

Assessment of the Role of Pharmacists in Preventing Medication Errors in Hospital Settings

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ABSTRACT

Medication errors can have serious consequences for patients in hospital settings. As medication experts, pharmacists play a critical role in preventing medication errors. This literature review examines the roles of pharmacists in preventing medication errors in hospital settings. The review identified several roles of pharmacists in preventing medication errors, including medication order review, medication reconciliation, providing drug information and education, and participation in interdisciplinary teams. The review also identified barriers to pharmacist involvement in preventing medication errors, such as limited access to patient information and limited communication with other healthcare professionals. Overall, the literature suggests that pharmacists can play a crucial role in preventing medication errors in hospital settings and that efforts should be made to overcome the barriers to their involvement.

Keywords- Medication, Pharmacists, Hospital settings, Errors, Education.

I. INTRODUCTION

Medication errors are a significant cause of morbidity and mortality worldwide, particularly in hospital settings. Pharmacists are critical members of the healthcare team who play a vital role in preventing medication errors in hospital settings. The primary responsibility of pharmacists is to ensure the safe and effective use of medications by patients. [1-5]

A systematic review of studies on the role of pharmacists in preventing medication errors in hospital settings found that pharmacists' interventions reduced the incidence of medication errors by up to 78%. These interventions included medication reconciliation, patient counseling, and pharmacist-led medication review. Moreover, the review suggested that the involvement of pharmacists in patient care significantly reduced the length of hospital stay and healthcare costs. [6-9]

Pharmacists' knowledge of medication management, drug interactions, and dosage adjustments is invaluable in ensuring that patients receive the right

medication in the correct dose and at the appropriate time. Additionally, pharmacists can play a crucial role in educating patients and their families about the safe and effective use of medications, including possible side effects and interactions. [10-12]

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Pharmacists play a vital role in hospital settings, where medication safety and efficacy are critical to patient care. They are responsible for ensuring that patients receive the correct medication, in the appropriate dosage, at the right time, and in the most effective manner. Pharmacists collaborate with physicians, nurses, and other healthcare professionals to provide optimal patient care. In addition to dispensing medications, pharmacists also perform medication reconciliation, drug interaction screening, and patient education. They play a significant role in promoting rational medication use, preventing medication errors, and minimizing adverse drug reactions. [15-20]



Figure 1: Pharmacist

Several studies have highlighted the importance of pharmacists in hospital settings. A study by Bond et al. (2012) found that pharmacist-led medication reviews reduced medication-related problems and hospital readmissions. Another study by Gillespie et al. (2010) demonstrated that pharmacist interventions in medication management significantly reduced the length of hospital stay and healthcare costs. Pharmacists Preventing Medication errors. [21-23]

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Pharmacists also play a crucial role in preventing medication errors. A study by Leape et al. (1995) found that involving pharmacists in patient care reduced the incidence of medication errors. Furthermore, a systematic review of the literature by Alshehri and Maldonado (2020) demonstrated that pharmacists' interventions reduced the incidence of medication errors in hospital settings by up to 78%. [27-30].



Figure 2: Hospital Pharmacy

II. OBJECTIVE OF ASSESSMENT OF ROLE OF PHARMACIST IN HOSPITALS SETTINGS

The objective of assessing the role of pharmacists in hospitals in medication errors is to identify their responsibilities and contributions in preventing medication errors, reducing adverse drug reactions, and improving patient outcomes [31-35]. Medication errors can cause harm to patients and result in increased healthcare costs. Therefore, understanding the pharmacist's role in preventing medication errors can help to develop strategies and interventions to improve patient safety [36].

The assessment involves evaluating the pharmacist's involvement in the medication use process, including prescribing, transcribing, dispensing, administering, and monitoring medications. The assessment also aims to determine the effectiveness of pharmacist-led interventions in reducing medication errors, such as medication reconciliation, medication therapy management, and pharmacist-led medication education [37-40].

