Overview of the utilisation of automated decision support tools at dispensing in the pharmacies in the European countries

Master thesis in Pharmacy

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Abstract

The implementation of Information and Communication Technologies (ICTs) in the pharmacies over the last decades has entailed the possibility of using automated decision support systems (Drug Utilisation Review – DUR) generating alerts to help pharmacists to identify drug related problems when dispensing prescriptions. By using such computerised decision support tools, otherwise undetected problems can be identified, thereby patient safety is increased and direct as well as indirect health care costs are decreased.

Within the EU, many initiatives regarding patient safety and ICTs are ongoing. This study aimed to survey to what extent DUR is used in the European countries, and what kind of alerts are included in the systems, since an overview has been lacking. A questionnaire was e-mailed to the national organisations representing the community pharmacies in the member states of EU, PGEU (Pharmaceutical Group of the European Union) and EES, and to a number of pharmacy chains/co-operations in the same countries.

The study provides information for 26 countries out of the 34 included (76%). 14 out of these 26 countries (54%) stated there is an automated DUR in pharmacy operation. The most common kinds of alerts included were drug-drug interactions, duplication of drug treatment and contraindications, whereas alerts for adherence problems were the least common. The Netherlands, Germany, France, Portugal, Sweden and the UK have the systems most evolved. More countries will implement automated DUR in the near future, and many of the systems in use are continuously reviewed, indicating the development of DUR in Europe is proceeding.

Introduction

Information and Communication Technologies (ICTs) are becoming increasingly important in our daily lives and the healthcare sector is no exception. Rapid and reliable ICTs have become a crucial part of efficient and effective healthcare systems in Europe and their importance and utilisation will continue to increase.[1] Within the EU, the ICT tools in healthcare are known as eHealth, and cover the range of tools used to assist and enhance the prevention, diagnosis, treatment, monitoring and management of health and lifestyle. Through improvements in access to and quality of healthcare, eHealth can deliver significant benefits to the entire community. It contributes to citizen-centred health systems, a major goal within the EU, and to the overall efficacy, efficiency and sustainability of the health sector.[2, 3] Examples of eHealth are electronic medical records (EMR), e-prescriptions[1], digital x-ray images, telemedicine services, personal wearable and portable systems for monitoring and supporting patients and health information directed at citizens via webportals.[2, 4]

Although ICTs have been revolutionising the healthcare sector in recent years, the EU has found the efforts to be fragmented. eHealth tools and services have been widely introduced, but too often health authorities, hospitals or doctors have implemented their own individual systems, not communicating with each other.[1] Fragmented data are inadequate in terms of quality insurance as well as risk management.[5] This fragmentation results in unnecessary risks of medication misuse, polypharmacy and drug-drug interactions – not least among the elderly. Pharmaceuticals are frequently prescribed by several physicians unaware of each other, since prescription records generally are not shared among various facilities.[5, 6] At European level, this fragmentation is even more pronounced. The European Commission's point of view is that in a union where citizens increasingly travel across borders, individuals should be able to find the highest standards of healthcare wherever they go. The Commission's role is to help national organisations in all member states to learn from each other, thereby facilitating faster development of eHealth across the EU.[1] Since the early 1990s and up to 2004, the European Community research programmes have been supporting the development of eHealth with co-financing that have reached EUR 500 million. The total budget is twice that amount.[7]

[1] Prescriptions are entered a computerised module by the prescriber and transfered electronically to the pharmacy for dispensing, instead of being handed over to the patients in form of a paper for them to present at the pharmacy.

In 2004, the European Commission adopted the eHealth action plan, setting out a series of targets to be met in the years up to 2010. The three target areas were 1) how to address common challenges and create the right framework to support eHealth; 2) pilot actions to jump start the delivery of eHealth; and 3) sharing the best practices and measuring progress. One part of the pilot actions is integrated health information networks to link hospitals, laboratories, pharmacies, primary care and social centres. The eHealth action plan states that by the end of 2008, the main part of European health organisations and health regions should be able to provide online services such as teleconsultation, e-prescriptions, e-referral, telemonitoring and telecare.[7]

E-prescriptions is a part of eHealth where the pharmacies play a major role. There are several studies showing that (different levels of) drug related problems are common and a major hazard for patient safety. These problems may lead to hospitalisation and even death, and they result in vast direct and indirect costs for the health care system.[5, 8-12] Many of these problems and costs are also avoidable, since drug related problems often occur due to prescription errors[8, 13] and/or adherence problems[14, 15]. Pharmacists are important in detection and prevention of drug related problems,[8] uniquely trained to recognise them.[16] By assessing the appropriateness of the prescriptions regarding e.g. dose regimens; detecting potential drug interactions; liaising with physicians about safety issues and preferred medications when treating certain conditions, they are a major part of medication management.[17] The implementation of ICTs in the pharmacies over the last decades, such as e-prescriptions, has entailed the possibility of using automated decision support systems in order to help pharmacists to identify problems when dispensing medications. By using such computerised decision support tools, otherwise undetected drug related problems can be identified, thereby patient safety is increased and direct as well as indirect health care costs are decreased.[5, 9, 11, 17, 18] Computerised physician order entry systems may effectively reduce prescribing errors, especially when combined with a decision support system.[12, 19]

Drug utilisation review (DUR) is defined by United States Pharmacopeia as ”A process to assess the appropriateness of drug therapy by engaging in the evaluation of data on drug use in a given health care environment against predetermined criteria and standards.”[20] DUR can be a tool to identify preventable medication misuse, thereby contributing to cost savings and improvement of patient safety.[5, 21] Incorporated in the pharmacy dispensing system,

prescriptions can be screened and automatic alerts can be generated for potential drug related problems. Research shows that adverse drug events are vastly reduced where such systems are employed. The Institute for Safe Medication Practices (ISMP), an organisation for patient safety, often recommends computerised alerts as a way to remind staff about potential problems.[22] The magnitude of the problem of inappropriate prescribing is greater in long-term care and the consequences greater due to the frail elderly population. A system integrating computers, physicians and pharmacists improves prescribing patterns and quality of care by inexpensively identifying inappropriate prescribing in long-term care elderly. In addition, it would facilitate knowledge transfer since it could be readily adapted to updated practice guidelines.[23] The system may provide a better understanding for when the problems occur to the whole health care team.[9]

The DUR technologies are not new. DUR was described already in 1968 by the Department of Health in the US as a process aimed at rational prescribing and minimising needless expenditures.[15] However, the fast development of ICTs over the last decades has significantly facilitated the use of automated DUR. In the US, both prospective and retrospective DUR has been mandated since 1993 for state Medicaid programs according to the Omnibus Budget Reconciliation Act (OBRA) in 1990.[5, 24, 25]

DUR may be conducted retrospectively or prospectively. A prospective DUR (pDUR) is designed to enable pharmacists to detect potential problems with drug therapy when dispensing medications. The pharmacies can either use systems maintaining the patients' prescriptions dispensed at that particular pharmacy or, more accurately, systems with access to centralised information about the patients' prescription history, regardless of where the medication was purchased.[25] The prescriptions are screened against predetermined criteria for drug related problems in the system.[15] The 1990 act required criteria to be developed to identify problems in certain categories, including inappropriate dosage, overuse (early refills), underuse (late refills), duration of therapy, duplication of therapy, indications or contraindications, and drug-drug interactions. If the patient's prescription would violate the criteria, the pharmacist is to determine (sometimes by calling the prescribing physician) whether to dispense as written, to adjust the prescription, or not to dispense the prescription at all.[25] To be effective, pDUR should have 1) consistent definitions and unique identifiers for a core health data set across plans and providers; 2) an integrated, comprehensive database for

each beneficiary; 3) rules or criteria that define alerts for medication-related concerns; and 4) software algorithms to implement these rules.[5]

