Pharmacy Intervention in the Medication-use Process

the role of pharmacists in improving patient safety

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This paper was produced during an internship with the International Pharmaceutical Federation (FIP), Den Haag, Netherlands, 2009.

ABSTRACT

Medication errors arise throughout the three main categories of prescribing, dispensing, and administration of the medication-use process. The profession of pharmacy, and pharmacists, play a key role in reducing these errors by making appropriate interventions at each stage and by working with other healthcare professionals, governments and regulating bodies, and with pharmacy organizations on a global basis. The key steps in the medication-use process are outlined with potential harm to the patient listed, appropriate pharmacy interventions that can increase patient safety, and the pharmacy organizations around the world that are making the medication-use process much safer. The goal of this paper is to increase awareness of the importance of including the profession of pharmacy in managing patient safety throughout the medication-use process. Quick implementation of new and novel ideas, interprofessional collaboration, and fostering a culture of patient safety early in one's education are future roles for the profession and should be met with great enthusiasm.

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PATIENT SAFETY

A Standard Definition?

The role of pharmacists has been clinically proven to improve many outcomes regarding patient health, including greater patient safety, improved disease and drug therapy management, effective healthcare spending, improved adherence, and improved quality of life (Canadian Pharmacists Association, 2008). Health Canada and its own governing body on patient safety, the Canadian Patient Safety Institute (CPSI), formally established in 2003, acknowledge a lack of a standard definition of what patient safety is exactly making studies and generalizations about patient safety rather vague and difficult to conclude (Gardner J.P., Baker R.B., Norton P., and Brown A.D., 2002). The World Health Organization (WHO), along with input from CPSI, has since developed a conceptual framework in order to build a standardized taxonomy for patient safety definitions that should make future projects dealing with patient safety standardized from researcher to researcher and applicable to a wider, international community (World Health Organization, 2009). The WHO's new conceptual definition of patient safety reads as "the reduction of risk of unnecessary harm associated with healthcare to an acceptable minimum. An acceptable minimum refers to the collective notions of given current knowledge, resources available and the context in which care was delivered weighed against the risk of non-treatment or other treatment" (World Health Organization, 2009).

The explosive focus on patient care stemmed from a 1999 US report by the Institute of Medicine titled, *To Err is Human: Building a Safer Health System*. This report detailed the costs of medical errors to the US economy and how medical errors numbered higher than deaths due to AIDS, motor-vehicle accidents, and breast cancer, combined. The report then went on to describe how errors can be reduced (Institute of Medicine, 1999). Ten years have passed since that report was published in the US, yet organizations and institutions around the world are still having difficulty identifying, incorporating, and utilizing measures to help improve patient safety and reducing errors. The word "error", itself, brings about actions for prevention and distracts from the main goal of getting the right drug, with the right dose, with the right route, at the right time, to the right patient, a phrase known as "the five rights" (Benjamin, 2003). Acknowledging that errors will happen due to the human condition is one thing, and then blame is easily placed on that individual, however many experts in patient safety see new and existing errors as a fault with the systems that are in place. The systems approach assumes that a number of errors are inevitable and that the work environment can lead to the likelihood of certain errors occurring (Longo D.R., 2005). However, the systems approach says nothing of an individual's responsibility to prevent medical errors and should not be seen as an excuse for a culture that relies on others to identify and resolve errors or where errors are seen as being inevitable (Beso A., 2005). A Danish report on patient safety and medication errors in 2004 reported up to 0.6% of prescriptions handled in the UK resulted in errors and up to 15.2% of those reached the consumer. More alarming is that 8.7% of those errors can result in fatality (Knudsen, 2004). Although patient safety may be a relatively new global issue in healthcare, its relevance has been at the forefront in some major countries such as Australia since

1989, in the USA since the late 1990's, and the UK since 2001.

Errors and Near Misses

So where do these errors arise from? Many scientists have attempted to answer this question, but the ambiguity of what an "error" is and how it is reported make generalizations difficult. Many of the studies done to date, have looked primarily into hospital error prevention and have identified all major steps in the medication-use process as areas for improvement, the systems approach. More often, the most common errors discovered were in dosing errors, directions that were unclear or missing, and incorrect prescriptions (Prescrire international, 2004; Feifer R.A., 2003). Other contributing factors include interruptions, distractions, poor working environments (job satisfaction, employee interpersonal relationships, workload, other responsibilities, and physical setup), and poorly disseminated information from one healthcare professional to another (poorly written prescriptions, no communication at all, or incomplete information) – a breakdown in seamless care. A new concept in error typing, which further adds to the ambiguity of what an error is, is the term "near misses". Jeffs *et al.* state that errors, or

> *"vulnerabilities arise from complexities inherent in delivering health care and inadequate defenses, leading to potentially dangerous situations. Near misses are powerful reminders of system vulnerabilities associated with care processes… [such as] recovery processes, planned recoveries or proactive practices and referred to as close calls or good catches in clinical venues. The differentiating factor in whether a near miss becomes an adverse event is the presence or absence of recovery mechanisms"* (Jeffs L, 2008).

Voluntary reporting of medication errors and near misses make up what we know of medication errors in general, however, a large proportion of medication errors are unknown. This is what is known as the iceberg phenomenon where what we know presents the tip of the iceberg and what we don't know of medication errors is much like the rest of the iceberg where almost 90% of it is hidden under water (Figure 1). However simply filling in more forms is not the only answer as it has been found that response rates decline as those filling out the forms notice their reports are being ignored, no action has resulted from filling out the form, or they mistakenly believe that filling out the medication error report is an admission of carelessness, neglect, or incompetence and thus fear being blamed and held liable (Anderson D.J., 2001). Errors are best remedied when all errors, real or potential, are reported and evaluated as part of a continuous quality assurance program. As such, the Danish National Board of Health

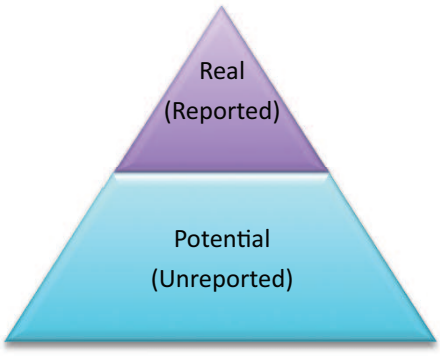

Figure 1
The Iceberg Phenomenon as related to real (what we see) and potential errors (what is hidden).

departed from the usual stance of their healthcare workers voluntarily reporting medication errors and in 2003 enacted the Act on Patient Safety in the Health Service that obligated all healthcare workers to report adverse drug reactions to a national reporting system. In addition, the Danish National Board of Health and all hospital owners are mandated to take the appropriate corrective actions (Knudsen P., 2007).

PHARMACEUTICAL CARE

To understand how pharmacy plays a role in patient safety, one must look at the level of care the profession provides already. The International Pharmaceutical Federation (FIP) amended and adopted Hepler and Strand's definition of pharmaceutical care to read as "… the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve or maintain a patient's quality of life" (Wiedenmayer K., Summers R.S., Mackie C.A., Gous A.G.S., Everard M., and D. Tromp, 2006). Thus, one can view pharmaceutical care as a vital component to providing patient care. It seems odd, however, that the practice of pharmaceutical care is relatively a new venture in healthcare itself and even more puzzling as to its slow uptake into the medication-use process. The "five rights" are seemingly the intention of every pharmacist in everyday practice, however human nature and its beauty to distinguish one individual from another based on "imperfections" prevents a robotic and error-free environment from occurring.

Errors in Dual-process Reasoning

Looking at the pharmacist, human factors that contribute to medication errors, and therefore a breakdown in pharmaceutical care, result from three broad classifications, modal (the way in which errors occur), contextual (dealing with the specifics involved), and psychological. The latter category includes knowledge-based, rule-based, action-based, and memory-based errors (Aronson, 2009). These four subcategories make up what are known as flaws in dual-process reasoning (Figure 2). As part of this process, System One reasoning is based on previous experience, intuition, association, and assumed thinking, that is to say, it is without a lot of thought involved and almost robotic in nature. Rule-based errors, "using a bad rule or misapplying a good rule", and action-based errors, "slips", fall into System One type reasoning errors. Knowledge-based and memory-based errors fall into System Two type reasoning errors which is an analytic, slow, and cognitively demanding process, where every situation is treated independently of other past experiences, even if they are exactly the same (Aronson, 2009; Schroyens W., 2003). Logically, System Two reasoning would lead to fewer pharmacist' errors, however time constraints, workplace demands, patient demands, and the inability for pharmacists to assert themselves and their role in the medication-use process – their value to society – can lead to a failure in this process, and therefore result in errors being made.

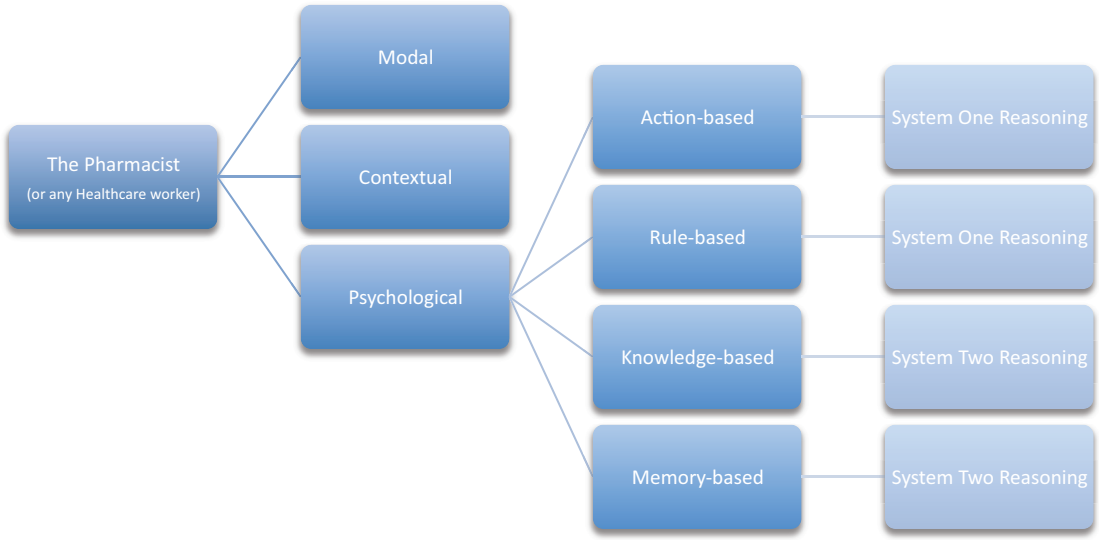

FIGURE 2

Concept of dual-processing reasoning that can lead to Pharmacist based errors.

WHAT PHARMACY CAN DO

The role of pharmacy in the medication-use process has been proven to be beneficial in the areas of medication history taking, patient and drug education committees, therapeutic drug committees, and integration of technology (Schneider, 2007). The profession has long argued over changes to the process itself to include enhanced interdisciplinary collaboration, reduce therapy-related errors, and to find well-functioning models and create more of these models as medication demands increase over the years (Cooksey J.A., 2002). The rate of adoption for new technology can be prolonged up to 20 years with different pharmacies (including acute care settings) adopting varying innovations, formats, and systems making communication between healthcare facilities sometimes difficult due to incompatible technologies. In addition, not every technology is necessarily sustainable either economically or through patient or healthcare worker acceptance (Schneider, 2007).

PHARMACY ENABLERS

A set of factors, or enablers, are responsible for the proper functioning of any profession. Identifying all enablers in pharmacy is difficult and time consuming, however each factor plays an important role in patient safety. That is to say, each factor that makes the profession of pharmacy to work properly also allows for improved patient safety. A few of these enablers help pharmacy to make the medication-use process function properly as well and include governmental laws which shape the scope of practice of pharmacy, job satisfaction, interprofessional collaboration, patient empowerment, and pharmacy access (rural versus urban locations).

Scope of Practice

The scope of practice is an act that is determined by each country's or region's governing board of pharmacy. The

act in many countries allows the pharmacist to participate within certain areas of the medication-use process only, while in other countries, the scope of practice is so broad and inclusive, that the pharmacist can practice throughout the entire medication-use process from diagnosis to prescribing to dispensing to monitoring. The scope of practice is an important determining enabler that allows pharmacy's intervention within the medication-use process to ensure patient safety. At times, the pharmacist' hands are tied due to an exclusive and limiting scope of practice.

Job Satisfaction

Related to this enabler is the pharmacist' job satisfaction. The profession is changing from simply dispensing medication and counseling patients to one where pharmacists play a more clinical role in patient care. If the scope of practice limits what a pharmacist can do and prevents individual growth and advancement, this can lead to a decrease in job satisfaction. In addition, poor working environments; increased workloads; distractions; improper staffing; unfair rotation of shifts; inadequate salary, employee benefits, or holiday time; lack of opportunities for continuing education; limited and access to current literature (textbooks or electronically) can lead to poor job satisfaction. This in turn can affect the quality of care received and put patients at harm (Aronson, 2009).

