Introduction

In Norway most healthcare providers have adopted to electronic patient journal systems (1). Over the last 3-4 years electronic prescription systems have been adopted by both primary care- and hospital physicians working with outpatients. After introducing these systems for outpatients more and more hospitals are now introducing computerized physician order entry (CPOE) systems for inpatients. All prescribing systems are introducing decision support for the physician during the prescribing process.

Background

The most common way of introducing decision support in computerized physician order entry (CPOE) systems are warnings on drug combinations that should be avoided, like drug-drug interactions or duplicate prescriptions, see figure 1.

To allow for decision support in the CPOE system, structured drug registers and indexes are needed. An index that is commonly used in CPOE solutions is the Anatomical Therapeutic Chemical Classification (ATC) System. The system was developed by World Health Organization (WHO) for better supporting statistics analysis of drug usage (2).

The ATC-system classify drugs into five different levels, see figure 2.

Active substances (chemical substances) used in more than one therapeutic area can be classified with more than one ATC-code. An example is acetylsalicylic acid which is used both as an analgesic (ATC N02BA01) and as an antithrombotic (ATC B01AC06).

Further, for combination products with more than one active substance, the ATC-codes are different from the single active substances. An example is losartan classified in C09CA01, while the combination of losartan and hydrochlorothiazide is classified in C09DA03.

Objective

The purpose of this study was to evaluate the use of ATC-codes as an index in a CPOE decision support system for duplicate prescribing and critical information. It also demonstrates how the relation between active substance and ATC-codes have impact on the specificity of the warnings.

Material and Method

The study is case-study using a fictive prescribing system with the ATC-classification as an index to give warnings for the prescriber. This is shown with real life prescribing examples and knowledge on algorithms for duplicate prescribing and critical warnings in CPOE systems.

Results

Some of the identified problems of incorrect use of the ATC-classifications can be illustrated following a patient admitted to hospital with the following active prescriptions on admission:

The patient is allergic to:

During the stay two new drugs were prescribed to the patient:

These examples of new prescriptions will not give rise to any warnings to the doctor for penicillin allergies or duplicate prescriptions of losartan since there is no match between the ATC-codes of the drugs involved.

Discussion

Using the ATC-codes to create warnings for duplicate prescriptions and critical information without proper knowledge of how medicines are classified, have obvious problems since there is no 1:1 relation between an active substance and an ATC-code. In Denmark reports on medication error for patients due to lack of warnings on ATC-code have been reported (3).

To better support active substances in multiple ATC-codes some systems have tried to create warnings on the 4th level of the ATC-code, this can work in some cases like for penicillin (J01CE) but if introduced widely the relevance of the warnings will decrease (4). It also requires good knowledge of the classification of medicines to register them correct.

An alternative way of introducing warnings on critical information and duplicate prescriptions will be to use structured information about the active substances; in Norway this is available for all medicines through a nations medicines register (FEST) (5). Another solution could be to use an expert group that classifies relevant relations between medicines, a similar system that is used for drug-drug interactions (6).

Conclusion

Use of the ATC-classification as a single index for warnings on duplicate prescriptions and other critical warnings will lead to lack of clinical relevant warnings in the CPOE systems. Manual connection of ATC-codes or using higher levels of the ATC-code could be a solution, but this should not be performed locally in different systems. Manual alteration of the index used will require good knowledge of the classification system, it is time consuming and it will require regular updates. A national system to ensure equal level of warnings between systems should be considered.