

Obstacles and Preventions of Drug Related Problems - A Review

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ABSTRACT

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Drugs are important in prevention and treatment of disease and health complaints. The increasing number of available drugs and drug users as well as more complex drug regimens led to more side effects and drug interactions, and complicates follow-up. There are different classifications of Drug Related Problems (DRPs) with different focus. Both documenting and classifying DRPs are essential to improve the process of medication's use. DRPs are relatively common in hospitalised patients and can result in patient morbidity and mortality, and increased costs. Problems related to drug therapy may be averted by preventive interventions. Several possibilities for prevention exist, especially for the prevention of medication errors. Prescribing, transcription and interpretation errors can be reduced by using computerised physician order entry. Divided drug related problems in hospitalised patients are mainly divided into two categories: extrinsic drug related problems and intrinsic drug related problems. Some measures to avoid DRPs are the avoidance of look-alike packages, education of personnel involved in the drug distribution process and introducing systems for early detection of adverse drug events. Early detection is important in the prevention of adverse drug reactions and thus each hospital should have a system for the detection of adverse drug reactions. Identifying risk factors that contribute to the development of adverse drug reactions, may also aid in the prevention of these reactions, although the effect of a focus on risk factors is likely to be smaller than the effect of a focus on medication systems improvements.

Keywords: Prevention, Prescribing, Transcription, Interpretation

INTRODUCTION

Drugs are important in prevention and treatment of disease and health complaints. The increasing number of available drugs and drug users as well as more complex drug regimens led to more side effects and drug interactions, and complicates follow-up. Drug-related problems (DRPs) lead to substantial morbidity and mortality, as well as increased health care expenditure, which in turn affect both patients and society. International studies show that hospitals and general practices have a high prevalence of such problems, mainly in the older patients.¹ Drugs are a dualistic therapeutic tool. They are intended to cure, prevent or diagnose diseases, signs or symptoms, but the shadow side is that improper use can be the cause of patient morbidity and even mortality.²

There are different classifications of DRPs with different focus. Both documenting and classifying DRPs are essential to improve the process of medication's use. In practice, professionals need a patient oriented base to implement pharmaceutical interventions. Drug related problems are frequent among patients discharged from hospital.³ A drug prescribing error rate of 5.8% in take-home prescriptions has been reported in non-European settings. The most common

types of errors were wrong dosage, inappropriate schedule and missing information.

There are 8 types of Drug related problems adverse drug reactions, drug interactions, drug use without indication, failure to receive drugs, improper drug selection, overdosage, subtherapeutic dosage, and untreated indications. Examples of DRPs seen in patients with asthma include overuse of short-acting beta-agonists (overdosage), poor compliance with inhaled corticosteroids, and inadequate inhaler technique (both examples of failure to receive drugs). When undetected or unrecognized, a DRP may result in drug-related morbidity or even drug-related mortality.⁴

DRUG RELATED PROBLEMS IN HOSPITALISED PATIENTS:

Drug related problems include medication errors (involving an error in the process of prescribing, dispensing or administering a drug, whether there are adverse consequences or not) and adverse drug reactions (any response to a drug which is noxious and unintended, and which occurs at doses normally used in man for prophylaxis, diagnosis, or therapy of disease, or for the modification of physiological function). Furthermore, adverse drug events can be defined as an injury whether of not causally - related to the use of a drug.

Drug related problems are relatively common in hospitalised patients and can result in patient morbidity and mortality, and increased costs. In order to get an overview of studies on drug related problems in hospitalised patients, with specific

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attention to the incidence of drug related problems and their costs, to the possibilities of prevention and to the effect of these interventions, we performed a literature search.

Incidences of medication errors reported in studies vary widely. The range of reported incidences of adverse drug reactions is even wider. These wide ranges can be largely explained by the different study methods and definitions used.

Problems related to drug therapy may be averted by preventive interventions. Several possibilities for prevention exist, especially for the prevention of medication errors. Prescribing, transcription and interpretation errors can be reduced by using computerised physician order entry. Together with the use of automated dispensing systems and barcode technology, this will aid in the reduction of both dispensing and administration errors. Education of nursing staff involved in the process of drug distribution is another important measure for preventing medication errors. Finally, the introduction of systems for the early detection of adverse drug reactions may help to reduce problems related to drug therapy. Identifying risk factors that contribute to the development of adverse drug reactions, may aid in the prevention of these reactions.