2.1 Types of medication errors

A medication error is any preventable event that leads to the inappropriate use or administration of medication, which could cause harm to the patient. There are various types of medication errors that can occur in healthcare settings. Here are some examples:

1. Prescribing errors: These occur when a medication is prescribed in the wrong dose, route, frequency, or duration. It could be due to misreading or misunderstanding the patient's medical history, allergies, or drug interactions.[41]

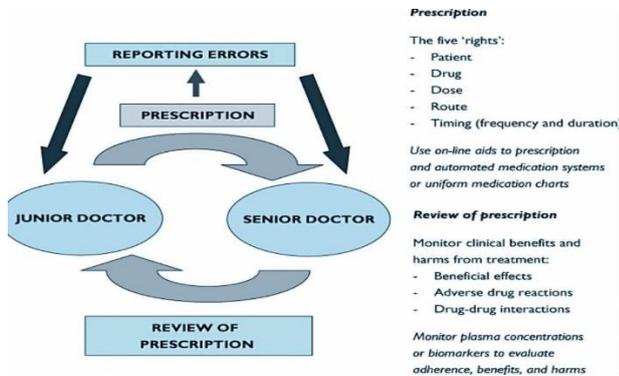


Figure 3: Method of Prescribing Chart and Report error.

2. Dispensing errors: These occur when the medication is incorrectly prepared or labeled by the

pharmacy or dispensary. It could be due to a misinterpretation of the prescription, confusion between similar-sounding drug names, or incorrect dosage calculations.[42-45]



Figure 4: Top dispensing errors

3. Administration errors: These occur when the medication is given to the wrong patient, in the wrong dose, or through the wrong route. It could be due to a lack of attention or distractions during the administration process, or confusion between similar-looking drug names.[46-48]

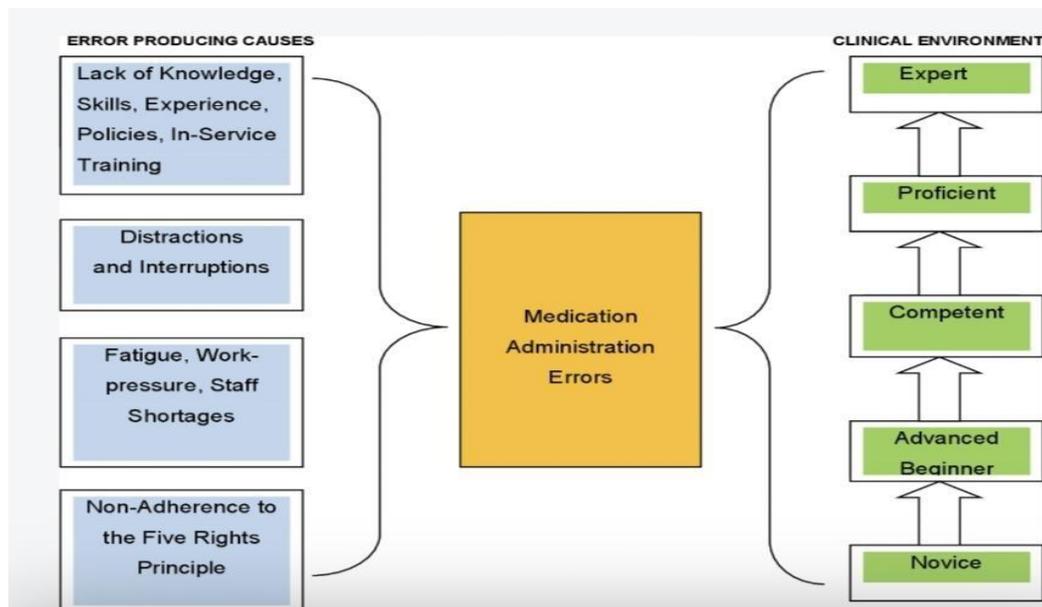


Figure 5: Competency in clinical environment and showing medication error producing causes

4. Monitoring errors: These occur when the patient's response to medication is not properly monitored or documented. It could be due to a lack of communication between healthcare providers, inadequate patient education, or failure to recognize and report drug adverse reactions.[49]

