

Division of Social Pharmacy  
Faculty of Pharmacy  
University of Helsinki

# Information Technology Development Needs in Community Pharmacies: A Strategic Approach

ANNA WESTERLING

ACADEMIC DISSERTATION

To be presented, with the permission of the Faculty of Pharmacy of the  
University of Helsinki, for public examination  
in Auditorium 1, Info Center Korona, Viikinkaari 11, University of Helsinki,  
on Friday 9<sup>th</sup> December 2011, at 12 noon.

Helsinki 2011

Supervisors: Professor Marja Airaksinen, Vice Dean, Ph.D.  
Division of Social Pharmacy  
Faculty of Pharmacy  
University of Helsinki  
Finland

Pharmacy Owner Veikko Haikala, Ph.D.  
Espoo 3<sup>rd</sup> (Keskustan) Pharmacy  
Finland

Co-supervisors: Associate Professor Simon Bell, Ph.D.  
Quality Use of Medicines and Pharmacy Research Centre  
Sansom Institute  
University of South Australia  
Australia

Professor Alan Lyles, Sc.D., M.P.H.  
School of Public Affairs  
University of Baltimore  
USA

Reviewers: Professor Han de Gier, Ph.D.  
University of Groningen  
The Netherlands

Victoria Losinski, Ph.D.  
Director of Practice Implementation  
Medicines Management Systems, Inc  
USA

Opponent: Hannes Wahlroos, Ph.D.  
Espoo 7<sup>th</sup> (Tapiolan Otso) Pharmacy  
Finland

© Anna Westerling 2011  
ISBN 978-952-10-7221-5 (paperback)  
ISBN 978-952-10-7222-2 (PDF, <http://ethesis.helsinki.fi>)  
ISSN 1795-7079

Yliopistopaino, University Press  
Helsinki, Finland 2011

## ABSTRACT

In the context of health care, information technology (IT) has an important role in the operational infrastructure, ranging from business management to patient care. An essential part of the system is medication management in inpatient and outpatient care. Community pharmacists' strategy has been to extend practice responsibilities beyond dispensing towards patient care services. Few studies have evaluated the strategic development of IT systems to support this vision.

The objectives of this study were 1) to assess and compare independent Finnish community pharmacy owners' and staff pharmacists' priorities concerning the content and structure of the next generation of community pharmacy IT systems, 2) to explore international experts' visions and strategic views on IT development needs in relation to services provided in community pharmacies, 3) to identify IT innovations facilitating patient care services and to evaluate their development and implementation processes, and 4) to assess community pharmacists' readiness to adopt innovations.

This study triangulated qualitative and quantitative data collected by a qualitative personal interview of 14 experts in community pharmacy services and related IT from eight countries; a national survey of Finnish community pharmacy owners (mail survey, response rate 53%, n=308), and of a representative sample of staff pharmacists (online survey, response rate 22%, n=373).

Finnish independent community pharmacy owners gave priority to logistical functions but also to those related to medication information and patient care. The managers and staff pharmacists have different views of the importance of IT features, reflecting their different professional duties in the community pharmacy. This indicates the need for involving different occupation groups in planning the new IT systems for community pharmacies. A majority of the international experts shared the vision of community pharmacy adopting a patient care orientation; supported by IT-based documentation, new technological solutions, access to information, and shared patient data. Opportunities to achieve this vision included IT technology, professional skills, and inter-professional collaboration. Threats associated with implementing this vision included high costs, pharmacists' attitudes, and the absence of acceptable IT solutions. Community pharmacy IT innovations were rare, which is paradoxical because owners' and staff pharmacists' perception of their innovativeness was seen as being high. Community pharmacy IT systems development processes usually had not undergone systematic needs assessment research beforehand or evaluation after the implementation and were most often coordinated by national governments without subsequent commercialization. Specifically, community pharmacy IT developments lack research, organization, leadership and user involvement in the process.

Those responsible for IT development in the community pharmacy sector should create long-term IT development strategies that are in line with community pharmacy service development strategies. This could provide systematic guidance for future projects 1) to ensure that potential innovations are based on a sufficient understanding of pharmacy practice problems that they are intended to solve, and 2) to encourage strong leadership in research, development of innovations so that community pharmacists' potential innovativeness is used, and that professional needs and strategic priorities will be considered even if the development process is led by those outside the profession.

## **ACKNOWLEDGEMENTS**

This study was carried out at the Division of Social Pharmacy, Faculty of Pharmacy, University of Helsinki during 2006–2011. The financial support provided by the Association of Finnish Pharmacies and the Finnish Pharmaceutical Society is gratefully acknowledged. Thanks are due to many people who have supported me.

First, my sincerest and deepest gratitude goes to my main supervisor Professor Marja Airaksinen, Ph.D. (Pharm.), Head of the Division of Social Pharmacy, for all her guidance and support. I also wish to express my gratitude to my employer and supervisor Veikko Haikala, Ph.D. (Pharm.), who encouraged me to start this process, for practical advice and support. I also want to express my thanks to my co-supervisors Associate Professor Simon Bell, Ph.D. (Pharm.) and Professor Alan Lyles, Sc.D., M.P.H. for sharing their extensive knowledge and excellent advice, and for giving valuable comments.

Professor Han De Gier and Director Victoria Losinski are warmly thanked for reviewing the thesis and giving valuable comments. Thomas Fulda, BA, MA, is thanked for revising the language of the manuscript, and also for giving valuable comments concerning the substance which improved the thesis.

I would like to thank the previous and current staff of the Division of Social Pharmacy, University of Helsinki. I owe special thanks to my colleague and dear friend, Saija Leikola, M.Sc. (Pharm.) for her continuous support from desperate to fun moments. Together we were able to inspire and encourage each other, as well as share the room during congresses. I also want to express my gratitude to my master's thesis worker and co-author Jaana Hynninen, M.Sc. (Pharm.).

I am grateful to the previous and current staff members in Espoo 3<sup>rd</sup> (Keskustan) pharmacy for being supportive and understanding during this long process.

My special thanks go to my parents for their love and support; my mother Tuulikki Jokimies and my father Timo Jokimies *in memoriam*, who passed away during this process. My parents have always emphasized the academic orientation and supported me and my sisters in our studies. I also want to thank my sisters Maria Jokimies and Sonja Auvinen and their families for sharing the joys and harms, and especially Maria for helping me with the language issues of this work and Sonja for peer-support.

Last but not least, my warmest thanks and love go to my own family, my husband Stephan and our sons Elias and Matias. This process has required a lot of time and hard work, and the computer has often been reserved for mom. Thank you for your love and flexibility.

Kirkkonummi, December 2011

*Anna Westerling*

# CONTENTS

1 INTRODUCTION	19
2 PHARMACEUTICAL CARE	24
2.1 Evolution of pharmaceutical care	25
2.1.1 The United States	27
2.1.2 Evolution internationally with special emphasis in Europe	28
2.2 Drug-related problems	30
2.3 Evolution of medication management services in community pharmacies	31
3 HEALTH INFORMATION TECHNOLOGY IN COMMUNITY PHARMACIES	35
3.1 Electronic Health Records (EHR)	37
3.1.1 Electronic Health Records in different countries	39
3.1.1.1 North America	40
3.1.1.2 Europe	41
3.1.1.3 Australia	43
3.1.2 Electronic prescribing	43
3.1.2.1 Electronic prescribing in Europe	46
3.1.2.2 Electronic prescribing and Computerized Physician Order Entry in the United States	48
3.1.3 Clinical decision support systems	50
3.1.3.1 Computerized Drug Utilization Review in the United States	51
3.1.3.2 Clinical decision support systems in Europe	55
3.2 Health information technology in medication management	55
3.2.1 Disease management and risk assessment	56
3.2.2 Drug-related problems	62
3.2.2.1 Drug-drug interaction screening	63
3.2.2.2 Adverse drug reactions	64

3.2.3 Medication Therapy Management (MTM)	64
3.2.4 Clinical medication reviews	67
3.3 Internet as a facilitator of new patient care services in community pharmacies	69
3.3.1 Internet pharmacies	70
3.3.2 Social media	71
3.4 Future visions	74
4 IT DEVELOPMENT STRATEGIES AND PROCESSES	76
4.1 SWOT analysis as a strategy development tool	76
4.2 Diffusion of Innovations as a theoretical framework	77
4.2.1 Generation of Innovations	78
4.2.2 Perceived innovativeness	78
5 CONTEXT OF THE STUDY	81
5.1 Finnish community pharmacy system	81
5.2 History of the IT development Finnish community pharmacies	84
5.3 Current information technology in Finnish community pharmacies	86
5.3.1 Community pharmacy information technology systems	86
5.3.2 Electronic prescribing	88
5.3.3 Extranet applications	88
5.3.4 Community pharmacy intranet	89
6 CONCLUSION OF THE LITERATURE REVIEW	91
7 AIMS OF THE STUDY	92
8 MATERIALS AND METHODS	94
8.1 Quantitative study (I-II)	96
8.1.1 Study design	96
8.1.2 Questionnaire	96
8.1.3 Data collection	98

8.1.4 Analyses	98
8.2 Qualitative study (III-IV)	101
8.2.1 Study design	101
8.2.2 Study participants	101
8.2.3 Interview guide and data collection	102
8.2.4 Analyses and coding framework	103
8.2.3 STUDY III Visions for community pharmacy IT systems and patient care	104
8.2.4 STUDY IV Generation of innovations in community pharmacy IT	104
9 RESULTS	106
9.1 Priorities for IT system among Finnish community pharmacy owners (I)	106
9.2 Opinion comparison concerning IT system in Finnish community pharmacies (II)	108
9.3 Perception of Finnish community pharmacy practitioners' innovativeness (I-II)	112
9.4 Visions of the pharmaceutical care and the IT systems for the community pharmacies (III)	113
9.4.1 Visions on Community Pharmacy Services and IT Support	113
9.4.2 Opportunities and threats to achieve the vision	116
9.4.3. Strengths and weaknesses of the current IT systems	116
9.5 The processes for generating community pharmacy practice IT innovations (IV)	118
10 SUMMARY OF KEY FINDINGS	124
11 DISCUSSION	126
11.1 Finnish community practitioners needs for IT system	126
11.2 The future of pharmacy practice – visions, concerns and strategies	129
11.3 Paradox between innovativeness and innovations	132
11.4 Methodological considerations	134
11.4.1 Quantitative studies I-II	135



11.4.2 Qualitative studies III-IV	136
11.4.3 Ethical considerations	137
12 CONCLUSIONS	139
12.1 Implications in practice	139
12.2 Further research	140
13 REFERENCES	141
APPENDICES	167
ORIGINAL PUBLICATIONS	172



## LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following original publications, referred to in the text by the Roman numerals (I-IV):

- I           Westerling AM, Haikala VE, Bell JS, Airaksinen MS: Logistics or patient care - which features do independent Finnish pharmacy owners prioritize in a strategic plan for future information technology systems? *J Am Pharm Assoc* 2010;50(1):24-31
  
- II           Westerling AM, Hynninen JT, Haikala VE, Airaksinen MS: Opinion comparison concerning future information technology in Finnish community pharmacies. *Pharm World Sci* 2010;32(6):787-794
  
- III          Westerling AM, Haikala VE, Airaksinen MS: The role of information technology in the development of community pharmacy services: visions and strategic views of international experts. *Res Soc Adm Pharm* 2010
  
- IV          Westerling AM, Haikala VE, Lyles A, Hynninen JT, Airaksinen MS: A community pharmacy IT paradox - community pharmacists' self-perception of innovativeness not matched by actual innovations? Submitted

The original publications are reprinted with the permission of the copyright holders.

# **DEFINITIONS OF THE KEY CONCEPTS**

## **Community Pharmacy**

Community pharmacy is a health care unit which is responsible for acquiring and distributing drug products to patients and for providing pharmaceutical services which include evidence-based guidance of drug therapy and health promotion in order to achieve rational use of medicines (Medicines Act 395/1987). The obligations set for a community pharmacy vary in different countries.

## **Diffusion of innovations**

Rogers (2003) defines diffusion as the communication process of the innovation to an individual's or to a social system's use. In this process individuals create and share information about the new innovation in order to reach an understanding of it, which happens through certain channels and within a certain timeframe.

## **Extranet**

Extranet as a computer network allowing controlled access from the outside, but is not accessible to the general public. Extranet is usually used for specific business or educational purposes for professional groups, suppliers or partners (BusinessDictionary 2011).

## **Generation of Innovations**

Generation of Innovations consists of six phases, usually beginning with the 1) Problem or Need; 2) Research; 3) Development; 4) Commercialization; 5) Diffusion and Adoption; 6) Consequences (Rogers 2003).

## **Information technology**

Information Technology (IT) is defined by the Information Technology Association of America (ITAA) and the International Foundation for the Information Technology (IF4IT) as the "technology" used for the study, understanding, planning, design, construction, testing, distribution, support and operations of

software, computers and computer-related systems that exist for the purpose of data, information and knowledge processing.

### **Innovation**

The widely used Rogers' (2003) theory on Diffusion of Innovations defines innovation as a "new idea, practice or object perceived by a person or unit".

### **Internet**

The internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite (TCP/IP) to serve billions of users worldwide (Wood and Smith 2005).

### **Intranet**

Intranet is a network of documents that is identical in appearance and function to the World Wide Web, but is closed off from the general Internet by a firewall, so that the documents are accessible only within a defined local network (BusinessDictionary 2011).

### **Logistics**

Logistics is the management of material, service, information and capital flow (LogisticsWorld 2011). In this study's framework the logistics means stock management in the community pharmacy context.

### **Management**

The verb manage comes from Italian *maneggiare* (to handle – especially tools), which in turn derives from the Latin *manus* (hand). Nowadays management can be defined as the act of getting people together to accomplish desired goals using available resources efficiently and effectively, including planning, organizing, staffing, leading or directing, and controlling an organization (a group of one or more people or entities). Resourcing encompasses the deployment and manipulation of human, financial and technological resources.

## **Medication management**

Medication management means planned system of processes and behaviours which determine how medicines are used by patients (Shaw et al. 2002). The focus is on the appropriate and safe use of medicines and on prevention of medication errors (NCC MERP 2005). There are many aspects related, such as getting the right drug at the right time to the right patient, avoiding potentially harmful drugs, drug-drug interactions and adverse reactions. Monitoring of medications is especially important for patients taking numbers of medications or patients with chronic illnesses and multiple diseases, which is common among elder people.

## **Medication management services**

Medication management services mean the processes for designing, implementing, delivering and monitoring patient-focused pharmacotherapy. The services can cover all aspects of the supply and therapeutic use of medicines, from individual patient level to an organizational level (Shaw et al. 2002, Agency for Health Care Research and Quality 2011).

## **Medication Therapy Management (MTM)**

Medication Therapy Management is a distinct service or group of services that optimize therapeutic outcomes for individual patients (The American Pharmacists Association 2004). MTM services are "provided by licensed pharmacists, as a collaborative, multidisciplinary, inter-professional approach to the treatment of chronic diseases for targeted individuals, to improve the quality of care and reduce overall cost in the treatment of such diseases" (Compilation of Patient Protection and Affordable Care Act 2010). Medication Therapy Management Services are independent of, but can occur in conjunction with, the provision of a medication product.

## **Patient care**

"Pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention. The practice of clinical pharmacy embraces the philosophy of pharmaceutical care; it blends a caring

orientation with specialized therapeutic knowledge, experience, and judgment for the purpose of ensuring optimal patient outcomes” (American College of Clinical Pharmacy 2008).

### **Pharmaceutical care**

Pharmaceutical care is “a patient-centered practice in which the practitioner assumes responsibility for a patient’s drug-related needs and is held accountable for this commitment” (Cipolle et al. 2004). The professional orientation started in 1990 with the discussion of the philosophy by Hepler and Strand in 1990. The evolution of the professional philosophy and practice is discussed in Chapter 2. Since early 1990s, community pharmacies worldwide have been urged to adopt pharmaceutical care in their practices (Hepler and Strand 1990, FIP 1997, Christensen and Farris 2006, Hughes et al. 2010).

### **Policy**

Policy means a principle, plan, or course of action, as pursued by a government, organization, or individual (Webster’s New World College Dictionary 2011) intended to influence and determine decisions and actions. A policy is a broad framework that shapes thinking and guides long-term decision-making. A national drug policy defines and sets medium and long-term goals for the pharmaceutical sector and sets up the strategies to reach the goals (WHO 2001, Väänänen 2008).

### **Social media**

Social media is collections of Web- and mobile-based applications that allow individuals “to 1) construct a public or semi-public profile within a bounded system, 2) articulate a list of other users with whom they share a connection, and 3) view and traverse their list of connections and those made by others within the system.” (Boyd and Ellison 2008).

### **Strategy**

The term strategy (Greek *στρατηγός*, [*strategos*]) was originally used in the military and it concerned deciding the means used to achieve a specific goal in

the war. A strategy is concerned with the actions and resources needed to achieve specific long-term objectives. Strategy is a bridge between the vision and policy, and concrete operational outcomes.

### **Vision**

Vision is an ability through mental activity to perceive something that is not visible and to develop a strategy to make it a reality in the future. An organization or profession would like to achieve the vision in the mid-term or long-term future (BusinessDictionary 2011).

### **Web 2.0**

Web 2.0 technologies focus on connecting people by characteristics of user-generated content, openness and networking effects (O'Reilly 2008).



## ABBREVIATIONS

AACP	The American Association of Colleges of Pharmacy (US)
ADR	Adverse drug reaction
AFP	The Association of Finnish Pharmacies
APhA	The American Pharmacists Association (US)
ASHP	The American Society of Health-System Pharmacists, previously the American Society of Hospital Pharmacists (US)
CMR	Comprehensive Medication Review (Finland)
CDSS	Clinical Decision Support System
CPOE	Computerized physician order entry (US)
DDI	Drug-drug interaction
DMMR	The Domiciliary Medication Management Review (Australia)
DRP	Drug-related problem
DUR	Drug Utilization Review (US)
eGK	Elektronische Gesundheitskarte (Electronic health card in German)
eHC	Elektronic Health Card (Germany)
ECHO	Economic, Clinical and Humanistic Outcomes
ECJ	The European Court of Justice
EHR	Electronic health record
EMR	Electronic medication record
E-MAIL	Electronic mail
EU	European Union
ePHR	Electronic personal health record
FIP	International Pharmaceutical Federation
GP	General Practitioner
GPP	Good Pharmacy Practice
HIMMS	The Healthcare Information and Management Systems Society
HIT	Health information technology
HHS	Department of Health and Human Services (US)
HMR	Home Medicines Review (Australia)
HRQOL	Health-related quality of life
IF4IT	International Foundation for Information Technology

IT	Information technology
ITAA	Information Technology Association of America (US)
ITDM	IT-enabled diabetes management (US)
MAP	Medication-related action plan
MTM	Medication Therapy Management (US)
MTR	Medication Therapy Review (US)
MTMS	Medication Therapy Management Services (US)
NEHTA	The National eHealth Transition Authority (Australia)
NL	The Netherlands
NHS	The National Health Service (UK)
OBRA'90	Omnibus Budget Reconciliation Act of 1990 (US)
ONC	The Office of the National Coordinator for Health Information Technology (US)
OTC	Over-The-Counter
PCNE	Pharmaceutical Care Network Europe
PG	The Pharmacy Guild of Australia
PMR	Personal medication record
PWDT	Pharmacist's Workup of Drug Therapy
RSS	Really Simple Syndication
RxHub	The National Patient Health Information Network™ (US)
SPSS	Statistical Package for the Social Sciences
SWOT	Strengths, Weaknesses, Opportunities and Threats
UK	United Kingdom of Great Britain and Northern Ireland
US	United States of America
USP	The United States Pharmacopeia
WHO	World Health Organization
WWW	World Wide Web

# 1 INTRODUCTION

*"I am providing pharmaceutical care, what should my technology be doing"*

IT-expert interviewed

Community pharmacies are an essential part of health care and have a role in promoting public health. It is expected by the societies that pharmacists work as members of the health care team and promote health by assuring safe, appropriate and economic use of medications (Medicines Act 395/1987, Ministry of Social Affairs and Health 2007, Council of Europe 2007, Ministry of Social Affairs and Health 2011). Since the 1990 publication of Hepler and Strand's landmark vision of pharmacists' involvement in patient care (Hepler and Strand 1990), community pharmacies have been urged to adopt patient care services and pharmaceutical care in their practices. The pharmacy profession worldwide has made patient-oriented services its long-term strategic priority (FIP 1997, Christensen and Farris 2006, WHO 2006, Palmer et al. 2007, Hughes et al. 2010). Community pharmacies have a special responsibility for assuring appropriate and safe pharmacotherapy for the patients in outpatient care.

Information technology (IT) is increasingly important in health care. Health Information Technology (HIT) is a broad array of technologies used in managing and sharing health information electronically (Jamal et al. 2009). It is regarded as a tool for improving quality, safety and efficiency of health systems (Chaudry et al. 2006). Medication management systems are an example of this technology. An optimum community pharmacy IT system should 1) support business management and administration; 2) support dispensing and reimbursement routines, and 3) facilitate medication management by supporting new cognitive pharmaceutical services. Innovative solutions are needed to support the infrastructure for these services, but they must be feasible also in a business sense. The development of such IT systems is subject to significant constraints, such as the needs to manage the logistics of product selection, procurement and dispensing; to facilitate communication within the pharmacy; and to integrate

functionalities with other health care service providers (e.g., through sharing patient information).