Definitions of drug related problems

Drug related problems have been defined in a very broad and different way across studies, including medication errors, adverse drug reactions, overdoses, non-compliance and therapeutic failure. The interpretation of study results depends on the definition used by the different authors for the drug related problems. When reviewing literature, we found that the same terms are often defined in different ways. For example, the term 'adverse drug event' was used for an adverse drug reaction of unclear causal relationship to a drug, but also for a combination of medication errors and adverse drug reactions, which actually led to patient morbidity or mortality. We tried to define the different terms in an unequivocal way, so that they may clarify the different problems we describe in this review. All retrieved articles were interpreted by using these definitions.

We divided drug related problems in hospitalised patients into two categories: problems that involve an error (extrinsic drug related problems) and problems that involve no errors (intrinsic drug related problems). In the first category a mistake is made somewhere in the drug distribution and/or production process (from the prescribing of the drug to the administering of the drug). These drug-problems can be called medication errors. Medication errors may or may not result in patient morbidity.

The second category consists of problems that occur even when no errors have been made in the entire process of drug distribution. These problems are called adverse drug

reactions. Adverse drug reactions always result in discomfort or harm to the patient.

We defined adverse drug events as a combination of medication errors and adverse drug reactions, with the condition that this combination leads to patient morbidity. Finally, in our definitions, overdose (in suicide attempts) and therapeutic failures are excluded, which is in accordance to the definitions used in the literature.

These definitions are described in table 1.^{6,7}

Table 1: Definitions of drug related problems

Drug Related Problem	A circumstance that involves a patient's drug treatment that actually, or potentially, interferes with the achievement of an optimal outcome. ⁵
Medication Error	A medication error is 'a failure in the treatment process that leads to, or has the potential to lead to, harm to the patient'. ⁶
Adverse Drug Reaction	An adverse drug reaction (abbreviated ADR) is an expression that describes harm associated with the use of given medications at a normal dosage during normal use. ⁷
Adverse Drug Event	An injury resulting from the use of a drug. ⁸

Possible causes and methods for prevention

Medication errors

In our review we found that medication errors were divided into four main categories, namely prescribing errors, transcription/interpretation errors, dispensing errors and administration errors. The last three categories can also be called 'distribution errors'. Hartwig et al. describe the results of a voluntary reporting system for medication errors: 45% of all reported errors were administration errors, 32% were transcription errors, 13% were dispensing errors and 4% were prescribing errors.⁹ In another study by Leape et al. 39% of medication errors were found to be prescribing errors, 38% were administration errors, 12% transcription errors and 11% dispensing errors.¹⁰

Prescribing errors

Prescribing errors involved prescription of a wrong drug (indication error), right drug to wrong patient (contraindication, known allergy, drug-drug interaction), wrong dose (dosing error) or wrong dosage form (e.g. tablets prescribed for patient unable to swallow). In a study by Tully and Tallis, 34% of patients admitted to an elderly care unit experienced one or more adverse drug reactions and drugs considered unnecessary were prescribed in 20% of the patients. These drugs accounted for a third of all adverse drug reactions.¹¹

Tully and Tallis were also involved in a larger study among 416 elderly patients admitted to a teaching hospital. Almost half of all adverse drug reactions were associated with drugs that were absolutely contraindicated and/or deemed unnecessary.¹² Vargas et al. found a relationship between the number of adverse drug reactions and the number of potential drug-drug interactions.¹³ Another study by Seeger et al. states that preventable adverse drug reactions in hospitalised patients were associated with dosing and previous allergy to the drug.¹⁴ Lesar et al. found an error rate of 4 errors per 1000 medication orders, of the errors with potential for adverse patient effects, 13.9% were due to decline in renal or hepatic function requiring alteration of drug therapy, 12.1% to known drug allergy, 11.4% to using the wrong drug name, dosage form or abbreviation, 11.1% to incorrect dosage calculations and 10.8% to incorrect dosage frequency.¹⁵