Interprofessional Collaboration

Collaborative practice, or interprofessional collaboration, is another enabler that allows pharmacy to make an intervention in the medication-use process. By working with other professionals, healthcare or otherwise, pharmacists can lend their drug knowledge expertise to help identify and solve medication related issues and increase patient safety. The WHO EuroPharm Forum in 2005 acknowledged the importance of collaborative efforts to reduce patient harm by stating that "the approach to safe medication practices should be multidisciplinary and should include patients, professionals and their organizations and all other stakeholders involved in the medication use process". A report from the Council of Europe further added the need to share risk reduction information amongst professions, establish local targets in implementing safe medication practices, and that a culture of medication safety should start, and is fostered by, undergraduate, postgraduate, and continuing education by educational faculties, especially those in healthcare (Airaksinen, 2005).

Patient Empowerment

There has been a shift from a didactic transfer of information from the healthcare worker to the patient to a more collaborative approach between the parties involved. As such, the patient must take on the responsibility to become more active in his/her health by actively asking and seeking out questions and answers they may have. This enables the profession of pharmacy to consider the patient as an inclusive member of the medication-use process instead having a minor, exclusive role. Empowering the patient allows for increased patient safety by creating an awareness that their rights to the knowledge of their treatment, medication use, and expectations of

the healthcare system are being looked after by their healthcare team and are being fulfilled to the best abilities by all parties involved (Awe, 2003).

Pharmacy Access

The ability to access pharmacy services is another enabler that plays an important role in patient safety in the medication-use process. As seen in most healthcare fields, there are a disproportionately low number of pharmacists and pharmacies in rural areas to meet the needs of that population. Inadequate access can lead to patient harm when the pharmacist' expertise is missing. There are many more factors that enable the profession of pharmacy to function properly and ensure patient safety during the medication-use process. These factors play an important role in the capability of pharmacists to improve patient safety.

THE MEDICATION-USE PROCESS

In order to understand how pharmacists reduce errors, we must look at where in the medication-use process these errors are occurring. The United States Pharmacopeia identifies five major categories in the medication-use process: 1. Prescribing; 2. Transcribing/documenting; 3. Dispensing; 4. Administration; and 5. Monitoring (USP, 2004). The WHO uses three distinct phases of medication use: prescribing, administration, and monitoring (World Health Organization, 2009). The five processes outlined by the USP and the three processes outlined by the WHO can be grouped into three major categories when talking about patient safety and the role that the pharmacist and pharmacy can play when making appropriate interventions to ensure patient safety – either preventatively or after the incidence has occurred. Here, using both of these references, we streamline the USP medication-use processes 1 and 2 to form the first category called prescribing; process 3 will form the second category called dispensing; and processes 4 and 5 will make up the third category called administration (USP, 2004). This classification system also allows one to draw links between the level at which the pharmacist' intervention occurred – the location – and which healthcare team would be more likely to be involved (Figure 3). Studies have shown that prescribing errors account for roughly 39% of all errors during the medication-use process and are due to a lack of knowledge of the prescribed drug, lack of an established relationship with the patient, mental slips from distractions, or calculation errors.

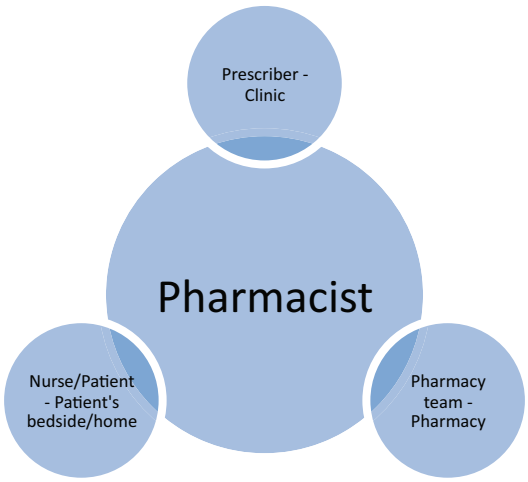

Figure 3
The relationship between the healthcare team and location (team - location) of where the pharmacist' intervention can occur in the medication-use process as set out in this paper.

Transcription and verification account for 12% of errors and are mainly due to the inability to read illegible handwritten prescriptions, the use of abbreviations, and misusing leading and trailing zeros. Calculation errors, preparation errors, and distribution errors contribute to 11% of the errors made during the dispensing stage of the medication-use process. Finally, 38% of errors occur during the administration of medications due to the "five wrongs", look-a-like packaging, failing to double check, failing to understand what the drug does, unclear medication orders, and understaffing (van den Bemt P.M.L.A., 2000; Schneider, 2007).

PHARMACY INTERVENTION IN THE MEDICATION-USE PROCESS

To see where pharmacy can and has worked at reduce medication related errors, tables 1, 2 and 3 represents the medication-use process as outlined above in the three main categories of prescribing, dispensing, and administration, respectively; the errors that can result at each stage of the process; the pharmacy intervention that can be applied to prevent or reduce the number of the errors; and the pharmaceutical organizations that are, in the past or currently, working on improving patient safety at each stage. Table 4 represents the pharmacy organizations that are working on improving patient safety, overall. The function and application of the pharmacist in the medication-use process, as seen from these tables, goes well beyond what society believes is the traditional role of pharmacists, dispensing. Future goals of this project are to include novel ways in which pharmacy can improve patient safety and use this document as a resource to reducing patient harm.

Table 1

Identification of potential risks patient harm in the prescribing stage of the medication-use process; pharmacy's potential interventions at each step; and the pharmacy organizations working on improving patient safety.

Prescribing	**Identification of the Patient Correct Name**	Potential Risk	If the patient was misidentified due to the same name on file, different spelling of the name, or a similar name, they may not receive the proper drug. Privacy also plays a role here, where misidentification of the real patient may lead to divulging of another patient's private information or the prescriber may prescribe a medication according to another patient's medical history where in fact, the real patient may be allergic to that medication.
		Pharmacy Intervention	Pharmacy has very little intervention at this point in the medication-use process. However, there are some instances where doctors may access a central database of patient electronic files made/updated/contributed to by pharmacies and find out if they have the correct patient and/or update their files. When the pharmacist makes a referral letter to the prescriber, this letter will also correctly identify the patient's name. In acute care settings, medication reconciliations, patient identification numbers, and electronic patient files can be used to properly identify the patient's correct name, in addition to intensive care units where pharmacists participate in building a patient's medication profile.
Prescribing	**Identification of the Patient Correct Age**	Potential Risk	Some drugs need dose adjustments according to a patient's age and incorrect information would result in potential harm including fatality. Drugs in pediatric patients are an example and drugs that are corrected for renal clearance in the elderly are another example. Age also plays a role in therapeutic choices made by prescribers for example, can a patient of a certain age handle surgery and recovery?
		Pharmacy Intervention	In some countries, the doctors have access to a central electronic patient file system and the pharmacist can update information regarding a patient's age before the prescriber even sees the patient. Should a pharmacist make a referral, a letter to the prescriber could also include this information. In a hospital, medication reconciliations, patient identification numbers, and electronic patient files can be used to properly identify the patient's correct age.

Prescribing	**Identification of the Patient Correct Weight and Height**	Potential Risk	Dosing of some medications especially in children and chemotherapy rely on body surface area or need to take into account factors such as obesity or pregnancy. Incorrect information regarding a patient's height or weight will result in sub-therapeutic effects or potential toxicity.
		Pharmacy Intervention	As mentioned earlier, in some countries, it is possible for the pharmacist to add this information into a patient's electronic file or referral letter before the prescriber sees the patient. In acute care settings, the pharmacist may ask for the height and weight to be determined during the time when a medication history is taken and may be done before the prescriber sees the patient.
Prescribing	**Identification of the Patient Genotype of Patient**	Potential Risk	The main enzymatic system responsible for detoxification and conversion, or nonsynthetic and conjugation reactions is the cytochrome P450 complex of which there is documented polymorphism between races resulting in overproduction, underproduction, or complete depletion of these enzymes (for example, warfarin metabolism depends enantiomers of CYP2C9, CYP1A2, and CYP3A4). Genotyping can also be done for patients to screen for certain genetic diseases such as sickle cell anemia. These variabilities can result in medication harm to patients including fatality.
		Pharmacy Intervention	In some countries, pharmacists perform genotype testing and the interpretation of results that will allow them to make the appropriate pharmacotherapy adjustments. This information is then shared with the prescriber by a referral letter or a central patient electronic file system that is accessible by the prescriber and maintained/contributed to by the pharmacist. In hospitals, this genotyping may be ordered by the pharmacist or done by the pharmacist during the medication reconciliation period before the prescriber sees the patient. Results can then influence the pharmacotherapy chosen for the patient.
Prescribing	**Identification of the Patient Sexual Orientation**	Potential Risk	There is evidence that indicates that members of the lesbian, gay, bisexual, and transgendered community suffer disparaging healthcare compared to their heterosexual peers. This population also suffers from a lack of general health care, compassion, and understanding of the health related issues that affect these individuals more so than heterosexual individuals.
		Pharmacy Intervention	At this point in the medication-use process, it is difficult for pharmacy to have an intervention due to privacy issues. Extreme discretion must be used.

Prescribing	**Information needed for a diagnosis** **Signs and symptoms**	Potential Risk	Erroneous identification or omission of signs and symptoms can lead to misdiagnosis and unwarranted treatment or a lack of treatment. This can have potentially devastating effects where treatment is not started, is delayed, is not given, or is fatal. Identification of "red-flags" (signs, symptoms, side effects, or events that may occur and warrant appropriate medical attention/intervention) is important by all prescribers and pharmacists in order to ensure patient safety and correct diagnosis.
		Pharmacy Intervention	If a pharmacist makes a referral letter detailing what the patient is experience, signs and symptoms, then this can be used by the prescriber to aid in his/her diagnosis. In addition, the pharmacist can encourage the patient to see their doctor by educating them on signs and symptoms that warrant appropriate, professional medical attention. In acute care settings, the pharmacist is part of daily rounds known as interprofessional collaboration (collaborative practice) and make note of the patient's signs and symptoms in their chart.
		Pharmacy Organization	Pharmaceutical Society of Australia; The Pharmaceutical Society of Australia's "Pharmacy Self Care" program provides information on prevention and early detection of a disease, drug related problems, and improved use of medicines for pharmacies providing education modules and health campaign tools for pharmacists, pharmacy assistants, and consumer health information resources. The program aims to educate patients to recognize their signs and symptoms and encourages them to see their physician. Irish Pharmaceutical Union, Ireland; The "Minor Ailments Management" campaign informed the public how to self-treat minor ailments effectively, how to use nonprescription medicines correctly and to know when to seek advice from their local pharmacist or GP. PharmaSuisse, Swiss Association of Pharmacists, Switzerland; Starting in 2006, a yearly campaign called "Headaches", informed patients to consult their pharmacists first on some diseases therefore saving them money on health insurance. As part of this theme, a campaign was organized on the theme of headaches. A poster was created as well as a headache agenda/diary to record headaches, the type, and the treatment used (and its effectiveness). Based on this record, the pharmacist was able to guide patients in treatment and/or refer him to his medical doctors.

