (12%). Others Occupation includes Construction and Factory Workers, Drivers etc.

Site wise distribution of O.A.

The Site wise distribution of O.A. is given below:

Table b: Site wise distribution of O.A.

S.N.	Site of O.A.	No. of Cases	% of Cases
1	Lumbar	24	14.7
2	Hip	4	2.5
3	Knee	16	9.8
4	Lumbar + Hip	22	13.5
5	Lumbar + Knee	35	21.5
6	Hip + Knee	25	15.3
7	Lumbar + Hip + Knee	33	20.2
Total		163	100

The above table shows that Lumbar + Knee (21.5%) is most commonly affected site of O.A. while Lumbar + Hip + Knee (20.2%) remains the second most affected site followed by Lumbar (14.7%), Hip (2.5%), Knee (9.8%), Lumbar + Hip (13.5%), Hip + Knee (15.3%).

Co-morbidities wise distribution of patients

The Co-morbidities wise distribution of patients is presented below:

Table c: Co-morbidities wise distribution of patients

S.N.	Co-morbidities	No. of patients	% of patients
1	Present	107	65.6
2	Absent	56	34.4
Total		163	100

In our Study, we found that Co-morbidities was present among 65.6% and absent among 34.4% of patients.

Details of Co-morbidities in O.A. patients

The Details of Co-morbidities in O.A. patients are listed below:

Table d: Details of Co-morbidities in O.A. patients

S.N.	Co-morbidities	No. of patients	% of patients
1	Hypertension	23	21.49
2	Diabetes Mellitus	17	15.88
3	COPD	15	14.01
4	Heart diseases	11	10.28
5	Hypothyroidism	9	8.41
6	Asthma	7	6.54
7	Hyperthyroidism	6	5.6
8	Hypotension	4	3.73
9	Hypertension+ Diabetes Mellitus	4	3.73
10	Diabetes Mellitus + Hypothyroidism	3	2.803
11	Hypertension + COPD	3	2.803
12	Gastritis	3	2.803
13	Hypertension + Gastritis	1	0.93
14	Diabetes Mellitus + Gastritis	1	0.93
Total		107	100

Among Co-morbidities cases, Hypertension was present among 21.49% of patients followed by Diabetes Mellitus 15.88%, COPD 14.01 %, heart diseases 10.28%, Hypothyroidism 8.41%, Asthma 6.54%, Hyperthyroidism 5.60%, Hypotension 3.73% followed by other diseases.

Distribution of drugs by Route of administration:

The Distribution of drugs by Route of administration is shown below:

It shows that 79% of patients were prescribed with Oral Route of administration. Similarly, 21% of patients were prescribed with Topical Route of administration for effective treatment. Oral route of administration includes medicines like Tablet, Capsule etc. Topical route of administration includes medicine like Cream, Gel, Ointment etc.

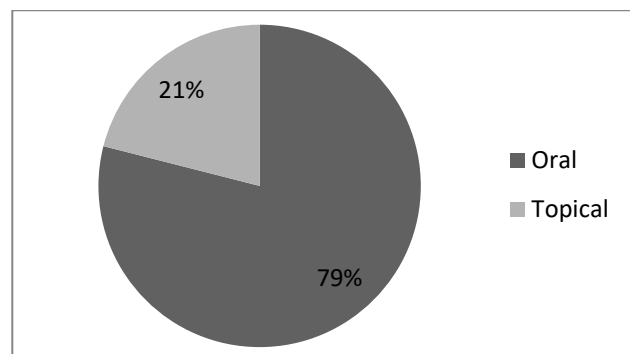


Figure e: Distribution of drugs by Route of administration

Classification of Drugs Prescribed in O.A.

The table of Classification of Drugs Prescribed in O.A. is shown below:

Table e: Classification of Drugs Prescribed in O.A.

