Review of Literature:

1. **Van den Bemt PMLA et al (2007)** has reviewed various literatures on drug-related problems and classified the term “drug-related problems”. Drug-related problems can be divided into intrinsic and extrinsic toxicity. Intrinsic toxicity is due to the interaction between the pharmaceutical, chemical and/or pharmacological characteristics of the drug itself and the human bio-system. Extrinsic toxicity caused by the handling of the drug either by the healthcare team or patient. Intrinsic toxicity can be explained by adverse drug reaction of the drugs whereas extrinsic toxicity by medication errors. [1]


3. **Yvonne Koh et al. (2005)** showed that polypharmacy is one of the causes for drug-related problems on admission or during hospitalization among inpatients. They conducted a retrospective, cross-sectional study in a 404 bed acute-care hospital in Singapore. Data were collected for 347 patients (54.2%) prescribed polypharmacy. The number of medications per patient ranged from 5 to 14 (mean 7.4 ± 2.1). DRPs were defined as inappropriate treatments, potential drug interactions, inappropriate dosages, unsafe drugs for patients, and ADRs experienced by patients on admission and during their inpatient stay. During this study DRPs present on admission and those discovered while hospitalized, they will be discussed as a whole with emphasis on potential drug–drug interaction, appropriate dosages, and ADRs, as these DRPs might have been preventable if proper checks were carried out by physicians and pharmacists. [12]

4. **Kevin T. Bain et al.** suggested that prevalence and predictors of medication related problems in elder patient is more. The elderly patients are frail, frequently suffer from multiple physical problems, and often are treated with numerous medications, which may place them at risk for medication-related problems (MRPs) and subsequent need long-term care (LTC) facility.

The study is to determine the demographics, clinical characteristics of patients, types of MRP’S (Medication Related Problems) present and to identify the risk factors related to MRPs. In this study the total patients are 142 in that males are 34 (23.9%) and females
are 108(76.1%). The overall age ranges from 66-97 yrs. On studying all these patients 287 potential MRPs were identified, of which the most prevalent was an actual or potential adverse drug reaction (56.3%). Propoxyphene was prescribed for 18% of patients and it accounts for one third of MRPs. On verifying the diagnosis and condition of the patient PIM (Potentially Inappropriate Medication) accounts for two third of MRPs. Potentially untreated indication was found in 62 (43.7%) patients. The most common diseases involved were COPD (30.7%), CHD (29%), CHF (24.2%), DM (11.3%) and cerebrovascular disease (4.8%). All the treatment includes missing the drugs in the specific disease in its therapy. For example: In COPD missing the Bronchodilator therapy, in CHD missing the Statin and aspirin in its therapy and in CHF missing the Angiotensin II receptor blockers. In the study investigation MRPs were classified for its identity as: drug use without indication, untreated indication, potentially improper drug selection, potentially low and high dose, actual or potential ADR, failure to take therapy and duplication in the therapy. The intention of the study is to make the better patient health care associated with MRPs by defining the goals like identifying the ADR’S, inappropriate medication, Adherence, Interventions. MRPs are the common problems seen in elderly patients and which is also a challenge to the prescribers. But with some effort and work we can able to reduce the problems commonly occurred in hospitals. [13]

5. Ronald H.B.et al. (2000) discussed that the problems relating to the use of medicines are manifold. They may differ in pharmacological, pathological, epidemiological and legal respects. Pharmacovigilance is concerned with all such problems: adverse effects and interactions as well as problems relating to ineffectiveness, inappropriate use, counterfeiting, dependence or poisoning. Practically all medicine-related problems can be classified in one basic system, taking into account their characteristics and distinctions. This system distinguishes between appropriate and inappropriate drug use, dose-related and dose unrelated problems, and types A (‘drug actions’), B (‘patient reactions’) and C (‘statistical’) adverse effects. This classification may serve as an educational tool and may be useful in when choosing a study method and for the design of effective strategies in pharmacovigilance.