Prescribing	**Information needed for a diagnosis Medication History**	Potential Risk	Not understanding what a patient has taken previously or is currently taking, by failing to do a thorough medication inquiry or medication reconciliation, may result in medication failure (redundancy), drug interactions, drug-disease/food interactions, drug contraindications, abuse, non-compliance, or serious harm. Proper medication histories may also highlight if the patient's current signs and symptoms are caused by medications. Allergies and intolerances are important to determine the course of treatment and selection of pharmacotherapy.
		Pharmacy Intervention	In community pharmacy settings, pharmacists can be utilized to provide prescribers with a list of medications that the patient is on (by phone, fax, or referral letter or when admitted into acute care settings) and to update electronic files that prescribers have access to. The pharmacy should be consulted on every patient, especially when dealing with high-risk patients such as those with renal or hepatic dysfunction, those with polypharmacy, those on risk drugs such as warfarin, and the young. In acute care settings, pharmacists have been proven to conduct a more through drug history including the dose, strength, schedule, any OTC medications or herbals/vitamins taken, than any other healthcare professional.
		Pharmacy Organization	American Society of Health-System Pharmacists (ASHP) and the ASHP Foundation, United States; "My Medicine List™" is a tool that patients can use to keep track of the medications they are taking including all of a patient's current medications, including prescription, over-the-counter, dietary supplements and herbal products. The medicine list should be used as a tool to stimulate dialogue between patients/caregivers and health professionals about a patient's current medication use. Hungarian Society for Pharmaceutical Sciences and the Hungarian Association of Private Pharmacists, Hungary; The "Ask your Pharmacist to Ensure your Medication Safety" program includes a protocol and several tools that have been developed including a poster to promote dialogue between pharmacists and patients (patients are encourage to provide the key information to pharmacists so that he can ensure the patient's medication safety); a leaflet for the patients; and a medication card (MediKártyát), where the name of the medicines, its strength, dosage and other relevant instructions are written down by the pharmacist, the medical doctor or the patients. Additionally, allergy to medicines was also included there.
Prescribing	**Information needed for a diagnosis Social History**	Potential Risk	Drug interactions and therapeutic results can potentially arise or change due to a patient's social history which may include smoking, drinking alcohol, taking illicit drugs, socioeconomic factors and the level of literacy, especially health literacy. These could lead to compliance issues, misunderstandings, abuse, or serious interactions including toxicities and death or a lack of therapeutic outcomes.
		Pharmacy Intervention	In acute care and community settings, it is possible for the pharmacist to ask questions regarding a patient's social history in a nonthreatening and nonjudgmental manner. This information maybe recorded in a patient's electronic file for the prescriber to read. In some instances, the pharmacist plays a role in referring patients to social workers and in most cases is an advocate for the patient in drug acquisition, and can communicate these needs to the practitioner ahead of time. Thorough medication histories can also provide insight into a patient's social history by elucidating the types of medications a patient is taking, for example, methadone is taken for opiate addiction, and may give some insight into compliance/adherence, for example, the patient is not taking the medication that was prescribed earlier because they cannot afford it.

Prescribing	**Information needed for a diagnosis Sexual History**	Potential Risk	Where appropriate, the sexual history may provide insight into a patient's social behavior in addition to the patient's social history taken (above). If this is missed, potential teratogenic medications may be prescribed to women who are or are thinking of becoming pregnant. Adverse reactions may also take place in men who are prescribed certain medications that can affect their reproductive organs.
		Pharmacy Intervention	There is little pharmacy intervention here, however, in some countries where the physician has access to a central database of patient electronic files, a patient's sexual history can be elucidated through the medication history available such as contraceptive pills, the "morning after pill", or certain antibiotics.
Prescribing	**Information needed for a diagnosis Physical Exam**	Potential Risk	When done incorrectly, there is the possibility of useful diagnostic criteria such as physical palpitations, heart rate, blood pressure, stimulus response, etc. to result in misdiagnosis and errors in drug therapy.
		Pharmacy Intervention	Although, not part of a pharmacist's duties, pharmacists can ask questions that help in diagnosis of the patient's condition by asking the patient about their physical state. This can be communicated to the prescriber by using a referral letter.
Prescribing	**Information needed for a diagnosis Mental Exam**	Potential Risk	Proper identification of patient's mental wellbeing is important to determine knowledge, awareness, and capability of drug regimes. Communication and understanding are vital to proper health care.
		Pharmacy Intervention	Pharmacists, in accordance with the patient's prescriber, may also utilize mental exam questionnaires to help facilitate and direct pharmacotherapy and help the reporting of symptoms being experienced by the patient. The prescriber may also access the central patient electronic database, in some countries, to see a medication profile that would provide information on the patient's mental history. If the pharmacist makes a referral letter to the prescriber, then it may detail some of the mental exam questionnaire information or signs and symptoms that the pharmacist has noted or been made aware of.
		Pharmacy Organization	Association of Danish Pharmacies, Denmark; During "Depression Campaign", patients were invited to talk to their pharmacist about depression. Pharmacists provided key information on the information of treatment adherence and offered patients with a leaflet on the depression. PharmaSuisse, Swiss Association of Pharmacists, Switzerland; This yearly "Burn-out Campaign" was designed for patients to ask their pharmacist to help them detect the first signs of a burnout and then report to their doctor for a complete exam.

Prescribing	**Information needed for a diagnosis** **Diagnostic tests and clinical parameters**	Potential Risk	If not done properly, can lead to further health complications. If invasive procedures are done to collect samples for diagnostic tests, then the potential for infection, cross contamination, and psychological harm exists.
		Pharmacy Intervention	Academic detailing can help inform prescribers to the reasons behind the importance of these tests such as suspected drug toxicity, drug interactions, old test results needing to be updated, and whether drug therapy should continue. In some countries, pharmacists can order diagnostic tests and offer information to the patient on diagnostic results and/or follow up. Examples of tests ordered that provide useful information to the pharmacist include: • Serum concentrations of sodium, potassium, chloride, glucose, blood urea nitrogen, and carbon dioxide • Serum concentrations of various drugs • Anticoagulation studies • Blood tests (CBC, WBC with differential, ESR, ALT/AST, and Bilirubin) Standardized practice guidelines for pharmacists have been developed in many countries to minimize the risks associated with these tasks such as infection. In hospital settings, the pharmacist can order these lab tests without the permission of the doctor in order to gain a better understanding of how prescribed drug therapy is working and to evaluate if a referral is needed.
		Pharmacy Organization	Collectif National des Groupements de Pharmaciens d'Officine, France; An "Early Detection for Renal Disease" campaign was organized in one of the French Regions (Pays-de-Loire). 136 pharmacists took part of this campaign that was organized between 15 October 2007 and 31 January 2008. The campaign included a screening of at risk patients i.e. with diabetes, hypertension, older than 65 years or with a family history. Austrian Chamber of Pharmacists, Austria; The "Health Checks (10 minutes for my health)" campaign, took place in Vienna and Lower Austria in April and May 2006. This screening campaign aimed to detect elevated health risk factors. Pharmacies measured weight, blood pressure, abdominal size, cholesterol and blood sugar. Patients were not charged and could remain anonymous. PharmaSuisse, Swiss Association of Pharmacists and the Swiss Foundation for Cardiology, Switzerland; During 1 week (2 – 10 June 2009), Swiss pharmacies offered "Hand on your Heart", a free evaluation of cardiovascular risk for patients. This risk test was based on a questionnaire, blood pressure test, BMI and measurement of waist circumference.
Prescribing	**Information needed for a diagnosis** **Interpretation of diagnostic tests**	Potential Risk	Misinterpretation can lead to therapies that are unwarranted, sub-therapeutic, or toxic.
		Pharmacy Intervention	In some countries, pharmacists are trained to interpret diagnostic test results as part of their educational curriculum and good practices have been developed such as avoiding abbreviations and symbols to prevent confusion and would allow for interpretation by any healthcare worker. These results can also lead to referring the patient to their physician and/or correct specialist. Pharmacists can also be utilized to discuss the meaning of these results with the patient, especially with regards to tests on drug effects.

Prescribing	Academic detailing can inform prescribers to a standardized way of writing prescriptions starting with the correct name and date of birth of the patient; the current weight and height if the prescription is for a child; the current date; the generic name of the drug; the dose; the route of administration; the frequency of administration; the days supply; number of repeats; contact information of the doctor (especially on discharge prescriptions from hospitals); any special calculations used to determine special doses; other legal requirements such as license number; and diagnosis. The number of medications written on a single prescription sheet should be limited to three or four based on the size of the paper. Electronic prescribing is another way of standardizing information found on the prescription.		
Prescribing	**Writing the prescription Correct Patient and Diagnosis**	Potential Risk	As mentioned above. See "Prescribing – Identification of the Patient; Correct Name" and "Prescribing – Information needed for a diagnosis".
		Pharmacy Intervention	
Prescribing	**Writing the prescription Correct Drug**	Potential Risk	Prescribing the incorrect drug could potentially lead to detrimental effects including drug interactions, drug-disease interactions, allergic responses, teratogenesis, abortion, or therapeutic failure.
		Pharmacy Intervention	The pharmacist can talk to doctors and take active roles on therapeutic committees in hospitals, for example, advocating to avoid sound-a-like drugs, drugs with narrow therapeutic ranges, and high-risk medications to help avoid errors in prescribing.

Prescribing	**Writing the prescription Correct Strength**	Potential Risk	There is good evidence that shows most prescribing errors occur due to overdose of medications. Harm may result if the patient is under-dosed as well. Mistakes in prescribing drug strengths can also arise when confusing similar therapeutic drugs for a given condition such as Eltroxin® and Synthroid® for treating hypothyroidism. The use of abbreviations and not understanding the importance of leading and trailing zeros can lead to exponential drug delivery and fatality.
		Pharmacy Intervention	Pharmacists are in key positions to report and educate prescribers about drug strength abnormalities and practice guidelines or reference materials with standardized protocols. For example, any time that a prescriber goes outside of these recommended doses, a brief explanation should be supplied to the pharmacist to avoid lengthy delays in the patient's acquisition of the medication and prescription pads can include spaces for the prescriber to write the patient's height and weight down so that the pharmacist, in any setting, may verify the dose. Academic detailing by pharmacists can highlight where changes still need to be made. Pamphlets on the use of abbreviations and leading and trailing zeros should accompany prescriptions that are sent back to the prescriber for clarification. Some pharmacy governing bodies already work with colleges of physicians and surgeons and other prescribing authority bodies on minimizing these types of errors.
Prescribing	**Writing the prescription Correct Route**	Potential Risk	Administration errors results when the correct route of administration is not stated, or confusion may arise when the route of administration is completely omitted. The use of abbreviations also adds confusion to the clarity of the prescription.
		Pharmacy Intervention	Pharmacists can work with prescribers to clarify the most common route of administration for the most common drugs that have more than one alternative for administration. In acute care settings, the pharmacist, working on therapeutic drug committees, may limit the number of drugs and the number of differing formulations of the drug so that these errors are minimized. In addition, because certain formulations are not available, the pharmacist must work with nursing staff on the compatibility of enteral feeding tube delivery of drugs.
Prescribing	**Writing the prescription Correct Time**	Potential Risk	If the dosing schedule is too difficult to follow (i.e. getting up in the middle of the night) or requires the patient to dose frequently (i.e. more than four times daily), then compliance may be affected. In addition, patients may miss doses and risk "doubling up" on the next scheduled dose putting them at risk of toxicity. The dosing schedule may not be suitable for some patient's lifestyle, for example if a patient works out in the morning and usually takes vitamin supplements or protein products that contain a lot of iron in them to maintain body mass, taking levothyroxin which is usually taken in the morning, will interfere with their lifestyle.
		Pharmacy Intervention	Academic detailing can educate prescribers with the knowledge on compliance issues once dosing schedules become complicated. For elderly patients, the young, and the mentally challenged, the use of blister packs, SMS, dosette trays, homecare, or caregivers is another way to help with difficult dosing schedules and can be prescribed by the general practitioner or on the recommendation of the pharmacist.

Prescribing	**Writing the prescription Abbreviations not used**	Potential Risk	Abbreviations commonly lead to medication errors due to sloppy handwriting, inconsistent use of abbreviations, unstandardized use of abbreviations, and overuse of abbreviations on prescriptions. These situations can lead to potential harm in a patient, especially when the prescriber is unavailable to clarify the prescription for the pharmacist.
		Pharmacy Intervention	Example brochures and posters can be distributed to prescribers informing them that abbreviations should be avoided at all times. Pharmacists and pharmacy organizations can explain to prescribers that it may take longer to write out the prescription but it will improve patient safety at the patient level and during dispensing.
		Pharmacy Referral	Manitoba Institute of Patient Safety, Canada; In May 2008, developed the "DO NOT USE: Dangerous Abbreviations, Symbols, Dose, and Designations" campaign. The goal is to eliminate the use specified dangerous abbreviations, symbols and dose designations in the following, hand printed orders and prescriptions, Medication Administration Records (MAR), preprinted orders and clinical pathways, electronic systems (e.g. order entry), electronic Medication Administration records, and automated dispensing cabinets. The list is available online, by poster format, and can be installed on your PDA.
Prescribing	**Writing the prescription Electronically produced prescriptions**	Potential Risk	When prescribers are reluctant to learn new technologies, the technology itself becomes useless. In addition, partially learning a new technology limits the full capabilities of its use and can lead to patient harm.
		Pharmacy Intervention	Pharmacists can educate and recommend electronic prescribing programs. In some countries, this is already the standard. Governing pharmacy bodies and pharmacists can promote certain software packages and offer educational classes to prescribers on how to use the technology to the fullest benefit. This would make prescriptions uniform and provide enhanced patient safety. In acute care settings, electronic prescribing is slowly becoming more common. The pharmacists in these positions should be advocating all hospitals to move forward with this technology.