A retrospective DUR (rDUR) involves evaluation of patterns of drug therapy, either concurrent with therapy or after the therapy is completed, according to United States Pharmacopeia. rDUR studies permit analysis of relatively large amounts of data for a large number of prescribers, dispensers and patients to establish patterns of prescribing, dispensing and drug use in particular patients.[20] Although each prescription might have been acceptable, the pattern over time might still be suboptimal. The focus of the rDUR can also be to identify the use of high-cost drugs and adherence to pharmacotherapy recommendations when treating certain conditions.[15] If a prescription is found to violate the criteria for optimal drug use, the case can be analysed by a panel of e.g. physicians and pharmacists to establish the reasons for the divergent prescribing behaviour.[25]

Although the benefits of DUR are remarkable, there are some disadvantages. In many cases, clinically insignificant warnings are as likely to appear as those that are vital. When practitioners become accustomed to unimportant or clinically irrelevant alerts, they often ignore these as false alarms. As a result, both physicians and pharmacists may override computerised alerts without properly checking them. This alert fatigue may lead to an increased rate of undetected, nevertheless important, errors.[22, 26, 27] This scenario is particularly plausible when the workload is high[22] or if the pharmacy organisation will not dedicate the personnel time required to adequately address the alerts.[28] Even when a potential problem is properly alerted, it may erroneously be assumed that the prescriber is already aware of the problem, hence intervention is failed. There are strategies to optimise the effectiveness of alerts and minimise the possibility of overriding the more significant ones. Some clinicians believe that it is imperative to strengthen the difficulty of overriding e.g. dangerous interactions.[26] Nevertheless, if the system forces a response to the alert, the first reason listed on the screen is often chosen for bypassing the alert, instead of appropriately addressing the issue.[22] Another approach is to adjust the systems only for high severity level of e.g. drug interaction alerts to appear. However, the drug interaction levelling system used by information vendors is based upon the volume of clinically documented cases, rather than the potential for patient harm. More significant alerts should also be as visible as possible. Some systems may allow large screen fonts in a contrasting colour, flashing

messages, or other means of distinguishing the alert. Pop-up messages is another possible strategy. No longer applicable alerts should be deleted.[22]

Research has also shown that overrides often are justifiable, suggesting problems with the quality of the alerting systems.[11, 26, 27] The effectiveness of DUR depends on the criteria used to judge the drug and the technology used to implement the system. These criteria are set by the vendors, often resulting in lack of independent verification.[5] Published compendia are often inconsistent in their rating of importance and management recommendations regarding e.g. drug-drug interactions.[24, 26] Consensus-based management strategies included in the alert systems are therefore important to identify the most salient problems with drug therapy from a systematic review of the scientific literature, doing so with acceptable levels of sensitivity and specificity. Furthermore, there is a critical need for pharmacoepidemiologic studies of the clinical and economic relevance of these criteria and their relation to patient outcomes.[25]

Although there are issues to be solved regarding automated DUR, many are identified and improvement strategies are ongoing, some mentioned above. Research also suggests that the systems are improving.[16] And despite these disadvantages, there are considerable benefits involved in terms of identifying otherwise undetected drug-related problems, thereby increasing patient safety and decreasing direct as well as indirect health care costs. As mentioned earlier, the efforts regarding implementations of ICTs in Europe have been fragmented, and currently an overview of the use of DUR in Europe is lacking. Nor the DUR systems in use regarding what kinds of problems they are alerting for are covered. This study aims to survey:

a/ to which extent automated DUR is used at community pharmacies in the European countries;

b/ which types of alerts are produced;

c/ how many alerts are produced in routine use;

d/ if the tools have been evaluated/validated.

Methods

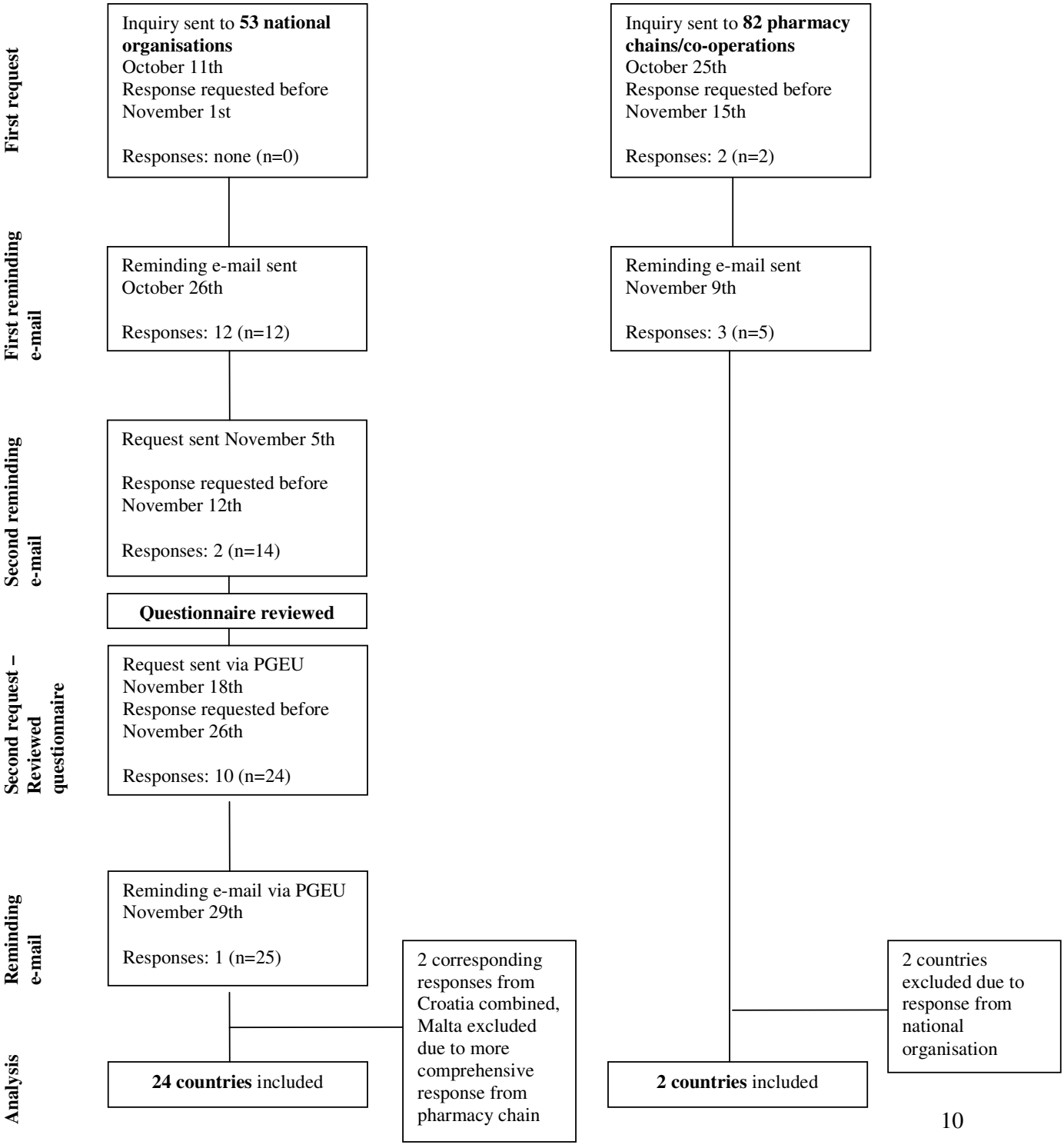
The survey was carried out using a questionnaire of eleven questions chosen to provide a sufficient overview of the utilisation and structure of automated DUR in the European countries. The questionnaire and the background letter sent with it are seen in Appendix 1. The countries included are the member states of the PGEU (Pharmaceutical Group of the European Union) and the EU countries who are not members of the PGEU. Also Iceland was included, being part of the EES. The recipients of the questionnaire in each country were the national organisations representing the community pharmacies and a number of pharmacy chains/co-operations.