Causes for errors in prescribing were lack of knowledge about the prescribed drug, unfamiliarity with the patient and mental slips due to distraction [17] or calculation errors.^{16,17,18} In the study by Lesar et al.¹⁹ 30% of errors were due to lack of knowledge of the drug, 29% to lack of knowledge regarding patient factors and 17.5% to dose calculations.¹⁹

Prevention of prescribing errors

Different approaches were described in the literature to prevent prescribing errors. These approaches included improving education with respect to drugs and patient characteristics important for drug therapy using a pharmacy computer for medication order entry and by using computerised physician order entry.²⁰ One of the actions Hartwig et al. took in response to the number of allergic reactions reported in their hospitals, was the upgrading of the pharmacy computer system to facilitate capture of allergy information.²¹ In Salt Lake City in the US the "Health Evaluation through Logical Processing (HELP)" system was developed, in this pharmacy based computer system, all medication orders were entered as well as information regarding known drug allergies and appropriate drug administration rates. As the computer also uses laboratory information on patients and orders for specific 'tracer' drugs (antidotes), alerts for potential adverse drug events can be sent to physicians. Evans et al. showed that prospective surveillance for known drug allergies, and appropriate drug administration rates, can reduce the number of adverse drug events.²² Furthermore, they showed that early notification of physicians of potential adverse drug events allowed for modifications of drugs and/or dosages that could reduce the progression of mild adverse drug events to more serious conditions. Medication order entry in a pharmacy computer system was also used in the study by Raschke et al.²³ This computer generated primary prevention alerts (e.g. linking aminoglycoside dosage to creatinine clearance of the patient and thus recommending dosage adjustment) and

secondary prevention alerts (laboratory values and use of 'tracer' drugs in order to detect adverse drug events at an early stage). Computerised physician order entry eliminates the need for transcription of orders by nursing staff and for interpretation of orders by pharmacy staff. Anderson et al. showed that computerised physician order entry could result in a 21% reduction in prescribing errors.²⁰ The computer system Bates et al. used in their study on the effect of computerised physician order entry, provided the physician with a menu of medications from the formulary and default dosages.²⁴ For a number of medications relevant laboratory test results were displayed on the screen at the time of ordering. Furthermore, the computer provided a limited drug-allergy check, drug-drug interaction check and drug-laboratory check (e.g. potassium levels in patients receiving potassium). Physician order entry using this computer system resulted in a 55% decreased rate of non-intercepted serious medication errors.

In a more recent study Bates et al. report an increased sophistication of the physician order entry. They thus found a larger reduction in medication errors: from 142 per 1000 patient days to 26.6 per 1000 patient days.²⁵

Another strategy for the prevention of prescribing errors is the use of clinical pharmacy services. Leape et al. have shown that the presence of a pharmacist on rounds in a medical intensive care unit was associated with a lower rate of prescribing errors (3.5 prescribing errors per 1000 patient-days with a pharmacist, compared to 10.4 prescribing errors per 1000 patient-days without a pharmacist).²⁶ In a study by Bond et al., it was shown that increased staffing for clinical pharmacists was associated with lower drug costs. Better patient care is mentioned by the authors as one of the reasons of this cost reduction.²⁷

Transcription/interpretation errors

Many drug distribution systems rely on transcription of physician orders by nursing staff, which offers substantial opportunity for error. Handwritten orders (either directly written by physicians or after transcription by nurses) need to be interpreted by pharmacy personnel and translated into the dispensing of the right drug and the right dosage. West et al. have found verbal medication orders to be associated with a lower rate of errors, mainly due to a smaller rate of transcription errors.²⁸ These results are not in line with other studies, as verbal orders are generally perceived to be associated with a high rate of errors.²⁹ Illegible handwriting and the use of abbreviations and decimal points are especially associated with erroneous interpretation.³⁰

Prevention of transcription/interpretation errors

Prevention of this category of errors can best be achieved by computerised physician order entry, which eliminates the need for both transcription and interpretation.