Prescribing	**Writing the prescription** **Patient understands why and for how long they are taking the drug**	Potential Risk	When a patient doesn't understand what or why they are taking a medication, compliance is affected, as the patient may not see the benefit of its use. Some medications require lengthy periods of time before a noticeable effect will occur. This information needs to be given to the patient by the doctor and by the pharmacist later on.
		Pharmacy Intervention	Providing doctors with information on patient compliance statistics when pharmacotherapy is emphasized by all of their healthcare professionals reinforces the importance of the medication's use and increases adherence. In some cases, the doctor can prescribe "therapeutic counseling" by the pharmacist in order to educate the patient properly, even though this should be a standard of care given regardless. Joint publications between pharmacy organizations and prescribing professions that educate patients about the correct use and compliance of medications along with support information should be displayed in the prescriber's office. In acute care settings, the patient should understand what new medications they have been put on and which medications have been discontinued. A medication list detailing the drug name, strength, dosing schedule, route of administration, and duration of treatment should accompany all discharged patients. If it is possible, that same sheet should be faxed over to the patient's regular pharmacy to ensure seamless care. In some countries that utilize electronic patient cards, the information on that file should be promptly updated to reflect the patient's new drug regime.
Prescribing	**Patient, Over the Counter (OTC) use**		The patient selects a product based on self-identification of signs and symptoms that they are currently experiencing or would like to avoid (prophylaxis treatment). If the patient asks for the pharmacist's advice, the pharmacist will run most of the same steps the prescriber would as outlined above. Most of the time, the pharmacist will not formalize the advice given in the form of a "prescription", however in some countries, the pharmacist does have prescriptive authority/rights and thus more of the steps mentioned above will be applicable.

Prescribing	**Patient, Over the Counter (OTC) use**	Potential Risk	The patient may not have a clear understanding of their signs and symptoms and an error or harm can result when they misdiagnosed themselves. If the patient does not understand the pathophysiology of what they are experience or what they want to avoid, they will inappropriately select an OTC product, when in fact, they should be going to see a healthcare professional or to the emergency room. This can result in prolonged illness, further complications that may need hospitalization, interactions with medications they are currently taking, or even death.
		Pharmacy Intervention	All pharmacy staff members should be asking patients if they have any questions regarding the OTC medication a patient is looking for or about to purchase and then refer the question to the pharmacist on duty. Where possible, the OTC medication is updated into the patient's electronic file to check for interactions with the patient's current medication regime. Special alerts (flyers, pamphlets, or symbols on containers/packaging) are used to help patients recognize high-risk interactions an OTC item may have with their medications and when to seek a healthcare professionals advice. The pharmacist should dispel any false information a patient gathers from the Internet, television, or from hearsay and educate the patient with evidence-based medicine.
		Pharmacy Organization	Irish Pharmaceutical Union, Ireland; The aim of the "Minor Ailments Management" campaign is to inform the public how to self-treat minor ailments effectively, how to use nonprescription medicines correctly and to know when to seek advice from their local pharmacist or GP. Irish Pharmaceutical Union, Ireland; The Irish Pharmaceutical Union provided pharmacists with a template to enable them to develop protocols for selling nonprescription medicines in a safe and appropriate way.
Prescribing	**Prescriptions written by other healthcare professionals**		Other healthcare professionals such as pharmacists, midwives, nurse practitioners, medical assistants, dentists, naturopathic doctors, and podiatrists may have the ability to make a diagnosis and posses prescriptive authority. Depending on the country and region, these diagnostic and prescriptive rights may be limited to the scope of practice for each profession and may be governed by differing licensing bodies.
Prescribing	**Prescriptions written by other healthcare professionals**	Potential Risk	As Above.
		Pharmacy Intervention	Pharmacy can play an active role in academic detailing to those professions where pharmacotherapy may not be emphasized as much in their curriculum as some other professions. In addition, each country's governing body of pharmacy should work together with other prescribing professions to create standard practice guidelines if they do not exist already. The diagnosis should accompany all prescriptions written by these healthcare workers and include the prescribers written name, phone number, supervising physician (if required), and license number.

Table 2

Identification of potential risks patient harm in the dispensing stage of the medication-use process; pharmacy's potential interventions at each step; and the pharmacy organizations working on improving patient safety.

Dispensing	The patient possesses a prescription (or knows what medicine to take) and is now going to the pharmacy for the prescription to be filled. However, the patient may not be able to fill the prescription due to financial constraints, language barriers, location of the pharmacy, religious beliefs, personal and familial beliefs, or from fear of side-effects, abuse potential, polypharmacy, or lack of understanding.		
Dispensing	**Access**	Potential Risk	If the patient does not receive the pharmacotherapy care that they need in order to help treat or alleviate the disease or illness from which they are suffering, this can lead to serious harmful outcomes including death.
		Pharmacy Intervention	The pharmacist acts as an advocate for the patient in drug acquisition and should look for ways in which the patient can receive their medication if they are not be able to afford it. The pharmacist can refer the patient to social assistance programs or social workers for help, can set up accounts where the patient makes payments in installments, or can dispense the amount of drug that the patient can afford at any given time. Options can be based on the patient-pharmacist relationship of trust and in accordance with local laws. The pharmacist is able to dispel any myths or misinformation that the patient may have acquired through the Internet, false advertisements, television, or hearsay in order for the patient to feel comfortable and access the pharmacotherapy.
		Pharmacy Organization	Pharmacy Guild of Australia, Australia; Developed an online directory that enables patients to choose pharmacies based on criteria, such as distance to their location (i.e. 5km from their location or more), based on the services provided (more than 30 services are listed), opening hours (including currently opened), and languages spoken (more than 20 languages referred in addition to English). The result of the request is a map showing the community pharmacies with the requested criteria (geolocalization through Google Map). Website is: http://www.findapharmacy.com.au Promotion for the use of generic drugs to decrease costs and increase drug access: Association of Danish Pharmacies, Denmark; Conseil national de l'Ordre des pharmaciens, France; Japan Pharmaceutical Association, Japan; Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain

Dispensing	**Description of the Transcribing Process (transferring the information provided on the prescription into the pharmacy's computer program)**	• The patient gives the prescription to the community pharmacy staff member for input or the nurse transcribes the prescription on to a requisition form that is faxed or electronically submitted to the pharmacy department in a hospital. In some cases, the prescriptions may be accessed via a central electronic prescription database that is then entered into the pharmacy's database for filling. • The patient is identified in the pharmacy's system as a returning patient or a new patient. If the patient is new, information regarding the patient's name, age, sex, allergies/intolerances, contact information, address, medical conditions, current medications including OTC and herbal/vitamin use, and insurance information needs to be gathered, especially if the person dropping off the prescription is not the patient. At the same time, a patient's information can be updated, and software should prompt staff members, as a failsafe, every year about changes in allergies, contact information, and insurance coverage. • The prescription is assessed if the medication is new for the patient or if they have had it before, i.e. a repeat on a medication that the patient has used before. For a repeat prescription, old prescriptions of the same medication can be inactivated even if repeats still exist for that prescription. • If a medication/prescription is to be transferred to the current pharmacy from another pharmacy, all information regarding the patient should be provided including the name, strength, prescriber, and first and last time they had the medication. This information should be sent by fax, electronically, or given verbally from one pharmacist to another pharmacist, or specially trained pharmacy technician. The original prescription may also be faxed over to the new pharmacy for verification if need be and the prescription inactivated in the original pharmacy. Certain medications can be transferred indefinitely, while others have limitations to the number of times they may be transferred (i.e. benzodiazepines), while some others are not allowed to be transferred at all (i.e. narcotics). Information regarding changes to pharmacotherapy such as discharge letters from hospitals that detail the reason for medication or therapy change (economic reasons, therapy no longer required, or adverse effects) should also be transferred to the new pharmacy. • In cases where the pharmacy does not have the medication on hand or in sufficient quantity, the pharmacist should make sure that the patient can acquire the medicine in a convenient manner such as part fills, transferring the prescription to a pharmacy with sufficient quantity (even to a competitor if need be), or special order the medication (provided it is within a reasonable timeframe). • In some countries, a generic substitute is automatically made when available for brand name drugs. If a patient or prescriber wishes for the brand name to be used, they must specify this on the prescription or verbally. • The prescription may be identified at this stage for its authenticity by the transcriber to prevent any misuse of drugs. • The prescription is transcribed into the computer software program via a staff member, by accessing the information on the patient's electronic card, or by accessing the prescription through the centralized prescription database.

Dispensing	**Transcribing**	Potential Risk	Handwritten prescriptions need to be interpreted by the nursing staff and/or the pharmacy staff which can lead to misinterpretation resulting in dispensing of the wrong drug (look-a-like drugs) with the wrong strength (the use of leading and trailing zeros and decimal points) getting to the wrong patient (same name patients with different dates of birth) at the wrong time (use of abbreviations that can be confusing such as Q.D. being mistaken for four times daily) by the wrong route (given incorrectly or omitted completely). Some routes of administration are considered to be inappropriate for administration and would result in therapeutic failure or adverse effects. In addition, omissions, extra doses, wrong rates of flow, duplication of drugs/therapies, drugs dispensed to which there are allergies/intolerances to, and missed doses can be made. Verbal medication orders, the use of abbreviations, non-standardized dosing, and errors in calculations can also occur. All of these incidences can lead to patient harm.
		Pharmacy Intervention	Academic detailing for the use of computerized order entry, standardized practice guidelines, and standardized prescription documentation can reduce patient harm. Pharmacy managers/owners can provide appropriate training and continuing education seminars with hands-on experience to pharmacy staff members and to prescribers who transcribe information into electronic formats to be retrieved by the pharmacy. In case of any doubt, the pharmacist contacts the prescriber.
Dispensing	**Description of the Medication preparation and filling Process**	The prescribed medication is picked from the pharmacy shelf based on proper stock rotation and is counted or is dispensed in unit doses prepared by the manufacturer. The label is generated and affixed on to the appropriate container with appropriate auxiliary labels and/or childproof lid.	
Dispensing	**Medication preparation and filling**	Potential Risk	Patient safety may be compromised when errors in calculations, preparation (counting from stock bottles or compounding), when stock is not rotated or stored properly, when the wrong drug is generically substituted or selected off the shelf/from the fridge, and when a multitude of drugs are being counted from stock bottles and excess medication (usually in tablet/capsule form) is placed back into the wrong container.
		Pharmacy Intervention	The pharmacist ensures that proper stock management is occurring so that medications are rotated properly (first-in-first-out or first-expiry-first-out), available in sufficient amount for the demand, and using different techniques of arranging the medications to avoid selecting or confusing them due to similar names or strengths. Alternatively, one can place similarly named drugs in separate areas away from each other. Many pharmacists have invested in barcode technology and other technologies (machine-readable devices) that can greatly reduce errors and offer double checks even before counting is done or before the pharmacist' verification step, which will then save time later on. Some countries have adopted standard operating procedures that map out several steps that need to be completed during the dispensing phase in order to ensure that the right drug and dosage was transcribed earlier. In addition, some countries have also adapted scanning technology into their transcribing step which allows for the original prescription to be scanned into an electronic file that will be linked to the prescription at all times such that, even with refills, the original can be cross-referenced again on a computer screen. The pharmacy manager and pharmacist (if not the same person) always order their stock supply from a reputable distributor or directly from validated manufacturers to avoid counterfeit drugs which can harm the patient.

Dispensing		Pharmacy Organization	National Pharmacy Association, United Kingdom; The NPA have produced Standard Operating Procedures (SOPs) on the storage of medicines at low temperatures for both England & Wales, and separately for Scotland. Pharmacists have a professional obligation to ensure that they store pharmaceutical stock correctly including medicines that require storage at low temperatures. The Royal Pharmaceutical Society of Great Britain (RPSGB) requires pharmacists and technicians to comply with the guidance published in Medicines, Ethics and Practice (MEP) relating to storage of medicines at low temperatures. This SOP developed by NPA helps pharmacist to comply with their obligations. Conseil national de l'Order des pharmaciens, France; The Dossier Pharmaceutique (DP) gathers information on a central data host for each patient and records of all the medicines dispensed to him or her by any community pharmacy (OTC drugs or prescribed drugs). Participation in the program is voluntary, and at any time, the patient can have access to it, delete it, or ask that a medicine is not recorded. The access to this DP requires two cards: the patient insurance card and the pharmacist's card. When the patient card is entered in the computer terminal, the information is downloaded on the server and then combined with the information available at the pharmacy computer. When the card is withdrawn, the information downloaded from the central server is deleted on the pharmacy computer. Patients can ask their pharmacist to print their DP (for instance, when they are about to go in a hospital) to ensure seamless care.
	Description of Compounding and/or reconstitution of a drug		• If the prescription needs compounding or reconstitution, then each ingredient in the prescription needs to use the same precautions mentioned in the steps earlier. • Each ingredient is correctly transcribed into the computer. • The ingredients are selected with the correct strength, from a reputable supplier, and possess a reasonable expiration date. In some countries, the pharmacist must verify each ingredient, by standardized tests, when it is received from the manufacturer. • Each ingredient is calculated in the correct proportions and according to tested formulations. If this is a new formulation, then enough of the compound should be made so that quality assurance tests can be performed on the product and the formula can be validated according to laws set up in the region. • All of the ingredients are measured correctly, and in some cases, twice. • The ingredients are prepared and mixed properly in accordance with the validated formula and with the appropriate equipment. Some countries require all prescription compounds to be made in specialty compounding pharmacies, in validated sterile areas, and/or by specially trained personnel. • All batch numbers, quantities, expiration dates of each ingredient, and methods of preparation are documented in sufficient detail. This step provides proof that proper procedures and ingredients of quality were used during preparation of the product and also helps to identify patients who receive these products in cases where a recall is announced for an ingredient. • Appropriate environmental control procedures, sterility testing, other quality assurance procedures, visual inspection, and monitoring programs are conducted. • Appropriate expiry/beyond-use date and storage conditions labeled on the container and appropriate patient education is given. In most cases, compounded medications do not have accompanying patient information leaflets, so the pharmacist must educate the patient and/or the person administering the medication as much as possible on the medication (see below on counseling procedures).