The national organisations were found on the member pages of the PGEU and Europharm Forum web portals (www.pgeu.eu and www.europharmforum.org) and by sending a request for this information to the members of the PCNE (Pharmaceutical Care Network Europe – an association for pharmacy research and development along the lines of pharmaceutical care). The PCNE request also resulted in contact information to a few individual researchers thought to be potential recipients of the questionnaire. The pharmacy chains/co-operations were identified by searching the Internet (using Google.com) for "pharmacy *COUNTRY*", "pharmacies *COUNTRY*" and "pharmacy chains *COUNTRY*". The hits were distinguished by relevance and further investigated in order to get an overview of what pharmacy chains/co-operations there are in each country. The web portals of the governments also were investigated. The web portals of each pharmacy chain/co-operation was searched for (using Google.com) from which contact information was collected.

The Malta government responded to a web inquiry with contact information to the public hospital pharmacy responding for the largest part of the dispensing of the National Health Service. The Pharmaceutical Society of Iceland responded with contact information to the Department of Pharmaceutical Affairs of the Ministry of Health. The inquiry regarding Sweden was not sent to the national organisation, but directly to the company responsible for DUR in Sweden (Apotekens Service AB). The distribution lists are seen in Appendix 3 and 4.

The inquiry was e-mailed to the national organisations on October 11th 2010 and to the pharmacy chains/co-operations on October 25th, requested to respond within three weeks. A reminding e-mail was sent, along with the questionnaire, on October 26th and November 9th

respectively to those who had not responded. The national organisations who had not responded within the time assigned received another e-mail, along with the questionnaire once again, on November 5th and were given another week to respond. Due to low participation, the questionnaire was reduced to two of the most essential questions (question 1 and question 7), and sent to the members of the PGEU via the PGEU Communication and Policy Officer (also being the contact person of the members). The reviewed questionnaire is seen in Appendix 2.



The responses were, if more than one from each country, prioritised in order for national organisations to exclude pharmacy chains/co-operations and individual researchers, except for Malta. In case of response from more than one national organisation, the answers corresponded.

The answers were entered a database (Microsoft Excel 2000) for further analysis.

Results

Out of the 53 national organisations and 82 pharmacy chains/co-operations the inquiry was sent to, 14 and 5 responded to it respectively. After the review of the questionnaire another 12 national organisations responded. Iceland responded there was no possibility to participate. Put together, this provides information for 26 countries out of the 34 included (76%). Which the responding countries and national organisations/pharmacy chains or co-operations are, along with their representatives and which of the two inquiries they responded to, is found in Appendix 5. The information available regarding the countries who responded to the reviewed questionnaire is limited to whether or not there is an automated DUR used in community pharmacies and, if so, what kind of alerts is generated by the system (question 1 and 7 of the original questionnaire). This however was considered the most valuable information and the major aim of the study.

Table 1. Number of community pharmacies and average number of patients per pharmacy

Country	**Number of community pharmacies**	**Number of inhabitants per pharmacy**
Belgium	5110	2115
Croatia	1100	4200
Czech Republic	2420	3934
Denmark	259	20000
Estonia	483	2700
Finland	811	6786
Germany	21548	3800
Ireland	1559	2853
Italy	17800	3300
Netherlands	1900	9000
Norway	640	7700
Sweden	1000	9000
Switzerland	1732	4387

11 out of the 14 countries who responded to the original questionnaire stated that medication history is available at the time of dispensing. All 11 stated information of what have been dispensed previously within the same pharmacy is available. 7 countries stated what has been dispensed previously at other pharmacies is also available, however 4 of these countries only have this information available under certain circumstances. In 5 countries clinical data sometimes is accessible at dispensing and 4 countries stated care documentation sometimes is

available, although not over all. It tends to be dependent on the activity of the pharmacies since this information is often entered by the pharmacists in order to be available for other pharmacists following. The information is available for networked pharmacies and/or pharmacies using the same software. 1 country stated contraindications can be made available by the GP.

14 countries (54%) stated that there is an automated DUR used in pharmacy operation. 12 countries (46%) stated there is not. 3 countries specifically stated DUR will be implemented in the near future. 5 countries stated all or almost all pharmacies in the country use the system. In 6 countries automated DUR can be performed outside the pharmacy, e.g. by prescribers.

The most common type of alert included in the systems was drug-drug interactions (all 14 countries). 12 out of these 14 countries also stated the interactions are risk-graded. Moreover, duplication of drug treatment (10 countries), contraindications (7 countries) and with care when used to children/elderly (6 countries) were rather common alert types. The least common kinds of alerts were too late refills – suggesting adherence problems (2 countries), too early refills – suggesting adherence problems and/or abuse of drug reimbursement (2 countries), drug normally prescribed for opposite gender (4 countries) and unusual dosages (4 countries). 4 countries also declared there are additional types of alerts, such as pregnancy and lactation, renal impairment, use warnings, adverse reactions etc. All 4 countries having alerts for unusual dosages stated the alerts are patient related (in general, children, elderly) and 2 of them stated the systems alert for too high/too low dosages.

Table 2. Number of countries using the different kinds of alerts

Kind of alerts generated by the system	**Countries using alert (n=14)**	
Drug-drug interaction	14	100%
Duplication of drug treatment	10	71%
Contraindications	7	50%
With care when used to children	6	43%
With care when used to elderly	6	43%
Unusual dosages	4	29%
Drug normally prescribed for opposite gender	4	29%
Other	4	29%
Too early refills (adherence problems)	2	14%
Too late refills (adherence problems)	2	14%

7 countries (50%) stated they have dealt with the problem of alert fatigue. 5 of them by adjusting the default levels of the system and 2 of them by trying to adjust the alerts to clinical relevance reviewing them in reference groups and/or not including alerts unless their significance is confirmed. 4 countries declared their instruments have been evaluated. 3 of them with reports to be published.

Table 3. Medication history available when dispensing

Country	Dispensed previously within the same pharmacy	Dispensed previously at other pharmacies	Dispensed in hospitals at discharge	Clinical data	Care documentation (including letters and phone calls to doctors)	Other data
Belgium	Yes	No	No	Sometimes	Sometimes	-
Croatia	-	-	-	No	Sometimes	-
Czech Republic	Yes	-	-	No	No	No
Denmark	Yes	Yes	Yes	No	No	-
Estonia	-	-	-	Sometimes[1]	No	Undispensed prescriptions[2]
Finland	Yes[3]	No	No	Sometimes	Sometimes	-
Germany	Yes	Sometimes[4]	No	Sometimes	No	No
Ireland	Yes	(No)	No	No	No	No
Malta	Yes	Yes	No	No	No	No
Netherlands	Yes	Sometimes[5]	(No)	Sometimes[6]	Sometimes	Contra-indications if made available by the GP
Norway	Yes	No	No	No	No	No
Sweden	Yes	Yes	Yes	No	No	-
Switzerland	Yes	Sometimes[7]	No	No	No	No

[1]Diagnose code in case of paper prescriptions

[2]All prescriptions saved in a database

[3]Saved 13 months according to law

[4]Only if the pharmacies are networked. One pharmacist can operate up to three additional branches to the main pharmacy.