Due to the lowering prices of medicines, community pharmacies are forced to seek enhanced productivity and cost-effectiveness in their routine operations. At the same time, they are expected to innovate and implement new professional patient care services. These new services are expected to improve appropriate use of medications and these demands are increasingly set by the society (Ministry of Social Affairs and Health 2011). Consequently, the availability of suitable IT programs can be a key factor in determining the direction that the professional practice will take within community pharmacies. However, the IT is not an intrinsic value, but an important tool and facilitator for a pharmacist in pharmaceutical service provision. When the features of the IT systems do not support the provision of cognitive pharmaceutical services, it is difficult for pharmacists to develop their professional role with regard to the provision of patient care. Thus, achieving the pharmacy profession's strategic goals requires new functionalities for community pharmacies' IT systems.

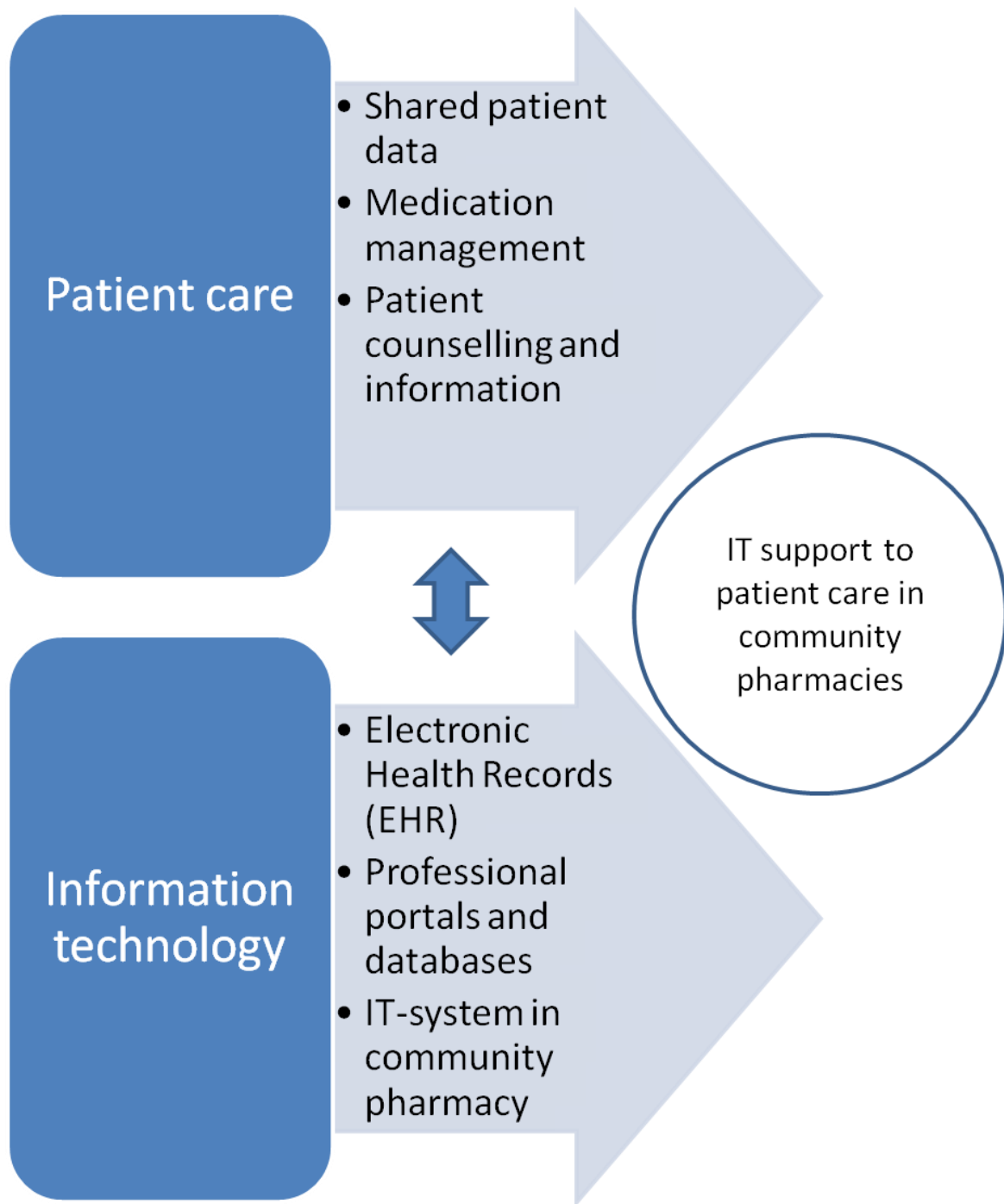
Despite the importance of patient care services and the existence of a vast body of literature on them, there have been few studies evaluating experiences with IT systems in community pharmacies. Particularly, a holistic view has been missing. Instead, the existing literature primarily focuses on the software required for discrete functions, such as electronic prescribing (Bates et al. 1998, Bates et al. 1999, Mekhjian et al. 2002, Spencer et al. 2005, Grossman et al. 2007, Donyai et al. 2008), procedures for drug utilization review (DUR) (Armstrong and Markson 1997, Lyles et al. 1998, Monane et al. 1998, Chui and Rupp 2000, Chrischilles et al. 2002, Bluml 2005), and medication therapy management (MTM) (American Pharmacists Association and the National Association of Chain Drug Stores Foundation 2008, Bluml 2005, The Lewin Group 2005, Mc Givney et al. 2007, Barnett et al. 2009, Klimek 2009). Most service implementation studies have focussed on assessing facilitators and barriers to change and its management (Roberts et al. 2005, Palmer et al. 2007, Roberts et al. 2008, Gastelurrutia et al. 2009). Few studies have taken a broader view on the strategic and long-term

development of IT systems. One of the few events having a long-term strategic focus was an expert conference organized by the United States Pharmacopeia (USP) in 1992 to identify a vision for the future of the pharmacy by 2020 (Bezolt et al. 1993). At that time, the three most important factors affecting the future of the community pharmacy were considered to be: the market change from local to global; achieving cost-effectiveness in the health care; and the benefits brought by IT. Even though IT was identified among the three most important factors determining the community pharmacy systems' future already in the early 1990s, little discussion has followed about the strategic importance of IT in service provision support and financial management of community pharmacies. The goal of this thesis is to examine this gap in the literature.

The literature review of the thesis describes a conceptual, theoretical and contextual framework of the study (Chapters 2-6). The search strategy for this literature review was to identify studies related to patient care in the community pharmacy context and information technology supporting medication management in community pharmacies. To search for this data, electronic database PubMed was used. Additional strategies included searching bibliographies of eligible studies, a handsearch of the medicines informatics journals, as well as documents and statements established by international and national organizations. The connections and a complete view with all aspects related in this research area are presented in Figure 1.

The theoretical basis for this thesis was the professional philosophy of pharmaceutical care. Chapter 2 describes the evolution of this professional philosophy into practice and the desired role change of the pharmacists through the provision of services. The IT applications needed to support medication management and patient care services in community pharmacies are discussed in Chapter 3. Included in this discussion are: 1) Electronic Health Records, including electronic prescribing and clinical decision support systems; 2) Health Information Technology in medication management; and 3) Internet as a facilitator of new patient care services in community pharmacies.

The empirical part of this thesis focuses on community pharmacy IT development needs to support patient care service provision. International and national perspectives were examined in this respect. For the strategic analysis of the current status of IT systems a SWOT analysis method developed by Albert Humphrey in 1960s–1970s was applied. The SWOT method is designed to identify strengths, weaknesses, opportunities and threats in the current action. Rogers' theory on Diffusion of Innovations was applied as achievements in community pharmacy IT development were considered to be innovations (Chapter 4). The thesis also reviews the Finnish pharmacy system and IT development in the community pharmacy context from the strategic perspective (Chapter 5).



**Figure 1** *Illustration of areas where information technology can support patient care in the community pharmacy context.*

## 2 PHARMACEUTICAL CARE

The traditional role of the community pharmacist has been compounding, packaging and dispensing medications. Technological change and development of drug industry have been changing this role. Increasing use of medications has brought new challenges in terms of inappropriate and unsafe use of medicines (Hepler and Strand 1990). According to the early definition, quality assurance with regard to pharmacotherapy is based on identifying, resolving and preventing drug-related problems (DRPs). The goal of optimum pharmacotherapy can be achieved by ensuring definite clinical outcomes that can vary depending on the disease and its status as well as patient and medication. Thus, the goal can be: 1) Curing a disease; 2) Elimination or reduction of patient's symptoms; 3) Arresting or slowing a disease process; and 4) Preventing a disease or symptoms (Hepler 1996). The debate has emphasized the responsibility of pharmacy profession in patient's care, which has led to the evolution of a professional philosophy and practice known as "pharmaceutical care" (Hepler and Strand 1990, Berenguer et al. 2004). An updated definition of pharmaceutical care is "*a patient-centered practice in which the practitioner assumes responsibility for a patient's drug-related needs and is held accountable for this commitment*" (Cipolle et al. 2004). The focus is on the whole patient, drug therapy use, and the recognition of a specific patient's individual drug therapy needs (McGivney et al. 2007).

It is evident that community pharmacist's involvement in this kind of quality assurance functions will require close collaboration with the patients and other health care providers, particularly prescribers. Since the international launch of the pharmaceutical care philosophy in 1990 (Hepler and Strand), the role of the pharmacists in pharmaceutical care has been expanding (Nkansah et al. 2010). According to evidence, pharmacists are cooperating more with patients and other health care professionals to identify, prevent, and resolve drug-related problems, promote rational prescribing and health education (Nkansah et al. 2010). The change process can be seen as an innovation diffusion process of implementing the professional philosophy into practice. The importance and impact of



pharmaceutical care in the entire health care system and society must be addressed through evidence, which has been cumulating quite slowly (Nkansah et al. 2010). Examples of practice-management barriers prohibiting the widespread adoption and implementation of pharmaceutical care practices in the community have been reported to be: community pharmacies's physical organization and workflow, the shortage of pharmacies and other resources, and the lack of a standard payment mechanism for services and training (McGivney et al. 2007). Finding strategies and tools for dealing with these challenges is a professional and policy issue involving the entire health care sector.

## **2.1 Evolution of pharmaceutical care**

This Chapter is primarily based on two sources: a review article by Berenguer et al. (2004), and a Danish doctoral thesis by Rossing (2003). These sources were used because of they cover the entire development of the philosophy of pharmaceutical care. The information of these two sources has been updated by a literature search in 2010–2011. The evolution and launch of the pharmaceutical care philosophy and practice is presented in Table 1 and described in more detail in Chapters 2.1.1 and 2.1.2. The first Chapter (2.1.1) describes the evolution of pharmaceutical care in the United States (US), because the entire philosophy originates from there as an extension of clinical pharmacy in hospitals. The other Chapter (2.1.2) briefly describes the landmarks of the international launch of pharmaceutical care, with the special emphasis on developments in Europe and initiatives taken by international organizations to promote its implementation.

**Table 1** Landmarks in early phase evolution of Pharmaceutical Care as a professional philosophy (based on Rossing 2003, Berenguer et al. 2004).

Year	Landmark	Reference
1960-	Clinical pharmacy in hospital setting (US)	Angaran et al. 1988
1975	Millis Report (US)	Millis 1975
	Clinical aspects: rational and safe use of medicines	Mikael et al. 1975
1979	Standards for Good Pharmaceutical Practice (US)	Brodie 1980
1984	Conference: Pharmacy in the 21 <sup>st</sup> Century organized by American Association of Colleges of Pharmacy (AACP)	
1985	Hilton Head Conference organized by ASHP (US)	Hepler 1985
1987	Relationship between the patient and the pharmacist: patient's awareness and commitment to the drug therapy (US)	Hepler 1987
1988	Pharmacist's Workup of Drug Therapy (PWDT), (US)	Strand et al. 1988
1989	International launch of the Pharmaceutical Care concept in two articles entitled: "Opportunities and Responsibilities in Pharmaceutical Care"	Hepler and Strand 1989
1990		Hepler and Strand 1990
1990	Definitions and categorization of DRPs (US)	Strand et al. 1990
	OBRA'90 (Omnibus Budget Reconciliation Act of 1990), (US)	Department of Health and Human Services, Health Care Financing Administration 1992
1991	First Course in Europe on "Research Methods in Pharmaceutical Care" (Hillerod, Danmark)	Herborg et al. 2001
1992-1995	Minnesota Pharmaceutical Care Project (US)	Tomechko et al. 1995
1992	EuroPharm Forum was founded (Europe)	<a href="http://europharmforum.org">http://europharmforum.org</a>
1993	The Tokyo Declaration (1993): FIP Standards for Good Pharmacy Practice, GPP), revised versions in 1997 and 2011 (FIP/WHO), the first global initiative	<a href="http://www.fip.org">http://www.fip.org</a>
1994	Creation of researchers' network in Europe: Pharmaceutical Care Network Europe (PCNE)	<a href="http://pcne.org">http://pcne.org</a>
1998	Statement of Professional Standards and revised definition of Pharmaceutical Care, FIP Council in 1998 (global initiative concerning FIP member countries)	<a href="http://www.fip.org">http://www.fip.org</a>
2000-	National and local demonstration studies (mostly in USA, also in Europe, Australia and other continents, see Figure 2)	Christensen and Farris 2006, Hughes et al. 2010

### 2.1.1 The United States

The philosophy of pharmaceutical care evolved from clinical pharmacy in the United States in the 1960s (Table 1). The first pioneers in hospital setting expanded the level and scope of professional functions to more patient-oriented services (Angaran et al. 1988). In 1975 the American Association of Colleges of Pharmacy (AACP) convened a board of experts in order to draw up a report entitled "Pharmacists for the Future", known as the Millis Report (Millis 1975). This report insisted the need to involve pharmacists in the control of rational drug use. The *Standards of Good Pharmaceutical Practice* were created in 1979 in collaboration with the AACP and the American Pharmaceutical Association. A member of the working group, Dr. Brodie, described the change of the profession from a product-oriented to a patient-oriented practice in a conference in 1980 (Brodie 1980). The following conferences continued the discussion, and in the Hilton Head Conference organized by the American Society of Hospital Pharmacists the term *pharmaceutical care* was introduced in 1985.

In 1987 Hepler discussed the importance of the relationship between the patient and the pharmacist (Hepler 1987). In his definition the patient's awareness and commitment to the drug therapy was emphasized. Later on, Hepler and Strand (1989, 1990) underlined the pharmacist's responsibility to guide drug therapy to improve the quality of the patient's life. These publications presented the vision of pharmacists' involvement in patient care internationally in order to guide the development of the pharmacists' professional role.

As the Pharmaceutical Care concept evolved in the United States, it was first enacted into law by the Omnibus Budget Reconciliation Act (OBRA'90) in 1993 which required pharmacists to counsel patients about prescriptions received (Department of Health and Human Services, Health Care Financing Administration 1992, Fulda and Wertheimer 2007). This law also implemented a prospective drug utilization review (pDUR) for Medicaid recipients. The law covered Medicaid recipients but most American states extended these services by

revising state laws regulating pharmacy practice to all patients receiving prescription drugs (Canaday 1994, Schatz et al. 2003).

*Minnesota Pharmaceutical Care Project* was carried out between 1992–1995 to determine whether an innovative professional practice could be implemented in the context of the community pharmacy emphasizing the accountability of the pharmacists in the patient's drug therapy needs (Tomecho et al. 1995, Cipolle et al. 1998). As a result of this project, the authors concluded that pharmaceutical care optimized treatments resulting in a positive outcome for patients and health care providers (Cipolle et al. 1998). Furthermore, the following significant findings were identified as a basis for professional change:

- 1) Pharmaceutical care practice was described so it could be learned, applied and disseminated among other professionals.
- 2) A new management system was developed to guide the profession.
- 3) A payment system was designed and applied.
- 4) A computerized documentation system was designed to document the medications of patients.

### **2.1.2 Evolution internationally with special emphasis in Europe**

The International Pharmaceutical Federation (FIP) has been the key organization promoting and coordinating implementation of pharmaceutical care philosophy internationally. FIP has been closely cooperating with World Health Organization (WHO) in this respect. WHO released a document called Tokyo Declaration 1993 on the role of pharmacists in the health care system during the FIP Congress in Tokyo in 1993 in order to guide the development of pharmaceutical care practice internationally (WHO 1993). The Tokyo Declaration was based on the FIP drafted document "*Guidelines for Good Pharmacy Practice*" which was intended to be a standard for every practicing pharmacist in order to ensure worldwide appropriate quality of pharmacotherapy for every patient (Table 2) (FIP 1993). In 1997 FIP released jointly with WHO the "*FIP statement of professional standards*" in order

to ensure the quality of information through the relationship between the pharmacist and the patient to promote safe and effective use of medications (FIP 1997). This statement was again updated in 2010 (FIP 2010) and approved by WHO General Assembly in May 2011. In the FIP organization Community Pharmacy Section has been the key coordinator of implementation of pharmaceutical care.

**Table 2** *The requirements and main elements of Good Pharmacy Practice (GPP) as jointly defined by FIP and WHO (FIP 1993, 1997).*

<p><b>The requirements of good pharmacy practice</b></p> <p>Good pharmacy practice requires that a pharmacist's first concern in all settings is the welfare of patients.</p> <p>Good pharmacy practice requires that the core of the pharmacy activity is the supply of medication and other health care products of assured quality, appropriate information and advice for the patient, and monitoring of the effects of use.</p> <p>Good pharmacy practice requires that an integral part of the pharmacist's contribution is the promotion of rational and economic prescribing and of rational use of medicines.</p> <p>Good Pharmacy Practice requires that the objective of each element of pharmacy service is relevant to the patient, is clearly defined and is effectively communicated to all those involved.</p>
<p><b>The main elements of Good Pharmacy Practice</b></p> <ol style="list-style-type: none"> <li>1. Health promotion and illness-prevention</li> <li>2. Supply and use of medicines</li> <li>3. Self-care</li> <li>4. Influencing prescribing and medicine use</li> </ol>

In Europe, WHO EuroPharm Forum was founded in 1992 in order to involve community pharmacists in promoting WHO *Health for All* goals (EuroPharm Forum 2011). For this purpose, EuroPharm Forum established professional programs for community pharmacies in selected key areas, such as therapeutic outcomes monitoring in asthma, diabetes and cardiovascular diseases,

pharmacists' involvement in smoking cessation and patient counseling (EuroPharm Forum 2011). In order to coordinate research activities and develop methodology of outcomes research in this area a European platform called Pharmaceutical Care Network Europe (PCNE) was established in 1994 (EuroPharm Forum 2011). Both these international organizations have been instrumental in implementing the new professional philosophy and related pharmaceutical services in European countries (van Mil et al. 2004a).

## 2.2 Drug-related problems

A core element of the philosophy and practice of pharmaceutical care is *“to identify, solve and prevent drug-related problems, DRPs”* (Hepler and Strand 1990). Implementation of this process has initiated an ongoing international trend for developing DRP classification systems (van Mil et al. 2004b). The first definition of DRPs was presented by Hepler and Strand in their 1990 landmark article. It is as follows: *“drug-related problem is an event or circumstance involving a patient's drug treatment that actually, or potentially interferes with the achievement of an optimal outcome”* (Hepler and Strand 1990). Some years later in 1996, Segal published the following definition: *“a circumstance of a drug therapy that may interfere with a desired therapeutic objective”* (Segal 1996).

Hepler and Strand (1990) classified DRPs into eight categories: 1) Untreated indications; 2) Improper drug selection; 3) Subtherapeutic dosage; 4) Failure to receive drugs; 5) Overdose; 6) Adverse reactions; 7) Drug interactions; and 8) Drug use without indication. This has inspired a vast number of other researchers to modify the original DRP classification by Hepler and Strand and to create their own definitions (e.g., Strand et al. 1990, Berardo et al. 1994, Caleo et al. 1996, Chen et al. 1996, Poirier and Gariépy 1996, Westerlund et al. 1999, Raynor et al. 2000, Titley-Lake and Barber 2000, Krska et al. 2001, Gilbert et al. 2002, Schaefer 2002, PCNE 2002, Consensus Committee 2002). Comparisons of the different definitions and classifications have been presented (van Mil et al. 2004b, Björkman et al. 2008). The large amount of different systems indicates a lack of

agreement concerning both DRP definitions and classifications (Björkman et al. 2008). The first definitions were very detailed, because of the need for research and documentation. Recently the definitions have been simplified and the aim is to apply the DRP models to the routine community pharmacy practise. These systems are still evolving and under lively debate in the international scientific literature.