5. Documentation errors: These occur when medication administration or other medication-related information is inaccurately recorded in the patient's medical record. It could be due to incomplete or illegible handwriting, computer glitches, or incomplete documentation.[50]

III. HOW TO CORRECT MEDICATION ERRORS IN HOSPITAL SETTINGS

Medication errors are a significant concern in hospitals, as they can cause harm to patients and increase healthcare costs. Preventing medication errors requires a comprehensive approach that involves all members of the healthcare team, including pharmacists. However, when medication errors do occur, hospitals must take swift action to correct them and prevent them from happening in the future.[51-52]

To correct medication errors in hospitals, healthcare providers can implement several strategies. One such strategy is to provide additional training and education to healthcare providers on medication safety and the proper use of medications. This can include regular medication safety training sessions, updating medication protocols and policies, and implementing systems that require healthcare providers to double-check medication orders and dosages.[53]

Another strategy is to use technology to help prevent medication errors. For example, hospitals can implement computerized physician order entry (CPOE) systems that allow healthcare providers to enter medication orders directly into a computer system, reducing the risk of errors caused by illegible handwriting or transcription errors. Additionally, hospitals can use electronic prescribing (e-prescribing) systems that automatically check for potential drug interactions and allergies.[54]

Pharmacists also play a critical role in correcting medication errors in hospitals. When a medication error occurs, pharmacists can review the patient's medication orders and make any necessary corrections. Additionally, pharmacists can work with healthcare providers to ensure that patients receive the correct medications and dosages, monitor patients for adverse drug reactions, and provide patient education on medication use.[54-57]

IV. ROLE OF PHARMACIST IN HOSPITALS

Pharmacists play a vital role in hospitals as they are responsible for ensuring the safe and effective use of medications. They work closely with other healthcare professionals to provide optimal patient care. Below are some of the roles and responsibilities of pharmacists in hospitals:

1. Medication Management: Pharmacists are responsible for managing and dispensing medications to patients. They ensure that the right medication is given to the right patient at the right time and in the right dose. They also provide information to patients about how to take their medication and any potential side effects[14].

2. Drug Information: Pharmacists are a valuable resource for healthcare professionals in providing information on medications, dosages, interactions, and adverse effects. They provide information to doctors, nurses, and other healthcare professionals to ensure that patients receive appropriate and safe medication therapy[58].

3. Medication Safety: Pharmacists are responsible for ensuring medication safety in hospitals. They monitor medication orders to prevent errors in dosing, drug interactions, or contraindications. They also work with healthcare professionals to reduce medication errors and adverse drug reactions[59].

4. Patient Education: Pharmacists play an important role in educating patients about their medications. They provide information on how to take medications, what to expect, and potential side effects. They also answer any questions that patients may have about their medication therapy[60].

5. Clinical Pharmacy Services: Pharmacists provide clinical pharmacy services in hospitals by working with healthcare teams to provide patient-specific drug therapy recommendations. They also participate in medication management rounds, provide drug therapy monitoring, and manage medication-related problems[61].

4.1 Handling of prescription '-

Prescription handling is an essential responsibility of pharmacists in hospitals to ensure safe and effective medication therapy.

1. Verification and Accuracy: Pharmacists are responsible for verifying the accuracy and completeness of the prescription to ensure that the medication is appropriate for the patient's medical condition, age, and other factors such as allergies or drug interactions[62].

2. Dosage and Administration: Pharmacists must check the dosage, strength, and route of administration of the medication before dispensing it to the patients [63]

3. Communication and Documentation: Pharmacists communicate with the prescriber to clarify any ambiguous information and to resolve any discrepancies that may arise during prescription processing. They also document prescription information accurately to ensure continuity of care and to maintain patient safety[64].

4. Importance in Medication Management: Prescription handling is a critical component of medication management in hospitals, and pharmacists play a vital role in ensuring safe and effective medication therapy[65].

V. CONCLUSION

In conclusion, preventing medication errors is a critical issue in hospital settings, and the role of pharmacists in achieving this goal cannot be overstated. Pharmacists play a vital role in medication management, including reviewing medication orders, dispensing medications, educating patients on medication use, and monitoring for adverse drug reactions. Their expertise and involvement in the medication use process make them key players in identifying and preventing medication errors before they occur.