[5]If dispensed in another pharmacy in the region after opening hours.

[6]In some regions creatinin clearance and potassium level. In 2011/2012 pharmacists will get access to INR, pharmacogenetic parameters and plasma levels of drugs, potassium and sodium.

[7]If networked or between pharmacies using one particular software.

In Italy medication history sometimes recorded at local level. To what extent is not known. In Sweden everything is saved in prescription repository for 15 months, i.e. all e-prescriptions and the paper prescriptions that have been dispensed.

Table 4. Which of the countries who do use automated DUR in pharmacy operation

Country	No	Yes
Austria	1	
Belgium		1
Bulgaria	1	
Croatia	1	
Czech Republic		1
Denmark	1	
Estonia	1	
Finland		1
France		1
Germany		1
Ireland		1
Italy	1	
Latvia	1	
Lithuania	1	
Malta	1	
Netherlands		1
Norway		1
Portugal		1
Romania	1	
Serbia	1	
Slovakia		1
Spain		1
Sweden		1
Switzerland		1
Turkey	1	
UK		1
Total 26	**12**	**14**

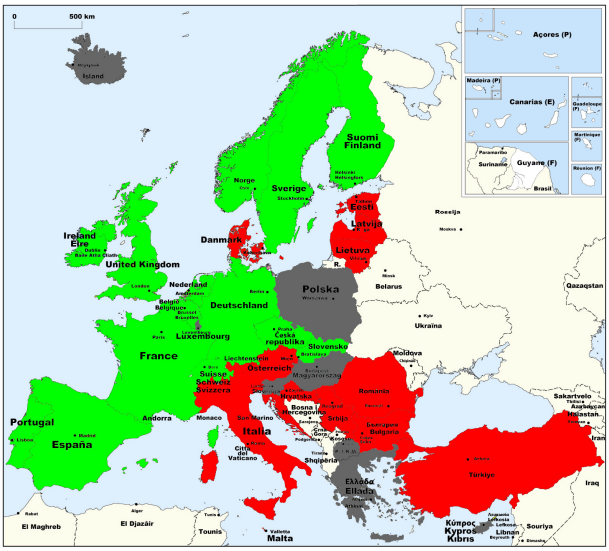


Fig. 1. Overview of the utlisation of DUR in Europe

Countries using DUR
Countries not using DUR
Countries not participating

Table 5. Utilisation of DUR in the countries

Country	**In what pharmacy operation is DUR used (community pharmacies; public pharmacies at hospitals; both)?**	**How many pharmacies use the system?**	**Retrospective or prospective DUR?**
Belgium	Community pharmacies	~4000 (almost all)	Retrospective
Czech Republic	-	~50%	-
Finland	Community pharmacies	-	Prospective
Germany	Both	-	Both possible (usually prospective)
Ireland	Community pharmacies	All	-
Netherlands	Both	All	Real time and retrospective[1]
Norway	Both	All	-
Sweden	Community pharmacies	~400 (~40%)	Prospective
Switzerland	Both	>95%	Both

[1]The alerts are generated during prescription. They are logged and can be looked up and counted afterwards. The pharmacist can do searches for optimising pharmacotherapy.

Table 6. Possibility to perform automated DUR outside the pharmacy (e.g. central database)

Country	**No**	**Yes**	**Yes, by prescribers**
Belgium	1		
Estonia			1
Finland	1		
Germany			1
Ireland	1		
Netherlands		1	
Norway			1
Sweden			1
Switzerland	1		
Total 9	**4**	**1**	**4**

The Finish database theoretically can be used anywhere. In the Netherlands DUR is used by GPs, but also there is a centralised database for searches to be performed for the lack of useful combinations of drugs etc.

The databases used by the DUR systems are national databases maintained by the national pharmacy organisations themselves in Belgium, Germany, the Netherlands and Norway. In Spain, the database used is the national state-owned database of all drugs and medical devices, as in Sweden, in addition to a national medical item repository and the prescription

repository – both maintained by Apotekens Service AB. The national interaction database in Finland used by the four Finnish DURs is maintained by Medbase in Finland and Karolinska Institutet in Sweden. The Irish DIFs each use their own database.

Table 7. Kind of alerts generated by the system

Country	Drug-drug interaction	Unusual dosages	Contraindications	Duplication of drug treatment	With care when used to elderly	With care when used to children	Drug normally used for opposite gender	Too late refills	Too early refills	Other
Belgium	Yes	No	Yes	No	No	No	No	No	No	No
Czech Republic	Yes	-	-	-	-	-	-	-	-	-
Finland	Yes	No	No	Yes	No	No	No	No	No[1]	-
France	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	-
Germany	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	-
Ireland	Yes	No	No	No	No	No	No	No	No	-
Netherlands	Yes	Yes	Yes[2]	Yes	Yes	Yes	Yes	Sometimes[3]	No[4]	Yes[5]
Norway	Yes	No	No	Yes	No	No	No	No	No	No
Portugal	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes[6]
Slovakia	Yes	No	No	Yes	No	No	No	No	-	No
Spain	Yes	No	Yes	Yes	No	No	No	No	No[7]	Yes[8]
Sweden	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No[1]	-
Switzerland	Yes	-	-	No	No	No	No	No	No	-
UK	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes[9]
Total	**14**	**4**	**7**	**10**	**6**	**6**	**4**	**2**	**2**	**4**

[1]Already included in the dispensing system due to reimbursement of drugs.

[2]Includes renal impairment, drugs and driving, sports, pharmacogenetics, pregnancy and lactation, allergies and alerts concerning the pregnancy avoiding program of the EMA.

[3]Not in the national database, but software companies do have such alerts.

[4]Part of duplication of drug therapy alerts.

[5]A program for tracing adverse events and alerts for lack of complementally pharmaceuticals, e.g. opioids prescribed without laxative or NSAIDs prescribed without gastrointestinal protection to elderly.

[6]Adverse reaction.

[7]Nevertheless, an estimated date for next dispense according to prescribed dosage is provided.

[8]Pregnancy and lactation, use warnings.

[9]Most systems recognise a new strength or form of the drug.

Table 8. Risk-grading of drug-drug interactions

Country	Are the interactions risk-graded?	If yes – how?
Belgium	Yes	Six levels
Finland	Yes	A-D based on clinical significance, 0-4 based on level of documentation.
France	Yes	-
Germany	Yes	Based on the intervention needed to minimize the risk of the interaction.
Ireland	Yes	A simple numerical grading is used in the IPU Drug Interaction Database. (One of three systems. No information about the other two.)
Netherlands	Yes	Whether or not it is an interaction combined with whether or not action is needed.[1]
Norway	No[2]	
Portugal	Yes	Three levels
Slovakia	Yes	Three levels
Spain	Yes	Three levels
Sweden	Yes	Three levels
Switzerland	Yes	Three levels and related to evidence. All systems offer an individual alert setting.
UK	Yes	Usually graded by severity – either numbered, starred or coloured.

[1]'Yes/yes' interactions appear on the screen, 'Yes/no' interactions do not appear on the screen but can be printed on the list of alerts, 'no/no' interactions are not shown anywhere but can be looked up if needed.

[2]In Norway the risk-grading of drug-drug interactions has been excluded as an approach for dealing with alert fatigue.

Table 9. ATC level of alert for duplication of drug treatment

Country	3rd level	4th level	5th level	Other	N/a
France					1
Germany				1	
Netherlands				1	
Norway		1			
Portugal			1		
Slovakia	1				
Spain		1			
Sweden				1	
UK				1	
Total 10	**1**	**2**	**1**	**5**	**1**

In Germany the ATC level of alert depends on what software is used and the adjustments made by the pharmacy. The Dutch system alerts on several hierarchical levels of the identification of the drug, each level has its own alert. Pseudo-double is included too, as it is in Portugal. In Sweden alert is not only generated on ATC code level, but within the same group, different route of administration. In UK most systems will pick up duplication of same drug, and if 2 or more items contain e.g. paracetamol.