Dispensing	**Compounding and/or reconstitution of drug**	Potential Risk	There is a large risk for contamination, infection, the wrong ingredients to be selected, and the formulation to be incorrectly calculated, prepared, and dispensed with the wrong information regarding its use, delivery, storage, or expiry.
		Pharmacy Intervention	Although significant changes have already taken place as to which pharmacies and which pharmacists may compound, every pharmacist makes sure a quality product is made to the best of their ability. Advocating for proper equipment, training, and making referrals to specialty compounding pharmacies when the formulation is too difficult should be at the forefront of all pharmacist' minds. Some countries have laws in which only certified pharmacists and pharmacies may compound, even the simplest of formulations. Certification can be obtained by some pharmacy organizations or at the governmental level according to each country's regulation.
Dispensing	**Description of the Verification Process**		• The pharmacist verifies the prescription to be valid and free from discrepancies and continues if authenticity is proven. If the prescription is deemed to be fraudulent, then the pharmacist must document on the prescription why the pharmacy did not fill the prescription and make a note in the patient's chart and report the incident to the prescriber and the proper authorities if need be. • The pharmacist verifies the container's contents and label to what was prescribed (the original prescription), to the stock bottle's contents (if not dispensed in unit-doses prepared by the manufacturer), and to patient's computer profile for drug interactions and compliance. In some cases, the medication containers are scanned into the patient's profile for verification. Pharmacy staff members will verify the stock/medication's expiry date and storage conditions, by employing proper stock rotation (first-in-first-out or first-expiry-first-out). • The pharmacist consults the prescriber, by phone or fax, if clarification is needed (dose adjustment) or if any drug-related problem is discovered and is remedied on the spot, within a few days, or the patient is referred back to the prescriber. • The original prescription is then filed in the pharmacy. A copy may be given to the patient but must be clearly labeled with "copy" written on it and/or with a stamp from the pharmacy from which it was filled. • If the medication is not picked up right away, the prescription is bagged and placed into a drawer, usually in alphabetical format, for the patient or authorized person to pick it up. In some cases, storage and holding of medications does not occur.

Dispensing	**Verification**	Potential Risk	If the prescription is fraudulent, then potential harm may arise when the patient takes the medication for which there is no medical need. There are risks of interactions between medications/foods/diseases, compliance issues, and dispensing the wrong drug.
		Pharmacy Intervention	The pharmacist makes sure that all parts of the dispensing phase in the medication-use process have been followed carefully and without error. The pharmacist interprets the prescription, paper or electronically produced, for validation and authenticity. If the prescription is accessed via a centralized prescription database, then validation is automatically done. The pharmacist can also verify if compliance is an issue with the patient by reviewing the patient's profile and if potential drug-drug/food/disease interactions exist. Barcode technology can help reduce errors when verifying medications against what is prescribed on the prescription. Unit-dose systems can also reduce errors as the manufacturer has already accurately verified the package's contents. If a discrepancy is found on the prescription in terms of what was prescribed, then a secured fax, phone call, or email should be sent to the prescriber detailing the situation and should contain enough information to correctly identify the patient. An explanation to the patient can then be made as to the status of the prescription.
		Pharmacy Organization	Austrian Camber of Pharmacists and the National Health Insurance; The Medication Safety Belt was developed for the prevention of a drug-related problem and improved use of medicines and holds the personal medication profile of a patient. The patient or pharmacist can access the profile immediately to avoid interactions and adverse events with prescribed medicines. The access to the medication profile is made through a chip card and the information is collected on the server of the National Health Insurance. Ordre des Pharmaciens du Québec, Canada; The Ordre des pharmaciens from Quebec sends alert messages to all community pharmacies regarding risks of medicines abuse and diversion. There are 3 different sources for these messages: reports from pharmacists about fake/falsified prescriptions, voluntary request from patients (who voluntarily want to act on their own abuse) and suspicion of medicines abuse (a patient consults several prescribers and pharmacies to obtain medicines). Conseil national de l'Order des pharmaciens and the French Drug Regulation Authority, France; Two communication documents were published in May 2007 by a joint working group gathering the French Health Products Safety Agency (AFSSAPS) and the Ordre national des Pharmaciens (French Council of Pharmacists) experts on communication and on counterfeit medicines. A 12 page guide for pharmacists, where the first part describes the problem: definition of a counterfeit medicine, its spread worldwide, in Europe and in France, the risks for patients, counterfeiting and other healthcare products, and the Internet which is the main vector of counterfeit healthcare products sales in France. Its second part underlines the actions of pharmacists and their role in the fight against counterfeit medicines: how to detect a counterfeit product, the role of pharmacists with their patients, what to do when suspecting a medicine to be counterfeit, where to find further information, and what kind of legislation is infringed by medicine counterfeiting.

Dispensing	**Patient picks up the prescription**	Potential Risk	If the patient is incorrectly identified or misrepresents themselves as someone else, then prescriptions may fall into the wrong hands. This can lead to patient harm when the actual patient does not receive their medication and when the incorrect patient receives a medication not intended for them. This error can lead to potentially fatal situations.
		Pharmacy Intervention	In countries where a wait time is common before a prescription is handed over to the patient, photo identification and/or a signed consent form from the original patient stating that another individual may pick up his/her medications is required, in some cases, by law – a personal health information act. The staff may also recognize the patient through an established relationship. Some countries also give numerical slips that must be presented back at the pharmacy in order to pick up the medication and to help identify the order prescription much faster than by standard filing systems of alphabetical order. Privacy must also be taken into consideration, and prescriptions should not be stored in an area where the public may be able to view the stored prescriptions or can gain easy access to them. Locked drawers or sliding cabinets can easily remedy this issue.
Dispensing	**Patient Counseling The pharmacist verifies the patient's identification**	Potential Risk	As mentioned above.
		Pharmacy Intervention	

Dispensing	**Patient Counseling** **The pharmacist should verify if the patient understands the given instructions by paying attention to the patient's verbal feedback, facial expressions, and body language.**	Potential Risk	Inappropriate dissemination of information from the pharmacist to the patient can result in therapeutic failure, issues with compliance, inappropriate use of pharmaceutical products (medicines, devices, etc.), or patient harm (overdose, under-dose, missed dose, abuse, etc.).
		Pharmacy Intervention	The pharmacist pays attention to visual cues, body language and asks for verbal confirmation and feedback to let the pharmacist know if the information provided was understood. Using premade cards with cartoons depicting how one should take their medication will help those patients who speak a different language or are deaf. In acute care settings, this may be difficult as some patients are bedridden or too ill to communicate back. Upon discharge of a patient, the pharmacist should review all of the medications a patient leaves with or now requires from a community pharmacy. In some countries, this information is also shared with the patient's community pharmacy.
		Pharmacy Organization	FIP, based in Den Haag, Netherlands; Féderation Internationale Pharmaceutique and its Military and Emergency Pharmacy Section (MEPS) developed culture specific pictograms. This project has been undertaken by MEPS to give health professionals a means of communicating medication instructions to people who have no language in common with and/or who may be illiterate. Pharmacy Guild of New Zealand, New Zealand; This "Pharmacy Translation Kit" contains 76 basic words and phrases translated into Chinese, Hindi, Japanese, Korean, Maori, Samoan and Tongan. The kit will help pharmacists to communicate essential information such as "do not stop taking this medication, even if you feel better".

Dispensing	**Patient Counseling** **Storage and transport of medications**	Potential Risk	Certain medications, such as vaccines or insulin, require storage in the fridge otherwise they degenerate and could cause harm to the patient if used. Exposure to extreme temperatures (cold or hot), light, moisture, differences in pH, or air can lead certain drugs to oxidation and potentially convert the medication into toxic compounds. Rough handling of medications during transportation can lead to protective coatings coming off, chipping in tablets, separation of emulsions, or damage to the protective container.
		Pharmacy Intervention	The pharmacist provides patient education so that they understand how to transport and store their medication in a place that will not lead to degradation of the medicinal product. Pharmaceutical devices are also provided with clear instructions on storage, transportation, and cleaning. If toxic compounds can be produced after a long period of storage, then patients are made aware of this. Pharmacy organizations are producing pamphlets on how to store and transport a patient's medication. In some countries, cold packs, insulators, cushioned packaging, and temperature tracking devices are given/loaned to patients to ensure safe delivery of the medication to the patient's home and may be used for the entire treatment period before it is discarded/returned to the pharmacy. In some acute care settings, pharmacy staff educate nursing staff on the proper storage and transport of medications in order to reduce the costs of damaged goods, for more efficient delivery of medicine, for safe handling of potentially dangerous medications, and to increase patient safety.
		Pharmacy Organization	Conseil national de l'Ordre des pharmaciens and the French Drug Regulatory Authority, France; The Ordre national des pharmaciens, the French Drug Regulatory Agency and the French Pharmaceutical Companies Association have developed a patient brochure to list the 7 key rules on the proper use and storage of medicines at home.
Dispensing	**Patient Counseling** **Name of drug**	Potential Risk	When patient's do not know the name of the drug they are taking, it makes the connection between the medications and how to take the medication properly much more difficult, especially for those patients taking more than one drug. This can lead to administration errors such as taking the medication on the wrong dosing schedule, by the wrong route, with incompatible drugs, or lead to patient harm including death. Not knowing the name of the medication can also be hazardous in certain situations such as the patient requiring more medication but is not at their usual pharmacy, is being admitted to the hospital, or is being questioned by other healthcare professionals on their medication history.
		Pharmacy Intervention	Pharmacists clearly state the brand name (if applicable), the generic name, and point these out on the package/label for the patient to see. A printout of all the medications that a patient takes could be carried with the patient at all times in case of emergency such as loss of consciousness or where the patient cannot verbally express what they are taking. A printout could be offered biannually or annually by the pharmacy. Different colored lids or labels may be used by some pharmacies to distinguish different drugs if a patient is taking more than one drug. Some computer programs also offer the ability to distinguish the name of the drug and the written instructions on the label by increasing the font size. In acute care settings, it is important for the pharmacist to state the new and old drugs a patient is on upon discharge. This will provide a base knowledge for the patient to receive further drug information should they require it from their community pharmacist.