A comprehensive approach to medication safety in hospitals involves collaboration among multiple healthcare professionals, including physicians, nurses, and other staff. It also requires the development and implementation of policies and procedures that promote medication safety, such as computerized physician order entry systems and barcode medication administration systems. Regular training and education for healthcare professionals on medication safety best practices is also essential in preventing medication errors. Therefore, it is

essential that hospitals recognize and support the critical role of pharmacists in medication safety by providing them with appropriate resources, ongoing education and training, and sufficient staffing levels. By working together with other healthcare professionals, pharmacists can help ensure the safe and effective use of medications in hospital settings, ultimately improving patient outcomes and reducing healthcare costs.

REFERENCE

- [1] Alshehri, M., & Maldonado, A. Q. (2020). The role of pharmacists in preventing medication errors in hospital settings: a systematic review of the literature. *Journal of Pharmacy Practice*, 33(5), 647-654.
- [2] Pham, J. C., Story, J. L., Hicks, R. W., Shore, A. D., Morlock, L. L., Cheung, D. S., & Pronovost, P. J. (2014). National study on the frequency, types, causes, and consequences of voluntarily reported emergency department medication errors. *Journal of emergency nursing*, 40(1), 6-13.
- [3] Zillich, A. J., & McDonough, R. P. (2018). The role of the pharmacist in medication safety. *Medication Safety in Pharmacy Practice*, 25-38
- [4] Alshehri, M., & Maldonado, A. Q. (2020). The role of pharmacists in preventing medication errors in hospital settings: a systematic review of the literature. *Journal of Pharmacy Practice*, 33(5), 647-654.
- [5] Pham, J. C., Story, J. L., Hicks, R. W., Shore, A. D., Morlock, L. L., Cheung, D. S., & Pronovost, P. J. (2014). National study on the frequency, types, causes, and consequences of voluntarily reported emergency department medication errors. *Journal of emergency nursing*, 40(1), 6-13.
- [6] Zillich, A. J., & McDonough, R. P. (2018). The role of the pharmacist in medication safety. *Medication Safety in Pharmacy Practice*, 25-38.
- [7] Bond, C. A., Raehl, C. L., & Franke, T. (2012). Clinical pharmacy services, pharmacy staffing, and hospital mortality rates. *Pharmacotherapy*, 32(9), 835-845.
- [8] Gillespie, U., Alassaad, A., Henrohn, D., Garmo, H., Hammarlund-Udenaes, M., Toss, H., ... & Melhus, H. (2010). A comprehensive pharmacist intervention to reduce morbidity in patients 80 years or older: a randomized controlled trial. *Archives of Internal Medicine*, 170(Supplement), 868-874.
- [9] Leape, L. L., Cullen, D. J., Clapp, M. D., Burdick, E., Demonaco, H. J., Erickson, J. I., & Bates, D. W. (1999). Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. *Journal of the American Medical Association*, 282(3), 267-270.
- [10] Institute of Medicine (US) Committee on Quality of Health Care in America. (2000). *To err is human: Building a safer health system*. National Academies Press (US).
- [11] American Society of Health-System Pharmacists. (2018). ASHP guidelines on preventing medication errors in hospitals. *American Journal of Health-System Pharmacy*, 75(19), 1493-1517.
- [12] Poon, E. G., Keohane, C. A., & Yoon, C. S. (2010). Effect of bar-code technology on the safety of medication administration. *New England Journal of Medicine*, 362(18), 1698-1707.
- [13] American Society of Health-System Pharmacists. (2017). ASHP statement on the role of the pharmacy technician in the hospital and health-system pharmacy practice. *American Journal of Health-System Pharmacy*, 74(19), 1506-1509.
- [14] American College of Clinical Pharmacy. (2014). The role of the pharmacist in the health care system: preparing the future pharmacist. *Pharmacotherapy*, 34(8), e133-e146.
- [15] World Health Organization. (2011). The role of the pharmacist in the health care system. Retrieved from https://www.who.int/medicines/services/innovations/who_emp_pharm_2011_1/en/.
- [16] American Society of Health-System Pharmacists. (2018). ASHP guidelines on medication order processing and order review. *American Journal of Health-System Pharmacy*, 75(3), 190-200.
- [17] World Health Organization. (2017). Medication without harm: WHO global patient safety challenge. Retrieved from <https://www.who.int/patientsafety/medication-safety/en/>.
- [18] National Coordinating Council for Medication Error Reporting and Prevention. (2015). NCC MERP index for categorizing medication errors. Retrieved from <https://www.nccmerp.org/sites/default/files/indexColor2001-06-12.pdf>.
- [19] Dubey A, Pandey M, Yadav S, Tripathi D, Kumari M, Purohit D, Hypolipidemic and haematological effects of ethanolic extract of *Tecoma stans* linn(bignoniaceae) seeds in alloxan-induced diabetic albino rats. *Korean Journal of Physiology and Pharmacology*, 2023;27(1),85-90. DOI:10.25463/kjpp.27.1.2023.8.
- [20] Dubey A, Dash SL, Kumari P, Patel S, Singh S, Agarwal S, A Comprehensive Review on Recent Progress in In vivo and In vitro Models for Hyperlipidemia Studies. *Pakistan Heart Journal*, 2023;56(01),286-297. <http://www.pkheartjournal.com>.
- [21] Anubhav Dubey, Niladry Sekhar Ghosh, Anubha Gupta, Shweta Singh, 2023. A review on current epidemiology and molecular studies of lumpy skin disease virus-an emerging worldwide threat to domestic animals. *Journal of medical pharmaceutical and allied sciences*, V 12 - I 1, Pages - 5635 - 5643. DOI: 10.55522/jmpas.V12I1.4583.
- [22] Pate S, Dubey A, Gupta Ak, Ghosh NS, (2023). Evaluation of Antimicrobial Activity of *Calotropis Gigantea* Extracts on Two Main Skin Infection Causing Bacteria - *Escherichia Coli* and *Staphylococcus Aureus*.12(1):145-157.
- [23] Dubey A, Ghosh NS, Singh R. Zebrafish as An Emerging Model: An Important Testing Platform for