S.N.	Classification of drugs	Name of drugs	No. of drugs	% of prescribed drugs
1	NSAIDS	Diclofenac (1.16% w/W)	163	19.52
		Acelofenac (100 mg)	95	11.37
		Diacerin (50 mg)	33	3.95
		Naproxen (500 mg)	29	3.47
		Etoricoxib (90 mg)	29	3.47
2	Antiulcers	Esomeprazole (40 mg)	66	7.9
		Pantoprazole (20 mg)	46	5.5
		Rabeprazole (40 mg)	51	6.1
3	Vitamins	Calcium + Calcitrol (500 mg + 0.25 mcg)	89	10.65
		Calcium (500 mg)	36	4.31
		Cholecalciferol (50 mcg)	63	7.51
4	SYSODA	Chondrotin Sulphate + Glucosamine Sulphate+Hyaluronic acid+Collagen peptide+Rosheip Extract	57	6.82
5	Muscle Relaxants	Chloroxazone + paracetamol (500 + 500 mg)	24	2.87
		Tizanidine (2 mg)	18	2.15
6	Others	Pregabalin + Methylcobalamin (75 mg + 750 mcg)	34	4.07
Total			835	100

It shows that NSAIDS (41.78%) were most prescribed drugs among the given classification of drugs followed by Vitamins (22.47%), Antiulcers (19.5%), SYSODA (7.51%), Muscle Relaxants (5.02%), Others (4.07%). Among NSAIDS Diclofenac (19.52%) was most Commonly prescribed while Naproxen and Etoricoxib was less Prescribed.

Details of Classes of NSAIDS in O.A.

The Details of Classes of NSAIDS in O.A. is listed below:

Table f: Details of Classes of NSAIDS in O.A.

S.N.	Classes of NSAIDS	No. of drugs	% of drugs
1	Aryl acetic acid derivatives	128	58.44
2	Anthraquinones	33	15.06
3	Propionic acid derivatives	29	13.24
4	Selective COX-2 inhibitors	29	13.24
Total		219	100

The above table shows that Aryl acetic acid derivatives (Aceclofenac, Diclofenac) were found to be most Prescribed by 58.44%. Similarly, Others NSAIDS like Anthraquinolones (Diacerin) 15.06%, Propionic acid derivatives (Naproxen) 13.24% and Selective COX-2 inhibitors (Etoricoxib) 13.24% were also prescribed.

Number of drugs per prescription

The details of Number of drugs per prescription is presented below:

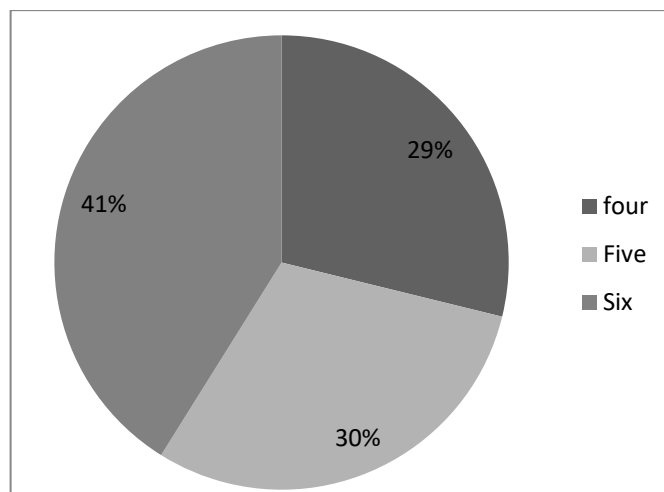


Figure f: Number of drugs per prescription

In the present study, we found that six (41%) was the highest number of drugs prescribed followed by five (30%) and four (29%).