### **2.3 Evolution of medication management services in community pharmacies**

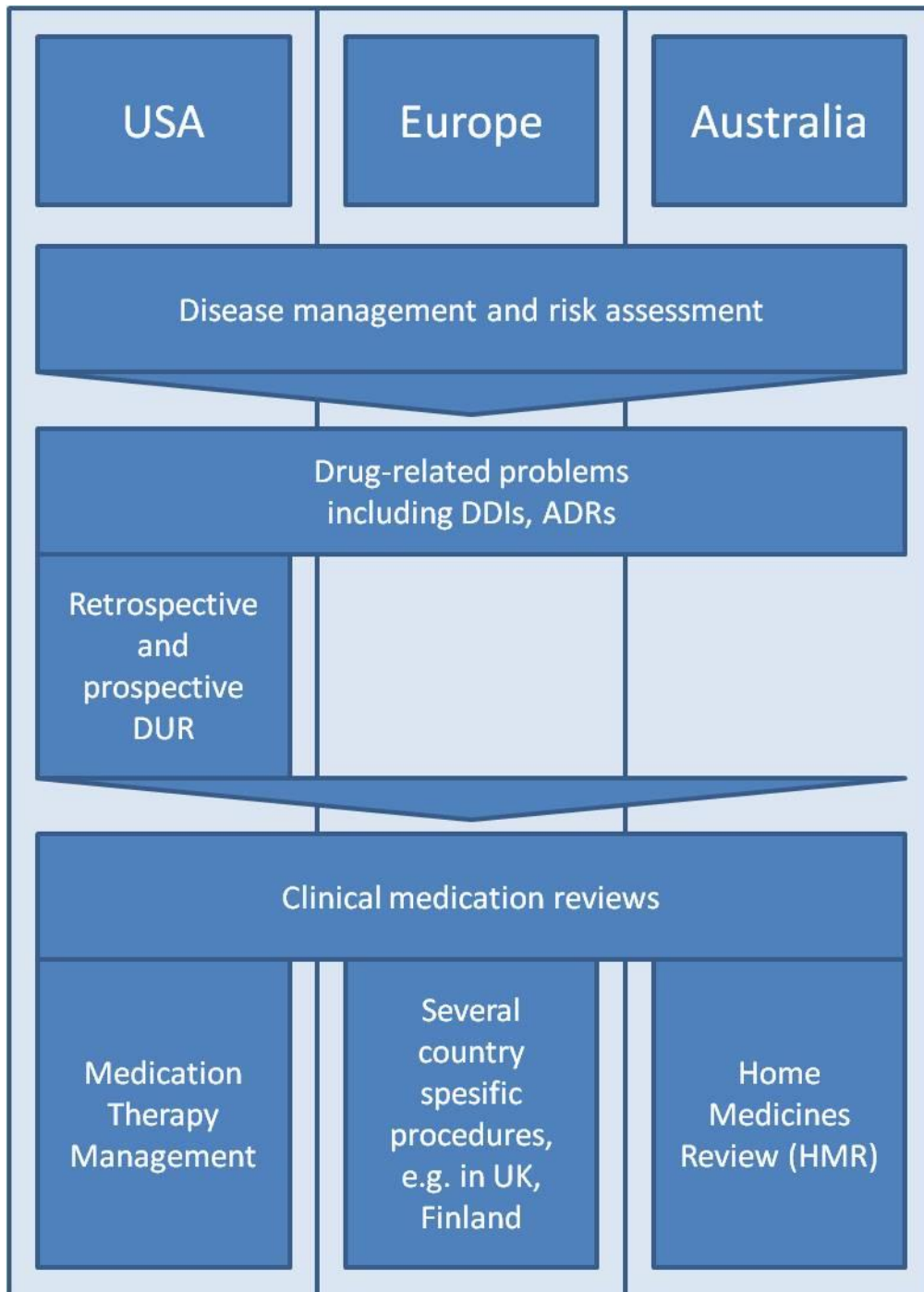
Even though there have been more than 20 years of development since the international breakthrough of pharmaceutical care philosophy, surprisingly little has changed in actual community pharmacy practice. The primary task of community pharmacists is still to dispense prescription medications and sell OTC-medications and other health-related products. This applies to all kinds of community pharmacy systems worldwide. There have been attempts to provide cognitive services to patients and other health care professionals in different countries (Christensen and Farris 2006, Hughes et al. 2010, EuroPharm Forum 2011). This chapter describes trends and achievements in community pharmacists' involvement in medication management systems by providing patient care services. In this review services provided by community pharmacies are included.

Medication management means a planned system of processes and behaviours which determine how medicines are used by patients (Shaw et al. 2002), the focus being on the appropriate and safe use of medicines and on prevention of medication errors (NCC MERP 2005). Patient care services in community pharmacies related to medication management have developed in a more comprehensive direction (Figure 2). Disease management and risk management have been the earliest patient care services related to medication management system in community pharmacies. Disease management is a system of coordinated health care interventions and communications for populations with

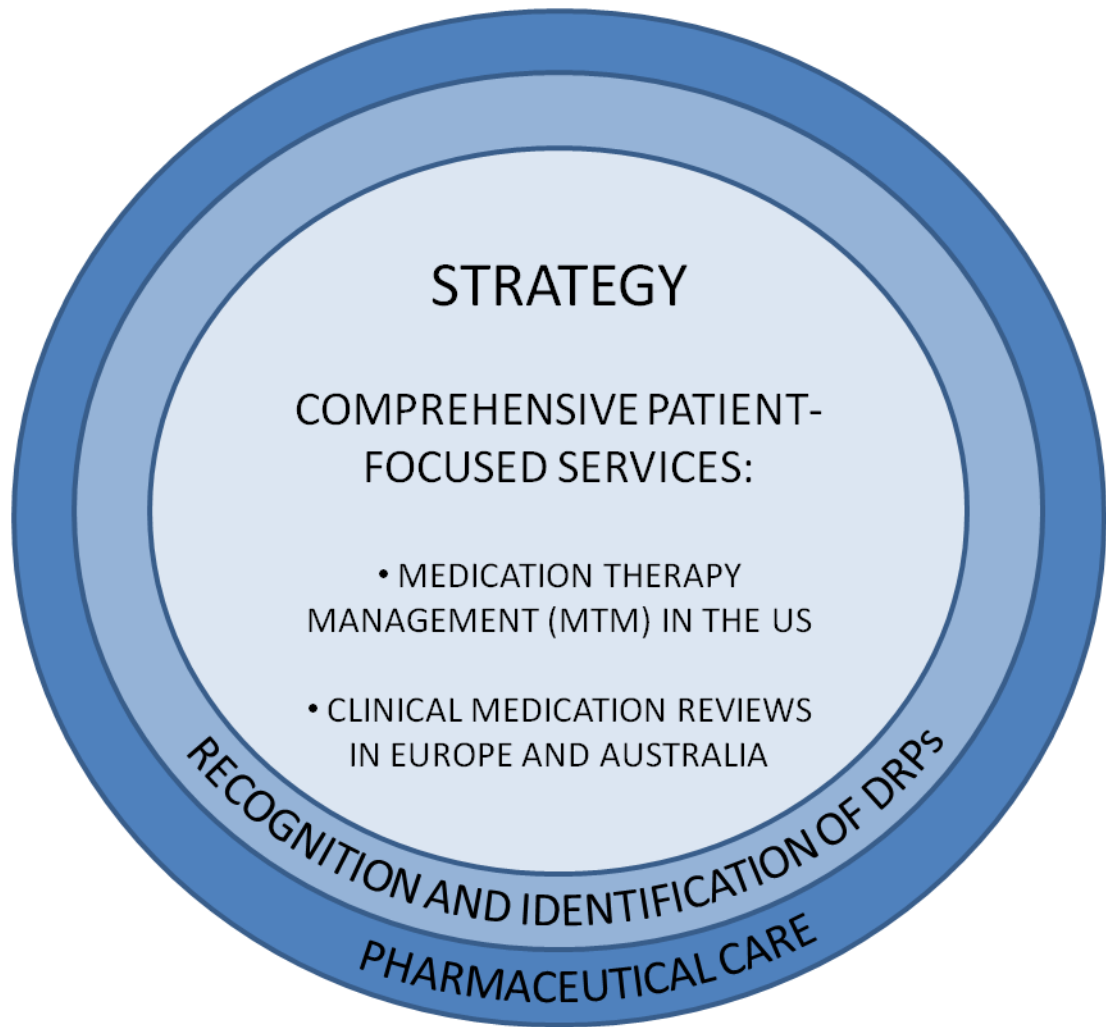
conditions in which patient self-care efforts are significant (Care Continuum Alliance 2011). In community pharmacy settings this means routine tracking of key elements of a disease through health observation, record keeping, and regular reporting. Risk management is applied in order to promote health and prevent diseases.

Since Hepler and Strand (1990) brought up the importance of recognition and documentation of drug related problems (DRPs) in assuring safe and appropriate medication use, community pharmacies have based their services on DRPs' recognition and documentation (Figure 2). DRPs include adverse drug reactions (ADRs) and drug-drug interactions (DDIs). In the United States, the first service concept to carry out DRP recognition has been Drug Utilization Review (DUR), which was described as early as 1969 in the Final Report of the US Department of Health Education and Welfare Task Force on Prescription Drugs (Figure 2). The evolution of patient care services related to medication management has led from distinct evaluations, such as drug-drug interaction screening, to more integrated and comprehensive services when all of the patient's medications are reviewed. As a result, a wide range of review services has been established, first in the US, and later on in other countries (Hakkarainen 2008, Figure 2). These services are in routine use and institutionalized in some countries (Hakkarainen 2008). Clinical medication reviews have been developed and adopted in Australia under the concept Home Medication Reviews (HMRs) (Medication Management Review Implementation Steering Group 2001) and in Europe in several countries (e.g., in UK and Finland, Hakkarainen 2008, Leikola et al. 2009, Labberton et al. 2011). In the United States Medication Reviews are currently included in the Medication Therapy Management (MTM), which also covers other health related services (Figure 2). According to the updated definition of pharmaceutical care (Cipolle et al. 2004), only the most comprehensive services (MTM, clinical medication reviews) are implementing the philosophy and practice of pharmaceutical care, when pharmacists take responsibility and accountability for the drug-related needs of the patient (Figure 3).





**Figure 2** *Evolution of patient care services supporting community pharmacists' involvement in medication management in the United States, Europe and Australia.*

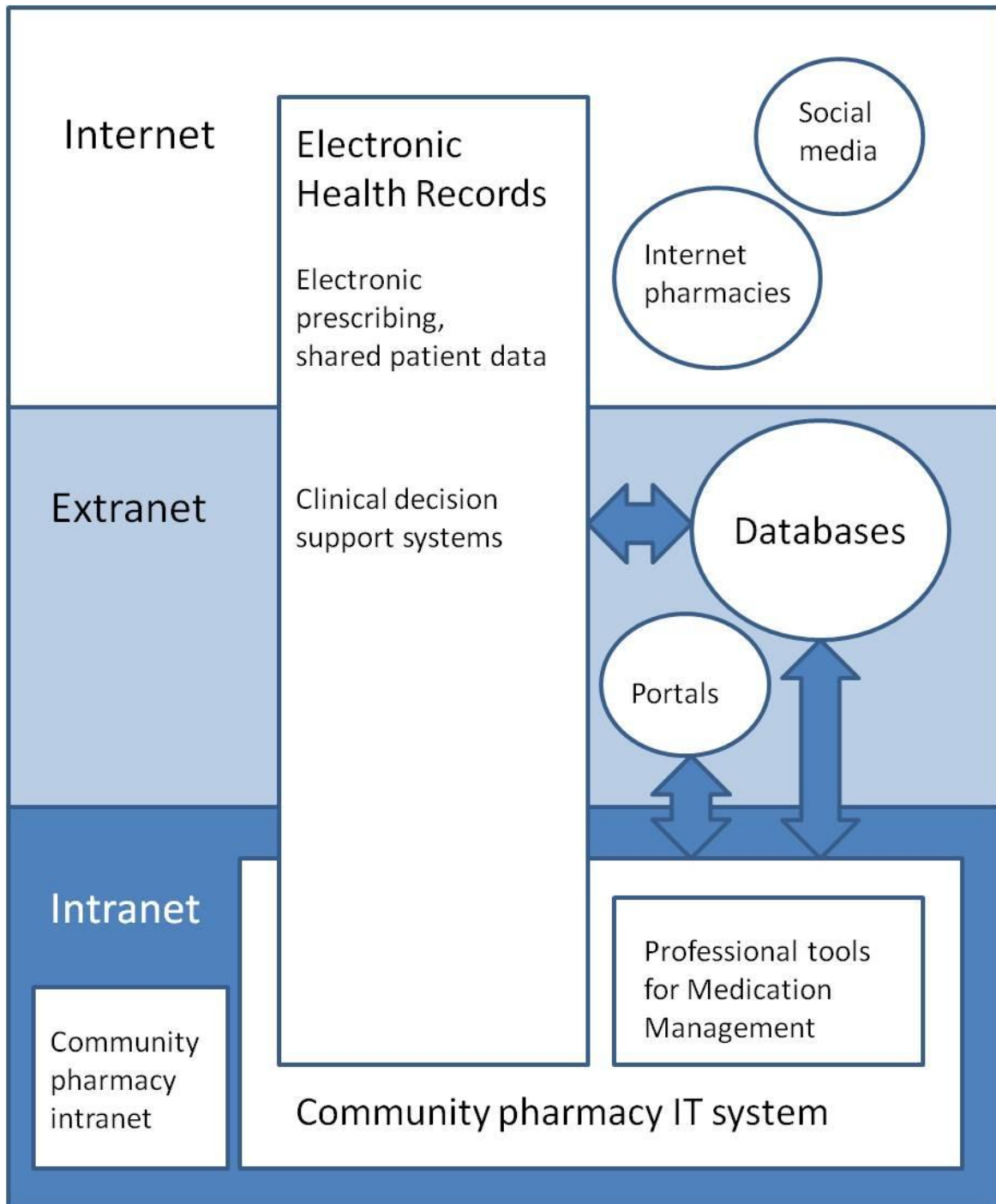


**Figure 3** *Pharmaceutical care services implementation as a strategy in the United States, Europe and Australia.*

### **3 HEALTH INFORMATION TECHNOLOGY IN COMMUNITY PHARMACIES**

Health Information Technology (HIT) is defined as a broad array of technologies involved in managing and sharing health information electronically (Jamal et al. 2009). It is regarded as a tool for improving the quality, safety and efficiency of health systems (Chaudry et al. 2006). The HIT is expected to benefit all members of health care: patients, payers, physicians and pharmacies (Balfour et al. 2009) by improving patient care, lowering costs, increasing efficiency and productivity, improving communication and healthcare delivery, and improving the reimbursement processes (Webster and Spiro 2010).

Community pharmacists started to use computer systems more than three decades ago (Webster and Spiro 2010). The first systems were designed for dispensing, billing and reimbursement purposes. Since then, applications have extended to a wide range of clerical and medication management functions. In this Chapter functions related to patient care services in community pharmacies are divided into three main categories; 1) Electronic Health Records, including electronic prescribing and clinical decision support systems; 2) Health Information Technology in Medication Management; and 3) Additional community pharmacy applications, including internet pharmacies and use of social media in communication on medicines. Areas of health information technology implementations related to patient care in community pharmacies are presented in Figure 4.



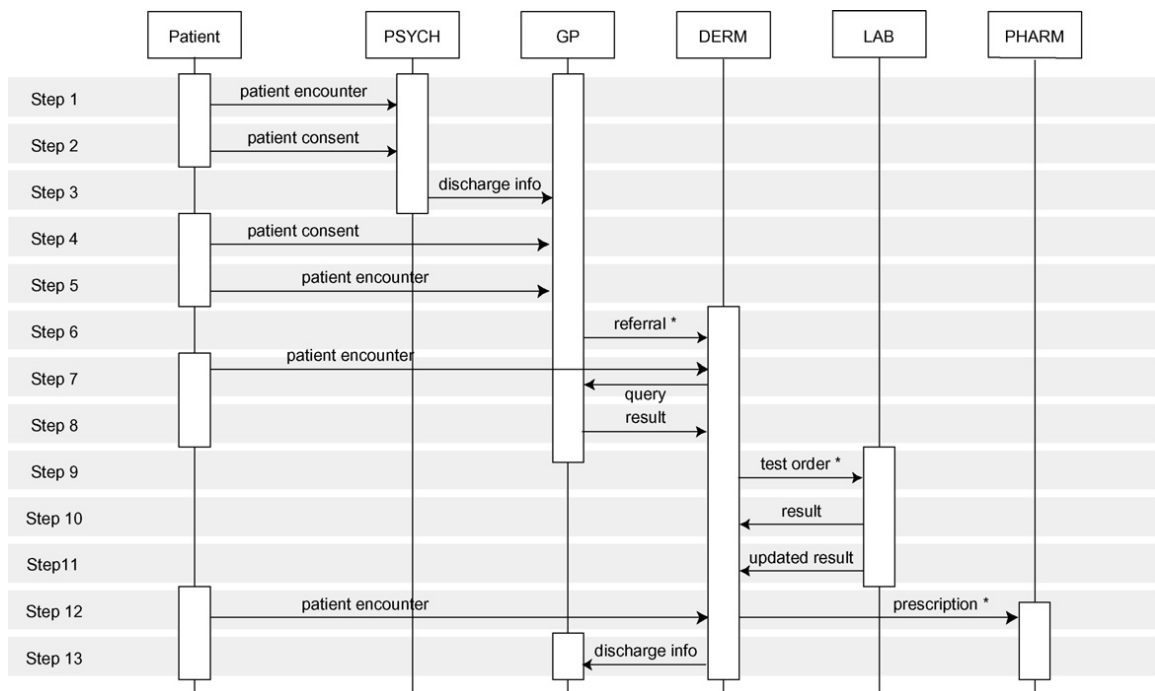
**Figure 4** Areas of health information technology implementations in community pharmacies.

### **3.1 Electronic Health Records (EHR)**

There is no consensus for the definition of Electronic Health Record (EHR). Gunter and Terry (2005) have defined EHR as a concept for collecting longitudinal electronic health information about individual patients and populations, in order to improve quality of care. By Webster and Spiro (2010), EHR is an individual patient's medical record including patient's demographics, medical history, drug history, allergies, progress notes, current medications, laboratory test results, radiology images and advanced directives. In the US, the Office of the National Coordinator for Health Information Technology (ONC) has recommended that EHR system should have four core functions: (1) Electronic documentation of providers' notes; (2) Results management; (3) Electronic prescribing known as Computerized Physician Order Entry (CPOE); and (4) Clinical decision support systems (CDSS) (Blumenthal et al. 2006).

The EHR systems are usually managed by the national governments and with the consultation through international cooperation (Friedman et al. 2009). The goal of the future is that EHR systems will provide information transfer pathways between community pharmacies, physicians and hospitals. Standards are central to integration. Integration of community pharmacy IT systems, hospital IT systems and physicians' Electronic Medication Records (EMRs) is necessary to ensure patient safety and productivity benefits of using IT in health record management. Most of the currently used systems are implemented locally providing communication as one-to-one exchange messages (van der Linden et al. 2009). While the data sharing increases between organizations, it challenges local systems developed for only small-scale use. There has been recognized a need for larger-scale EHR system, which requires ubiquitous communication between systems (Figure 5) (van der Linden et al. 2009). Community pharmacies as dispensing medications are included in these scenarios, but their involvement in the system has been planned to happen in the last phases (Figure 5). The need has been recognized for the more comprehensive systems which allow a secure

clinical data sharing and support communication between health care systems (van der Linden et al. 2009).



**Figure 5** Sequence diagram of a HER system scenario, in which each column represents the respective actor in the system (PSYCH=psychiatrist, GP=General Practitioner, DERM=Dermatologist, LAB=Laboratory, PHARM=Pharmacy), „\*“ refers to implicit patient consent (van der Linden et al. 2009).

The definition by ONC has outlined the structure of this Chapter. Since EHR is very broad in scope as defined, this Chapter focuses only on electronic prescribing and clinical decision support systems because these are the two functions that link pharmacies to EHR and rely on EHR data to support community pharmacists’ practice. The development of these functions will establish the basis for the integrated EHR systems between the health care professionals, such as community pharmacists and physicians.

### 3.1.1 Electronic Health Records in different countries

National electronic health record programs are under development and discussions in many countries, including Finland. These projects are challenged by long duration and limited resources. For this review five countries were selected in which 1) EHR programs have existed at least for five years; 2) the systems encompass various approaches of implementation; 3) pilot projects have been implemented; 4) published information in English or German were available (Deutsch et al. 2010) (Table 3). The United States (US) was added into the comparison in order to cover the description of health information technology (HIT) development in this country. The six countries included in this review were in different stages of their EHR implementation: Denmark and Canada have achieved the widest use, while Germany and Australia have implemented their first pilot projects (Deutsch et al. 2010). The EHR programs were analyzed on the basis of project reviews reported by Deutsch et al. in 2010.

**Table 3** *Most advanced EHR systems (described according to Deutch et al. 2010). Countries are listed in alphabetical order.*

<b>Country</b>	<b>Name of EHR</b>	<b>Coordinating Authority</b>
Australia	<i>HealthConnect</i>	National eHealth Transition Authority(governmentally coordinated organization)
Canada	<i>Canada Health Infoway</i>	Canada Health Infoway (non-profit organization)
Denmark	<i>MedCom</i>	MedCom (co-operative venture between authorities, organisations and private firms)
Germany	<i>German electronic health card</i>	The gematik GmbH (owned by payers and providers)
UK	<i>National Programme for Information Technology</i>	NHS Connecting for Health (governmentally coordinated organization)
US	Many companies providing EHR systems	The Office of the National Coordinator for Health Information technology (ONC) (governmentally coordinated organization)

### 3.1.1.1 North America

The Office of the National Coordinator for Health Information technology (ONC) was established in 2004 under the U.S. Department of Health and Human Services (HHS) in order to coordinate the development and implementation of HIT infrastructure. In 2009 Congress passed the American Recovery and Reinvestment Act of 2009 (ARRA 2009), which set a goal for the implementation of a nationwide health record system by 2014 (The White House 2009).