Biomedical Science. *J Pharm Negative Results* 2022;13(3): 1-7.DOI:10.47750/pnr.2022.13.03.001.

[24] Anubhav Dubey, Raghuvendra Singh, Ashish Kumar, Gaurav Mishra, Anubha Gupta, Anuj Sonker, & Amit Mishra. (2022). A Critical Review on Changing Epidemiology of Human Monkeypox-A Current Threat with Multi-Country Outbreak. *Journal of Pharmaceutical Negative Results*, 660–671. Retrieved from <https://www.pnrjournal.com/index.php/home/article/view/738>.

[25] Dubey, A., Yadav, P., Peeyush, , Verma, P., & Kumar, R. (2022). Investigation of Proapoptotic Potential of Ipomoea carnea Leaf Extract on Breast Cancer Cell Line. *Journal of Drug Delivery and Therapeutics*, 12(1), 51-55. <https://doi.org/10.22270/jddt.v12i1.5172>

[26] Dubey Anubhav Ghosh Sekhar Niladry, Saxena Gyanendra Kumar, Purohit Debashis, Singh Shweta, (2022). Management implications for neurotoxic effects associated with antibiotic use. *NeuroQuantology*, 6(20), 304-328. doi: 10.14704/nq.2022.20.6.NQ22034.

[27] Dubey, A., Ghosh, N. S., Rathor, V. P. S., Patel, S., Patel, B., &Purohit, D. (2022). Sars- COV-2 infection leads to neurodegenerative or neuropsychiatric diseases. *International Journal of Health Sciences*, 6(S3), 2184–2197. DOI: <https://doi.org/10.53730/ijhs.v6nS3.5980>.