Table 10. Measures to reduce alert fatigue

Country	Adjust alerts to clinical relevance	Adjust the default levels for alerting
Belgium		1
Finland		1
Germany		1
Netherlands	1	
Norway		1
Sweden	1	
Switzerland		1
Total 7	**2**	**5**

Netherlands and Sweden have aimed to adjust the alerts to clinical relevance by using reference groups. In the Netherlands an alert is only included if it is based on actual incidents or clinical significant changes of kinetics. Theoretical warnings are not included. Since last year, the alerts are suppressed when a drug is prescribed for the second or third time, meaning it will not appear the next time if managed properly. Most software systems also use a lag time of 14 days to avoid inadequate alerts regarding duplication of drug treatment if refilling too early.

Discussion

The main outcome of the study is the information that 14 out of 26 responding countries (54%) do have an automated DUR in use. The most common situation alerts are generated for is drug-drug interactions (all the countries using DUR) followed by duplication of drug treatment (10 countries out of 14 using DUR). More countries are on their way to implement DUR, and many of the systems in use are continuously evaluated, indicating the development of DUR is proceeding.

The results suggest that the Netherlands is the country with the most evolved DUR system, used in all pharmacies. It is the country with the most kinds of alerts incorporated into the system and the alerts regarding contraindications, unusual dosages and duplication of drug treatment are fairly sophisticated. In the near future, clinical data will be available for the pharmacists, such as INR and plasma levels of potassium, sodium and pharmaceuticals. By only including alerts based on clinically relevant cases or published significant kinetic changes; reviewing the alerts in expert groups possessing day to day clinical experience; and suppressing recurrent alerts, the problem of alert fatigue is dealt with. An evaluation of the system also is to be published next year.

The countries following are Portugal, France, Germany, Sweden and UK. Since the information from Portugal, France and UK is limited, it is hard to draw conclusions beyond the kind of alerts generated. Though the answers suggest that Portugal is the only country in the study having alerts to cover adherence problems regarding both too early and too late refills, and UK is the only of these countries not having alerts for contraindications. However, the UK information is based on the response of one national organisation while there are actually three PGEU member organisations representing the British pharmacies. The British responder also declared the answers to reflect what an *average* DUR system in UK would offer. The interaction information is only as good as the completeness of the patient records, and also as pharmacies are not networked, there could be interactions not picked up if the patient visits a variety of pharmacies, not all using the same ICT systems. The German and the Swedish systems are similar to each other. The adherence issues is the area not covered, nevertheless too early refills are already covered within the reimbursement system in Sweden. In addition, alerts for unusual dosages may be more developed in the Swedish system while the risk-grading of drug-drug interactions possibly is more sophisticated in Germany. The

pharmacists in Sweden also have access to medication history regardless of which pharmacy the medications were purchased from.

Dispensary systems in Ireland do not yet facilitate DUR. There is a pilot study underway but the form is filled in manually on a hard copy. Nevertheless, dispensary systems in community pharmacies have a Drug Interactions File (DIF) incorporated into the system. In Czech Republic, e-prescriptions were, according to a law, initiated in December 2007. The State Institute for Drug Control started the system on 1st of January 2009. However, the system is technically demanding to such extent that not a single physician has connected, and until today not a single e-prescription has been prescribed. Nevertheless the pharmacists in about half of the pharmacies use special software for drug interaction evaluation. The interaction with medications previously dispensed to the patient is possible to evaluate just approximately. Moreover, only the drugs delivered in one concrete pharmacy are included in the assessment. Czech Republic and Ireland are in this study still classified to have automated DURs since the term DUR has been interpreted differently by the countries.

In Croatia there is no DUR at the moment, but some chain pharmacies are starting to implement rDUR. In Italy there is not any project at national level regarding automated DUR yet. However, the Italian government launched the electronic health card scheme (EHC) at disposal of every patient before the end of 2012, which will contain medication history and clinical data. Implementation of e-prescriptions is planned together with the EHC, resulting in all community pharmacies having the right tools for implementation of automated DUR in the near future. In Austria DUR is currently under development. In 2007 an eHealth initiative was launched called the Medication Safety Belt, providing the pharmacist with the patient's complete health history regardless of prescriber and what pharmacy the medication was dispensed at. This pilot is probably to be established nationally next year, with DUR to follow. There are also initiatives in collaboration with Germany and Switzerland regarding the databases used (or to be used) by DUR.

Obviously the implementation of automated DUR at European level is proceeding. Apart from Ireland the answers did not provide any information whether more kinds of alerts were to be implemented in the systems or not. Denmark is an outlier being the only Scandinavian country as well as the only western European country not using automated DUR. e-prescriptions are used, and there are projects underway regarding integration of the dispensing

systems with the other health care systems.[29] Moreover, a centralised database for medication history was implemented recently. This implies eHealth is in progress and the tools to implement DUR are possessed. Even Austria is an outlier geographically, however initiatives are ongoing, mentioned above.

Several of the systems in use are being evaluated and adjusted, mainly by changing the default levels of the alerts regarding drug-drug interactions or adjusting them to clinical relevance. Two Belgian universities will soon publish a paper regarding the management of drug interactions in Belgian pharmacies. In the Netherlands, the information is being evaluated with arguments and decisions available for the pharmacists. The Dutch Society of Pharmacists (KNMP) has established a document regarding the interaction situations the systems have to comply to. Five pharmacies, representing the five pharmacy systems, have tested case descriptions based on requested outcome in the pharmacies regarding the interaction module. All systems had one or two points of improvement which will be implemented next year, when the evaluation also will be published and other modules will follow. The Swedish system has been evaluated in the US, where it was developed. A report is to be published probably next year. In Switzerland, the interaction information of the main database is built on the "Interaktionen Kompendium", which has been developed in collaboration between pharmaSuisse, Federal Union of German Associations of Pharmacists (ABDA) and Österreichische Apothekenkammer. It is now implemented in the reference database for all pharmacy management software solutions used by community pharmacies, as well as in the databases of Germany and Austria, and the interaction tool is validated by the developing pharmacist associations.

The trend is that the western and central European countries are the ones using DUR.
All the countries using such systems have alerts for drug-drug interactions. In some systems this is the only alert in use. In most of the systems the interactions also are risk-graded, some based on evidence. This indicates that a drug-drug interaction is the main focus in DUR, which is also supported by the number of studies performed on the subject.[6, 8, 16, 18, 24, 26, 30, 31] However, in case of adverse drug events, research states the majority is dose dependent.[19] Still only 4 countries remarkably states their automated DUR is alerting for unusual dosages. On the other hand 10 countries declare there are alerts for duplication of drug treatment, making it the second most common kind of alert. This might be considered a more serious issue, or at least might be thought of as a serious form of dosage error. The third

most common kind of alert is contraindications, followed by with care when used to children and elderly. The alerts for adherence problems are the rarest ones.

The responses to the inquiries were prioritised for national organisations to exclude pharmacy chains/co-operations and individual researchers, since the organisations were assumed to be able to provide a better overview, representing the community pharmacies on national level. It is plausible the insight/knowledge of future projects is greater as well. The exception is Malta, where the response from the national organisation was considered more a validation of the response from the pharmacy chain. This since the organisation responded to the reviewed questionnaire. The answers provided by both of the two responders corresponded, but information regarding medication history provided only by the pharmacy chain was considered valuable.