In the US health care system there are several public and private actors and insurance system resulting to the fragmented EHR systems. In the US, many companies provide EHR systems. Even though the United States has been a leader in implementing new services in pharmacy practice, there has been criticism concerning slow adoption and use of HIT (Schoen et al. 2006, Balfour et al. 2009). Challenges in the adoption process have been high costs of the technology, general resistance to change, misaligned incentives and the fractured payment systems (Balfour et al. 2009).

In the US, the electronic personal health record (ePHR) is an application of EHR. The system is initiated and controlled by the patient (Goedert 2011). ePHR can be generated by health care professionals, such as physicians and pharmacists, or by the patient. The Healthcare Information and Management Systems Society (HIMSS) defines ePHR as *“a universally accessible, layperson comprehensible, lifelong tool for managing relevant health information, promoting health maintenance and assisting with chronic disease management via an interactive, common data set of electronic health information and e-health tools”*. The ePHR is owned, managed and shared by the individual or his or her legal proxy(s) and must be secure to protect the privacy and confidentiality of the health information it contains. It is not a legal record unless so defined and is subject to various legal limitations (Health Information Management Systems Society 2011). Since 2001, patients have had right to access and even correct their own health information (Tsai and Starren 2001, Rashbass 2001). Ensuring privacy protection in the



access, storage and distribution of the patient data has been a challenge in the US (Mandl et al. 2001, Markwell 2001). EHR and/or ePHR have been seen as an opportunity for pharmacists to provide medication therapy management services (MTMS) by using the medical information provided by HER. It has been suggested that these tools could make medication errors nearly nonexistent in the future (Webster and Spiro 2010).

In order to promote implementation of EHR in Canada, *Canada Health Infoway* was founded in 2001 (Canada Health Infoway 2006). Infoway is a not-for-profit organization which receives funding from the Federal Government. Infoway is responsible for facilitating the development, maintenance and implementation of the health information standards. The implementation process has been divided in two steps: availability (step 1) and adoption (step 2) (Canada Health Infoway 2011). In March 2010, EHR systems were available to authorized physicians for 22% of the Canadian population, and the target goal is to have EHR available to authorized physicians for all residents of Canada (Canada Health Infoway 2011).

### *3.1.1.2 Europe*

In Europe Denmark has been one of the first countries that adopted technology in health care. In Denmark MedCom was founded as the national coordination organization for HIT to improve the efficiency and effectiveness of the Danish healthcare system in 1994 (Danish Centre for Health Telematics 2008). All health care stakeholders are part of this organization and finance MedCom. MedCom defines electronic data interchange formats for the health information to be shared through the Danish Health Data Network. In 2003, the portal was made available for providers and later for patients. In 2006, about 80% of the all exchanged healthcare information was sent electronically by the health care actors, e.g. GPs, hospitals and pharmacies. EU project on benefit analysis concerning the Danish EHR system suggested: 1) A need to define and evaluate long-term goals and strategies, 2) To develop precise and accepted standards, and 3) A need for

consensus and collaboration with stakeholders to achieve the adoption by the users (Wanscher et al. 2006).

In the United Kingdom (UK) the National Health Service (NHS) has defined a goal to provide good quality health services with modern IT (NHS 2006). The EHR program is part of the national health care reform. The *National Programme for Information Technology* was founded in 2002, and the IT related activities were concentrated in the organization *NHS Connecting for Health* in 2005 (Deutsch et al. 2010). The vision of the Programme is the NHS Records Service, which will share a patient's clinical record, such as characteristics of the patient, allergies, adverse drug reactions and major treatments, available electronically with all health care providers (House of Commons Committee of Public Accounts 2007). The Programme includes other services, such as electronic prescription service (EPS), an email and directory service for NHS staff, computer accessible X-rays and a facility for patients to book electronically outpatient appointments. The Programme is expected to cost £12.4 billion over ten years, being the largest single IT investment in the UK to date. A status report from 2007 showed that 80% of the planned scheduling component was implemented, 20% of the medication component and 30% of the national EHR system (NHS 2007). By 2010 EHR systems' implementation has been delayed because of severe barriers challenged during the development process (Gold 2010).

The German Health Reform 2003 is responsible for implementation of the eHealth in Germany (Bundesministerium fuer Gesundheit - Gesundheitskarte), including an EHR system. The target of the eHealth implementation is to improve the quality of the German healthcare system, its efficiency and patient empowerment. The project has started with the German electronic health card (Elektronische Gesundheitskarte; eGK) which will be the central component of the national EHR system in the future. In 2005, *The Gematik GmbH* was founded to be responsible for the implementation and maintenance of the eGK and the other related projects, such as the national EHR system (Gesellschaft fuer Telematikanwendungen der Gesundheitskarte mbH 2011). The organization is owned by health care payers and providers. In 2005, the first pilot tests in

implementation of German electronic health card were assessed. However, medical community has strongly resisted the eGK project. The main criticism has concerned the technical solution, poor demonstration of the added value, data protection, cost analysis and poor alignment of the physicians' requirements (Deutsch et al. 2010).

### *3.1.1.3 Australia*

The Australian EHR system, HealthConnect, is based on a cooperative project between the Australian government and the states and territories. The goal is to achieve patient empowerment, quality improvements and higher efficiency of the health system. In 2004 the National eHealth Transition Authority (NEHTA) was founded to support the Ministry of Health in the implementation of EHR project, consisting of members of federal, state and territory governments. NEHTA is responsible for the coordination of the implementation, defining the relevant standards and terminologies, defining the patient and provider identifiers and supporting the legislation. The national EHR system is planned to be implemented by 2014. Parts of the architecture and the standards are specified and several regional pilots have been implemented (Deutsch et al. 2010).

### **3.1.2 Electronic prescribing**

Electronic prescribing is electronically transmitted prescription data between prescribers, pharmacies, and payers. It can also include messages regarding new prescriptions, prescription changes or cancellation, refill requests and other prescription information (Webster and Spiro 2010). Electronic prescribing is known in European countries as ePrescribing. In the US, the term Computerized Physician Order Entry (CPOE) describing the physicians' systems has also been used. The physicians create the electronic prescription in their IT system from where it is transmitted through a secure network and reached by the community pharmacy. Electronic prescribing systems have a major role in EHR systems to

support patient care (Figure 1). After electronic documentation, which is usually managed by local IT systems, electronic prescribing systems are the basis for integration of IT systems and sharing patient data between physicians and community pharmacies. The development processes of electronic prescribing systems have been under development since 1980s. However, only during recent years the systems have been implemented in routine use but are still not in wide spread use.

The International Pharmaceutical Federation (FIP) has launched a statement of professional standards concerning the electronic prescribing which can be used when establishing national e-prescribing systems (FIP 2001). In this statement FIP supports the use of electronic prescribing in order to improve the quality of care, to reduce medication errors, to ensure security and to improve desired outcomes of medication therapy. However FIP indicates patient confidentiality and prescriber's intention and verification are development challenges.

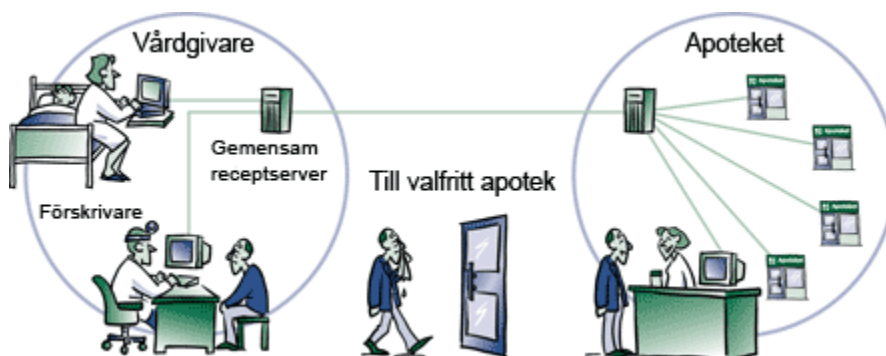
In Europe there has been a rapid growth in electronic prescribing adoption during recent years. However, there is large variation in the electronic prescribing systems. The technical models have varied and the models implemented earlier are currently obsolete. The milestones of electronic prescribing implementations are presented in Table 4. These countries were selected as examples because the technical implementation varies in their electronic prescribing systems. In addition to selected European countries, also the US was included (Table 4). In the US, RxHub is the National Patient Health Information Network™ providing secure access to more than 90% of people with commercial prescription coverage in the UnitedStates.

**Table 4** Milestones of electronic prescribing implementations in selected European countries and the US (Medcom 2011, Gematik 2011, Åstrand 2007, Ax and Ekedahl 2010, Surescripts 2011).

Denmark	Germany	Sweden	The United States
<ul style="list-style-type: none"> <li>• 1995-96: MedCom I project: to develop and test standards for messaging, e.g. prescriptions: communication network between health professionals</li> <li>• Value Added Network Service: electronic prescription send through the mailbox of the operator to the selected pharmacy</li> <li>• 2009: 90% of prescriptions are transmitted electronically</li> <li>• 2010-2011: MedCom VII project: e-records including patient information for professionals and patients will have access to their own data</li> <li>• In the near future: Common Medication Card (FMK): a server based up-to-date card including patient's full and current medication</li> </ul>	<ul style="list-style-type: none"> <li>• 2005: First pilot tests of Elektronic Health Card (eHC ) (eGesundheitskarte/eGK)</li> <li>• Patient's PIN code essential to access to the shared database</li> <li>• eMedication Profile to detect potential risks in pharmacies</li> <li>• Expected to be in use in October 2011</li> </ul>	<ul style="list-style-type: none"> <li>• 1980-81: national/regional project formed</li> <li>• 1983: the world's first transferred electronic prescription in June</li> <li>• 1999: national task force formed</li> <li>• 2002: new multi-disciplinary model for local/regional implementation</li> <li>• 2000-2006: rapid growth of transferred electronic prescriptions</li> <li>• 2005: new mandatory law</li> <li>• 2005-2006: electronic prescription database for storing information</li> <li>• 2009: re-regulation of the Swedish pharmacy market:               <ul style="list-style-type: none"> <li>- Apotekens Service AB takes over the electronic prescription database</li> <li>- all Swedish pharmacies can access the database</li> <li>- nearly 100% of the prescriptions transmitted electronically</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• 2001: RxHub was created by three leading pharmacy benefit managers (PBMs)</li> <li>• 2001: Intelligent network connection between physicians and pharmacies called Surescript founded by the National Association of Chain Drug Stores and the National Community Pharmacists Association</li> <li>• 2003: the eHealth Initiative launched the Electronic Prescribing Project involving various stakeholders</li> <li>• 2003: The Medicare prescription Drug, Improvement, and Modernization Act (MMA) established additional standards for electronic prescribing</li> <li>• 2008: the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA), provides incentives to physicians when they ePrescribe for Medicare patients</li> <li>• 2008: Surescripts and RxHub merged, name was simplified to Surescripts in 2009</li> <li>• 2009: used by 34% of office-based prescribers</li> <li>• 2010: Electronic Health Record Incentive Program announced by the Centers for Medicare &amp; Medicaid Services (CMS) for the Medicare and Medicaid Programs</li> <li>• 2010: 91% of community pharmacies were connected for prescription routing</li> </ul>

### 3.1.2.1 Electronic prescribing in Europe

The world's first electronic prescription was sent in Sweden in 1983 (Table 4) (Åstrand 2007). The national monopoly (Swedish Corporation of Pharmacies, Apoteket AB) enabled a systematic development of an electronic prescribing system, which was extended in 2002 to cover all general practitioners (GPs) in the Stockholm's neighbouring area (Ax and Ekedahl 2010). The electronic prescription implementation strategy in Sweden was structured as a joint venture project between the County Council and Apoteket AB (e-Receipt Stockholm). The electronic prescriptions are sent through by the physician to a national electronic prescription server (Landstingnätet, SLLnet) to the electronic prescription mailbox at Apoteket AB, which is used by all pharmacies (Figure 6). The patient is able to get the medication dispensed through any pharmacy. Each pharmacist has a personal PIN-code in order to extract prescriptions from the national electronic prescription server. The patient's agent can take the medicine from the pharmacy by having the patient's pharmacy card and knowing personal ID number. Today, nearly 100% of the prescriptions are transmitted electronically in Sweden.



**Figure 6** *The technical model of the ePrescribing system in the Stockholm's area, Sweden (e-Receipt Stockholm 2011).*

In Denmark, the electronic prescribing development process started in 1995–1996 under the MedCom project, which is a co-operative venture between authorities, organizations and private firms, coordinating the eHealth in Denmark (MedCom 2011). Currently, 90% of the prescriptions are transmitted electronically. The

Danish system is based on the communication network Health Data Network (SDN), which can be used by all public and private organizations for e.g., exchanging data, transmitting images and prescriptions. The earlier system developed in the 1990's was technologically old-fashioned because the physician and the patient had to decide into what pharmacy the electronic prescription was sent through the operator's mailbox. The physician receives an alert when the prescription has been dispensed from the pharmacy.

In Germany, the electronic prescription system is based on the electronic health card (eGesundheitskarte/eGK) which contains a microchip (Heidelberg 2004). In this system the electronic prescription is saved in patient's health card (Figure 7). A PIN code for the pharmacist is needed to retrieve the prescription from the database. Physicians have their own professional cards to access the data, but the patient's PIN code is needed to activate the data. Also medical information can be saved on the card. The prescription information is on the server and can be opened by the PIN-code (the patient's or the pharmacist's code). The health card contains information that can be accessed by any provider treating the patient. It also can be non-server based, where the health card performs as a mean of transport. The weaknesses of the German system are the card costs for the society and the double system because both cards and the prescription database on the server are needed (Figure 7).



**Figure 7** *The technical model of the electronic health card in Germany (modified, Gematik 2011).*

### *3.1.2.2 Electronic prescribing and Computerized Physician Order Entry in the United States*

In the US, electronic prescribing is a process of prescribing medications using a computerized physician order entry (CPOE) system. Electronic CPOE systems exchanges prescriptions directly with the pharmacy (Virk et al. 2006). In the US, the CPOE systems vary in terms of functionalities included, and they have been available in the following graduated levels (eHealth Initiative 2004):

1. Electronic drug reference, no prescribing capability
2. Stand-alone prescription writer, with no medication history or supporting data
3. Addition of basic supporting data, such like allergies and demographics, which can be used by the system to generate alerts
4. Medication management – long-term tracking and monitoring of each patient's medications
5. Connectivity among practices, pharmacies, payers and patients
6. Integration with a more complete electronic health record

In some other countries, such as Finland, only the level 5 and 6 systems are considered as electronic prescribing. The CPOE systems in the US have been quite actively studied and discussed compared to electronic prescribing systems in other countries. The first published studies on CPOE systems have focused on experiences of physicians and hospitals (Schiff and Rucker 1998, Schiff 2002, Shulman et al. 2005, Grossman et al. 2007). Physicians were encouraged to eliminate handwritten prescriptions (Institute for Safe Medical practices 2011). According to the studies, there have been barriers in the implementation and adoption of the electronic prescribing systems in the US (Grossman et al. 2007, Cusack 2008). The physicians who have already adopted the system have reported that they are costly, incentives to use are misaligned, implementations may be difficult and the systems often disrupt or inhibit workflow (Cusack 2008). Two main barriers to use the electronic prescribing among physicians have been reported to be: 1) The tools to view and import patient data have found to be



difficult to use; 2) The data has not always been perceived as useful enough (Grossman et al. 2011). Still both CPOE and clinical decision support systems are more widely adopted in inpatient settings than in outpatient one's.

Even if there are some evidence that CPOE has reduced medication and transcription errors (American Society of Hospital pharmacists 1993, Bates et al. 1998, Bates et al. 1999, Kohn et al. 1999, Bates et al. 2001, Kuperman 2001, Mekhjian et al. 2002, Spencer et al. 2005, Quality Interagency Coordination Task Force (QulC) to the President 2011, Institute for Safe Medical practices 2011), there are also several studies reporting new types of errors induced by the electronic prescribing technology (Bates et al. 1999, Bates et al. 2001, Ash et al. 2004, Graber 2004, Coombes 2004, US Pharmacopeia 2005). These results may not be generalized to the other countries in the same extent because of the different health care structures, reimbursement systems and clinical practice (Goundrey-Smith 2006). These errors may be generated by system design flaws, poor decision support rules and lack of training in the functionality of systems that could conceivably result in errors (Coiera et al. 2006). Some of the systems have failed to alert clinically significant drug-drug interactions, and as a result, an inappropriate prescription has been generated that could potentially harm the patient (Bates et al. 2001). The community pharmacists' perspective has not been studied until recently (Motulsky et al. 2008, Rupp and Warholak 2008, Clauson et al. 2011). The variety of the systems makes it difficult to evaluate the systems and to make comparisons between studies.

Technically electronic prescription transmission in the US community pharmacies utilise nodal server eRX Gateway which is a standard-based messaging engine between the physicians' electronic medical record (EMR) systems and dispensing pharmacies (Virk et al. 2006). The infrastructure of the CPOE system requires integration of patient's clinical data and drug history as well as pharmacotherapy knowledge (Schiff 2002). The capabilities include medication prescription, data transmission, dispensing, administration and monitoring (Virk et al. 2006). The system also allows processing requests for new prescriptions, modifying or cancelling prescriptions and refill requests.

### 3.1.3 Clinical decision support systems

Clinical decision support system (CDSS) is an application that analyses data from the electronic health record to help healthcare providers make clinical decisions. The simplest models provide access to information in order to assist in decision-making while the more sophisticated models apply patient clinical data and generate patient-specific treatment advice (Garg et al. 2005, Robertson et al. 2010). Most typically systems applied in clinical practice so far have been based on different kinds of automated prescription medicine prompts and reminders, as in DUR e.g., for detecting drug-drug interactions (Becker et al. 2005). The community pharmacists' patient-focused role requires that also community pharmacists will have access to patient data and appropriate decision support systems (Calabretto et al. 2005). Medication safety is the traditional area pharmacists and clinical decision support systems may change prescribing outcomes, the effects being most consistent in the context of drug safety (Morris et al. 2007, Robertson et al. 2010). However, the patient outcomes produced by the health care software applications are rarely examined, and when studied, the results are inconsistent (Chrischilles et al. 2002, Garg et al. 2005).

Automated prescription medicine prompts and reminders may improve patient care (Garg et al. 2005). Alert management for pharmacists and physicians is critical to achieving patient safety benefits. However, there is little literature describing or evaluating electronic clinical decision support systems for pharmacists. There is a need for ensuring a focused, limited set of evidence based alerts and optimizing over time based upon the data and feedback. An electronic prompt in variety of setting for a targeted clinical intervention has a significant effect on health professionals' behavior (Garg et al. 2005). This has also been demonstrated in community pharmacies (Reeve et al. 2008). Reminders and alerts can improve the quality, safety and effectiveness of care by reducing reliance on memory and presenting evidence-based clinical guidelines at the point-of-care (Rind et al. 1994, Evans et al. 1998, Garg et al. 2005, Saleem et al. 2005). However, there is also growing evidence that poorly designed, implemented or used clinical decision support systems may cause harm, even

lead to death (Bates et al. 2001). Pharmacists' awareness of decision support functionalities has recently been reported to be limited (Hines et al. 2011). In this interview study some pharmacists were not completely informed about the limitations and capabilities of their software. Pharmacists' knowledge and training would have potentially positive impact on the quality of clinical decisions (Hines et al. 2011). Also the IT systems used by community pharmacists have been reported to perform less than optimally clinically relevant interactions (Saverno et al. 2011).

### *3.1.3.1 Computerized Drug Utilization Review in the United States*

In the United States (US), the first drug utilization review (DUR) programs were initiated in the end of 1960s (Fulda and Hass 1992). DUR is defined by the United States Pharmacopeia (USP) as *"A process to assess the appropriateness of drug therapy by engaging in the evaluation of data on drug use in a given health care environment against predetermined criteria and standards"* (USP 1996). The aim is to prevent different kinds of drug-related problems (DRPs), such as drug-drug interactions (DDIs), adverse drug reactions (ADRs), as well as duplicate and misuse of medication. DUR became legally mandated by the Omnibus Budget Reconciliation Act of 1990 (OBRA'90) in January 1993 (Department of Health and Human Services, Health Care Financing Administration 1992, Fulda and Wertheimer 2007). DUR is a patient care service which does not represent pharmaceutical care. Alerts are performed at the systems level and the rules are being applied without discrimination or consideration for the patient as an individual.

DURs are classified into three main categories: 1) Prospective DUR – evaluation of patient's drug therapy before dispensing; 2) Concurrent DUR – ongoing monitoring of drug therapy; and 3) Retrospective DUR – review of therapy after the patient has received the medication (Figure 8). The retrospective DUR (rDUR) was the first type of DUR implemented. It is a computer-aided program which reviews patients' medical history profiles against predetermined standards set by

the State DUR Board. This can happen either concurrently with the therapy or after it. The rDUR program is focused on the interaction between prescribing physician and the patient. Intervention letters, patient's medical profile and possible guidelines and publications are mailed to selected providers with response forms. Cost savings are calculated after the re-review conducted a year after the original review (Ohio Medicaid 2011).