Details of WHO Recommended Prescribing Indicators

The Details of WHO Recommended Prescribing Indicators is shown below:

Table g: Details of WHO Recommended Prescribing Indicators

S.N.	Details	Optimal Value	Result
1	Average no. of drugs Prescribed	1.6-1.8	5.12
2	% of drugs Prescribed by generic name	100	0
3	% of drugs Prescribed from National List of Essential Medicine (NLEM)	100	79.88
4	% of Patients with an Injection Prescribed	13.4-24.1	0
5	% of Patients with antibiotic	20-26.8	0

Our research shows that Average no. of drugs Prescribed was 5.12, % of drugs Prescribed by generic name was 0%, % of drugs Prescribed from National List of Essential Medicine (NLEM) was 79.88%, % of Patients with an Injection Prescribed was 0% and % of Patients with antibiotic was 0%.

Details of WHO Recommended Patient Care Indicators

The Details of WHO Recommended Patient Care Indicators is given below:

Table h: Details of WHO Recommended Patient Care Indicators

S.N.	Details	Optimal Value	Result
1	Average Dispensing time (Sec)	>180	225.13
2	% of medicine actually dispensed	100	100
3	% of medicine adequately labelled	100	100

The above table shows that Average Dispensing time (Sec) was 225.13, % of medicine actually dispensed

was 100% and % of medicine adequately labeled was 100%.

Details of WHO Recommended Facility Specific Indicators

The Details of WHO Recommended Facility Health facility Indicators is presented below:

Table i: Details of WHO Recommended Facility Specific Indicators

S.N.	Details	Optimal Values	Result
1	% of availability of Copy of EDL to Practitioners	100	100
2	% of key drugs in the Stock	100	100

In our research, we found that % of availability of Copy of EDL to Practitioners was 100% and % of key drugs in the Stock was 100%.

DISCUSSION:

This study's findings are based on an analysis of the prescription drug pattern among outpatient Osteoarthritis (O.A.) patients at tertiary care hospitals' Orthopedics department. A total of 163 patient records, including various demographic details and information about medicines, were gathered through the use of information gathering forms.

According to our study, Female (69%) are more likely to be victims of the disease. This could be explained by the fact that women going through menopause have lower levels of estrogen, which is less cartilage-protective. In a related study conducted in Karnataka, India, it was shown that male patients had a higher prevalence. Out of the 300 patients, 180 (60%) were female and 120 (40%) were male ¹¹.

Our analysis of the age distribution criteria showed that the age group most impacted was 50–60 years old (27.22%) of the entire population. In older age as the amount of lubricating fluid inside your joints diminishes and the cartilage thins, joint movement becomes less flexible and more rigid. Additionally, joints might feel stiff due to the shortening and loss of flexibility of ligaments. According to another comparable study conducted, the age group of 51 to 60 years old had the highest prevalence (46.28%) of any other age group ¹².

In accordance with this study, the most often afflicted location for osteoarthritis was lumbar + knee (21.5%). It can be explained by the fact that Lumbar, Hip and Knee are the most common our body weight bearing joints leading to destruction of cartilages due to loss of synovial fluid. Another comparable research in Haryana, India, revealed that the most often afflicted location was the knee (87.33%), followed by the lumbar (6.67%) and hip (6%) ¹³.

In our study, six (41.1%) was the most medications administered to the patient in our current study, followed by five (30.1%) and four (28.8%), indicating the use of poly pharmacy. A similar study that reveals that the average number of prescription medicines was 2.62 ¹⁴.

According to our data, In terms of delivery mode, oral was recommended 79% of the time, even with topical was recommended 21% of that time. The reason behind

Oral route as most preferred route of drugs administration may be due to a high degree of patient compliance, affordability, the absence of sterility restrictions, versatility in dosage form design (tablets, capsules, liquid, or chewable tablets). A distinct investigation revealed that less gels and creams were used and that 86.05% of the medications were administered orally ¹⁵.