It is to be noted that the results are only as good as the information provided by the responders of the questionnaire. In some cases it has not been possible to determine whether the responder was mandated to speak for the organisation. Moreover, terms might have been understood differently from one recipient to another, not least the term DUR, and the risk that the compiler has misinterpreted the responses cannot be eliminated. Cross-checking the responses could have been one approach to secure the validity. Direct communication for clarification and minimising the risk of misinterpretation is to prefer, if possible. In some countries there are more than one organisation representing the community pharmacies. Responses from all recipients might alter the results. In case of more than one response from a particular country in this study, the answers corresponded positively or to a large extent.

Unfortunately it is hard to draw conclusions beyond whether DUR is used or not, and what kinds of alerts are generated by the system. This since the questionnaire, and the background information sent with it, was significantly reduced due to few responses. The results compiled were provided from 12 national organisations and 1 pharmacy chain responding to the full questionnaire (12 countries), 11 national organisations responding to the reviewed questionnaire and 2 pharmacy chains responding no DUR is used. The issues above, however, were considered the major aims of the study. Only 1 country contributed with statistics of how many alerts are produced in routine use, hence this part of the study is not considered.

According to this study, it is more likely the information requested is provided when the questionnaire is not too extensive. A web-based questionnaire could possibly have been a better approach, not least regarding the will to participate. It would also have entailed the possibility of stating standard options for the answers, thereby minimising the risk of misinterpreting them. However, the performed approach with more open questions provided additional information which otherwise would probably not have been provided. In addition the recipient was able to see the entire questionnaire immediately which is likely to minimise the risk of not fulfilling it. The study provides information for 76% of the countries within the EU, the PGEU and the EES. The picture of which of the European countries that use automated DUR is somewhat clear. It also provides fairly satisfying information of which kinds of alerts the systems in use are generating. Currently, 54% of the countries in this study have a DUR system in use, and obviously the development of DUR in Europe is proceeding.

Future research is needed to complete the survey with the missing countries. This study is to be seen as a pilot and indicates that inquiries might very well be sent as performed, however further communication might be needed. Since the term DUR is differently thought of, it is crucial to state exactly what is meant by the questions. It might be a better approach to focus on identifying and confirming the participation of a namegiven recipient in the organisations before the questionnaire itself is sent out. There is also more information about the DUR systems that needs to be discovered, e.g. the unanswered questions of this questionnaire.

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Appendix 1 – Background letter and questionnaire

Overview of the utilization of automatic DUR in the Euorpean countries

Information and Communication Technologies (ICTs) are becoming an increasingly important part of healthcare systems. These tools and services, known as eHealth, contribute to better and more efficient healtcare, used appropriately. Examples of eHealth include electronic medical records, electronic prescriptions, digital X-ray images, health cards and health information directed at citizens via web portals.

Although ICTs have been revolutionising the healthcare sector in recent years, the EU has found that efforts have been fragmented. The European Commission's point of view is that in a union where citizens increasingly travel across borders, individuals should be able to find the highest standards of healthcare wherever they go. Therefore, building a European eHealth Area is one of the major goals in the strategy for development of eHealth. The Commission's role is to help national organisations in all member states to learn from each other, thereby facilitating faster development of eHealth across the EU. In 2004, the Commission adopted the eHealth action plan, setting out a series of targets to be met up to 2010.

Drug prescription and dispensing is a part of eHealth in which the pharmacies play a major role. There is a discrepancy between prescription error rates and problems detected, acted upon and recorded by pharmacists, and there is a need for an increase in efficiency. One of the targets in the eHealth action plan was that the majority of the European healthcare organizations should be able to provide e-prescriptions by the end of 2008. The implementation of computers within pharmacies in prescription dispensing and/or e-prescribing enables possibilites to use ICTs as trigger tools, such as automatic drug prescription review (DUR), to increase detection rates of errors and problems. However, a drawback with automatic DUR tools is the volume of alerts produced, and how to discriminate those of relevance and clinical importance from those that are of little relevance or importance.

Currently, an overview of how the development of eHealth is proceeding at the pharmacies in the European countries is lacking. A project is run by the European Society of Clinical Pharmacy (ESCP) which aims to find out –

- to which extent automatic DUR is used at community pharmacies today in European countries
- what types of signals/alerts that are produced
- how many signals/alerts are produced in routine use
- if the tools have been evaluated/validated
- how pharmacists deal with the alerts and what the outcome(s) is(are)

The project group consists of Nina Griese (D), Foppe van Mil (NL) and Anders Ekedahl (S).

Your help is needed to implement this project, which will be carried out using a web-questionnaire of eleven questions to understand if/how DUR is used among the pharmacies in the European countries.

I kindly request *ORGANIZATION / PHARMACY CHAIN* to answer this inquiry (attached to this e-mail) and, therefore, I need you to please refer this request to someone speaking for your organization who will be appointed this assignment. It is of great importance that the organization's point of view is the one stated in the answers.

If contributing with your part, of course you will be provided the full report when completed, thereby get an overview of the utilization of DUR in the European countries. It has to be made clear that your answers will not be used in your competitive disadvantage in any way. The project is seen strictly as a survey of the proceeding of eHealth in the European pharmacies.

The reply of *ORGANIZATION / PHARMACY CHAIN* is most valueable, and awaited within the next three weeks, i.e. before 01/11/10.

If, for any reason, you cannot provide this information, please respond to this e-mail with a person/organization who can answer the inquiry instead.

The results of the questionnaire will be available to those who respond to it as soon as the results have been compiled.

I am doing this as a part of my master thesis in pharmacy at University of Gothenburg, Sweden where Anders Ekedahl is my supervisor. I really do hope you will find the time to help me with these issues.

If you have any questions or concerns, please do not hesitate to contact me.

I thank you in advance.

Yours sincerely,

Mathias Landerdahl

Pharmacy student,
University of Gothenburg
+46 XXX XXXXXX
[redacted]@[redacted]

INQUIRY
"Overview of the utilization of automatic DUR in the Euorpean countries"

Please either type your answers directly in this document and return it, or return the answers separately in a mail, clearly numbered.
Please respond to the following e-mail address:
[redacted]

BASIC DATA

Date for response:
Responder:
Position:
Country/region:
Number of –
community pharmacies:
public pharmacies at hospitals:
hospital pharmacies:
Average number of patients–
per community pharmacy:
per public pharmacy at hospital:
per hospital pharmacy:

Q0

What data are accessible at the community pharmacy at the point of dispensing?

A) Medication history?
   If yes: To what extent?
   1) What has been dispensed previously within the same pharmacy to the patient?
   2) What has been dispensed previously at other pharmacies to the patient?
   3) What has been dispensed in hospitals at discharge?
   4) Other?
B) Clinical data?
   If yes: To what extent?
C) Care documentation (incl. letters and phonecalls to doctors)?
D) Other data?

Q1

Is there an automatic DUR in pharmacy operation at community pharmacies?

If yes: What is the name of the soft-ware?

If more than one – the questions Q2-Q8 should be responded to for each one of the tools used.

Q2

What kind of DUR is used – retrospective or prospective?

Q3

Is there any way to perform automated DUR outside the pharmacy (e.g. central database)?

Q4

A) In what pharmacy operation is DUR used (community pharmacies; public pharmacies at hospitals; both)?
B) How many pharmacies use the system?

Q5

What is the aim of the system – screening for problems at dispensing?
Other aim – such as screening for DDIs only, dosage problems only, etc.?

Q6

What type of database is the DUR using, apart from the drug consumption data?

A) A national database?
   If yes: maintained by whom?
B) A database of the software producer?