The prospective DUR (pDUR) screens patient's medication regimen during the prescription dispensing process by analysing the episodes of drug use and in case of potential problems alerts the pharmacist (US Pharmacopeia 1997). According to OBRA'90 (Department of Health and Human Services, Health Care Financing Administration 1992), prospective DUR requirements have been set for all pharmacists dispensing medicines under Medicaid (a public health insurance program). After that, most state governments extended the service for all patients (Schatz et al. 2003). Most community pharmacists in the United States use the DUR software applications that are resident on their pharmacy IT systems (e.g., in-store computer-aided pDUR). The DUR software is also possible to use online (e.g., online computer-aided pDUR). Both systems generate electronic alerts when a prescription claim violates a pre-established criterion for appropriate use, which include the indication of the type of problem. Only the online system is able to detect the profile of all medications, not just those which are generated by one pharmacy which is important particular patients maintain home in more than one place. Concurrent DUR evaluates drug therapy and intervention, while the therapy is undergoing. This is targeted at patients at high risk of drug-induced illness and communicates the risk factors to the physicians and pharmacists involved.

Concurrent DUR		
During drug therapy, patients who are at high risk of drug-induced illness		
Retrospective DUR		Prospective DUR
Physician and consumer		Pharmacists perform by law (OBRA 1990)
<ol style="list-style-type: none"> <li>1. Therapeutic appropriateness</li> <li>2. Over and under utilization</li> <li>3. Appropriate use of generic products</li> <li>4. Therapeutic duplication</li> <li>5. Drug-disease contraindications</li> <li>6. Drug-drug interactions</li> <li>7. Incorrect dosage or duration of therapy</li> <li>8. Clinical abuse or misuse</li> </ol>		<ol style="list-style-type: none"> <li>1. Over and under utilization</li> <li>2. Therapeutic duplication</li> <li>3. Drug-disease contraindications</li> <li>4. Drug-drug contraindications</li> <li>5. Incorrect drug dosage or duration of drug treatment</li> <li>6. Drug allergies</li> <li>7. Clinical abuse or misuse</li> </ol>

**Figure 8** Retrospective, concurrent and prospective DUR (based on Ohio Medicaid 2011).

In cases recognising any drug-related problems listed above (Figure 8), pharmacists shall try to prevent or resolve the problems, e.g., by consulting the prescriber. When DUR is implemented effectively, it is demonstrated to enhance appropriate medication use (Lyles et al. 1998, Fulda 2004).

However, there have been several problems with the implementation Drug Utilization Review systems in the US. There has been a need for predetermined criteria and standards and the focus should be on significant problems based on scientific evidence in order to reduce the number of false positive alerts (Lyles et al. 1998, Chrischilles et al. 2002, Fulda et al. 2004). There is a risk that alerts will be overriding when they focus on insignificant problem or when the pharmacist receives alerts from on line systems that duplicate alerts from in store systems. The lack of evidence-based guidelines and recommendations are a major reason for the variation in the rates of intervention when preventable, clinically significant

problems are identified. Also there have been software application related problems, because of the lack of the criteria, which and how many of them should be included in the system (Hazlet et al. 2001). The system vendors have decided which criteria to be included to the system without the evidence to support the decisions (Chrischilles et al. 2002). An emerging critical component of the decision support systems is ensuring integration of alerts and making sure that the users are not frustrated and desensitized by encountering similar alerts from a variety of different systems. This “alert fatigue” is well described in the literature; the pharmacists desensitization is greatest when the alerts are perceived as repetitious, time consuming, inappropriate or not relevant to the decision; resulting that the users override the alerts without reading them (Lesar et al. 1997, Bates et al. 1999, Abookire et al. 2000, Kuperman et al. 2001, Major et al. 2002, Ahearn and Kerr 2003). Even when the alert system is perceived helpful, the users can become frustrated by being delayed by the alert, especially when they have difficulty interpreting the alert or receive the same alert repeatedly (Glassman et al. 2002, Magnus et al. 2002, Ahearn and Kerr 2003, Feldstein et al. 2004, Peterson and Tenni 2004). In an observational study (Chui and Rupp 2000) pharmacists’ response to the alerts were observed and only 12% of the online alerts resulted in an intervention. There is not any research concerning critical evaluations of decision support systems or their outcomes (Calabretto et al. 2005) and only few assessing the users’ views and preferences concerning the development of alert systems (Bates et al. 2003a).

The evidence of the effectiveness of DUR in preventing and resolving drug therapy problems has been limited (Lipton and Bird 1993, Soumerai and Lipton 1995), and even more systematic and standardized DUR has been suggested to cover all the parties and conditions (Lyles et al. 1998, Fulda et al. 2004). The US health system is a combination of public and private actors (Christensen and Farris 2006) which challenges the development of health IT with fragmented and several kinds of procedures. Of different DUR implementations, pDUR has been more difficult to implement, however all DUR implementations are needed. The opinions of the pharmacists have been studied to be positive towards DUR in the early phase of its implementation (Armstrong and Markson 1997).

### *3.1.3.2 Clinical decision support systems in Europe*

Within European countries, clinical decision support systems have been evaluated twice, in 1997 (Hartikainen 1999) and in 2010 (Landerdahl 2010). These studies were conducted among national organisations representing community pharmacies in the member states of EuroPharm Forum (Hartikainen 1999) and EU through the Pharmaceutical Group of the European Union (PGEU) (Landerdahl 2010). In 1997, ten out of 18 responding European countries reported having some kind of systematic clinical decision support systems (drug utilization review) in use (Hartikainen 1999). Four countries reported not having any systematic computer aided systems in this respect. These countries were Italy, Austria, Estonia and Finland. The most common system reported by countries was drug-drug interaction screening (80% of the countries) and the second most common was having a medical record system (60%). The most widely used system was in the Netherlands, where all the community pharmacies were encouraged to use it. In 2010, 14 EU countries reported having decision support systems in use (Landerdahl 2010). The most common alerts generated involved drug-drug interactions, duplicated medication, and contraindications. The most evolved systems were in the Netherlands, Germany, France, Portugal, Sweden and the UK.

## **3.2 Health information technology in medication management**

Medication management is a planned system of processes and behaviors which determine how medicines are used by patients (Shaw et al. 2002). The focus is on the appropriate and safe use of medicines and on prevention of medication errors (NCC MERP 2005). There are many aspects related, such as avoiding potentially harmful drugs, drug-drug interactions and adverse reactions. Monitoring of medications is especially important for patients taking numbers of medications or patients with chronic illnesses and multiple diseases, which is common among elder people. Health information technology (HIT) tools are necessary in managing increasing volume of clinical data (Figure 1). In community pharmacies

cognitive services require supportive IT systems. In the following section IT software applications involvement in medication management functions in the community pharmacies are discussed.

### **3.2.1 Disease management and risk assessment**

Care Continuum Alliance (formerly Disease Management Association of America) defines disease management as *“a system of coordinated health care interventions and communications for populations with conditions in which patient self-care efforts are significant”* (Care Continuum Alliance 2011). Disease management can not be considered as pharmaceutical care, because it focuses on a specific disease, providing patients with the tools and knowledge they need for taking some responsibility of their own care (McGivney et al. 2007). The philosophy and practice of pharmaceutical care focuses on the whole patient (McGivney et al. 2007). However, as a patient care service disease management is often conducted by community pharmacists and requiring the support of IT.

The United States (US) has been a leader in innovative community pharmacy services to involve pharmacies in medication management (Table 5). This also can be seen in the proportion of evaluated demonstration projects reported since 1980s (Table 5). The earliest outcomes studies were conducted among patients with such diseases that the clinical outcomes of pharmacotherapy were easy to determine and measure. Examples of such outcomes are blood pressure and cholesterol in cardiovascular conditions, blood sugar in diabetes, and peak exhaling flow (PEF) in asthma. Later on, the tendency has been to apply e.g., the ECHO model to assess rigorously, Economic, Clinical and Humanistic Outcomes of the intervention of pharmaceutical service (Kozma et al. 1993). Some studies included patients from more than one condition groups. Not all studies include a comprehensive description of the service provided. This makes it difficult to compare different studies, but also to estimate effectiveness of a particular service. Furthermore, interventions can have integrated elements (e.g., education and monitoring), which makes it impossible to assess each element's impact on



detected outcomes. The same difficulty lies in evaluation of impact of medication reviews as the procedures vary a lot, e.g., in terms of comprehensiveness.

In 1990s at the MacColl Institute for Healthcare the Chronic Care Model was launched emphasized the activation of the patients with the self-management support and decision support tools to ensure that the treatment decisions are based on guidelines (Wagner 1998, Wagner et al. 2001, Institute for Healthcare Improvement 2011). FIP launched a statement concerning pharmacists' role in chronic disease monitoring in 2006 (FIP 2006). It has helped to clarify definitions and concepts related to disease monitoring. Later on, the studies on patient care services in community pharmacies have also evaluated risk screening services, such as osteoporosis risk screening (Goode et al. 2004, Liu et al. 2007), and cardiovascular risk screening (John et al. 2006, Peterson et al. 2010). Additionally, some studies have selected participants according to some other characteristics, e.g., patients with high risk of drug-related problems (Malone et al. 2001, Taylor et al. 2003), home care patients (Meredith et al. 2002), patients with repeat prescriptions (Bond et al. 2000) and patients on warfarin therapy (Jackson et al. 2004). It is evident that more evidence on the outcomes of community pharmacists' involvement in patient care services is needed. Attention should be also paid on the rigorous of the research, particularly on study designs and outcomes measures. Of the outcomes measures, most challenging are related to patient's quality of life and cost optimization. Health-related quality of life (HRQOL) is an objective of pharmaceutical care but also a viable patient outcome (Murdaugh 1997). Several studies have shown that community pharmacists may improve this outcome by optimizing medication therapy (Niquille and Bugnon 2010).

**Table 5** *Studies on patient care services related to community pharmacists' involvement in disease management.*

<b>Condition</b>	<b>Study group</b>	<b>Service</b>	<b>Country</b>	<b>Reference</b>
Several conditions	Patients of all ages and conditions	Detection and identification of drug-related problems (DRPs) (Minnesota project)	US	Tomechko et al. 1995
Cardiovascular disease	Patients with hypertension or heart failure	Monitoring and identification of adverse drug reactions	US	Schneider et al. 1982
	Hypertensive patients	Education and monitoring	US	Park et al. 1996
	Patients with COPD	Education and monitoring	US	Solomon et al. 1998
	Hypertensive patients	Telephone-based monitoring	US	Mehos et al. 2000
	TOMCOR study in patients with former acute coronary episodes	Blood pressure control	Spain	Alvarez de Toledo et al. 2001
	Patients with angina pectoris	Medication review	UK	McGovern et al. 2001
	Hypertensive patients	Blood pressure control	Portugal	Garcao et al. 2002
	Patients at high risk for cardiovascular events	Education and monitoring (SCRIP Study*)	Canada	Tsuyuki et al. 1999, 2002
	Hypertensive patients	Education and monitoring	Thailand	Sookaneknun et al. 2004
Dyslipidemias	Patients with dyslipidemia	Documentations of contributions to health and quality of life (ImPACT project**)	US	Bluml et al. 1998
	Patients at risk for coronary artery disease (patient records search)	Pharmacist-directed lipid management program	US	Nola et al. 2000
	Patients at high risk for DRPs and with dyslipidemia	Detection and identification of DRPs (IMPROVE***)	US	Ellis et al. 2000
	Patients with dyslipidemia	Education and monitoring program with home visits	Australia	Peterson et al. 2004
	Patients with dyslipidemia	Education, monitoring, detection and identification of DRPs	Chile	Paulos et al. 2005

Diabetes	Asheville project Patients with type 2 diabetes	Setting and monitoring treatment goals, diabetes education, home glucose meter training	US	Cranor et al. 2003a Cranor et al. 2003b
	Patients with type 2 diabetes	Medication review	UK	Wermeille et al. 2001
	Patients with type 2 diabetes	Group education	Sweden	Sarkadi and Rosenqvist 2004
	Patients with type 2 diabetes and vascular risk factors	Face-to-face goal-directed medication and lifestyle counseling, telephone-based monitoring	Australia	Clifford et al. 2005
	Patients using oral medication	Management with weekly visits or telephone calls	US	Odegard et al. 2005
	Patients with type 2 diabetes	Management and review, education, self-management support and reminders	Australia	Krass et al. 2007
Reactive airways disease	Patients with hypertension or chronic obstructive pulmonary disease (COPD)	Education and monitoring	US	Solomon et al. 1998
	Patients with asthma	Therapeutic Outcomes Monitoring protocol	Finland	Närhi 2001
	Patients with asthma	Education and monitoring	Malta	Cordina et al. 2001
	Patients with asthma	Therapeutic Outcomes Monitoring protocol	Denmark	Herborg et al. 2001
	Asthma self-management tools	Assisted self-monitoring	South Africa	Bheekie et al. 2001
	Patients with asthma or COPD	Education and monitoring	US	Weinberger et al. 2002
	PC in pediatric asthma	Asthma management service	US	Stergachis et al. 2002
	Patients with asthma or COPD	Peak expiratory flow rates (PEFR) measures	US	Weinberger et al. 2002
	Patients with asthma	Telephone-based self-management advice	UK	Barbanel et al. 2003
	PC in pediatric asthma	Asthma education and monitoring program	Chile	Gonzalez-Martin et al. 2003
Patients with asthma	Rural asthma management service (RAMS) with control visits	Australia	Saini et al. 2008	
Pain disorders	Patients with chronic pain disorders	Telephon-based PC services	US	Gammaitoni et al. 2000
	Patients with musculoskeletal disorders	Detecting and resolving DRPs using a touch screen technology	US	Ernst et al. 2001 Ernst et al. 2003

Mental illness	Patients with depression	Monitoring treatment adherence and preventing relapse (collaborative care)	US	Boudreau et al. 2002
	Patients using antidepressants	Coaching	NL	Brook et al. 2003
	Patients with depression	Patient education, monitoring, management of adverse reactions and the prevention of relapse (collaborative care)	US	Capoccia et al. 2004
	Patients with new antidepressant	Telephone-based education and monitoring	US	Rickles et al. 2005
	Patients treated with antipsychotics	Detailed monitoring and management of extrapyramidal symptoms	US	Stoner et al. 2000
Other conditions	Hemodialysis patients	Detection and identification of drug-related problems	US	Manley et al. 2003
	Medicaid patients at high risk of DRP	Detecting and resolving DRPs (IOWA Medicaid program)	US	Carter et al. 2003

\* Study of Cardiovascular Risk Intervention by Pharmacists (SCRIP)

\*\*IMPROVE study (Impact of Managed Pharmaceutical Care on Resource Utilization and Outcomes in Veterans Affairs Medical Centers)

\*\*\* ImPACT project (Improve Persistence and Compliance with Therapy)

The aim of IT supported disease management and risk assessment is to routinely track key elements of a disease through health observation, record keeping, and regular reporting in order to promote health and prevent diseases. The disease management systems are aimed at 1) payers; 2) health care providers, e.g. physicians and pharmacists; or 3) patients (Bu et al. 2007, McMahan 2008, Wyne 2008). Payers' systems track and monitor information and provide feedback to patients and providers (Bu et al. 2007). The professionals involved in disease and chronic care management should increase sharing of patients' clinical data through EHR systems across care settings in a secure fashion (Marchibroda 2008). In the US, some Medication Therapy Management programs use health IT to identify an at-risk population relying on patient identification, stratification of care, coordination of care, and safety evaluation (McMahan 2008).

The disease management systems aimed at patients include educational resources, data-gathering systems between patient visits such as electronic diary tools, and/or reminders (Wyne 2008). The fourth category has been suggested which would integrate patient and provider technologies into a single system (Bu et al. 2007). IT enabled disease management can also be integrated with the clinical decision support systems to compare information from patients' electronic medical records against a set of rules.

Diabetes has been one of the most popular conditions in disease management implementation (Jackson et al. 2006, Wubben and Vivian 2008). In developed countries, its prevalence is high, it is often associated with comorbid conditions, and the treatment requires multiple medications and measurement of outcomes. These factors provide an opportunity for the implementation of diabetes management systems (Wyne 2008). As an example of disease management software, integrated IT-enabled diabetes management (ITDM) a computer simulation model was created to assess the potential evidence of integrated system (Bu et al. 2007). This model included the registry, self-management, and remote monitoring technologies. The study results suggested that diabetes registries may be the most beneficial way to manage diabetes, while the self-management tools alone may offer the least benefit (Bu et al. 2007). This study

provided evidence that ITDM improves processes of care, prevents development of diabetes complications, and generates cost savings. However, this model's benefits have to be weighed against implementation costs.

### **3.2.2 Drug-related problems**

Most IT systems related to DRP screening have focused on screening drug-drug interactions (Becker et al. 2005). Computer-based drug-drug interactions screening systems are in routine use in community pharmacies in several countries.

The first application to recognize drug-related problems with the aid of computers was the *Minnesota Pharmaceutical Care Project 1992-1995* (Tomechko et al. 1995). In this project the data from 5480 patients were analysed and followed for 12 month period in community pharmacies. Of these patients, 43% presented DRPs and 18% had more than one DRP. 25% of DRPs occurred due to unnecessary or inadequate medication. Polypharmacy and several diagnoses were more liable to lead to these problems. Today medication management services are provided for the patient, health plans, practitioners and employers by a company called Medication Management Systems in order to rapidly implement medication therapy management programs with the support of IT (Medsmanagement 2011).

In Sweden there is in a routine use a computerized application for data collection of detected DRPs called LRPi ATS (Drug Related Problems in ATS, the Swedish pharmacy computer system) and a national DRP database (SWE-DRP) for documenting DRPs and interventions related to non-prescription medicines (Westerlund et al. 1999). The program is consisted of a number of menus, from which usually one option was to be selected and open-ended fields to be filled out (Westerlund et al. 1999). This instrument was connected into an existing program "Symptom Advice Intervention" which includes a symptom menu and self-medication treatment flowcharts. The pharmacists document with the help of the

program which underlying symptom the customer was seeking help (Westerlund et al. 1999). Patient's information is not included in the documentation of these programs. The information of the database is used in research purposes.

### *3.2.2.1 Drug-drug interaction screening*

Several studies have evaluated the programs for DDI screening (Jankel and Martin 1992, Barla et al. 1992, Hazlet et al. 2001, Barrons 2004, Perrin et al. 2004, Becker et al. 2005, Vonbach et al. 2008, Reis and Cassiani 2010). One of first and most widely adapted electronic drug-drug interaction program has been Micromedex's DrugReax® developed by Thomson Micromedex ([www.micromedex.com](http://www.micromedex.com)). Computerized screening for DDIs and other potential drug related problems (DRPs) are becoming available in most community pharmacy IT systems. This has the potential to increase the recognition of DDIs and DRPs beyond those detected using a manual review process (Westerlund et al. 2001, Chrischilles et al. 2002, Westerlund 2002).

There have been several problems with the computerized DDI screening software in the ability to screen the clinically significant DDIs (Jankel and Martin 1992, Lyles et al. 1998, Fulda et al. 2000, Abarca et al. 2004). The recent performance of community pharmacy IT systems in screening for selected DDIs has improved (Abarca et al. 2006). Still the quality improvements should focus on the high probability of true-positive adverse clinical effects. Also quality of the database and how it is linked to medicinal products database can influence the proportion of true-positive signals.

### 3.2.2.2 Adverse drug reactions

The early definition for adverse drug reactions (ADRs) was provided by WHO in 1970: *"any response to a drug which is noxious and unintended, and which occurs at doses normally used in man for prophylaxis, diagnosis or therapy of disease, or for modification of physiological function"* (WHO 1970). Lately, another definition has been presented: *"An appreciably harmful or unpleasant reaction, resulting from an intervention related to the use of a medicinal product, which predicts hazard from future administration and warrants prevention or specific treatment, or alteration of the dosage regimen, or withdrawal of the product."* (Edwards and Aronson 2000).

ADRs are associated with considerable morbidity and mortality (Lazarou et al. 1998). This latter definition emphasizes the prevention in order to avoid these harmful reactions. To prevent them several methods have been recommended including computerized prescribing (Shulman et al. 2005, Donyai et al. 2008), computerized screening and alerts (Bates et al. 1998, Chrischilles et al. 2002, Kuperman et al. 2007, Brett 2009, Roten et al. 2010), communication and data sharing between health professionals (Sweeney 2002). In community pharmacy context, identification of ADRs is included in the computerized DUR service model in the US, and the documentation of ADRs is included in the LRPi ATS program in Sweden.