The classification proposed in this paper covers the entire scale of medicine-related problems, taking into account their basic characteristics and distinctions, and is generally
applicable. It may serve as an educational structure for a good understanding by practitioners and scientists (e.g. clinicians, pharmacists, pharmacologists and epidemiologists) of the complex problems relating to drug treatment. In addition, it may be useful for the proper choice of a study method and for the design of rational and efficient strategies for the scientific study of medicines after approval. [14]

6. **Foppe van Mil et al (2005)** suggested that concept of drug related problems is essential for pharmaceutical care, and the pharmaceutical care process. There are many classifications available to code drug related problems such as ABC system, ASHP classification, Cipolle et al., Granada consensus, Hanlon, Hepler/Strand, Krska et al., Mackie, PAS, PCNE Classification, PI-doc, SHB-SEP and Westerlund classification. But not all these classifications are easy to use. There are eight criteria that should be considered in the selection of drug related problem classification and these criteria are appropriateness, acceptability, feasibility, interpretability, precision, reliability, validity and responsiveness. Systematically documentation of DRPs in practice or for research is difficult. There are a number of instruments available for documentation. But the available validation data for some instruments show poor reproducibility. There is a numerous way to assess the drug treatment process and identify the drug-related problems by different professionals. [15]

7. **Frank R. Ernst et al (2001)** conducted to estimate of $76.6 billion for the annual cost of drug-related morbidity and mortality resulting from DRPs in the ambulatory setting in the United States to reflect current treatment patterns and costs. The main outcome measures in this study were average cost of health care resources needed to manage DRPs. This study revealed the mean cost for a treatment failure was $977. For a new medical problem, the mean cost was $1,105, and the cost of a combined treatment failure and resulting new medical problem was $1,488. Overall, the cost of drug-related morbidity and mortality exceeded $177.4 billion in 2000. Hospital admissions accounted for nearly 70% ($121.5 billion) of total costs, followed by long-term-care admissions, which accounted for 18% ($32.8 billion). Since 1995, during study observers that the costs associated with DRPs have more than doubled. Treatment patterns and cost give economic and medical burdens for society which associated with DRPs. More attention
should be directed toward developing solutions that reduce preventable morbidity, mortality, and costs associated with DRPs. [16]

8. **Kumar K.S et al. (2011)** examined medication records of 286 patients and 218 medication administration errors were observed in 167 patients who received 1430 doses. The frequency rate of medication administration errors was found as 15.24%. Out of 218 medication administration errors, 112 errors (51.37%) were observed in surgery department and 106 errors (48.62%) were observed in medicine department. The most common types of errors observed were omission errors (n=72) and improper dose (n=38), followed by wrong time (n=28), wrong strength (n=21), wrong rate (IV infusion rate was too fast, (n=18), wrong drug (drug other than the prescribed one, (n=12), and others (Patients refusal to take medication/not bought the medication, (n=14). [17]

9. **Anne J. Leendertse et al (2008)** revealed that information exists on potential risk factors associated with preventable medication-related hospitalizations. During the study, 29 852 patients were admitted to the 21 participating hospitals, of which 12 793 were unplanned admissions. The frequency of unplanned admissions included as possibly or probably medication related problems was 5.6% (714). A total of 332 of these cases (46.5%) were assessed as potentially preventable among 714 admissions. [18]

10. **Patrick M. Eichenberger et al. (2010)** examined in this study to explore the occurrence, nature and pharmacist’s management of drug-related problems (DRPs) detected in community pharmacies using the modified PCNE classification system in new prescriptions. During prescription processing in the community pharmacies, 419 clinical and technical DRPs (or both) were detected in 329 prescriptions. In relation to the total number of prescribed drugs (n = 2309) we found 6.1% (n = 141) clinical and 12.0% (n = 278) technical DRPs. [19]

11. **Andrea H et al, (2007)** examined Drug-related problems (DRPs) such as inappropriate prescription, clinically relevant drug-drug interactions, nonadherence, and adverse drug reactions are common. The corresponding economic impact incurred is quite extensive, with costs in the US estimated at $177 billion in 2000. In a review of international studies, it was found that as many as 28% of all emergency department visits were related to DRPs and as many as 24% resulted in hospital admission. It has been argued that up to 70% of these occurrences were avoidable. A follow-up analysis suggests that a
considerable amount of direct healthcare costs could be saved by more fully using the competencies and skills of the pharmacist and provision of pharmaceutical care. [20]

12. **Samartin M U et al (2011)** showed that emergency department has a high incidence of medication-related problems in hospital. The trained healthcare team and staff pharmacist help in rectify medication-related problems early and improve the cost-effectiveness of drug therapy. [21]

13. **Pauline E I et al (2004)** showed that frequency of medication-related problems not only occurs in inpatient but also present in discharged patient from hospital. [22]

14. **Fernando F L et al (2005)** evaluated the concept of drug-related problems in numerous literatures. By reviewed the various articles from retrieval like MEDLINE search and identified that drug-related problems (DRPs), drug therapy problems (DTPs), medicine-related problems (MTPs), medication-related problems (MRPs), drug-treatment failure, pharmacotherapeutic problem and medication errors have been used to describe a concept that is under the same causes and problems. Therefore all the above terms used to define the similar unclear concept. [23]