Q7

What kind of signals/alerts are generated by the system?

A) Drug-drug interaction?
   - Are the interactions risk-graded?
     If yes: How?
B) Unusual dosages
   - Yoo high, too low?
   - Patientrelated (in general; children; elderly)?
C) Contraindications (drug-disease interaction)?
D) Duplication of drug treatment?
   - On what ATC level (also psuedo-double)?
E) Superveillence/with care when used to elderly?

F) Superveillence/with care when used to children?
G) Individual is prescribed drug normally used for opposite gender?
H) Too late refills; gaps in refills (adherence problem)?
I) Refill too early (adherence problem and/or abuse of drug benefit/reimbursement)?
J) Other?

Q8

How many signals/alerts are produced per patient, per prescription (mean ± SD; Median, uq, lq; pareto distribution)

A) In total?
B) Per category of signal/alert?

Q9

Many systems produce a large amount of signals/alerts – have you dealt with discrimination/reducing signals/alerts to those of clinical importance/relevance?
If yes: How?

Q10

A) Has the instrument been evaluated (yes; no; planned)?

If yes:

B) How? Validation?
C) What is the outcome?
D) Is there any publication/report of the evaluation?

Appendix 2 – Reviewed questionnaire and background letter

PGEU- inquiry on the utilization of automatic DUR in the European countries

"Patient Safety: Maximising Patient Safety in Europe through the safe use of medicines"

Within the community pharmacy sector, many initiatives are already ongoing. However, these have to be coordinated and integrated in the global sphere of the continuum of care. Community pharmacists have been working in the development of processes and tools to ensure Patient Safety in community pharmacies, but it is important that both community pharmacists and health policy makers realise the synergies that can arise from integrating those processes in the Patient Safety path.

Information and Communication Technologies (ICTs) are becoming an increasingly important part of healthcare systems. These tools and services, known as eHealth, contribute to better and more efficient healthcare, used appropriately.

Drug prescription and dispensing is a part of eHealth in which the pharmacies play a major role. There is a discrepancy between prescription error rates and problems detected, acted upon and recorded by pharmacists, and there is a need for an increase in efficiency. The implementation of computers within pharmacies in prescription dispensing and/or e-prescribing enables possibility to use ICTs as trigger tools, such as automatic drug prescription review (DUR), to increase detection rates of errors and problems.

We want to create an overview of to what extent automatic drug prescription tools/ expert decision support tools are used in the dispensing process at community pharmacies in Europe.

The responses will be compiled by a master student (Mathias Landerdahl with Anders Ekedahl as supervisor) and the results results of the inquiry will be available as soon as the results have been compiled (within 3 weeks after the last day for the responses). We kindly request you to respond to this questionnaire and **return your answers at latest by the 26th of November** to

[redacted]@[redacted]

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Anders Ekedahl
Associate professor
Pharmacy Practice Research
Linnæus University
Kalmar, Sweden

[redacted]@[redacted]
+46 XX XXX XXXX

Questionnaire: **(Please respond to** [redacted]@[redacted]**)**

Question 1

Is there an automatic DUR in pharmacy operation at community pharmacies in your country? (please tick the appropriate)

Yes __ (please continue with Question 2)

No __ (if the answer is No, the inquiry stops here)

Don´t know __ (if the answer is Don´t know, the inquiry stops here

Question 2 If yes: What kind of signals/alerts are generated by the system?

A. Drug-drug interaction? Yes__ No__ Don´t know__

Are the interactions risk-graded? Yes__ No__ Don´t know__
If yes How?

B. Unusual dosages Yes__ No__ Don´t know__

If yes a/ Too high, too low? Yes__ No__ Don´t know__

b/ Patientrelated (in general; children; elderly)? Yes__ No__ Don´t know__

C. Contraindications (drug-disease interaction)? Yes__ No__ Don´t know__

D. Duplication of drug treatment? Yes__ No__ Don´t know__

If yes On what ATC level (also psuedo-double)?

E. Superveillence/with care when used to elderly? Yes__ No__ Don´t know__

F. Superveillence/with care when used to children? Yes__ No__ Don´t know__

G. Individual is prescribed drug normally used for opposite gender?

Yes__ No__ Don´t know__

H. Too late refills; gaps in refills (adherence problem)? Yes__ No__ Don´t know__

I. If yes - Refill too early (adherence problem and/or abuse of drug benefit/reimbursement)?
Yes__ No__ Don´t know__

J. Other Yes__ No__ Don´t know__

If yes – what kind of signal?

Thank you for your cooperation!

Appendix 3 – Distribution list, national organisations

Name	Institution	Country
	der Österreichischen Apothekerkammer	Austria
Isabelle de Wulf	Association Pharmaceutique Belge	Belgium
Francis Patout/ Piet van Maerke	Orde der Apothekers	Belgium
	Bulgarian Pharmaceutical Union	Bulgaria
Maja Jakševac-Mikša	Croatian Pharmaceutical Society	Croatia
Danijela Huml	Croatian Chamber of Pharmacists	Croatia
	Cyprus Pharmaceutical Association	Cyprus
	Czech Chamber of Pharmacists	Czech Republic
Luděk Jahodář	Czech Pharmaceutical Society	Czech Republic
Birthe Søndergaard	Apotekerforeningen	Denmark
Christian Krüger Thorsted	Pharmadanmark	Denmark
Kaidi Sarv	Estonian Pharmacists Association	Estonia
Ilkka Oksala Sirpa Peura	Finlands Apotekareförbund	Finland
	Fédération des syndicats pharmaceutiques de France	France
	Union Nationale des Pharmacies de France	France
Anne-Laure Berthomieu	l'Ordre des Pharmaciens	France
	Unioin des Syndicats de	France

	Pharmaciens d'Officine	
Nina Griese	ABDA	Germany
	Panhellenic Pharmaceutical Association	Greece
	Hungarian Chamber of Pharmacists	Hungary
Sigríður Siemsen	Pharmaceutical Society of Iceland	Iceland
Einar Magnusson	Department of Pharmaceutical Affairs, Ministry of Health	Iceland
Pamela Logan	Irish Pharmaceutical Union	Ireland
	Federation of the Order of Italian Pharmacists	Italy
Mauro Lanzilotto	Federfarma	Italy
	Assofarm	Italy
	Latvian Pharmaceutical Society	Latvia
	Lithuanian Pharmaceutical Association	Lithuania
	Syndicat des Pharmaciens Luxembourgeois	Luxembourg
	Pharmaceutical chamber of Macedonia	Macedonia
	Malta Chamber of Pharmacists	Malta
Lilian M Azzopardi	Malta Pharmaceutical Association	Malta
	Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie	Netherlands
Jostein Soldal	Apoteksföreningen	Norway
	Norges Farmaceutiske Forening	Norway

	Polish Pharmaceutical Chamber	Poland
Suzete Costa	National Association of Pharmacies	Portugal
	Order of Pharmacists	Portugal
	College of Pharmacists in Romania	Romania
	Romanian Pharmacy Owners' Association	Romania
	Farmacie.ro (Network for pharmacies in Romania)	Romania
	Pharmaceutical Society of Serbia	Serbia
	Slovak Chamber of Pharmacists	Slovakia
	Slovenian Chamber of Pharmacy	Slovenia
	Academe and Research Network Slovenia (?)	Slovenia
	General Spanish Council of Pharmacists	Spain
	Swiss Association of Pharmacists	Switzerland
	Turkish Pharmacists' Association	Turkey
Mark Neale	Pharmaceutical Society of Northern Ireland	UK
Nicola Rossi	National Pharmacy Association	UK
	Royal Pharmaceutical Society of Great Britain	UK
	National Pharmaceutical Association	UK
Bharat Patel	Essex LPC	UK