		Pharmacy Organization	Pharmacy Guild of Australia; "Patient Medical Profiles" (PMP) are provided by community pharmacies. It is a complete list of all medicines patients are taking, whether they are prescribed, vitamins, herbal medicines or over-the-counter medicines. The PMP includes the medicine name, image of the medication where available, directions and important counseling advice to help patients. It can be used by patients but also by other healthcare professionals (e.g. when patients enter a hospital).
Dispensing	**Patient Counseling Route of administration**	Potential Risk	Many medications have alternate routes of administration. The chosen route by the prescriber, taking into account the patient's preference, needs to be clearly instructed and reinforced to the patient. Harm may arise when a patient takes a medication by an alternate route as some ports of entry into the human body bypass first-pass effects that change the drug (prodrug), that significantly lower or increase the bioavailability of the drug, and that detoxify the drug. This could lead to toxicity within the patient. If the route of administration requires special preparation, and the patient doesn't understand this, infection, permanent damage, or scarring may occur.
		Pharmacy Intervention	Clearly stating the route of administration is important to avoid patient confusion, as can be the case with suppositories that are mistakenly ingested rather than being inserted rectally. Proper instructions on how to prepare the site of administration, if needed, are also communicated with the patient or the caregiver. For routes of administration that are difficult to understand or are not understood by the patient, patient printouts with step-by-step instructions including diagrams are often provided. Routine follow up with the patient is performed when dealing with uncommon routes of administration.
		Pharmacy Organization	Royal Dutch Association for the advancement of Pharmacy, and the Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie (KNMP) Netherlands; Development of short animated films on "Administration Instructions" that showed step-by-step instructions on how a specific medicine should be used. It covers injecting insulin and checking blood glucose. These movies are available on www.apotheek.nl
Dispensing	**Patient Counseling Dose**	Potential Risk	As mentioned above.
		Pharmacy Intervention	

Dispensing	**Patient Counseling Timing**	Potential Risk	If the patient does not understand when to take the medication and the duration of the medication regime, it places the patient at risk of overdosing, under-dosing, noncompliance, potential increase in duration of treatment, and fatality.
		Pharmacy Intervention	The pharmacist educates the patient on the number of times the medication should be taken, what time of the day the medication should be taken (if used only once daily or if the medication has a drug interaction and must be separated from meals or other drugs), the time interval between doses, and the appropriate amount to take at each dosing interval. Some countries have set up text messaging or an SMS service that the pharmacist can help set up with the patient to remind them when to take their medication. This helps with compliance, understanding of the medication regime, and allows the pharmacist to set up monitoring parameters for the patient to follow and to assess progress. When patients come back for repeats on medications, the pharmacist can also check to see if the medication is being used correctly in terms of compliance, the number of days between the last fill, and pharmaceutical device use, if applicable.
		Pharmacy Organization	Pharmacy Guild of Australia, Australia; The Pharmacy Asthma Management Service (PAMS) is provided by specially trained pharmacists within community pharmacy settings and involves a six month cycle of assessment, management and review for patients with poorly controlled asthma and aims to assist asthma patients manage their condition and help maximize the health benefit they get from their medicines. Association of Danish Pharmacies, Denmark; Patients can register for free on apoteket.dk, the website of the Association of Danish pharmacies. On this website, users can register multiple subscriptions to the same phone number, so they receive an SMS for each drug. This is useful if the patient takes several drugs at different times over the days or weeks. It is particularly interesting for women with contraceptive pills, for instance, as they can ask to receive a SMS on their phone on a regular time (e.g. every 28 days, for instance).
Dispensing	**Patient Counseling What to do if patient misses a dose**	Potential Risk	Patients have a tendency to double-up on a dose if they have missed one earlier, leading to the possibility of toxicity and patient harm. Missing a dose can also alter the therapeutic regime by altering time to steady state, time above MIC, INR results, etc.
		Pharmacy Intervention	Information regarding what to do if a patient misses a dose is provided by the pharmacist and in the patient information leaflet that accompanies the dispensed medication. This will avoid potential toxicities and therapeutic failures. Dispelling the belief that 'more drug equals a faster therapeutic outcome' is important for compliance and therapeutic outcomes to be achieved.

Dispensing	**Patient Counseling** **Method of preparation if needed**	Potential Risk	If patients, nurses, or caregivers do not understand how to prepare their medication, for example mixing a powdered medication that is to be taken orally into water/juice or using alcohol swabs to disinfect the skin before an injection, it can result in therapeutic failure, non-adherence, cross contamination, degradation of the medication, and frustration by the prescriber as to why the pharmacotherapy is not working. In some cases, the way a patient prepares their medication can be questioned when medications are being refilled or suspected in cases of therapeutic failure. If the medication is not prepared properly, overdoses and under-doses are possible putting the patient at risk of harm.
		Pharmacy Intervention	The pharmacist provides clear verbal and/or written instructions on how to prepare the medication and what to prepare the medication with (i.e. a certain juice to be used/avoided or special equipment that is needed), with a demonstration if possible. Complex preparations should be avoided and if possible, medications that have more than one step of preparation should be simplified by combining a few of the steps together for the patient ahead of time (if they are shelf-stable). In some cases, where the pharmacist may deem the patient to not have a clear understanding of the preparation technique (for example with the elderly, those with dexterity problems, the young, the mentally challenged, the blind, or the deaf), medications that need to be prepared by the patient should be avoided all together and a different medication with the same therapeutic effect should be selected. The pharmacist can ask the patient to recite how they will prepare the product in order to demonstrate their understanding.
Dispensing	**Patient Counseling** **Patient is given appropriate measuring utensils (spoons/syringes) if needed, especially for children**	Potential Risk	The patient may not receive the appropriate amount of medication leading to suboptimal dosing or toxicity. Many household measuring devices do not provide consistent and accurate means of measurement of liquid drug delivery and may be inappropriate in some populations, i.e. using a tablespoon for an infant. In addition, confusion may arise if patients are unaware of the differences in size of the measuring equipment they are using. For example, a tablespoon holds three times the amount of a teaspoon and a mistake like this can result in a potentially dangerous situation. If medications such as tablets need to be split, then household knives are inappropriate to use and may pose safety risks for the patient.
		Pharmacy Intervention	Where possible, measuring devices such as a measuring spoons or syringes are provided to patients. Proper measuring technique is also demonstrated with instructions on how to care for the measuring device. Pill-splitters should be made available for purchase to ensure accurate dosing or if the pharmacy provides the service, the tablets should be split for the patient to avoid errors and confusion, should the patient be taking more than one medication. The pharmacist can make referrals to other healthcare providers to demonstrate how injections are to be correctly done in those countries where injections are not part of the scope of practice for pharmacists.

Dispensing	**Patient Counseling** **Patient is shown how to use pharmaceutical products if needed, for example, asthma inhalers or glucose meters**	Potential Risk	If the patient is not shown how to use their medication device properly, therapeutic outcomes are compromised and this can lead to serious harm. In addition, the pharmaceutical device itself can cause harm to the patient if it is used incorrectly.
		Pharmacy Intervention	Proper administration and device technique would be ideally demonstrated each time a patient receives a prescription for a medication that requires the use of a device for medication delivery. Using visual aids, talking with caregivers/parents/guardians/ or interpreters, and using pharmaceutical demonstration devices can be done and readily available. This allows the pharmacists to show patients proper technique and solidify their understanding of their medication regime should they not understand what was verbally communicated to them due to a lower education level, illiteracy (regarding the patient information leaflet), mental challenges, being young, being elderly, being deaf or blind, or not understanding the spoken language. Patient information leaflets detailing the drug's use and possible indications usually accompany each prescription along with information on how to contact the pharmacy in case there are questions. Diagrams are included where appropriate.
		Pharmacy Organization	Association of Danish Pharmacies, Denmark; The "Asthma Campaign" program was initiated to assess and improve inhaler technique amongst asthmatic patients and to improve the use of medicines. Irish Pharmaceutical Union, Ireland; Posters and attack cards were on display in pharmacies across the country and a special DVD providing practical demonstrations on inhaler technique and how to use spacers correctly (a special device which helps children take their medication more effectively) were made available. Copies of the DVD have been disseminated to all pharmacists and GPs in the community. Royal Dutch Association for the advancement of Pharmacy, and the Koninklijke Nederlandse Maatschappij ter bevordering der Pharmacie (KNMP) Netherlands; Development of short animated films on "Administration Instructions" that showed step-by-step instructions on how a specific product should be used. It covers injecting insulin and checking blood glucose. These movies are available on www.apotheek.nl Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; This campaign was organized by the Colegio Oficial de Farmacéuticos de Cuidad Real in 2005 in order to inform the population about the use of inhalers and any similar treatments which require specific skills for implementation.

Dispensing	**Patient Counseling** **Patient is given sharps/biohazard container if needed**	Potential Risk	There is a potential for the patient to reuse needles that could lead to infection, damage to the body, for others, or themselves, to be accidentally injured by the used needles, and for the transmission of disease.
		Pharmacy Intervention	Pharmacy staff members can offer the patient biohazard or "sharps" containers every time an injectible medication or device is purchased. The patient receives the proper counseling on safe disposal, including a demonstration if the biohazard container is complicated to use, and that other means of storing used injectibles such as in empty bleach bottles, soda-pop bottles, boxes, etc. are not appropriate and can put others at risk of harm.
		Pharmacy Organization	National Association of Pharmacies, Portugal; The intervention of pharmacies in the area of risk reduction, mitigation of damage, and protection of public health has its origins in 1993 with the "Say No to a Second-hand Syringe" program. The aim was to prevent reusing syringes and encourages users of injection drugs to deposit used syringes in the appropriate container. Users may also receive a kit containing 2 syringes, 2 alcohol wipes, a preservative, an ampoule of distilled water, a filter, and a bag with different information.
Dispensing	**Patient Counseling** **Proper interval between incompatible drugs or foods**	Potential Risk	Certain medications can interact with each other and cause a precipitation of one or both of the medications, bio-deactivation of one or both of the medications, enhancement of one or both of the medications, or to cause idiosyncratic reactions within the body. Without observing proper time intervals between the drug or food incompatibilities, then therapeutic failure can result. Examples include divalent cation interactions with tetracyclines, fluroquinolones, or levothyroxin, and statins with erythromycin.
		Pharmacy Intervention	Patient counseling includes what drugs and foods may interact with prescribed medications, especially those that are newly prescribed medications and is reiterated upon every third or fourth renewal of a medication repeat. The pharmacist also asks patients about their recent drug or food intake when medications that are known to have drug/food interactions receive dosage increases to assess for true therapeutic dosage failure. Pharmacists point out and highlight these interactions in the patient information leaflets provided as well as verbalize any major interactions providing a brief explanation as to why this interaction is important to avoid. Pharmacists explain any vitamin supplement interaction as well as any homeopathic or herbal interaction.
Dispensing	**Patient Counseling** **Side effects**	Potential Risk	The recognition of side effects and "red flags" are important in terms of compliance, adherence, and safety of the patient. These areas can lead to serious harm in a patient, including fatality.
		Pharmacy Intervention	With every prescription, including renewals, the patient is often counseled on the major side effects that may occur with the medication as well as the major "red flags" that would tell the patient to go to the emergency room should they occur. The patient is asked to read over the patient information leaflet provided or when necessary (if the patient has a lower understanding, illiterate, blind/deaf, mentally challenged, the elderly, the young, foreign language), the pharmacist will read the information to the patient or explain the information more thoroughly (use of visual aids or an interpreter may be necessary).

Dispensing	**Patient Counseling** **Timeline of therapeutic outcomes/duration of treatment**	Potential Risk	If the patient does not understand when to expect therapeutic outcomes, then failure cannot be properly assessed and compliance may be affected. In addition, if the patient does not understand that certain medications may take up to months to reach steady state or have an effect, then they might increase their dose (taking more of the medication), without proper authorization, in order to notice an effect. This places the patient at risk of toxicity, therapeutic failure, and can be potentially fatal.
		Pharmacy Intervention	Timelines to therapeutic effect including the time it takes to start noticing an effect, the time that the therapeutic effect should be reached, and when a patient should go back to the prescriber if no effect has been noticed given the appropriate time, is often communicated to the patient. Patients are also told that therapeutic effects and timelines can differ in some individuals. In cases where an effect may not be noticeable to the patient, such as blood pressure control, then appropriate monitoring parameters, such as testing the patient's blood pressure, can be set up and conducted within appropriate timelines to assess for therapeutic effect/failure.
		Pharmacy Organization	Irish Pharmaceutical Union, Ireland; This campaign was to improve the rational use of antibiotics, for better adherence/concordance to the treatment and for improved use of medicines. Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; A new campaign that highlights the importance of correctly using antibiotics and included posters and booklets that were displayed in pharmacies. In addition, the campaign also educated patients not to self-medicate with antibiotics and to continue the treatment until the end. Hungarian Society for Pharmaceutical Sciences and the Hungarian Association of Private Pharmacists, Hungary; A national campaign to "Educate Patients on Rational Use of Antibiotics" to prevent antimicrobial resistance. Pharmacists from Budapest took part of this campaign and displayed brochures to their patients highlighting three messages: a prescription is needed for antibiotics; take the medicine as long as prescribed (don't stop before the end of the treatment); and it is recommended to take probiotics while taking your antibiotics. The brochure also relayed the website developed by the National Hungarian Institute for Health on antibiotic resistance. Czech Pharmaceutical Society, Czech Republic; This "Antibiotic Resistance Awareness Campaign" included the display of posters in all community pharmacies as well as the distribution of leaflets to patients. The key information provided included, why antibiotics should be prescribed by a physician; when and how long should patient take their antibiotic; what food and beverages should be avoided during a treatment with antibiotics; what side effects can be expected; when to stop taking antibiotics; and why not taking on your own initiative.
Dispensing	**Patient Counseling** **What to do in emergency situations**	Potential Risk	If the patient does not understand what situations constitute an emergency situation and what to do should they occur, then the patient is at increased risk of harm and fatality.
		Pharmacy Intervention	In addition to side-effect information, situations that would alert the patient to go to the hospital are clearly communicated. The pharmacist emphasizes that waiting for these emergency signs and symptoms to retract on their own with time is inappropriate and can lead to greater harm.