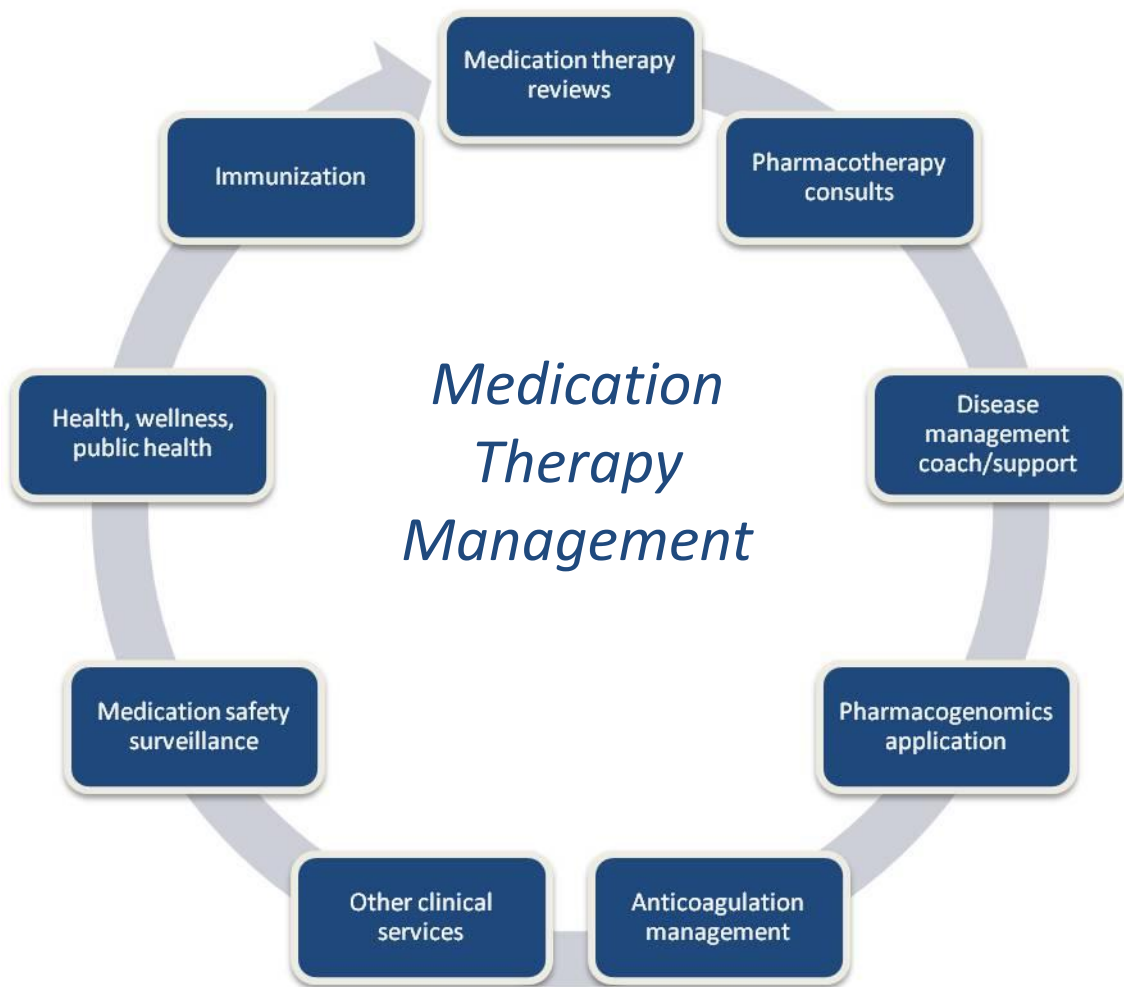
### 3.2.3 Medication Therapy Management (MTM)

Medication Therapy Management (MTM) Services were created in the US during 2003-2004 (Bluml 2005) on the basis of philosophy of pharmaceutical care (McGivney et al. 2007). Numerous national professional pharmaceutical organizations and participants were involved in the development of the definition of MTM services (Bluml 2005). The process was coordinated by the American Pharmacists Association (APhA) in order to effectively implement and deliver the new MTM services to patients. The key concepts for the MTM definition were



outlined as follows (Bluml 2005): “1) MTM is a distinct service or group of services that can occur in conjunction with or independent of the provision of a drug product; 2) MTM encompasses a broad range of professional activities and responsibilities; and 3) MTM programs should include a core set of considerations to provide value to key stakeholders in the health care delivery system.”

According to the Consensus Statement, five core elements of medication therapy management in community pharmacy practice were defined: 1) Medication Therapy Review (MTR); 2) Personal Medication Record (PMR); 3) Medication-Related Action Plan (MAP); 4) Intervention and/or referral; and 5) Documentation and Follow-Up (American Pharmacists Association and the National Association of Chain Drug Stores Foundation 2008). All the elements included in the MTM model are presented in Figure 9. The services are independent, but they can occur in conjunction of the provision of a medicinal product. In 2003, the Federal Government launched the Medicare Prescription Drug, Improvement, and Modernization Act which for the first time on a national level included outpatient prescription drugs as a covered service under Medicare and allowed pharmacists to be reimbursed for direct patient care services (Medicare Prescription Drug, Improvement, and Modernization Act 2003). According to this law, the goal is that the service or group of services optimize therapeutic outcomes for individual patient. MTM services have been presented to improve patient safety by reducing the total number of medication-related complications (Isetts et al. 2008, Klimek 2009, Ramalho de Oliveira et al. 2010). In this service model the pharmacists work in an interprofessional team and share the clinical data of the patient (Bluml 2005). Despite the the evidence and potential opportunities of MTM services, there are several challenges including reimbursement, justification of the service and stakeholder acceptance (Pellegrino et al. 2009).



**Figure 9** *The elements included in Medication Therapy Management in the US (American Pharmacists Association 2011).*

MTM programs use HIT to identify an at-risk population and reach this population in the most appropriate measure (McMahan 2008). MTM programs that apply HIT use it for patient identification, stratification of care, coordination of care and safety evaluation (McMahan 2008). In one health care system pharmacists document therapeutic outcomes at every patient using a software documentation program (Ramalho de Oliveira et al. 2010). Barriers to MTM service delivery for patients have been presented to be a lack of interoperability between technology systems, software and system platforms (Millonig 2009), and perceived ability to respond to patient interest, pharmacy-related factors and enabling factors (Blake and Madhavan 2010).

### 3.2.4 Clinical medication reviews

The most advanced of the clinical medication review models developed so far are Medication Therapy Review (MTR) in US, Home Medicines Review (HMR) in Australia, and Comprehensive Medication Review (CMR) in Finland (Medication Management Review Implementation Steering Group 2001, Hakkarainen 2008, Leikola et al. 2010, American Pharmacists Association 2011). Most of the existing medication review software are focusing on data-storage and reporting facilities and do not provide support or reasoning capabilities (Healthcare Management Advisors 2003).

In the US, Medication Therapy Review (MTR) is defined as one of the five core elements of the MTM services (American Pharmacists Association and the National Association of Chain Drug Stores Foundation 2008). MTR is a pharmacist-provided, *“systematic process of collecting patient-specific information, assessing medication therapies to identify medication-related problems, developing a prioritized list of medication-related problems, and creating a plan to resolve them”* (American Pharmacists Association and the National Association of Chain Drug Stores Foundation 2008). This service model has been shown to decrease the amounts of physician visits, emergency department visits, hospital days and overall healthcare costs (Bunting and Cranor 2003, Cranor et al. 2003b, Christensen et al. 2004, Garrett and Bluml 2005).

In Australia, the Home Medicines Review (HMR) service commenced operation in 2001 (Medication Management Review Implementation Steering Group 2001). This service model was earlier known as Domiciliary Medication Management Review (DMMR) (The Pharmacy Guild of Australia 2002). In Australia, the medication management services are a community implementation trial of Quality Use of Medicines, which forms the central component of the broader medicines policy in Australia (Canberra 2002). The pharmacists are funded to provide medication management services to the patients. HMR is a patient-focused service, the accredited pharmacist works with the patient and the physician in order to evaluate medication related information with a view to identifying,

preventing and resolving DRPs and optimising health outcomes, especially with elderly. While conducting the service in interprofessional collaboration, there is a high potential to reduce medication errors (Chen et al. 1999, Sweeney 2002, Emblen and Miller 2004, Van et al. 2011). In Australia, the Pharmacy Guild (PG) started a project in 2001 in order to develop standards for software used in assisting pharmacists to conduct Home Medicines Reviews (HMRs) (The Pharmacy Guild of Australia 2002). Also they evaluated five currently available computer software applications called MiracleMMR, Mediflags, Cognicare, MyDMMR and Erye Care (Rigby 2004). According to these evaluations, Computer-based systems simplify the process of documentation and decision making. Some of this software contains decision support information, while others just enable data entry, generation of forms for remuneration and some statistical analysis (Rigby 2004). In Australia, there are preliminary experiences of a decision support system for medication review (Bindoff et al. 2007). This intelligent knowledge-based support system contextualizes the potential drug therapy problems by taking into consideration the patient's demographics, other medical conditions and drugs. The system is not based on static rules to trigger alerts, but utilizes a multiple classification ripple-down rules approach, which allows the user to build rules and knowledge base incrementally according to users own needs. In the pilot study of the system, the number of the rules progressed linearly as more cases were analyzed.

In Finland, Comprehensive Medication Review (CMR) as a distinct service has a short history (Leikola et al. 2009). The first pilot group started medication review training program in 2004 and in 2009 about 100 pharmacists have been educated and accredited to conduct comprehensive medication reviews in Finland. CMR is service provided by accredited pharmacist in a collaborative health care team (Leikola et al. 2009). The review should be problem-based including the evaluation of the patient's medical records, face-to-face interview, analysis, report and follow-up (Peura et al. 2007). The efficiency and profitability of the medication review service in Finland would be improved by having computer software that would streamline documentation, analysis and the follow-up procedures.

However, most challenging is the fee policy, because the service is not remunerated by the Finnish society.

### **3.3 Internet as a facilitator of new patient care services in community pharmacies**

Patients are demanding online pharmacies, services via the internet to support self-care and self-management of chronic diseases increasingly in future. There is room for patient care innovations which potential has not been well utilized. Also the social media provides new opportunities because of the attainability, educational opportunities, and possibilities for interprofessional collaboration (Cain et al. 2010).

The internet is one of the most successful and important technological innovation of our times. The users of the internet seek information about their medications (Berger et al. 2005, Pohjanoksa-Mäntylä et al. 2009) and share their experiences (Powell et al. 2003). Also pharmacies have started to provide counseling using the internet (Zehnder et al. 2004, Holmes et al. 2005, Ghoshal and Walji 2006, Pohjanoksa-Mäntylä et al. 2007, Pohjanoksa-Mäntylä et al. 2008). The internet has been recommended for use in communication with patients, and to enhance patient counseling and education (Felkey and Fox 2001). The internet technology offers new opportunities for pharmacists to deliver patient care services virtually (Pohjanoksa-Mäntylä 2010). However, the quality and reliability of the health information available on the internet has been a topic of concern (Impicciatore et al. 1997, Eysenbach and Diepgen 1998, Gottlieb 2000, Kiley 2000, Eysenbach 2002, Eysenbach et al. 2002, Kiley 2002, Meric et al. 2002, Bernstam et al. 2005, Adams 2010). The internet also provides opportunities to transfer data effectively between health care providers. It has made possible electronic prescribing and sharing patient data.

### **3.3.1 Internet pharmacies**

Because of the demand of more individual services pharmacists have started to provide their services on the internet. Patients are more and more willing to use the internet. Internet pharmacies can provide the opportunity for consumers to save time and money by purchasing their medicines via internet (Weiss 2006). This has been typical in the United States (US), where medicines are protected by US patents and consumers have ordered cheaper generic drugs from Canadian internet pharmacies (Quon et al. 2005, Veronin 2007).

A number of studies have shown a concern for patient safety (Bruckel and Capozzoli 2003, Montoya 2008, Bessell et al. 2002, Weiss 2006). In most cases the drugs purchased over internet come from other countries, the pharmacies are not licensed, they may provide drugs without a prescription, the drug composition may be something else than it should be and the patient counseling for the drug use is missing (Montoya and Jano 2007, Montoya 2008). Counterfeit medicines are estimated by WHO account for 10% of prescriptions ordered on the internet and the fighting against them requires international cooperation (Schweim and Schweim 2009). The use of internet pharmacies also provides an opportunity for drug misuse (Nielsen and Barrat 2009, Forman et al. 2006). Risk to patient safety requires regulation of internet pharmacies, through urgent national and international action (Ghodse 2010). In Europe, the European Court of Justice (ECJ) has ruled that over-the-counter medicines are allowed to be purchased from internet pharmacies inside EU (The European Court of Justice 2004).

Unfortunately consumers are not able to recognise the danger or are easily misled by the online sellers, especially young consumers (Ivanitskaya et al. 2010). Consumers would benefit from education initiatives that develop their information evaluation skills and communication about the risks of buying medications online (Ivanitskaya et al. 2010). Despite the recognition of these risks, the use of internet is increasing in the pharmacy practise because pharmacists have an opportunity to maximize their efficiency and effectiveness.

### 3.3.2 Social media

Evolution of social media is changing the way of communication in society. Social media has rapidly become a part of everyday life for people of all ages. There is great potential also for community pharmacists to use social media in providing patient care service such as disease and medication management (Figure 4). Opportunities provided by social media should be evaluated in the strategic planning by the pharmacy profession.

Social media has been defined as a collection of Web- and mobile-based applications that allow individuals “to 1) *construct a public or semi-public profile within a bounded system, 2) articulate a list of other users with whom they share a connection, and 3) view and traverse their list of connections and those made by others within the system.*” (Boyd and Ellison 2008). Social media applications (Clauson et al. 2010, Table 6) are build on the technological foundations of Web 2.0. that focus on connecting people by characteristics of user-generated content, openness and networking effects (O’Reilly 2008). Some of these applications are targeted to more professional use and some are social tools. Social media can promote open and transparent access to health information, focused on patient behaviors and needs. These applications provide interactive and participatory environments with message-tailoring capabilities, which are different from traditional media such as television, radio or newspapers (Chai et al. 2009, Cain et al. 2010). The potential impact of social media in health care covers 1) Informing, educating, and empowering people regarding health issues; 2) Mobilizing community partnerships to recognized and solve health problems; and 3) Researching innovative solutions to health problems (Cain et al. 2010).

**Table 6** Overview of Web 2.0 tools and applications (Clauson et al. 2010). Originally published in [*Pharmacists' duty to warn in the age of social media. Am J Health-Syst Pharm* 2010;67:1290-1293] (c) 2010, American Society of Health-System Pharmacists, Inc. All rights reserved. Reprinted with permission. (R1123)

Social Media Tool	Example(s)	Explanation	Reference
Blogs	Blogger, WordPress	Birectional online diary that allows readers to post comments	Boulos et al. 2006
RSS* aggregators	Google Reader, PeRSSonalized Medicine, Pageflakes, Netvibes	Software that centralizes feeds of customized information sources	Cain and Fox 2009
Social networking	Facebook, MySpace, LinkedIn, hi5, Ning, PharmQD	Website that allows creation of personal profiles that enable participants to connect with others	Cain 2008
Wikis	Wikipedia, MedPedia, AcaWiki, Knol	Website in which anyone can create, modify, or delete a topic entry	Clauson et al. 2008
Microblogs	Twitter, Yammer	Brief form of blogging (e.g., 140 characters) to give user status updates, disseminate information, and network with others	Hawn 2009
Podcasts	iTunes	Online digital media files that can be downloaded to a computer or personal audio player (e.g., iPod)	Clauson and Vidal 2008

\*RSS = Really Simple Syndication

In health care environments social media applications have shown their benefits in various applications. These include smoking cessation, obesity, asthma management, diabetes and human immunodeficiency virus prevention. Wikipedia ([www.wikipedia.org](http://www.wikipedia.org)) has become a source of health- and medicine-related information. Successful outcomes from the commercial social media application QuitNet.com has been showed in smoking cessation among IBM employees (Graham et al. 2007), which suggests potential impact despite the possible bias of the study. During the global emergence of H1N1 virus in the US the Centers for Disease Control and Prevention shared an information video through a traditional



website receiving 100 000 hits and through a social media (YouTube) receiving more than 2 million hits (iHealthBeat 2011). Microsoft HealthVault and GoogleHealth are applications providing personal health records which give patients access to and control over their own health information and empowers them to take more responsibility of their own health. Health sites such as PatientsLikeMe ([www.patientslikeme.com](http://www.patientslikeme.com)) allow networking between individuals with same disease to communicate, share experiences and expand their knowledge of their ailment.

Concern has been presented that openness of social media and internet-based information could mislead the patient or offer inaccurate information (Ahmad et al. 2006). This is an important reason for pharmacists and other health care professionals to participate in social media as professional actors. Safety, privacy and professional image have been presented as risks related to online information sharing (Cain 2008).

Pharmacy as a profession has adopted social networking slowly. However, community pharmacists are the most accessible health care provider to interact with the public (Cain et al. 2010). Social media applications provide future possibilities for community pharmacies to informing and educating the public and empower and motivate individual patients, e.g., videos for guiding administration technique of asthma or other medicines could be shared through social media. Professional organizations and companies have assessed the suitability of social media for their purposes (Lukes 2010), which can be seen as an opportunity for pharmaceutical organizations and companies as well.

### 3.4 Future visions

Community pharmacies have not fully taken advantage of the opportunities to be involved in patient care services to assure rational and safe medication use. Although the profession itself has focused on professional patient-oriented services various barriers have occurred resulting in slow development of these services with heterogeneous outcomes (Nkansah et al. 2010). In order to provide services, IT solutions are important tools to implement individual care plans, patient monitoring and sharing patient information. There are also significant opportunities for the use of health information technology (HIT) in the disease and medication management. Future research should evaluate benefits of HIT especially in the long-term care, establishment of methods to identify and evaluate clinical outcomes, and determine the cost-effectiveness of using HIT (Jackson et al. 2006).

Patients' responsibility and involvement are likely to increase in future, fuelled by empowerment resulting from electronic tools for self-management. The HIT solutions will provide more and more sophisticated systems to manage health information and medication management. According to the USP (Bezolt et al. 1993), between the years 2011–2020 pharmacists will be the most important source of the medical information, available 24/7 from internet applications, such as virtual internet pharmacies and social media (Cain et al. 2010). It is also possible that in the future the EHR systems will expand on an international level, including patient's medical information sharing by all the health care providers (Coloma et al. 2011). The increase of international collaboration is considered important because of the need for integration of the systems in future.

Criticism has been presented towards health care system in the US: Today health care is characterized by more to know, more to do, more to manage, more to watch, and more people involved than ever before (Institute of Medicines 2001). These rapid changes have resulted to the chasm that the nation's health care delivery system has fallen far short in its ability to translate knowledge into

practice and to apply new technology safely and appropriately. A strategy for reinventing the system has been created with six aims for improvement:

1. *Safe*: avoiding injuries to patients from the care that is intended to help them.
2. *Effective*: providing services based on scientific knowledge to all who could benefit, and refraining from providing services to those not likely to benefit.
3. *Patient-centered*: providing care that is respectful of and responsive to individual patient preferences, needs, and values, and ensuring that patient values guide all clinical decisions.
4. *Timely*: reducing waits and sometimes harmful delays for both those who receive and those who give care.
5. *Efficient*: avoiding waste, including waste of equipment, supplies, ideas, and energy.
6. *Equitable*: providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.”

Pharmacy as a profession and as a part of health care is still in the process of changing with many new challenges ahead. Patients are demanding more and more individual services not provided at point-of-sale. These demands will impact community pharmacies.

## **4 IT DEVELOPMENT STRATEGIES AND PROCESSES**

Community pharmacy information technology (IT) systems' development and implementation require financial resources. Market areas are usually small in Europe because of small countries and language areas, even though there is variation from country to country. Resulting from the small markets, the limited financial resources challenge the development processes. That is why there should be investments in the long-term strategic planning of the IT systems in order to meet the needs and expectations of the users in community pharmacy practice. Poorly planned and implemented system slow down the work processes resulting their being expensive to use, and also establishing a medication safety risk for the patients. Important part in the strategic planning is to recognize the internal strengths and weaknesses of current IT systems compared with the needs of the community pharmacy IT systems.

Patient care services provided by community pharmacies as well as the IT systems supporting such services can be seen as innovations. That is why their planning, development and implementation benefit from theoretical models which examine the development and implementation process. In this Chapter two widely used models are described which are appropriate for strategic planning and systematic development of innovations based on needs.

### **4.1 SWOT analysis as a strategy development tool**

The theoretical background in the study III was a SWOT analysis which was used in evaluating the strategy to achieve the professional vision related to community pharmacy information technology supporting patient care services. SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis developed by Albert Humphrey is a tool for strategic planning and for helping decision making. It has been used widely in the business world, but also in health care IT evaluation and development (Gibis et al. 2001, Casebeer 1993). The SWOT analysis is an

assessment of objective data subjectively organized into four quadrants: Strengths, Weaknesses, Opportunities and Threats (Figure 10). The model structures the evaluation of an entity's current situation with its internal strengths and weaknesses contrasted to its external opportunities and threats.

	+	-
Internal	Strengths	Weaknesses
External	Opportunities	Threats

**Figure 10** *The four quadrants of the SWOT analysis by Humphrey.*

## 4.2 Diffusion of Innovations as a theoretical framework

The theoretical background in the study IV was the Rogers' described generation of innovations process (Rogers, 2003). Classical Roger's theory on Diffusion of Innovations has been used as a tool to guide generation of innovations in diverse industries since 1960's. In addition to guiding the actual innovation generation process, this theory helps to assess the readiness of a target population to adopt an innovation. According to Rogers (Rogers 2003), an innovation is a "*new idea, practice or object perceived by a person or unit*", and its diffusion occurs through channels and within a timeframe. Rogers indicates there are four main elements observed in the diffusion process of innovations which are: 1) The Innovation; 2) Communication channels; 3) Time; and 4) The social system. Individuals achieve an understanding of the innovation by creating and sharing information about it (Rogers 2003). Initially, the diffusion of innovation model was used to understand agricultural innovations and their adoption. Subsequently, it has been widely and

productively applied in many industries, including health care (Haider and Kreps 2004, Schommer et al. 2010).