Appendix 4 – Distribution list, pharmacy chains/co-operations

Name	Pharmacy chain/co-operation	Country
	Lloyds (Celesio)	Belgium
Chantal Leirs	Surplus Apotheken	Belgium
Paul Perdieus	Multipharma	Belgium
	Farmacia	Croatia
	Mandic Pharm	Croatia
	Baricevic	Croatia
	Bamapharm	Croatia
	Dr Max	Czech Republic
	Lloyds (Celesio)	Czech Republic
Matej Hronec	Novolekarna	Czech Republic
	Alphega (Alliance)	Czech Republic
	Pharmaland	Czech Republic
Jacob Lenau	A-Apoteket	Denmark
Dorte Brix	Apotekeren	Denmark
	Ditapotek	Denmark
	Apteek1 (Tamro)	Estonia
	Apotheka (Magnum Medical)	Estonia
	Euroapteek (Eurovaistines)	Estonia
Saija Leikola	Helsinki University Pharmacy Chain	Finland
	Alphega (Alliance)	France
	DocMorris (Celesio)	Germany
Sven Simons	MVDA (Phoenix)	Germany
	Meine Apotheke (Sanacorp)	Germany
	Vivesco (Anzag)	Germany
Sigurbjörn Gunnarsson	Lyfja	Iceland
	Lyf & Heilsa	Iceland
	Unicare (Celesio)	Ireland
	Boots	Ireland
Pat Durkin	McSweeney Pharmacy Group	Ireland
	Hickey's Pharmacies	Ireland
	McCabe's Pharmacy	Ireland
Brian Pagni	Bradley's	Ireland
	Alphega (Alliance)	Italy
	Admenta (Celesio)	Italy
	Farmacie Fiorentine A.FA.M. S.p.A.	Italy

	(Comifar)	
Dita Martinsone	Aptieka1 (Tamro)	Latvia
Vizma Viksna	Gimenes Aptieka (Tamro)	Latvia
	Eurovaistine (Eurovaistines)	Lithuania
	Seimos Vaistine (Tamro)	Lithuania
	N Pharmacies (=Norfos Vaistine)	Lithuania
	Gintarine Vaistine (PGF)	Lithuania
	Camelia	Lithuania
	Zegin	Macedonia
Susanna Dzingova	Promedika	Macedonia
Zorica Popandonova Ognenovska	Dr Panovski Pharmacy	Macedonia
Josette Sciberras (chief pharmacist)	Mater Dei Pharmacy Services	Malta
	Lloyds (Celesio)	Netherlands
	Escura	Netherlands
	Mediq (OPG)	Netherlands
	Kring (Alliance Boots)	Netherlands
	DocMorris (Celesio)	Netherlands
	Apotek1 (Tamro)	Norway
	Vitusapotek	Norway
	Alliance Apotekene/Boots	Norway
Terje Kvaal	Ditt Apotek	Norway
	Apteka Polska	Poland
	Dr Max	Poland
	Euroapteka (Eurovaistines)	Poland
	Sensiblu SRL	Romania
	Catena	Romania
	Farmaciile Dona	Romania
	Citypharma	Romania
	Richter Farmacia	Romania
	Helpnet	Romania
	Centrofarm	Romania
	Remedio	Romania
	Apoteka Pharmacity	Serbia
	Primax	Serbia
	Goodwill-Apoteka	Serbia
Beata Kochanova	Dr Max	Slovakia
	Cityfarma	Slovakia
	Alphega (Alliance)	Spain

	Amavita (Galenica)	Switzerland
	Coop Vitality	Switzerland
	Capitole Pharmacies (Phoenix)	Switzerland
	Lloyds (Celesio)	UK
	Boots	UK
	Alphega (Alliance Boots)	UK
(Victoria Steel)	Co-operative Group Pharmacy	UK
	Rowland's	UK
	Superdrug	UK
	Day Lewis	UK
Simon Lam	Morrisons	UK
	PCT Healthcare	UK
	Asda	UK
	Weldricks	UK
	John Bell Croyden	UK

Appendix 5 – Responders of the inquiry

Country	Organisation	Responder	Type of organisation	Questionnaire fulfilled
Austria	Österreichische Apothekerkammer	Herbert Schipper, Director	National Organisation	Reviewed
Belgium	Association Pharmaceutique Belge (APB)	Isabelle de Wulf	National Organisation	Full
Bulgaria	Bulgarian Pharmaceutical Union (BPHU)	Todor Naydenov, Secretary General	National Organisation	Reviewed
Croatia	Croatian Chamber of Pharmacists	Danijela Huml, Professional Associate	National Organisation	Full
Croatia	Croatian Pharmaceutical Society	Maja Jakševac-Mikša, Secretary General	National Organisation	Full
Czech Republic	Czech Chamber of Pharmacists	Havliček Stanislav, President	National Organisation	Full
Denmark	Association of Danish Pharmacists	Karsten Riis, M.Sc. Pharm	National Organisation	Full
Estonia	Estonian Pharmacists' Association	Kaidi Sarv, Head pharmacist	National Organisation	Full
Finland	University of Helsinki	Saija Leikola, PhD Student and part time community pharmacist	Research Institution	Full
France	Ordre National des Pharmaciens de France	Isabelle Baron, Chargée de Mission Affaires Européennes et Internationales	National Organisation	Reviewed
Germany	Federal Union of German Associations of Pharmacists (ABDA)	Dr. Nina Griese, Research Associate, Center for Drug Information and Pharmacy Practice	National Organisation	Full
Ireland	Irish Pharmaceutical Union	Pamela Logan, Director of Pharmacy Services	National Organisation	Full
Italy	Federfarma	Mauro Lanzilotto, responsible of international affairs	National Organisation	Full
Latvia	Aptieka1 (Owned by Tamro)	Dita Martinsone, Managing Director of Tamro Latvia	Pharmacy Chain	Reviewed
Lithuania	Seimos Vaistine (Owned by Tamro)	Loreta Adomonyte, Tamro Lithuania	Pharmacy Chain	Reviewed

Malta	Mater Dei Hospital Pharmacy	Josette Sciberras, Chief Pharmacist, Mater Dei Hospital	Pharmacy Chain	Full
Netherlands	Dutch Society of Pharmacists (KNMP)	Rian Lelie van der Zande, Manager of Medicines Information Centre	National Organisation	Full
Norway	Norwegian Pharmacy Association	Agnes Gombos, Senior Advicer	National Organisation	Full
Portugal	National Association of Pharmacies (ANF)	Sónia Queirós, Core Information Management	National Organisation	Reviewed
Romania	Romanian Chamber of Pharmacists	Silviu Constantinescu	National Organisation	Reviewed
Serbia	Pharmaceutical Society of Serbia	Dubravka Urosev	National Organisation	Reviewed
Slovakia	Slovak Chamber of Pharmacists	Pharm.Dr. Štefan Krchňák	National Organisation	Reviewed
Spain	General Council of Pharmacists of Spain	Sonia Ruiz, International Affairs	National Organisation	Reviewed
Sweden	Apotekens Service AB	Bodil Lidström, responsible for EES (the Swedish DUR system)	Maintaining company	Full
Switzerland	Pharmasuisse	Didier Ray, Head of Dept. politic & economy	National Organisation	Full
Turkey	Turkish Pharmacists' Association	Serif Boyaci, the Turkish Pharmacists' Association Executive Committee	National Organisation	Reviewed
UK	National Pharmacy Association (NPA)	Leyla Hannbeck, Head of Information Services	National Organisation	Reviewed