Nearly every patient in our research received a prescription for one or more classes of NSAIDS, either alone or in combination. Aceclofenac (11.37%) and diclofenac (19.52%), two phenylacetic acid derivatives, were the most frequently recommended for patients in our research. It may be prescribed mostly because Osteoarthritis is treated palliatively, with an emphasis on symptomatic alleviation, most frequently on pain. Similar findings from a study in Nagpur, India, indicated that diclofenac (18.5%) and aceclofenac (29.6%) were also often given for patients with moderate to severe osteoarthritis ¹⁶.

Our study did not prescribe any opioids and Corticosteroids which is consistent with a study conducted in Wendeng, China which found that compared to oral NSAIDS (14%), prescriptions for opioids were either less common or issued in conjunction with paracetamol, such as tramadolol (6%) and tramadolol + paracetamol (1.2%). The cause behind non-Prescribing of opioids and Corticosteroids is comparing the safety profile with other medications ¹⁷.

The American College of Rheumatology advises that acetaminophen be taken as a first option by patients with OA who are suffering mild-to-moderate pain. But in our research, they were always combined (Chlorzoxazone + Paracetamol) as combination treatment. This could be because other COX-2 inhibitors have demonstrated more efficacy and treating physicians don't believe it will be effective when administered alone ¹⁸.

The European League Against Rheumatism and the OA Research Society International have specifically suggested using diacerein and glucosamine sulfate, two Symptomatic Slow-acting Medications for Osteoarthritis (SYSADOA), during the initial stages of the disease. Just 3.62% of the prescriptions were included. Even while these drugs are generally safe and have the ability to reduce OA symptoms, their low prescription rate is low in comparison to NSAIDS ¹⁹.

To reduce the adverse effects of NSAIDS, anti-ulcer medications were often provided in addition to the medication itself. Esomeprazole (7.90%), Rabeprazole (6.10), and Pantoprazole (5.50%) were the most commonly prescribed anti-ulcer medications. Calcium + Calcitriol (10.65%), Calcium (4.31%), and Cholecalciferol (7.51%) were the other vitamins and minerals. Comparable research including prescriptions for vitamins and minerals (8.2%) and antacids (10.8%) was conducted in Chennai, India ²⁰.

According to our analysis, 58.44% of prescriptions were for aryl acetic acid derivatives (Aceclofenac and Diclofenac). The explanation for the decrease in the prescription of selective COX-2 inhibitors appears to be data that is now available suggests that patients receiving these medications may have a little higher risk of cardiovascular issues including heart attacks and strokes. Another Similar research in Karnataka, India reveals that the most commonly prescribed derivatives were aryl acetic acid such as Aceclofenac and Diclofenac (62.06%), afterwards propionic acid (13.79%) and para amino phenol (10.34%) ²¹.

In accordance with World Health Organization's (WHO) Recommended Prescribing indicators, our research reveals that the average number of prescriptions written was 5.12, 0% of prescriptions were written under a generic name; and 79.88% of prescriptions were written from the National List of Essential Medicines (NLEM) which does not satisfies Recommended Optimal values. An additional comparable study carried out in Lumbini, Nepal reveals that the WHO recommended Optimal values of average number of drugs per prescriptions was 2.9 and percent of prescription from NLEM was 17.2% ²².

We found that the average dispensing time (Sec) was 225.13 seconds, the percentage of medicine that was really delivered was 100%, and the percentage of medicine that was appropriately labeled was 100%. These results meet WHO Recommended Patient care indicators Optimal value. According to another study conducted in Maharashtra, India data of that study was average dispensing time (Sec) was 114 seconds ²³.

Our investigation revealed that 100% of practitioners had access to copies of the Essential Drugs List (EDL) and 100% of the stock included essential medications that complied with the WHO Recommended Facility Specific Indicators Value. Similar research was out in Vadodara, Gujarat showed that 100% of practitioners had access to copies of the EDL and 100% of important medications were in stock, both of which complied with the Recommended Facility Specific Indicators Value ²⁴.