[28] Kumar, A. ., Dubey, A. ., & Singh, R. . (2022). Investigation on Anti-Ulcer Activity of Momordica dioica Fruits in Wistar Rat. *International Journal for Research in Applied Sciences and Biotechnology*, 9(1), 105–111. <https://doi.org/10.31033/ijrasb.9.1.12>

[29] Dubey Anubhav, Tiwari Mamta, Kumar Vikas, Srivastava, Kshama, Singh, Akanksha. Investigation of Anti-Hyperlipidemic Activity of Vinpocetine in Wistar Rat. *International Journal of Pharmaceutical Research* 2020; 12(02):1879-1882. DOI: <https://doi.org/10.31838/ijpr/2020.12.02.250>.

[30] Raj Pratap Singh, Dr. Vishal Dubey, Anubhav Dubey & Dr. Shantanu, Liposomal gels for vaginal drug delivery of Amoxicillin Trihydrate, *International Journal of Medical Research and Pharmaceutical Sciences*;2020 7(8) 1-13.

[31] Gaurava Srivastav, Dakshina Gupta, Anubhav Dubey, & Neeraj Kumar. (2022). Investigation of Anti-Pyretic Activity of Cinnamon Oil in Wistar Rat. *Journal for Research in Applied Sciences and Biotechnology*, 1(3), 51–56. <https://doi.org/10.55544/jrasb.1.3.7>

[32] Kumar, N., Dubey, A., Mishra, A., & Tiwari, P. (2020). Ethosomes: A Novel Approach in Transdermal Drug Delivery System. *International Journal of Pharmacy & Life Sciences*, 11(5).

[33] Srivastava Kshama, Dubey Anubhav ,Tiwari Mamta ,Dubey Anurag, To evaluate the synergistic effect of pinitol with glimepride in diabetic wistar rats;7,(13)2020, 2058-2062.Dubey A., Kumar R., Kumar S., Kumar N., Mishra A., Singh Y. and Tiwari M. (2020). Review on Vinpocetine, *Int. J. of Pharm. & Life Sci.*, 11(5): 6590-6597.

[34] Srivastava K., Tiwari M., Dubey A. and Dwivedi A. (2020). D-Pinitol - A Natural Phytomolecule and its Pharmacological effect, *Int. J. of Pharm. & Life Sci.*, 11(5): 6609-6623.

[35] Dubey, A., Tiwari, D., Singh, Y., & Prakash, O. (2021). PankajSingh. Drug repurposing in Oncology: Opportunities and challenges. *Int J of Allied Med Sci and Clin Res*, 9(1), 68-87.

[36] Meher, C. P., Purohit, D., Kumar, A., Singh, R., & Dubey, A. (2022). An updated review on morpholine derivatives with their pharmacological actions. *International Journal of Health Sciences*, 6(S3), 2218–2249. <https://doi.org/10.53730/ijhs.v6nS3.5983>.

[37] Patnaik, S., Purohit, D., Biswasroy, P., Diab, W. M., & Dubey, A. (2022). Recent advances for comedonal acne treatment by employing lipid nanocarriers topically. *International Journal of Health Sciences*, 6(S8), 180–205. <https://doi.org/10.53730/ijhs.v6nS8.9671>

[38] Anubhav Dubey, Deepanshi Tiwari, Kshama Srivastava, Om Prakash and Rohit Kushwaha. A discussion on vinca plant. *J Pharmacogn Phytochem* 2020;9(5):27-31.

[39] kumar, R., Saha, P., Nyarko, R., Lokare, P., Boateng, A., Kahwa, I., Owusu Boateng, P., & Asum, C. (2022). Effect of Covid-19 in Management of Lung Cancer Disease: A Review. *Asian Journal of Pharmaceutical Research and Development*, 10(3), 58-64.

<https://doi.org/https://doi.org/10.22270/ajprd.v10i3.113>.
[40] Rasheed Khushnuma, Gupta Dakshina, Dubey Anubhav, Singh Yatendra , A REVIEW ON β -ESCLIN, *Indian Journal of Medical Research and Pharmaceutical Sciences*, 2021;8(1),10-16. DOI: <https://doi.org/10.29121/ijmrps.v8.i1.2020.2>.