Dispensing errors

Errors can occur, even after a correct interpretation of the medication order in the pharmacy. These errors can be subdivided into four categories: calculation errors, preparation errors, dispensing errors and distribution errors.³¹

Prevention of dispensing errors

Possibilities for prevention are the use of bar-coding, the use of strict preparation procedures and the use of double-checks. The unit-dose system provides the possibility for double-checking.³² By using an automated dispensing system, Klein et al. showed that the error rate could be reduced from 0.84 to 0.65%.³³ More studies are needed on the impact of this technology.

Administration errors

Administration errors occur in the last part of the distribution process, when the drug is administered to the patient. The errors that can occur in this stage involve the 'five rights': giving the right drug to the right patient at the right dose by the right route at the right time. A common classification includes wrong patient, wrong dose, wrong time, omissions, wrong drug, extra dose, improper route or method, wrong rate of flow, un-ordered drug and duplication of a drug.³⁴

Look-alike packages, lack of education on drugs, lack of double-checking, unclear medication orders (e.g. illegible handwriting, verbal orders) and under-staffing are common causes for these errors.

Prevention of administration errors

Preventive measures should include computerised physician order entry, the use of computer lists for administration (including printed drug names, dosages and routes and times of administration), the education of nurses and the introduction of double-checks. Further-more, automated cart filling and bar-coding may also be of use at this stage.³⁴

Adverse drug reactions

Adverse drug reactions are not caused by errors and therefore preventive measures to avoid them are not as easy to implement as for medication errors. However, as with medication errors, early detection of adverse drug reactions can result in the prevention of further harm to the patient. A computerised alert system could be used for this early detection. Because such a computerised system can only aid in the detection of previously known adverse drug reactions, it needs to be complemented by a voluntary reporting system. This will allow previously unknown adverse drug reactions to be detected as early as possible.

Another possibility to prevent adverse drug reactions lies in the identification of risk factors that contribute to the development of adverse drug reactions. Certain drugs can

then be avoided in patients with those risk factors. Age is generally considered to be a risk factor for adverse drug reactions, but some argue that it is not an independent risk factor.³⁵ They consider the increase of adverse drug reactions with increasing age to be the result of an increased number of drugs used by the patient and of the health status of the patient. This immediately reveals two more risk factors: number of drugs used and co-morbidity.³⁶ Another risk factor is the female gender, although this may be caused by the fact that women live longer than men and by their increased use of drugs.

Adverse drug events

Bates et al. have studied risk factors for adverse drug events (both preventable and non-preventable) in hospitalised patients.³⁷ After controlling for level of care and length of hospitalisation, few risk factors emerged. They conclude from their analysis that prevention strategies should focus on improving medication systems.

CONCLUSION

Medication errors and adverse drug reactions are relatively common in hospitalised patients and can result in patient morbidity and mortality and thus in increased costs. Our review shows a wide variety of incidences of both medication errors and adverse drug reactions. This wide variety can be largely explained by the different study methods and by the different definitions used. Therefore, one can only conclude that drug related problems are an important problem in hospitalised patients. The exact magnitude of the problem remains difficult to estimate from these studies.

These adverse consequences of drug therapy may be averted by using preventive measures. Several possibilities for prevention exist, especially for the prevention of medication errors. Introduction of the unit-dose system has resulted in substantial decreases in error rates in many hospitals. The implementation of computerised physician order entry can result in a major reduction in the number of medication errors. Furthermore, clinical pharmacists can contribute to the reduction of medication errors. The use of automated dispensing systems and of bar-coding may further reduce the error rates. Other measures are the avoidance of look-alike packages, education of personnel involved in the drug distribution process and introducing systems for early detection of adverse drug events. More studies are needed on the effects of such preventive measures.

Early detection is important in the prevention of adverse drug reactions and thus each hospital should have a system for the detection of adverse drug reactions. Identifying risk factors that contribute to the development of adverse drug reactions, may also aid in the prevention of these reactions, although the effect of a focus on risk factors is likely to be smaller than the effect of a focus on medication systems improvements.

In summary, drug related problems are an important problem in hospitalised patients, although the exact magnitude of the problem is difficult to estimate from the studies presented in our review. Drug related problems result in increased morbidity and mortality, so hospitals should introduce or further improve quality systems for the safe use of drugs.

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