Dispensing	**Patient Counseling** **Potential drug-drug/food/disease interactions**	Potential Risk	As with the risks of incompatible drugs/foods, certain medications, foods, and even disease states may interact with the patient's current medication leading to potentially detrimental outcomes. Some interactions may cause potentiation leading to toxicity, synergism leading to increased therapeutic effects including at a faster rate, or antagonism leading to decreased or no therapeutic effect.
		Pharmacy Intervention	Patient counseling includes major drug/food/disease monitoring and the patient is told to avoid these identified interactions. If the patient cannot guarantee to avoid these interactions, then changing the medication, in consultation with the prescriber, can be considered. Patients who are on multiple medications are monitored and assessed more carefully. Academic detailing may be necessary when pharmacists notice consistent patterns of improper prescribing with potential drug interactions. Pharmacists do not rely solely on software applications to identify these potential interactions as many programs lack information on herbals, foods, and diseases that may interact. Up to date references are on hand, in hardcopy or electronically, to cross reference information when necessary, especially when dealing with herbal medications.
		Pharmacy Organization	Croatian Pharmaceutical Society, Croatia; The goal of this campaign was to encourage patients to ask their pharmacists about which drugs or food they consume that could impair their driving abilities, how long they should wait before using vehicles, and when to take certain medications. Association of Danish Pharmacies, Denmark; A communication campaign ran from 31 October to 4 December 2004, and aimed to raise awareness on the risks of driving when taking certain treatments. The campaign on traffic safety was in collaboration with the Council for Road Safety. It also highlighted the risk of taking these drugs with alcohol. Dangerous drugs that can affect one's driving are often marked with a red warning triangle and they include drugs for anxiety, anti-epileptic drugs, drugs combating nausea induced by travel, some medicines treating severe pain, medicines for cough, and all preparations containing more than 10 percent alcohol.
Dispensing	**Patient Counseling** **Use of OTC and/or herbals/vitamins**	Potential Risk	Many patients do not divulge the use of multivitamins, herbals, or over-the-counter medications when routinely asked about the medications they are currently on, or were on. The reasons patients do not divulge this information include that they do not consider these products as medications because a prescription was not needed for their acquisition; they believe that these products are "natural" and therefore completely safe; and these medications may not be taken routinely enough to be considered as a medication they currently take. Risks of serious harm from interactions may arise when healthcare professionals overlook OTC's, herbals, or any other supplementation.
		Pharmacy Intervention	The pharmacist asks which herbals, supplements, or OTC medications a patient is currently on or has taken recently (as some herbal medications have long half-lives) and which ones to avoid while taking prescribed medications. In acute care facilities, these "other" medications can be included on any medication reconciliation performed. If a potential interaction is identified, then appropriate interventions are conducted including consulting with the prescriber to change the medication to one that will not interact.
		Pharmacy Organization	Ordre des Pharmaciens du Québec, Canada; The Ordre des Pharmaciens du Québec has developed an OTC Drugs Database for Patients available online in French. The OTC Drugs Database includes all drugs included in schedules II and III of the regulation, as well as most off-scheduled products, that is, products that can be sold outside pharmacies and that are listed in the database as out-scheduled products. The database is available freely to

			pharmacists and other users as a public service. Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; This campaign aims to highlight the risks of photosensitization associated with some OTC medicines sold in pharmacies. For any of these medicines, the pharmacist will paste a sticker on the package, inform patient about the risk of photosensitization associated with the product's use, and provide recommendations with regard to sun exposure.
Dispensing	**Patient Counseling** **Importance of compliance and adherence**	Potential Risk	Therapeutic failure will occur when patients do not understand the importance of compliance and adherence to medication regimes. Compliance may be affected by personal views on taking medication; religious beliefs; misinformation from friends, family, or the Internet; or from the fear that side effects that may occur. This can lead to potentiation of the current disease/illness, increased treatment periods, microbial resistance, decreased/increased biological response, or even death.
		Pharmacy Intervention	Pharmacists emphasize the importance of compliance and adherence to medications especially those medications that take a long time to reach therapeutic effect; those medications where the patient may not notice a therapeutic effect taking place; those medications used to treat infections; medications with complicated dosing schedules that cannot be simplified for the patient; and those medications with known side-effects that are difficult to manage. Understanding what a patient's personal, religious, and overall views are on medication help the pharmacist to tailor the given patient counseling advice so that compliance and adherence are optimized and that medication regimes are continued to completion. Blister packs, dosette trays, SMS reminders, computerized callback systems, homecare, the use of different colored lids, different colored labels, tall-man lettering, computer generated labels and patient information leaflets, and computer generated medication lists (detailing the name of the drug, strength, timing, route, known allergies) are being used to help those patients who are on multiple medications (polypharmacy) manage their medications more safely and are means to aid in medication compliance and to simplify medication regimes. The use of homecare services or respite is an option for elderly patients, those caring for mentally or physically challenged individuals, and those individuals who are overwhelmed by their current health situation. The pharmacist can play a role in advocating social services such as alcoholics anonymous, group therapy, social workers, personal insurances, social assistance, and referrals to other healthcare professionals such as physiotherapists, occupational therapists, speech pathologists, massage therapists, naturopaths, acupuncturists, chiropractors, dentists, midwives, doulas, and general practitioners for referrals to specialty fields such as gastroenterology. Pharmacy can also play a role in contacting the appropriate authorities when abuse of drugs, other persons, or other substances is suspected. Pharmacy management care services for chronic conditions can be initiated such as diabetes, blood pressure, anticoagulation, smoking cessation, and lipid programs to help patients maintain compliance and answer any questions they may have while achieving optimal pharmacotherapy.
		Pharmacy Organization	Pharmacy Guild of Australia, Australia; The "Diabetes Medication Assistance Service" involves an ongoing cycle of assessment, management and review for patients with type 2 diabetes and aims to assist diabetes patients manage their condition and help maximize the health benefit they get from their medicines. Pharmacy Guild of Australia, Australia; "Dose Administration Aids" are devices developed to assist at-risk patients in better managing their medicines by arranging their medicines into individual doses according to the prescribed dose schedule throughout the day. Pharmacy Guild of Australia, Australia; The "MedsIndex Score' is a method to evaluate patient's compliance for each of their chronic management therapy medicines. The score is calculated by monitoring

			repeat refill intervals of medicines and reporting against expected refill intervals based on the doctor's instructions. A score out of 100 is calculated with each of the medicines patients take regularly. The MedsIndex summary includes the name of the patient, the medicine name and strength, the quantity per prescription, the total daily dose. The day usage per prescription is then calculated and compared to the time between the originals prescription dispensing and its subsequent repeats. Association of Danish Pharmacies, Denmark; An "Asthma Campaign" was run from 22 January 2006 until 26 February 2006. During this campaign, pharmacists advised patients on asthma and the importance of compliance. They provided them with a patient leaflet containing lot of advice and useful tips regarding asthma medication. Association of Danish Pharmacies, Denmark; During this "Diabetes Campaign" held between 29 October and 3 December 2006, pharmacists promoted healthy lifestyle choices and adherence to treatment for diabetic patients. They also published a guide on diabetic treatment to be disseminated at the pharmacies. Association of Danish Pharmacies, Denmark; A communication "Compliance Campaign" was organized from 29 April to 4 June 2007. During this campaign, a special focus was made on techniques and products to improve compliance. On 10 May 2007, patients could obtain for free a pillbox (consisting of a box divided into smaller spaces, each of which may contain the dose of medicine for morning, noon and evening). Association of Danish Pharmacies, Denmark; A "Depression Campaign" was organized from 26 October to 29 November 2008 and focused on depression. During this campaign patients were invited to talk to their pharmacist about depression. Pharmacists provided key information on the information of treatment adherence and offered patients with a leaflet on the depression. National Association of Pharmacies, Portugal; The "Asthma National Campaign: Portuguese pharmacies identify non--controlled asthma patients" campaign offered models and tools for a national pharmacy based intervention campaign targeted to asthma patients. Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; In 2001, in collaboration with the Spanish Society for Hypertension, Consejo General de Colegios Oficiales de Farmacéuticos de España organized a communication campaign, "Compliance and Hypertension", to stress the importance of compliance amongst hypertension patients. It also stressed importance on risks factors and life style. Royal Pharmaceutical Society of Great Britain, United Kingdom; On 20 August 2009, the Society launched its "Ramadan Campaign" urging Muslims who are taking medication and fasting during Ramadan to seek advice from pharmacists on how to manage medicine intake effectively and safely in the interest of their health.

Dispensing	**Patient Counseling** **Patient is given appropriate monitoring parameters and follow-up**	Potential Risk	Much like the time to therapeutic effect, if the patient does not understand parameters to monitor during the time they are on medication, it can lead to noncompliance or discontinuation of use, increased use of medications to get a therapeutic effect (already discussed), disease progression, or a lack of confidence in the healthcare system from a lack of follow up and care by the healthcare professional.
		Pharmacy Intervention	The pharmacist provides the patient with monitoring parameters that the patient can use, or conduct by themselves (i.e. home blood pressure monitoring), in order to assess their progression with the medication regime. This will improve compliance and help the healthcare team to assess therapeutic outcomes/goals. Journals or diaries provide a tangible means to understanding the medication regime and so that the patient and healthcare team can visually identify patterns that are occurring. The pharmacist can arrange a follow up with the patient within an appropriate time, usually within three days to a week, especially for patients starting a new medication or those patients with high risk medications such as warfarin, antineoplasitics, HIV medications, etc. The follow up can be done via telephone, email, or in person at a mutually agreeable time. This ensures proper use of medications and offers the pharmacist another opportunity to educate the patient, reinforcing information already given to them when they were first counseled. Following up with patients has proven to increase compliance and knowledge of the patient. In acute care settings, the hospital pharmacist may provide the same monitoring parameters and ask to follow up with them by phone, email, or in person as may be the case with many high-risk medications such as low molecular weight heparin and warfarin regimes, or they can send a referral letter to the patient's community pharmacist for follow up and monitoring as well, where appropriate.
		Pharmacy Organization	Association of Danish Pharmacies, Denmark; Pharmacies organized the campaign "Do you track your blood pressure?" from 28 January until 4 March 2007. The campaign helped to highlight hypertension and to ensure better use of medicines. Irish Pharmaceutical Union, Ireland; This "Ask your pharmacist about Blood Pressure Campaign" was run in September 2006 and was a joint venture with the Irish Heart Foundation. This campaign aimed to raises awareness amongst blood pressure. Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; The Consejo General de Colegios Oficiales de Farmacéuticos de España together with Pfizer and the Spanish Society of Ophthalmology organized, in the summer 2004, a campaign called "All Against Glaucoma". The campaign provided tools to assist the pharmacist in monitoring patient pharmacotherapy in collaboration with ophthalmologists.

Dispensing	**Patient Counseling** **Patient asked to verify their understanding of the medication by stating at least the drug name, strength, dose, timing, why they are using the medication, and one major side effect**	Potential Risk	If the patient cannot repeat this basic information back to the pharmacist/healthcare worker, then the risk of harm arises from noncompliance, overdose, under-dose, side effects, and confusion between different medications.
		Pharmacy Intervention	The pharmacist evaluates, usually during each patient interaction, the level of understanding that the patient has in regards to the medication they are receiving. This is especially important in those patients taking more than one medication (polypharmacy), in the elderly, in patients who speak a foreign language, and with caregivers to the young or mentally challenged. Pharmacists can develop individual procedures or follow set standard operating procedures set up by the pharmacy in order to ensure that the steps mentioned above are covered, to the best of their ability. A checklist may be implemented to ensure each patient receives standardized treatment. Time constraints can be alleviated by efficient use of pharmacy staff and explaining to patients that counseling takes time. The information from patients who refuse counseling should be documented to prevent and avoid liability and negligence in the future.

Table 3

Identification of potential risks patient harm in the administration stage of the medication-use process; pharmacy's potential interventions at each step; and the pharmacy organizations working on improving patient safety.