[41] Dubey Anubhav, Kumar Abhay, Peeyush, Singh Jitendra, Medicinal property of Callistemon viminalis, *International Journal of Pharmacognosy and Life Science* 2021; 2(2): 15-20. DOI: <https://doi.org/10.33545/27072827.2021.v2.i2a.35>.

[42] Kumari Pushpa, Kumar Santosh, Shukla Bhanu Pratap, Dubey Anubhav, An overview on breast cancer, *International Journal of Medical and all body Health Research* www.allmedicaljournal.com,2021;2(3),59-65.www.allmedicaljournal.com.

[43] Saha Purabi Dubey Anubhav, Kumar Dr. Sanjay, Kumar Roshan, Evaluation of Enzyme Producing K. Pneumoniae and Their Susceptibility to Other Anti-Biotics, *International Journal of Innovative Science and Research Technology*2022;7(5),351-353. www.ijisrt.com.

[44] Panda Braja Bihari, Patnaas,Swastik, Purohit Debashish, Das Shubhashree, Dubey Anubhav, Impact of sodium starch glycolate on Physico-chemical characteristics of mouth dissolving film of Fexofenadine, *NeuroQuantology*2022 ; 20 (6)7604-7613. doi: 10.14704/nq.2022.20.6.NQ22759.

- [45] Dubey, Anubhav, Niladry Sekhar Ghosh, Nidhee Agnihotri and Amit Kumar et al. "Herbs Derived Bioactive Compounds and their Potential for the Treatment of Neurological Disorders." *Clin Schizophr Relat Psychoses* 16 (2022). Doi: 10.3371/CSRP.DANG.081922.
- [46] Dubey A, Pandey M, Yadav S, Tripathi D, Kumari M, Purohit D, Hypolipidemic and haematological effects of ethanolic extract of *Tecoma stans* linn(bignoniaceae) seeds in alloxan-induced diabetic albino rats. *Korean Journal of Physiology and Pharmacology*, 2023;27(1),85-90. DOI:10.25463/kjpp.27.1.2023.8.
- [47] Dubey A, Dash SL, Kumari P, Patel S, Singh S, Agarwal S, A Comprehensive Review on Recent Progress in In Vivo and In Vitro Models for Hyperlipidemia Studies. *Pakistan Heart Journal*, 2023;56(01),286-297. <http://www.pkheartjournal.com>.
- [48] Anubhav Dubey, Niladry Sekhar Ghosh, Anubha Gupta, Shweta Singh, 2023. A review on current epidemiology and molecular studies of lumpy skin disease virus-an emerging worldwide threat to domestic animals. *Journal of medical pharmaceutical and allied sciences*, V 12 - I 1, Pages - 5635 - 5643. DOI: 10.55522/jmpas.V12I1.4583.
- [49] Pate S, Dubey A, Gupta Ak, Ghosh NS, (2023). Evaluation of Antimicrobial Activity of *Calotropis Gigantea* Extracts on Two Main Skin Infection Causing Bacteria - *Escherichia Coli* and *Staphylococcus Aureus*.12(1):145-157.
- [50] Dubey A, Ghosh NS, Singh R. Zebrafish as An Emerging Model: An Important Testing Platform for Biomedical Science. *J Pharm Negative Results* 2022;13(3): 1-7. DOI:10.47750/pnr.2022.13.03.001.
- [51] Anubhav Dubey, Raghuvendra Singh, Ashish Kumar, Gaurav Mishra, Anubha Gupta, Anuj Sonker, Amit Mishra. (2022). A Critical Review on Changing Epidemiology of Human Monkeypox-A Current Threat with Multi-Country Outbreak. *Journal of Pharmaceutical Negative Results*, 660-671. Retrieved from <https://www.pnrjournal.com/index.php/home/article/view/738>.