15. **G R Passi et al (2007)** conducted observation study to identify medication error in pediatric population admitted in Neonatal Intensive care Unit (NICU), Pediatric Intensive Care Unit (PICU), Pediatric ward and rooming-in labor ward of teaching hospital of Indore. During study identified 68.5% of medication error those belonged to treatment procedure and clerical procedure of the hospital. The 27.3% of errors related to physiological factors, 14.9% errors related to equipment failure, 25.8% errors due to clerical mistakes, 21.4% errors related to carelessness and 10.5% errors related to lack of training. [24]

16. **L. K. V. Reddy et al (2009)** discussed the medication errors which is a retrospective study conducted on 500 inpatient records of hospital in Patan. Medication error categories first into prescription error, second administration error, third transcription error and fourth dispensing errors. Types of error included errors related to omissions 14 (2.8%), related to wrong time 7 (1.4%), wrong dose 5 (1%), wrong drug 5 (1%), unordered drug 4(0.8%), wrong route 1 (0.2%) and wrong patient 0 and adverse drug event 36 (7.2%). [25]
17. **M. Ramesh et al (2012)** revealed medication-related problems are a major poser to patient safety. Medication-related problems not only contribute to enhance in hospitalized but also morbidity and mortality. So that it is very important to identify the causes and trying to avoid medication-related problems in hospital or clinical. The pharmacist plays a very important role to minimize or preventing these medication-related problems by improving knowledge, adequate training and conversing with healthcare professionals. [26]

18. **J M Krahenbuhl et al (2007)** studied with an objective to develop a coding system incorporated into pharmaceutical software to routinely report and assess the process of community pharmacists interventions related to medical prescriptions. The developed coding system is very useful in managing the drug-related problems when compared with pharmacist intervention of previously observed. [27]

19. **P Agrawal et al (2012)** presented in his study that both gender have equal risk and young age group category (18-30) at high risk for medication-related problems. [28]

20. **H. Singh et al (2012)** study conducted on 3560 hospitalized patient and analyzed 118 admissions cause by medication-related problems. The most common MRPs noticed is noncompliance of the patients which can be minimized by the proper education and counseling of the patient and/or caretakers. [29]


22. **Rohan A Elliott et al (2009)** studied a risk-classification system for medication-related problems or intervention in elderly outpatients. The medication-related problems evaluated not only by pharmacist but also by geriatricians. Adverse events found more by pharmacists than geriatricians. The identification of medication-related problems/interventions needs an interaction or conversation between at least one doctor and pharmacist. The medication-related problems are classified into nil, low, moderate, high and extreme high. [31]
23. **S. Emami et al (2012)** reported a case about medication-related problems during oral medication administration in a 53-year-old patient with an enteral feeding tube who was admitted to the intensive care unit (ICU). The medication-related problems are reported errors in dosage form selection, methods of oral medication administration, and drug interactions and incompatibility with nutrition formula. [32]

24. **P Knudsen et al (2007)** emphasized the investigation of frequency and seriousness of medication-related problems. The medication-related problems are identified as 23/10000 prescriptions for prescription corrections, 1/10000 for dispensing errors, and 2/10000 for near misses. The potentially serious MRPs occurred in the transcription stage of the dispensing process. The most frequently reported MRPs were prescribing errors. [33]

25. **D L Kunac et al (2008)** concluded several methods for identifying medication-related problems in hospitalized children in New Zealand. Medication-related events were identified by using a multifaceted approach and further reviewed by three healthcare professionals (a clinical pharmacist, a clinical pharmacologist/ paediatrician, and a neonatologist). During the study period, 630 (83.3%) were identified by chart review; 111 (14.6%) by a voluntary staff quality improvement reporting system; 16 (2.1%) by interview of parents; and 4 (0.53%) events via the concurrent routine hospital-incident reporting system out of 761 medication-related events. One half of the medication-related events are preventable which caused harm to the hospitalized inpatients. [34]

26. **R Kaushal et al (2001)** reported medication errors and adverse drug events in pediatric inpatients. 616 medication errors (5.7%), 115 potential ADEs (1.1%), and 26 ADEs (0.24%) are reported when reviewing a total of 10778 medication orders. Of the 26 ADEs, 5 (19%) were preventable. Most of ADEs occurred at the stage of drug ordering and involved incorrect dosing, anti-infective drugs, and intravenous medications. Computerized based physician order entry prevents 93% and ward round based clinical pharmacists prevents 94% of ADEs. [35]

27. **Bates DW et al (1993 & 1995)** suggested that about one third of ADEs are associated with medication errors and they are preventable by healthcare system. [36, 37]