Administration	The use of unit dosing, automated carts, smart pumps, and bar coding in hospitals can help reduce errors at the administration level. Academic detailing to prescribers and to nursing staff can greatly reduce errors by informing them on proper storage conditions, reading labels properly, drug incompatibilities, alternate routes of administration, enteral tube-feeding and drug delivery, parenteral nutrition, proper use of antibiotics and pain medication, verification of patient information, and to remove medications from the patient's tray/drawer right before administration.		
Administration	**Patient transports and stores the medication correctly**	Potential Risk	As mentioned above.
		Pharmacy Intervention	

Administration	**Patient takes or is administered the correct drug**	Potential Risk	As above. The patient information leaflet provided with the prescription often includes how to administer the drug correctly and should contain diagrams where appropriate.
		Pharmacy Intervention	
		Pharmacy Organization	Irish Pharmaceutical Union, Ireland; A patient leaflet on paracetamol was developed by the Irish Pharmaceutical Union together with the Irish Pharmaceutical Healthcare Association. It highlights changes in the way paracetamol is sold in pharmacies, as well as information on the labeling. It also underlines the current risk of taking several drugs containing paracetamol simultaneously.
Administration	**Patient takes or is administered the drug by the correct route**	Potential Risk	As mentioned above.
		Pharmacy Intervention	The pharmacist can provide patient information leaflets and education to the patient and the care facility, if needed, on how to properly administer the medication by the correct route. This would include information on crushing, mixing with food/drink, splitting, or finding alternate routes of administration should the prescribed route be unavailable (i.e. a patient is vomiting and cannot take a medication by mouth and therefore another route for the tablet/capsule must be determined without compromising the therapy). Patients can refer to websites developed by pharmacy associations for further information (for example KNMP or Medication Safety).
Administration	**Patient or care facility stores the drug properly**	Potential Risk	As mentioned above.
		Pharmacy Intervention	
		Pharmacy Organization	Conseil national de l'Ordre des pharmaciens, France; The Ordre national des pharmaciens, the French Drug Regulatory Agency and the French Pharmaceutical Companies Association have developed a patient brochure to list the 7 key rules on the proper use and storage of medicines at home. These 7 rules are, always keep medicines out of reach from children, in one single place; keep medicines with their patient leaflets and their original boxes; do not store all medicines at home: you can give them to your pharmacists for recycling; check

			regularly the expiry date of medicines; do not automatically take a medicine you are used to take; do not share your medicines with other persons; do not throw your medicines in garbage or in toilets.
Administration	**Patient or care facility discontinues/tapers the dose down of the drug when told to**	Potential Risk	Some medications require a washout period, to be tapered down slowly, or need immediate discontinuation due to toxicity, organ damage, therapeutic failure, or simply the end of therapy. Not understanding how to properly discontinue the medication can lead to patient harm including seizures, rebound effects, or death.
		Pharmacy Intervention	The pharmacist can monitor and follow up with patients should they need to discontinue the use of their medications. Not all medications require tapering or a washout period, however those that do, can be monitored in patients especially in those with a lack of understanding.
Administration	**Patient notices a benefit from the drug in the timeline described by prescriber or pharmacist**	Potential Risk	As mentioned above.
		Pharmacy Intervention	The pharmacist is able to set up the patient to receive text messages or SMS reminders so that the patient remembers to take their medication.
Administration	**Patient recognizes any side effects**	Potential Risk	As mentioned above.
		Pharmacy Intervention	The patient can refer to the patient medication leaflet and other documents prepared by the pharmacist on the major side effects that may occur when taking the medication, or any interactions to avoid, and the appropriate steps to take should they occur (come back to the pharmacy, discontinue the medication, go to the emergency room, go to the prescriber, etc.).

Administration	**Patient recognizes "red flags" and understands what to do in emergency situations**	Potential Risk	As mentioned above.
		Pharmacy Intervention	The patient is told to read over the patient information leaflet and refer back to it if the patient experiences unusual signs and symptoms after taking a medication. The situations/side effects that indicate that a patient should seek medical attention are pointed out and highlighted if necessary. The patient is also told what to do in those cases (i.e. call for help, go to the emergency room, etc.).
Administration	**Patient monitors progress and outcomes**	Potential Risk	As mentioned above.
		Pharmacy Intervention	
		Pharmacy Organization	Pharmacy Guild of Australia; Community Pharmacies, Nursing homes, the HMR for Home Medicines Review (also known as DMMR - Domiciliary Medication Management Review) is a consumer focused, structured and collaborative health care service provided in the community setting, to optimize quality use of medicines and consumer understanding. It involves the consumer, their general practitioner, their pharmacy, and other relevant members of the health care team. Conseil national de l'Ordre des pharmaciens and the French Drug Regulatory Authority, France; The French Drug Regulatory Authority provided professionals through mail and Internet information on anticoagulation (AVK) treatment to all concerned healthcare workers from 2001 to 2004. Pharmacists were specifically informed through the journal of the National Council of pharmacists in January 2004. This information included AVK indications; proper use of AVK treatment; drug and food interactions involving AVK; importance of a regular coagulation monitoring by the International Normalized Ratio (INR) to ensure effective antithrombotic protection while minimizing the risk of bleed complications; and main therapeutic target area of INR. There was the conception of a notebook for patients that included general information on AVK treatment for patients, proper use of AVK treatment, food and drug interactions, advice for day life, warning signs, importance of a laboratory monitoring, a table to collect laboratory data of INR, optimal target INR, and particular advice of the physician, a card to be put in the patient's wallet to inform that he is currently under AVK treatment (in case of an accident, for instance, this information is crucial).

Administration	**Expiration and disposal of medications**	Potential Risk	Environmental safety is becoming a large focus all over the world, and proper disposal of unused medications or those that have expired are important to communicate to the patient. A disregard to proper medication disposal can result in hormones being released into water systems; sharps, such as needles and glass, being discarded in the regular trash leading to the risk of individuals being accidentally exposed to medications and/or blood-borne diseases; microbial resistance to antibiotics; and environmental harm resulting in loss of ecological sustainability. Expired mediation can cause harm when the parent compound degrades into a toxic compound, concentrates due to lost moisture, or becomes sub-therapeutic. Expired medications that are used by the patient can lead to patient harm and even death.
		Pharmacy Intervention	Pharmacies can encourage patients to bring back any unused or expired medications or pharmaceutical devices for proper disposal in accordance to local laws. If the pharmacy does not have the capability of disposing the medications properly, or if another waste-management system is set up in the region, this can be communicated to the patient. In addition, patients can be told to properly store any unused medications, not to redistribute the medications to other people, and to go through their medication cabinet at least once a year to remove any expired or unused medications so that they avoid any harm.
		Pharmacy Organization	Malaysian Pharmaceutical Society, Malaysia; This “Know your Pharmacist - Medicine Cabinet Clean-Up” campaign has been organized by the Malaysian Pharmaceutical Society and is a month long event (July) consisting of public forums, health campaigns, road shows, media/radio exposures, and also a "walk in" invitation for the public to consult their community pharmacies on their health and medication issues. The public was invited to call the pharmacies directly to fix an appointment with the pharmacist while each pharmacy may determine their own consultation times. The public is then asked to bring to the pharmacy all medicines stored at home. Pharmacists checked for expired or damaged drugs, and re-labeled non-expired medications if necessary. The pharmacist would dispose all unwanted drugs on their end. Pillboxes were given to selected customers to improve compliance. The pharmacist also filled a medicine summary card so that the customer would know the name, dosage and uses of the drugs they were taking. Pharmacists also checked all the medication for proper dosage and times, polypharmacy, drug interactions, and side effects. American Pharmacists Association, United States; Together with the US Fish and Wildlife Service and the PhRMA (Pharmaceutical Research and Manufacturers of America), the American Pharmacists Association organized a public awareness campaign, “SMARxT Disposal -- Responsible medication disposal safeguards Lives and Protects the Environment”, to safe disposal of medications. It aims to provide patients with information on how to safely dispose medications to prevent intoxication and damage to the environment. National Association of Pharmacies, Portugal; ANF developed models and tools for this campaign called, “Medication review campaign targeting elderly population”. A manual on Geriatric pharmacy services, bag for patients to bring in their medicines (to be reviewed by the pharmacist), personal medication record (for the patient), and spreadsheet to document care provided (for the pharmacist).

Table 4

Pharmacy organizations working on improving patient safety.	
Pharmacy Organizations, overall, on patient safety	Nova Scotia College of Pharmacists, Canada; In June 2008, the Nova Scotia College of Pharmacists launched its "SafetyNET" pilot project. This is a resource for pharmacy managers in Nova Scotia that would assist them in their legislated responsibility to develop and implement a process for continuous quality improvement in their pharmacy that includes a process for managing medication errors. Association of Danish Pharmacies, Denmark; Danish pharmacies organized a communication campaign from 11 March 16 April 2002 focusing on babies and children called "Maternal Health". This campaign consisted of the dissemination of free brochures on pregnancies and baby health and was combined with window posters and ads in national newspapers and TV commercials. One of the messages of the campaign is that the mother should consider that their children may not need medication every time they feel ill. The campaign also includes information on how to get children to take medicine when necessary. The second part of the campaign targeted pregnant women and women who are considering becoming pregnant. Among the advice to them is that they must take care to get enough minerals and vitamins, such as folic acid. The campaign will also address the issue of tobacco. Association of Danish Pharmacies, Denmark; A "Proper use of Medicines" campaign was initiated in 25 April 2004 by Danish pharmacies and ended in 29 May 2004. This campaign highlighted that there is always a possible side effect for every medicine. This campaign also reminded patients that since 2003, they could report any side effect not mentioned in the patient leaflet directly to the Danish drug regulatory agency. Association of Danish Pharmacies, Denmark; A communication campaign ran in September 2004 aimed to provide parents, grandparents and adults living or receiving visits of children with key messages on how to prevent any medicine-related accidents. Parents and relatives were invited to visit their community pharmacy to obtain a free brochure on "Children and Medicines". This brochure summarized key safety messages regarding the storage of medicines and recommends not taking medicines in front of children, as they tend to mimic what adults do. Association of Danish Pharmacies, Denmark; A "Medication safety campaign – There are no silly questions when it comes to medicines" campaign aimed to invite patients to ask pharmacists about their medicines, highlighting that when it comes to medicine, there are no stupid questions, but there are plenty of potential threats for misunderstanding. French Society for Clinical Pharmacy, France; The SFPC has developed a "Medication Errors Dictionary" in two languages, French and English, in order to improve the knowledge and use of terms related to medication errors. French Society for Clinical Pharmacy, France; This document is a methodology to facilitate an interdisciplinary evaluation of professional practices of adverse events related to medicines. Irish Pharmaceutical Union, Ireland; A communication campaign entitled "Ask about your medicines" was launched in March 2003 using Europharm Forum guidelines. Pharmacists provided patients with leaflets advising them of the questions they should ask when having a prescription completed while at the same time encouraging them to check the variety of medicines they might have at home and their continued suitability for use.

	Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; ISMP and Consejo General de Colegios Oficiales de Farmacéuticos de España have organized a campaign on the prevention of medication errors because of similar drug names. This campaign has established a systematic reporting of medication errors by phonetic or orthographic similarity in the names of the medications. In 2008, pharmacists are reporting these errors using the form (either through a paper form or an online form) corresponding to errors, actual or potential. Consejo General de Colegios Oficiales de Farmacéuticos de España, Spain; A communication campaign was organized targeting pharmacists and patients on the risks on buying medicines on the Internet (and more precisely on the risks of having counterfeit medicines). The Consejo General has developed an exhaustive document for pharmacists. PharmaSuisse, Societe Suisse des Pharmaciens, Swiss Association of Pharmacists, Switzerland; During one week (from 20 to 25 October 2008), pharmacies informed patients about the risks of counterfeit medicines purchased over the Internet through posters, flyers and advertisements on plastic bags. On 25 October 2008, pharmacists offered a free evaluation of medicines bought over the Internet by patients. National Pharmacy Association, United Kingdom; This campaign's aim was to emphasize the knowledge and expertise of a pharmacist and to highlight that patients can ask pharmacists about their medicines that they might not or would not ask their doctor. As a result, pharmacists also promoted the Medication Use review; introduced the concept of asking at the pharmacy about minor ailments and public health services (including cessation activity). National Pharmacy Association, United Kingdom; The General Practitioners Committee of the British Medical Association and the National Pharmacy Association have produced a workbook entitled "Improving communication between community pharmacy and general practice" to help facilitate local dialogue between the two professional groups, helping to improve patient care.

FUTURE ROLES

The medication-use process is complicated and relies on the support and input from many professional disciplines to work properly and to reduce errors. By creating a culture based on patient safety early in one's education, the premise is set at the beginning to take responsibility of one's actions and realize the consequences of one's actions even though our focus is set on a systems based approach for medication errors and blame. In addition, by consolidating the systems that have a proven history of successfully reducing errors in the medication-use process, and by sharing information between pharmacy organizations, the hope is to come up with one standardized process to follow and improve upon. It is important to foster new and novel ideas to improve patient safety and to implement these ideas into the medication-use process as quickly as possible. Of course, issues arise such as territorial rights, differences in the scope of pharmacy practice, and interprofessional collaboration, which make sweeping implementation of one standardized and safer medication-use process difficult, however the main result of increasing patient safety is the end goal of each profession involved in the medication-use process, each country's governing body on patient safety, and each government looking at reducing medication and healthcare costs. The role of pharmacy in reducing errors that occur during the medication-use process is invaluable, growing, and proven to be clinically significant over the interventions made by other healthcare professions. The future role of pharmacy is to assert itself amongst the other healthcare disciplines as a critically important profession needed to reduce errors made in the medication-use system; to bring about change and make the appropriate interventions where pharmacy has yet to make an impact on (as seen in the missing information on pharmacy interventions in table 1); and to continue to be the most trusted healthcare profession as viewed by the public by expanding the clinical roles of pharmacists.

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