Conclusion & Recommendations

According to the current study, Osteoarthritis affects women more than men .50-60 Age groups were mostly affected. NSAIDS remained most prescribed groups of drugs followed by Anti ulcers, Muscle relaxants etc. Appropriate choices such as muscle relaxants (Chloroxazone, Tizanidine), others (Pregabalin + Methylcobalamin) should be promoted. For the long-term care of osteoarthritis, SYSODA prescriptions

should be raised since they offer a building block for the production of glycosaminoglycans, which slows the disease's development and relieves joint pain symptoms. The prescribers ought to be educated concerning generic drug prescribing that can provide a variety advantages such as cost reduction.

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Conflict of Interest: The author declares that there is no conflict of interest.

REFERENCES:

1. Sinusas K. Osteoarthritis: diagnosis and treatment. American family physician. 2012.01.01;85(1):49-56.
2. Arden N, Nevitt MC. Osteoarthritis: epidemiology. Best practice & research Clinical rheumatology. 2006.02.01;20(1):3-25. <https://doi.org/10.1016/j.berh.2005.09.007>
3. Wieland HA, Michaelis M, Kirschbaum BJ, Rudolphi KA. Osteoarthritis-an untreatable disease?. Nature reviews Drug discovery. 2005.04;4(4):331-44. <https://doi.org/10.1038/nrd1693>
4. Felson DT. Osteoarthritis of the knee. New England Journal Medicine.2006.02.23;354(8):841-8 <https://doi.org/10.1056/NEJMcp051726>
5. Toegel S, Wu SQ, Piana C, Unger FM, Wirth M, Goldring MB, Gabor F, Viernstein H. Comparison between chondroprotective effects of glucosamine, curcumin, and diacerein in IL-1B-Stimulated C-28/12 Chondrocytes. Osteoarthritis and cartilage. 2008.10.01;16(10):1205-12. <https://doi.org/10.1016/j.joca.2008.01.013>
6. Lalhmangaihuali F., Litty George, Madhumitha R., Manvila Munipalli, Muhammed Saleem K.V., Parthasarathy G.. A Study on Prescription Pattern of Nonsteroidal Anti-Inflammatory Drugs (NSAIDS) in Osteoarthritis Patients at Tertiary Care Teaching Hospital. Int. J Drug Delivery and Nanotechnology.2023; 1(1):1-7.
7. Goruntla N, Ssesanga J, Bommireddy BR, Thamisetty DP, Kasturi Vishwanathasetty V, Ezeonwumelu JO, Bukke SP. Evaluation of Rational Drug Use Based on WHO/INRUD Core Drug Use Indicators in a Secondary Care Hospital: A Cross-Sectional Study in Western Uganda. Drug, Healthcare and Patient Safety. 2023.12.31;15(2):125-35. <https://doi.org/10.2147/DHPS.S424050>
8. Habibyar AF, Nazari QA. Evaluation of prescribing patterns using WHO core drug use indicators in a pediatric hospital of Kabul Afghanistan: A prospective cross-sectional study. Heliyon. 2023.11.01;9(11):1-7. <https://doi.org/10.1016/j.heliyon.2023.e21884>
9. Saurav Ghimire, Sushil Nepal, Sushil Bhandari, Prabha Nepal, Subish Palaian. A prospective surveillance of drug prescribing and dispensing in a teaching hospital in Western Nepal. J Pak MedAssociation.2009.10;59(10):726-731.
10. Kshetri, Dan Bahadur Baidwar. Knee pain and knee pain related disability in adults of the Western Development Region of Nepal. Doctoral thesis. Preston: University of Central Lancashire;2017
11. Patil LV, Nara M. A prospective observational study of prescription pattern of drugs used in the treatment of osteoarthritis in a tertiary care Hospital. Int J Basic Clin Pharmacol. 2017;6(3):85-88. <https://doi.org/10.18203/2319-2003.ijbcp20164757>
12. Murthy NR, Raghu S. A new horizon in the prescription pattern of drugs for osteoarthritis in a tertiary care hospital: A prospective