- [52] Dubey, A., Yadav, P., Peeyush, , Verma, P., & Kumar, R. (2022). Investigation of Proapoptotic Potential of *Ipomoea carnea* Leaf Extract on Breast Cancer Cell Line. *Journal of Drug Delivery and Therapeutics*, 12(1), 51-55. <https://doi.org/10.22270/jddt.v12i1.5172>
- [53] Dubey Anubhav Ghosh Sekhar Niladry, Saxena Gyanendra Kumar, Purohit Debashis, Singh Shweta, (2022) .Management implications for neurotoxic effects associated with antibiotic use. *NeuroQuantology*, 6(20), 304-328. doi: 10.14704/nq.2022.20.6.NQ22034.
- [54] Dubey, A., Ghosh, N. S., Rathor, V. P. S., Patel, S., Patel, B., &Purohit, D. (2022).Sars- COV-2 infection leads to neurodegenerative or neuropsychiatric diseases. *International Journal of Health Sciences*, 6(S3), 2184-2197. DOI: <https://doi.org/10.53730/ijhs.v6nS3.5980>.
- [55] Kumar, A. , Dubey, A. , & Singh, R. . (2022). Investigation on Anti-Ulcer Activity of *Momordica dioica* Fruits in Wistar Rat. *International Journal for Research in Applied Sciences and Biotechnology*, 9(1), 105-111. <https://doi.org/10.31033/ijrasb.9.1.12>
- [56] Dubey Anubhav, Tiwari Mamta, Kumar Vikas, Srivastava, Kshama, Singh, Akanksha. Investigation of Anti-Hyperlipidemic Activity of Vinpocetine in Wistar Rat. *International Journal of Pharmaceutical Research* 2020; 12(02):1879-1882. DOI: <https://doi.org/10.31838/ijpr/2020.12.02.250>.
- [57] Raj Pratap Singh, Dr. Vishal Dubey, Anubhav Dubey & Dr. Shantanu, Liposomal gels for vaginal drug delivery of Amoxicillin Trihydrate, *International Journal of Medical Research and Pharmaceutical Sciences*;2020 7(8) 1-13.
- [58] Gaurava Srivastav, Dakshina Gupta, Anubhav Dubey, & Neeraj Kumar. (2022). Investigation of Anti-Pyretic Activity of Cinnamon Oil in Wistar Rat. *Journal for Research in Applied Sciences and Biotechnology*, 1(3), 51-56. <https://doi.org/10.55544/jrasb.1.3.7>
- [59] Kumar, N., Dubey, A., Mishra, A., & Tiwari, P. (2020). Ethosomes: A Novel Approach in Transdermal Drug Delivery System. *International Journal of Pharmacy & Life Sciences*, 11(5).
- [60] Dubey, Anubhav, Niladry Sekhar Ghosh, Nidhee Agnihotri and Amit Kumar et al. "Herbs Derived Bioactive Compounds and their Potential for the Treatment of Neurological Disorders." *Clin Schizophr Relat Psychoses* 16 (2022). Doi: 10.3371/CSRP.DANG.081922.
- [61] Dubey A, Pandey M, Yadav S, Tripathi D, Kumari M, Purohit D, Hypolipidemic and haematological effects of ethanolic extract of *Tecoma stans* linn(bignoniaceae) seeds in alloxan-induced diabetic albino rats. *Korean Journal of Physiology and Pharmacology*, 2023;27(1),85-90. DOI:10.25463/kjpp.27.1.2023.8.
- [62] Dubey A, Dash SL, Kumari P, Patel S, Singh S, Agarwal S, A Comprehensive Review on Recent Progress in In Vivo and In Vitro Models for Hyperlipidemia Studies. *Pakistan Heart Journal*, 2023;56(01),286-297. <http://www.pkheartjournal.com>.
- [63] Anubhav Dubey, Niladry Sekhar Ghosh, Anubha Gupta, Shweta Singh, 2023. A review on current epidemiology and molecular studies of lumpy skin disease virus-an emerging worldwide threat to domestic animals. *Journal of medical pharmaceutical and allied sciences*, V 12 - I 1, Pages - 5635 - 5643. DOI: 10.55522/jmpas.V12I1.4583.