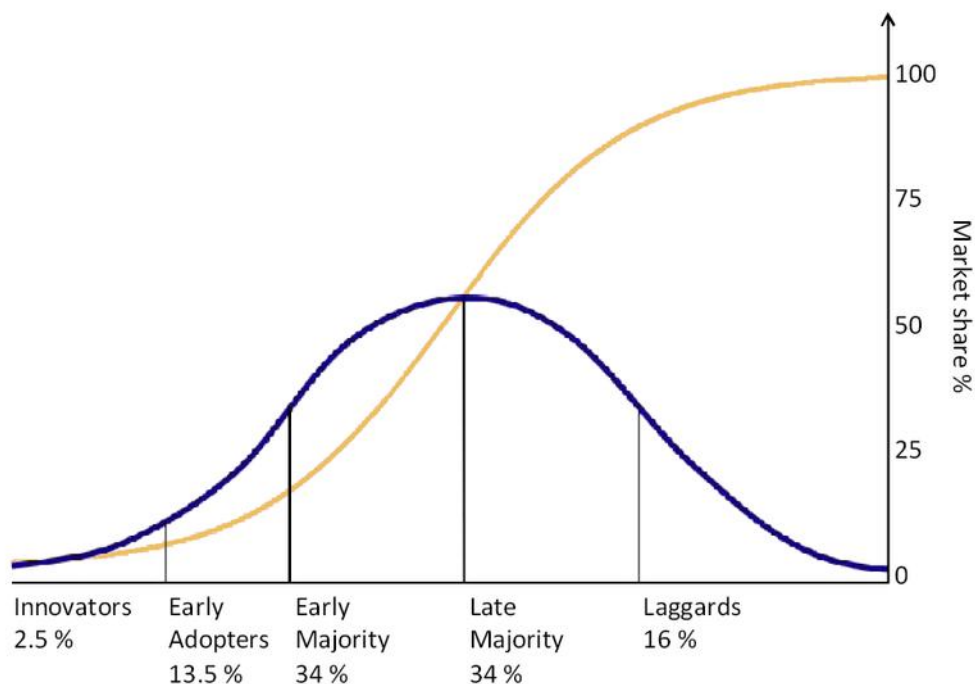
#### **4.2.1 Generation of Innovations**

Rogers' Diffusion of Innovations theory guided the study IV, particularly, the Generation of Innovations Process (Rogers, 2003, Chapter 4). According to Rogers, the generation of innovations process consists of six phases. The process usually begins with recognizing a problem or need (Phase 1). This activates research and development in order to create an innovation to solve the problem or to meet the need (Phase 2). Most innovations are created by scientific or evaluation research, which can be basic or applied research or both. The next phase (Phase 3) is the development phase which is often closely based on research putting a new idea in a form that is expected to meet the demands of potential adopters. Commercialization (Phase 4) converts the idea into a product or service, a role that is usually performed by private companies. The next important phase (Phase 5) consists of diffusion and adoption through communication channels. In the last phase (Phase 6) consequences of the innovation are observed and formally evaluated. These consequences can result from adoption, partial adoption or rejection of an innovation by individuals or social systems.

#### **4.2.2 Perceived innovativeness**

Rogers' taxonomy categorizes individuals and social systems according to their innovativeness and readiness to adopt innovations (Figure 11) (Rogers, 2003, Chapter 7). Innovators are the first adopters (2.5% of the population). They are venturesome, and able to cope with a high degree of uncertainty. Early Adopters (13.5% of the population) are role models for opinion leaders in their localities. Early Majority (34% of the population) frequently and deliberately interact, adopting new ideas just before the average system member. Late Majority (34% of the population) are sceptical and cautious, and adopts new ideas just after an

average system member. Laggards (16% of the population) are traditional: they are suspicious of innovations, and their point of reference is in the past. Rogers' theory and adopters curve (Figure 11) are based on observational data in an agricultural society gathered in the 1950s (Rogers 2003). This data was gathered by observing diffusion of farm innovations among farmers. Each adopter category has a different communication behavior that has been identified on the basis of extensive empirical research (Rogers 2003).



**Figure 11** Adoption categories in diffusion of innovations according to Rogers (2003).

There has been little research concerning community pharmacists' willingness to adopt innovations. The Rogers' theory diffusion of innovations has been examined with regard to the diffusion of pharmaceutical care in the Finnish community pharmacies (Saario 2005) and in the implementation of patient oriented activities in Dutch community pharmacies (Pronk et al. 2002) to assess the process of adoption of patient care in daily practice in community pharmacies. Both of these national studies evaluated diffusion of patient care in community pharmacies by examining the adoption of patient-oriented services and assessing pharmacists' receptivity to these innovations. In Finland the national TIPPA-project (2000–

2003) implemented patient care in pharmacies (TIPPA Project 2002). As a result of this project, a higher degree of utilizing the technology supporting patient counseling was reported (TIPPA Project 2005).



## **5 CONTEXT OF THE STUDY**

### **5.1 Finnish community pharmacy system**

Finland has a system of independently owned and professionally oriented community pharmacies that has been proactively developed by the profession (The Association of Finnish Pharmacies 1997, Puumalainen 2005, Ministry of Social Affairs and Health 2007, Ministry of Social Affairs and Health 2011). The community pharmacy system is highly regulated to ensure its commitment to the nation's health policy goals (Mossialos et al. 2008, Väänänen 2008, Ministry of Social Affairs and Health 2011). There are no chain pharmacies in Finland. In addition to the 600 independently owned pharmacies there are two university pharmacies owned by the University of Helsinki and the University of Eastern Finland. They have a special legal responsibility to pharmacy education and research (Medicines Act 395/1987).

By law, community pharmacies' main functions are to ensure an adequate supply of prescription and nonprescription medicines, and their safe, appropriate and economical use for the general public (Medicines Act 395/1987). The number of pharmacies is regulated by a licensing system which is administered by the Finnish Medicines Agency which is part of the Ministry of Social Affairs and Health. The license permits the pharmacy owner who needs to be a pharmacist with a Master's degree to run the main pharmacy, and up to three subsidiary outlets. Pharmacy owners have both professional and financial responsibility for their pharmacy. The average pharmacy employs 11 staff members of whom about 7 have a pharmacy degree (a B.Sc. or a M.Sc. degree, B.Sc. pharmacists are mostly responsible for dispensing and related services, e.g., medication counseling). An average community pharmacy dispenses 71,500 prescriptions per year, and the average gross revenue is approximately 3.3 million Euros (The Association of Finnish Pharmacies 2009). The gross revenue is derived primarily from prescription and non-prescription medication sales (approximately 89% of total sales).

During the last decade, there have been several remarkable changes that have influenced economy and service provision by Finnish community pharmacies, some of these changes are still under way (Ministry of Social Affairs and Health 2011). The changes that have influenced most the economy of Finnish pharmacies are generic substitution, implemented in 2003, and a reference price system, implemented in 2009 (Medicines Act 395/1987). They both have been effective methods for cutting drug costs paid by the society through public social insurance which covers the entire Finnish population. At the same time they have reduced pharmacy owners' incentives and motivation to invest in professional service development and provision.

Because of the statement of the European Court of Justice (ECJ) has given permission to purchase over the counter (OTC) medicines from internet pharmacies (The European Court of Justice 2004), in Finland national regulations and instructions have been prepared to allow the internet sale of medicinal products (Ministry of Social Affairs and Health 2007). The law went into effect in 2011(Law on changing Medicines Act 1112/2010), but only few Finnish community pharmacies have been interested in the possibility to sell OTC medicines from internet pharmacies.

The first steps towards patient care services in Finnish community pharmacies were taken in the beginning of 1980s as community pharmacists' involvement in patient counseling was mandated by law in 1983 (Medicines Act 395/1987). Five years later the National Agency for Medicines conducted a survey on public's expectations towards community pharmacy services in Finland. The survey showed most unmet needs for receipt of information about, both prescription and non-prescription medicines. The 1997 launch of a professional strategy for community pharmacy marked a milestone in the development of new roles for them (The Association of Finnish Pharmacies 1997). Since then, the development of patient care services has been more coordinated, and more strongly integrated into the local primary health care services (The Association of Finnish Pharmacies 1997).

The most systematic effort to improve patient counseling services in Finnish community pharmacies was the TIPPA Project started in 2000 (Puumalainen 2005, Kansanaho 2006). According to follow-up studies using a pseudo-customer method in 2000-2003, the quality and amount of counseling slightly improved (Puumalainen 2005). There is no evidence to show the later development in performance. What is known is that community pharmacists' importance as a medicines information source has increased. In 2007, for the first time, community pharmacists were mentioned by consumers as a source of medicines information more often (87%) than physicians (82%) (Keski-Hallila 2007).

Since the 1990s, the pharmacy profession, with the strong support and commitment of the owners' association (The Association of Finnish Pharmacies, AFP), has been actively promoting new roles and services. Three disease management programs; asthma, diabetes and heart disease programs, have been strategically prioritized because they cause major public health concern and the medication has a crucial role in outpatient care. The core of the pharmacy program is that each community pharmacy has specialized pharmacists to promote community pharmacies' contributions to national public health programs (The Association of Finnish Pharmacies 2007).

Recently service development in Finnish community pharmacies has primarily focused on managing medications for a continuously increasing number of geriatric patients in primary care. This is in line with priorities of Ministry of Social Affairs and Health (Kivelä 2006). The pharmacy services recommended by the authorities (Ministry of Social Affairs and Health 2007, Ministry of Social Affairs and Health 2011) include comprehensive medication reviews (Leikola et al. 2009) and automated dose dispensing. By 2009 about 100 pharmacists were accredited after one and half year training to conduct comprehensive medication reviews in Finland. These services are quite routinely available all over the country, although their effectiveness and value for improving patient outcomes are still under evaluation.

In the Finnish community pharmacies the current fee policy is based on dispensing prescriptions instead of paying for monitoring and follow-up services to assure

optimum therapeutic outcomes of the medications. This fee policy is a substantial barrier to the provision of professional services, even if there is a will in society to have access to those services (Kivelä 2006, Ministry of Social Affairs and Health 2011). It seems to be extremely challenging to change the public and private pricing and reimbursement policies. A shift in the economic policy is possible, but pharmacists need to be proactive to demonstrate the added value of those changes.

## **5.2 History of the IT development Finnish community pharmacies**

The milestones in the adoption of IT in Finnish community pharmacies are summarized in Table 7. The first IT systems were introduced into Finnish community pharmacies in the beginning of the 1980s. The first systems covered computer-aided dispensing, point-of-sale processing, logistics and later also salary calculation. In the beginning of the 1990's, the first features supporting patient care services were focused on patient information, such as leaflets and touch screen information systems. IT systems Linnea® and Salix® still are the primary IT systems used in the Finnish community pharmacies.

In 2000, a health information portal called Terveystieto for physicians and pharmacists was launched. It included professional guidelines. Two years later, a pharmacy data network Apteekkiverkko was launched for community pharmacies in order to provide safe access to professional intranet. The first pilot of electronic prescribing was in 2004, and in 2007 a law requiring electronic prescribing adoption during the next four years was enacted. The historical development of the community pharmacy has been described with more details by Hynninen (2007).

**Table 7** *Milestones in adopting IT systems in Finnish community pharmacies with special reference to patient care services (partially based on Hynninen 2007).*

<b>Year of implementation</b>	<b>Software</b>
1980	The first community pharmacy IT program for processing prescriptions
1986	The first computerized drug information system for prescription medicines (patient leaflets)
1990	Leaflet information system of the prescription medicines for the patient
1991	Self-service drug information kiosk in the pharmacy with touch screen
1991	The basis programs for the current community pharmacy IT systems (Linnea® and Salix®)
1997	Adopting electronic Martindale
1997	The first drug-drug interaction-program (DrugReax®)
1998	Electronic national pharmaceutical reference book
2000	Health information portal for physicians and pharmacists
2000	A checklist-type drug information database to support medication counseling
2002	Pharmacy data network, national intranet for pharmacies maintained by AFP
2002	Interaction programs based on SFINX-database
2003	Demonstration program for guiding administration technique of asthma medicines (AFP)
2004	Electronic prescribing (First Pilot)
2006	Demonstration program for guiding administration technique of insulin (AFP)
2007	Enact of the law concerning the electronic prescribing adoption during the next four years
2008	New pharmacy IT system MAXX® launched
2010	New pharmacy IT system pd3® launched (Pilot use)
2011	The law allowed internet pharmacies sell otc-medicines
2011	Program for comprehensive medication review in pilot use (Prodosis®)

## **5.3 Current information technology in Finnish community pharmacies**

### **5.3.1 Community pharmacy information technology systems**

The owner's association, through a national coordination group, coordinates IT systems' development for Finnish community pharmacies. The national coordination group consists both of owners and of pharmacists from the Association of Finnish Pharmacies (AFP) who have IT expertise. The coordination group's functions are to oversee and to coordinate priority IT projects for community pharmacies. The coordination group has access to external experts when needed to get a broader view of the IT issues facing community pharmacy. The coordination group has members from both IT system users.

There are two companies in Finland developing and producing two quite parallel IT systems for community pharmacies. Both companies are also developing their new systems. The Association of Finnish Pharmacies (AFP) owns a nonprofit data technology company Pharmadata which develops, distributes and provides technical support for the Salix® IT system. It is used by 58% of all independent community pharmacies in Finland. Linnea® is distributed by a private company called Receptum. New generation of community pharmacy IT systems were launched in 2008, when Receptum launched an IT system called MAXX®. Pharmadata launched a system called pd3® in 2010 in pilot use.

Both currently used IT systems Salix® and Linnea® were developed in the 1990s, but they have had new legally required features, e.g., the generics processing updates continuously. Much criticism of these IT systems has been presented concerning their functionalities (Teräsalmi 2006, Westerling et al. 2007, Westerling et al. 2010). The systems are focused on the technical processes of dispensing and logistics (stock management), while the support for patient care and cognitive services are not well supported. The system also provides the pharmacist a checklist of drug information to assist them with medication counseling. The current community pharmacy IT software does not contain

modules for medication management as a standard, but separate modul (Proкуро®) is sold to cover these features, such as drug-drug interactions screening with classification of the clinical significance, patient's medical history, allergy notes etc. Comprehensive medication review service is still not supported by IT, but there is a new program in pilot use to cover this (Prodozis®). The work of the pharmacist has changed to more patient-focused but the IT systems do not fulfil the requirements of the current practice. When IT systems supporting the dispensing and logistics are not up to date it is more difficult for the pharmacists to carry out their expanded professional role.

In a typical Finnish community pharmacy there are several IT workstations (Figure 12). One-third of Finnish community pharmacies maintained a working Web site in 2005 and 94% of those provided email medication counseling services (Pohjanoksa-Mäntylä et al. 2008), but the actual use of email communication has not been documented.



**Figure 12** *A typical Finnish community pharmacy.*

### **5.3.2 Electronic prescribing**

In Finland the law requiring electronic prescribing adoption during the next four years (2007-2011) was enacted in 1.4.2007 (61/2007). This original timetable proved to be impossible and the postponements to the new system were assessed in a national distribution plan for community pharmacies. The new timetable required electronic prescribing adoption for community pharmacies by the date 1.4.2012 (61/2007, 28§), for public health care 1.4.2013 and for private sector 1.4.2014. Electronic prescribing will set new IT requirements in the near future for all health care providers. In Finland the electronic prescribing will be implemented as a centralized database, which is developed and maintained by the reimbursement office called Kela. The health care professionals will use personal identification cards and codes in order to access the database. The patient is able to choose the pharmacy and all the medical information will be accessed in the database with the consent of the patient. There are strict rules in EU governing privacy and data protection. All health care professionals will be required to obey the privacy and data protection requirements.

### **5.3.3 Extranet applications**

The AFP pharmacy data network called Apteekkiverkko is used by 81% of community pharmacies. This network facilitates the distribution of information and provides the means to transmit electronic prescriptions. Since 2003, the AFP has maintained a national pharmacy extranet portal called Salkku first for the members of AFP but currently for all the community pharmacies. Its main task is to provide and share information for community pharmacists including professional information, law database and discussion forums. It also provides access to a national health information portal (Terveystieto), which was primarily designed for physicians and maintained by the Finnish Medical Society. Terveystieto portal contains a database of national evidence based therapeutic guidelines, a chronic illness database, medical news and electronic journals. Pharmacists also have access to this portal. However, patient records are not



presently shared between physicians and community pharmacies. Sfinx is a drug-drug interaction database developed for clinical decision support systems which has proved to be valuable tool for prescribing and dispensing (Böttiger et al. 2008). Other provided databases are the electronic journals database, chronic illness databases, e.g. kidney dysfunction or diabetes, and pregnancy and breast feeding databases.

In Finland suppliers have own extranet portals for community pharmacies (TWD, Tamro; OriolaPro, Oriola). Those portals allow access to detailed information related to logistics and current information about the products and online connections. Also chain pharmacies can have their own extranets for the member pharmacies in order to manage marketing and logistics.

#### **5.3.4 Community pharmacy intranet**

In the Finnish community pharmacies private intranets are still rare. The first published information considering community pharmacy intranet appeared in 2004 (Jansen). This early intranet application included forms, scanned information from the pharmaceutical companies, guidelines and regulations as well as the most important links to the internet. Since then, a few more pharmacies have adopted the use of private intranet and the contents of these sites have begun to include more information. Currently, the most advanced community pharmacy intranets also include e.g. work flow management, education material, rosters and compounding information. The content of the intranet could be developed further. Electronic forms, reports and more sophisticated tools for work flow management and staff communication and information are needed. An example of the contents of a community pharmacy intranet is illustrated in the Figure 13.



**Figure 13** *An example of a community pharmacy intranet's contents.*

## **6 CONCLUSION OF THE LITERATURE REVIEW**

The pharmaceutical care is guiding the practice of the pharmacy profession globally. The literature review confirms that community pharmacists are seeking a role that encompasses both dispensing drugs and providing pharmaceutical services. According to this view, pharmacists believe they can and should do more for patient care than solely dispensing medications: they should also take responsibility for patient monitoring to achieve optimal pharmacotherapy outcomes. To do this has increased demands new requirements on community pharmacies' access to IT and the information IT can make accessible. However, the lack of IT solutions for cognitive service support limits the adoption of them. Thus, developing IT solutions is essential to realizing pharmacy's strategic goals of providing patient care and clinical services. The importance of IT has been noted previously although little research has focused on it from a strategic approach. It will be important to understand the community pharmacy practitioners' requirements for IT systems and to explore visions and strategic views on IT development needs in relation to service provided in community pharmacies.

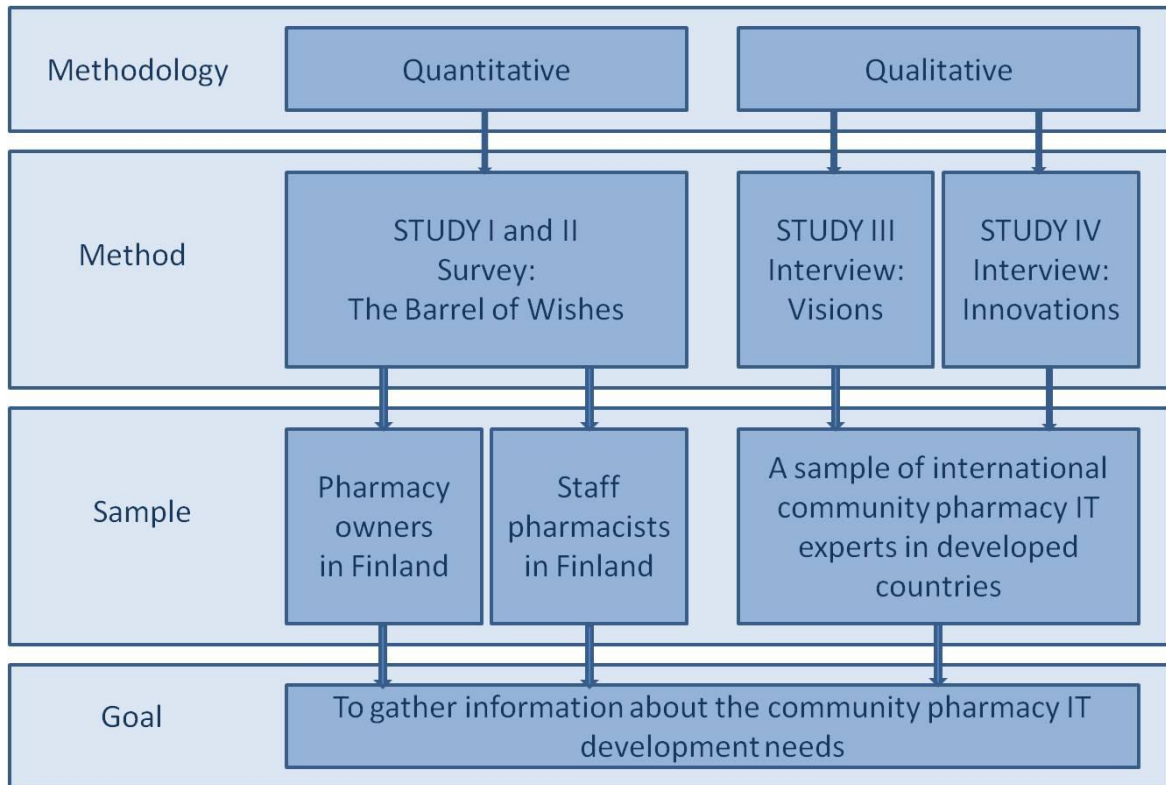
Change and IT innovations development processes might be accelerated by identifying internal and external strategic factors influencing it and by studying the theories which could contribute to making the innovation and development process work better. No previous study has assessed the entire process of innovation generation in community pharmacies. It would also be important to identify IT innovations that facilitate patient care services in community pharmacies, to evaluate their development process, and to assess community pharmacists' readiness to adopt them. The goal should be to enhance the community pharmacies' professional responsibility in the society.