- observational study. *National Journal of Physiology, Pharmacy and Pharmacology*. 2023;13(3):620-623.
13. Ummat A, Singh RJ, Kochhar S. An observational study of prescription pattern of drug for osteoarthritis in a north Indian medical college. *Asian journal of Pharmaceutical and Clinical Research*. 2019;12(7):308-10. <https://doi.org/10.22159/ajpcr.2019.v12i7.33882>
 14. Gupta M, Malhotra S. pattern of prescription of non-steroidal antiinflammatory drugs in the orthopaedic outpatient clinic of a North Indian tertiary care hospital. *Indian J Pharm* 2005;3(7):404-5 <https://doi.org/10.4103/0253-7613.19083>
 15. Bishnoi M, Kumar A, Kulkarni KS. Prescription monitoring of Management Pattern of Osteoarthritis with Non Steroidal Antiinflammatory Drugs at PUHC, Chandigarh in India. *Indian Journal of Pharmaceutical Sciences*, 2006; 68(4): 525-527. <https://doi.org/10.4103/0250-474X.27837>
 16. Siddiqui RA, Quazi SH, Khan S, Shende TR. Experience of the drug utilization pattern of nonsteroidal anti inflammatory drugs used in outpatient attendees (patients) having osteoarthritis of a tertiary care hospital in central India. *J Datta Meghe Inst Med Sci Univ*. 2023;18:70-3. https://doi.org/10.4103/jdmimsu.jdmimsu_317_22
 17. Akazawa M, Mimura W, Togo K, Ebata N, Harada N, Murano H, Abraham L, Fujii K. Patterns of drug treatment in patients with osteoarthritis and chronic low back pain in Japan: a retrospective database study. *Journal of pain research*. 2019.05. 21;12(3):1631-48. <https://doi.org/10.2147/JPR.S203553>
 18. Hochberg MC. Morbidity in osteoarthritis. *Clinical Exp Rheumatology J*. 2008;26(5):51-59.
 19. Bruyère O, Burlet N, Delmas PD, Rizzoli R, Cooper C, Reginster JY. Evaluation of symptomatic slow-acting drugs in osteoarthritis using the GRADE system. *BMC Musculoskeletal Disorders*. 2008.12;9(165):1-9. <https://doi.org/10.1186/1471-2474-9-165>
 20. Sahayam Sam Anbu J, Kulandaammal M, Prakash M. Pattern of drug prescribing in osteoarthritis patients attending orthopaedic outpatient department of a tertiary care hospital. *Journal of Drug Delivery & Therapeutics*. 2016; 6(5):14-17. <https://doi.org/10.22270/jddt.v6i5.1312>
 21. Gurung S, Babu S, Sabu S, Shibu RM, Begum R, Nanjwade BK. A study on prescribing pattern in the management of osteoarthritis and rheumatoid arthritis in the department of orthopaedics. *World Journal of Pharmacy and Pharmaceutical Sci*. 2016 .01.30;5(4):1472-93.
 22. Karki N, Joshi RR, Shrestha BK, Prasad P. Drug utilization pattern by using WHO core prescribing indicators in orthopedics and obstetrics/gynecology departments of a tertiary care hospital. *Journal of Lumbini Medical College*. 2019.05.21;7(1):18-23. <https://doi.org/10.22502/jlmc.v7i1.280>
 23. Ingle P, Patil PH, Lathi V. Study of rational prescribing and dispensing of prescriptions with non-steroidal ant-inflammatory drugs in orthopedic outpatient department. *Asian Journal of Pharmaceutical and Clinical Research*. 2015;8(4):278-81.
 24. Patel J, Shah S, Patel V. A Prospective Study On Evaluation Of Prescription Patterns Using Who Prescribing Indicators In Out Patient Department Of Tertiary Care Teaching Hospital. *Journal of Pharmaceutical Negative Results*. 2022.08.1;13(8):5195-203.