## 7 AIMS OF THE STUDY

The outline of the study flow is presented in the Figure 14.

The specific objectives of the study were:

1. To assess the independent Finnish community pharmacy owners' and the staff pharmacists' views and needs
  - a. to assess independent pharmacy owners' views on the prioritized content and structure of the next generation of community pharmacy IT systems, and to explore which they made priorities for inclusion in the next Finnish community pharmacy IT system (I)
  - b. to explore, whether the needs and attitudes of the pharmacy owners and staff pharmacists differ(II)
  - c. to assess community pharmacists' readiness to adopt innovations (IV)
  
2. To explore international experts' views and experiences with IT development needs and processes in relation to providing patient care services in community pharmacies
  - a. to explore international experts' visions and strategic views on IT development needs in relation to service provision in community pharmacies (III)
  - b. to identify IT innovations that facilitate patient care services in community pharmacies (IV)
  - c. to evaluate the IT innovations' development processes in countries with advanced community pharmacy systems (IV)
  - d. to explore, what can we learn from other countries and development processes concerning pharmacy IT (IV)



**Figure 14** Outline of the study flow.

## 8 MATERIALS AND METHODS

A triangulation process was used in this study by combining quantitative and qualitative methods (Figure 14, Table 8). The chosen methods were a survey and an interview.

Survey technique as a method has been widely used in pharmacy practice research (Smith 2002). In this study, a survey was conducted in two phases: first Finnish community pharmacy owners and the second community pharmacy staff pharmacists. A survey method was chosen which obtains knowledge from large number of practitioners in a short time. The survey was conducted while the planning process of the new information technology system for the community pharmacies had begun in Finland. The survey instrument included features related to the patient counseling, cognitive service concepts, pharmacy's internal processes as well as logistics in order to get a complete picture of the whole system in the community pharmacy, including the view of practitioners'.

Interviews are an example of qualitative studies which are used for gaining understanding of how and why people view and interpret phenomena (Smith 2002). The researcher is able to observe and ask questions in order to gather deeper understanding of phenomena of interest in the context in which they occur. The aim of the interview conducted for this study was to explore international experts' visions and strategic views on IT development needs in relation to services provided in community pharmacies. Questions on the development process of community pharmacy IT systems in different countries were also included in the interviews. Subjects of interest in this area were the development processes in the framework of SWOT analysis and Rogers' Generation of Innovations theories.

**Table 8** *Methods used in the original publications (I-IV).*

<b>STUDY</b>	<b>METHODS</b>	<b>PARTICIPANTS</b>	<b>ANALYSIS</b>
<b>I</b>	Semi-structured postal survey in 2006	All Finnish independent pharmacy owners (n=580), response rate 53%	Quantitative analysis; descriptive statistics (frequencies, percentages)
<b>II</b>	Semi-structured postal survey in 2006  Semi-structured internet survey in 2007	All Finnish independent pharmacy owners (n=580) response rate 53%  A representative sample of staff pharmacists (M.Sc. and B.Sc.) working in Finnish independent community pharmacies (n=1709), response rate 22%	Quantitative analysis; descriptive statistics (frequencies, percentages)
<b>III</b>	Interview study in 2007-2008	A purposive sample of international experts (n=14) familiar with the philosophy of pharmaceutical care and IT development	Qualitative analysis; Thematic content analysis, constant comparative method, theoretical framework
<b>IV</b>	Interview study in 2007-2008  Semi-structured postal survey in 2006  Semi-structured internet survey in 2007	A purposive sample of international experts (n=14) familiar with the philosophy of pharmaceutical care and IT development  All Finnish independent pharmacy owners (n=580), response rate 53%  A representative sample of staff pharmacists (M.Sc. and B.Sc.) working in Finnish independent community pharmacies (n=1709), response rate 22%	Qualitative analysis; Thematic content analysis, constant comparative method, theoretical framework  Quantitative analysis; descriptive statistics (frequencies, percentages)

## **8.1 Quantitative study (I-II)**

### **8.1.1 Study design**

The target population of the studies were the pharmacists working in the Finnish community pharmacies. The data of the first study were collected by using a mail survey that was sent to all independent pharmacy owners in Finland (n=580), in December 2006. Surveys were mailed by the Association of Finnish Pharmacies (AFP). After two electronic reminders sent through the national pharmacy intranet during a three week period, the study was closed. The second study was targeted to a representative sample of community pharmacists with Bachelor's (B.Sc.) and Master's (M.Sc.) degree obtained from the members of the Finnish Pharmacists' Association and the Finnish Pharmacists' Society. The survey study II was targeted at the pharmacists who were known to be employed in the community pharmacies. The data were collected by electronic online survey through the University of Helsinki. Invitation to participate in the study was send to all 2129 community pharmacists having a registered e-mail address in January 2007. After one reminder by e-mail to the 1709 pharmacists, who actually had a valid e-mail address, the study was closed. In both survey studies the participants were asked to respond anonymously.

### **8.1.2 Questionnaire**

The survey instrument (Study I and II) contained 126 structured features in two parts, one assessed experience with an existing IT system, and the other exploring features that might be included in a future IT system. This research report focuses the features of a future system (Appendix 1). The future IT system's list of features was derived from existing systems' features as well as potential new features, which were were identified from researchers' own professional experience and via conducting a review of the pharmacy practice literature concerning patient care services (Hepler and Strand 1990, WHO 2003,



van Mil et al. 2004a). Several additional items, such as “Online purchase of non-prescription items” and “Hospital discharge summary”, were added to the survey instrument after discussion with the IT Expert Group of the AFP and pharmacy practice researchers.

The list of features was grouped by themes into five categories: drug information and patient counseling (11 features); medication safety (10); inter-professional collaboration (10); pharmaceutical services (27) and the pharmacy’s internal processes (31). Patient counseling and inter-professional collaboration were based on the community pharmacists’ access to information, shared data and communication between health care providers. When the study was conducted in 2006, some of the drug information and patient counseling functions were available in software, but they were not systematically used in Finnish community pharmacies. Interprofessional collaboration between the physician and pharmacist has been seen as a solution to reduce drug morbidity and mortality (Sweeney 2002). Also the collaboration between different professions is needed to support service concepts, like comprehensive medication review (Chen et al. 1999). The questions about medication safety were based on classifications of drug-related problems (van Mil et al. 2004a, Strand et al. 1990, Schaefer 2002). These problems included documentation of drug-related problems, drug-drug interactions and adverse drug reactions. Documentation of prescribing and dispensing errors was also included. The list of pharmacy’s internal processes was from analysis of the management processes needed in community pharmacies. The pharmaceutical services list was derived from professional guidelines and the AFP’s pharmaceutical service visions (The Association of Finnish Pharmacies 1997).

The perceived value of each of these features was scored using five-point Likert scale. The survey instrument was pilot tested for face validity and further refined based on the comments of ten pharmacy practitioners. The subjective innovativeness of the respondents was researched by the instrument of innovativeness (Saario 2005, based on the theory of Rogers 2003, Appendix 2).

These results will be reported in the Chapter 9.3 Perception of Finnish community pharmacy practitioner' innovativeness (I-II).

### **8.1.3 Data collection**

For study I responses were received from 308 pharmacy owners (response rate = 53%). This response rate corresponds to that typically obtained in surveys targeted to Finnish community pharmacists (Kansanaho et al. 2004, Kansanaho et al. 2005, Puumalainen et al. 2005, Teinilä et al. 2008). The gender, age and geographical distribution of respondents were similar to those of the target population (Table 9).

For study II responses were received from 373 community pharmacists (response rate 22%). Of these, 34% were M.Sc. (n=128), 63% were B.Sc. (n=234) and 3% were students (n=11). The respondents represented 8% of the pharmaceutical staff members of the Finnish community pharmacies. Also in this study, the gender of the participants followed the gender distribution of the Finnish community pharmacists (Table 9). The pharmacists with the M.Sc. degree were more active respondents than B.Sc. pharmacists. The pharmacists aged 20-39 were more active respondents than the older pharmacists compared to the target population. The pharmacists working in a large pharmacy (annual prescription volume over 60 000) were more active to respond to the survey than the pharmacists in smaller pharmacies.

### **8.1.4 Analyses**

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 14.0 (Chicago, IL). Incomplete responses were included in the analysis and proportional data were presented in terms of the number of respondents who answered a particular question. Descriptive statistics were calculated and Pearson's chi-square tests were performed to examine which background variables were associated with pharmacy owners' opinions. Independent variables

were pharmacy owners' gender and age, and the size of the pharmacy in terms of the annual prescription volume. Large pharmacies were defined as those that dispense more than the average of 60,000 prescriptions per year. In the analyses,  $p < 0.05$  was set as the level of significance. Figures were produced by using Microsoft Excel® (Microsoft Corporation 2007).

**Table 9** Characteristics of the respondents (staff pharmacists, n=373; pharmacy owners, n=308) and the study populations (staff pharmacists, n=4498; pharmacy owners, n=580) (n.a. means “not available”).

	Pharmacy owners				Staff pharmacists (M.Sc. and B.Sc.)			
	Respondents		Target population		Respondents		Target population	
	%	n	%	n	%	n	%	n <sup>1)</sup>
<i>Degree</i>								
B.Sc. (Pharm.)					65	234	81	3674
M.Sc. (Pharm.)					35	128	19	824
<i>Gender</i>								
Female	70	199	70	420	91	338	93	3426
Male	30	87	30	184	9	35	7	255
<i>Age (years)</i>								
20-29	0	0	0	0	28	105	n.a.	n.a.
30-39	0	0	0	0	40	149	n.a.	n.a.
40-49	18	56	18	108	21	78	n.a.	n.a.
50-59	48	146	47	281	9	34	n.a.	n.a.
60 years and over	33	101	36	215	2	7	n.a.	n.a.
<i>Annual prescription volume</i>								
< 40 000	31	96	51	387	21	77	9	395
40 000 – 80 000	46	140	30	231	28	104	36	1520
> 80 000	23	69	19	148	51	192	55	2372
<i>Geographic location of pharmacy (provinces)</i>								
Southern Finland	37	111	34	207	44	161	42	1880
Eastern Finland	16	48	13	81	15	54	12	523
Western Finland	34	103	39	239	32	119	35	1534
Oulu	10	31	9	54	7	25	8	375
Lapland	4	11	4	22	3	10	3	138

1) Lääkeala numeroina 2006, [http://www.laaketietokeskus.fi/tiedostot/TASKUMUISTIO040406\\_\(ID\\_1102\).pdf](http://www.laaketietokeskus.fi/tiedostot/TASKUMUISTIO040406_(ID_1102).pdf)

2) Finnish Pharmacists's Association 13.4.2007, Finnish Pharmacists' Society 21.5.2007

3) Apteekit ja apteekkarit 2007, Tamro

4) Association of Finnish Pharmacists 25.1.2007 (M.Sc. and B.Sc), 1.1.2007 (Owners)

## **8.2 Qualitative study (III-IV)**

### **8.2.1 Study design**

Qualitative semi-structured theme interviews were conducted with a purposive sample of international experts to explore the visions of the participants in relation to community pharmacy services and implementation of IT to support service providing. This method was selected because it allowed the interviewer to re-word, re-order and clarify each question based on the responses of the participants (Tong et al. 2007). The study was designed in accordance with the RATS guidelines for conducting and reviewing qualitative research (Clark 2003).

The first part of the interview was designed to facilitate a SWOT (strengths, weaknesses, opportunities, threats) analysis discussed in more detailed way in Chapter 4.1. The second part of the interview was designed to identify IT innovations in community pharmacies and to examine their development process from an international perspective. Rogers' Diffusion of Innovations theory guided the research, particularly features concerning the Generation of Innovations (Rogers, 2003). This theory has been discussed in Chapter 4.2.

### **8.2.2 Study participants**

A purposive sampling strategy was employed to seek perspectives from a broad range of participants with special expertise. The inclusion criteria were that the experts: 1) were familiar with pharmaceutical care as a philosophy and its implementation in community pharmacies, and 2) have been involved in the development of community pharmacy IT systems. The participants were selected from eight developed countries with advanced community pharmacy IT systems (Table 10). The final sample size was determined by the point when data saturation occurred (when no new categories, themes or explanations emerged).

Potential participants were informed about the study and invited to participate by e-mail. All participants provided written informed consent to participate in the study.

**Table 10** *Study participants (n=14).*

<b>Employment status</b>		<b>n</b>
	University professor	3
	Researcher	2
	Pharmacy owner	3
	Manager in a national association	2
	IT expert in a national association	2
	Manager in a private company	1
	Government policy analyst specialized in medication management	1
<b>Country</b>		
	Australia	2
	Finland	4
	The Netherlands	2
	Portugal	1
	Sweden	1
	Switzerland	1
	The United Kingdom	1
	The United States	2
<b>Gender</b>		
	Females	7
	Males	7
<b>Language</b>		
	Native English	5
	Other language	9

### 8.2.3 Interview guide and data collection

The interviews were conducted with the aid of a semi-structured interview guide (Appendix 3). The interview guide was used to stimulate open discussion on pre-determined themes (Smith 2002), which related to the experts' visions for community pharmacy services and IT development. The interview guide was pre-tested for face-validity by conducting one pilot interview. No modifications were deemed necessary. Data from the pilot interview were not included in the final analyses. Although the informants were strategically selected, most of the

interviews (n=9) took place at the World Congress of Pharmacy and Pharmaceutical Sciences in 2007-2008, because it was a convenient way to meet the selected experts in person for an interview. Interviews with Finnish experts were conducted in Finland in 2007-2008. One of the international experts was interviewed by e-mail. The interviews lasted between 22 to 73 minutes each. All the interviews were conducted in English except for the interviews with the Finnish participants, which were conducted in Finnish.

#### **8.2.4 Analyses and coding framework**

With the written consent of the participants, all the interviews were digitally audio-taped and transcribed verbatim. Interviews with the Finnish participants were translated into English. Each transcript was repeatedly read by a researcher while listening to the audiotapes. A constant comparison approach was used to identify emerging patterns and key themes (Boeije 2002, Silverman 2000). Single words, sentences or groups of sentences related to a particular theme were coded by one researcher and verified by another researcher.

The themes from the data were subjectively organized into following areas: visions about patient care services; visions on IT; concerns on patient care services; and concerns on IT. By using SWOT analysis the themes from the data were subjectively organized into four quadrants: internal strengths and weaknesses, external opportunities and threats. Sub-themes that emerged under these quadrants were also coded. The data from the second part of the interview were subjectively organized based on the Rogers' (2003) theoretical framework of the Generation of Innovations Process into the six phases (Problem or Need; Research; Development; Commercialization; Diffusion and Adoption; Consequences). Any differences of interpretation were resolved through discussion with the other researchers in the group. Once key themes were identified the transcripts were purposively re-read to detect any discussion that deviated from these themes. When interpreting the data the

researchers remained aware of any potential biases, including their professional backgrounds (all were pharmacists).

### **8.2.3 STUDY III Visions for community pharmacy IT systems and patient care**

The first part of the interview was designed to explore visions concerning patient care and applying IT to support providing cognitive services in the community pharmacy practice and strategic views by facilitating a SWOT (strengths, weaknesses, opportunities, threats) analysis (Appendix 3, Part I). The experts' interviewed were asked to identify future patient care and community pharmacy service needs, as well as the future of the development of community pharmacy IT systems. The question order was planned so that the future vision related questions were asked first and the questions related to the current situation were asked after that. The reason for this sequence is that the experts were asked to give their assessments without priming due to thinking about current systems' capabilities. The survey respondents were asked to identify opportunities and threats for their vision of the future to be realized. They were also queried about the strengths and weaknesses of the current IT systems.

### **8.2.4 STUDY IV Generation of innovations in community pharmacy IT**

The second part of the interview was focused on the generation of innovations in community pharmacy IT. The semi-structured interview guide was derived from Rogers' theory (Rogers, 2003) including topic headings and open-ended questions (Appendix 3, Part II). The interview guide was used to stimulate open discussion on pre-determined themes (Smith 2002), which related to the experts' opinions on IT innovations and their diffusion process into the community pharmacy practise. First, the respondents were asked to name the key innovations in their countries' community pharmacy IT systems specifically related to medication management and patient care services. Following the

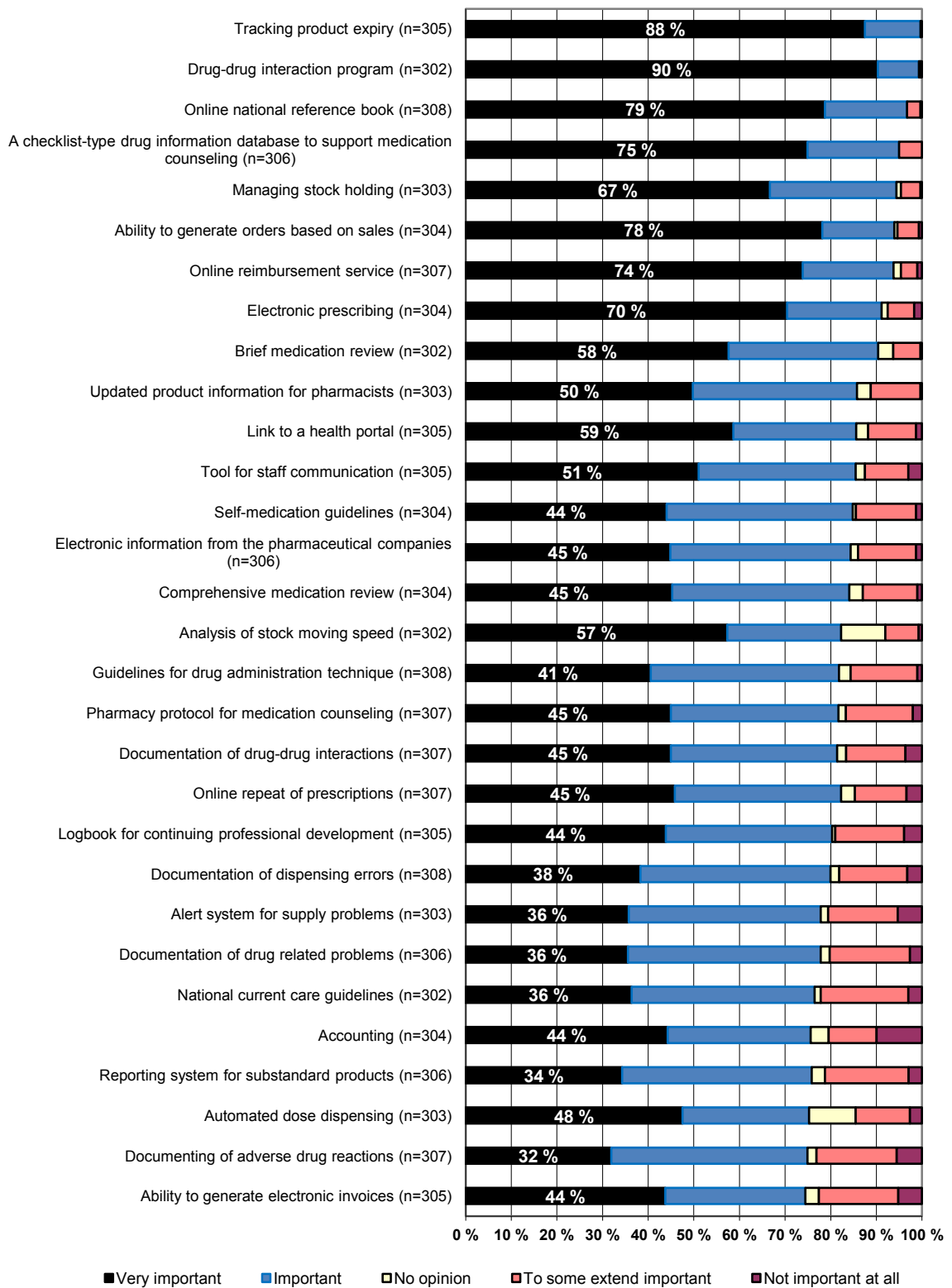


Generation of Innovations Process, they were asked to discuss the phases of the process with regard to particular IT innovations they identified. Finally, the experts were asked about their recommendations for national community pharmacy IT development processes.

## 9 RESULTS

### 9.1 Priorities for IT system among Finnish community pharmacy owners (I)

A total of 308 responses were received from Finnish community pharmacy owners (response rate 53%). The gender, age and geographical distribution of respondents were similar to those of the target population (Table 9). According to the respondents, features related to stock management, patient counseling and facilitating cognitive pharmaceutical services were prioritized for inclusion in a new IT system (Figure 15). Of these functionalities, tracking product expiration (100% of respondents regarded it as very or quite important) and drug-drug interaction (DDI) tracking software programs (99%) were rated highest, followed by the online national reference book (97%) and drug information database to support patient counseling (95%). Of the new IT services that were in a pilot testing at the time of the survey, the brief medication review and the comprehensive medication review (CMR) were considered very or quite important by 91% and 84% of the respondents, respectively. Establishing an online connectivity between the community pharmacy and partner providers (e.g., physicians and insurance companies) and supporting electronic prescribing were perceived as important. The lowest priorities were for features related to monitoring the laboratory test results (18% regarded it as very or quite important); checking patients' medication cabinets (22%); and medication monitoring and vaccination services (25%).



**Figure 15** The top 30 features prioritized by the pharmacy owners.

The respondents' gender was the variable most commonly associated with respondents' priorities for new IT system. Female pharmacy owners gave a higher priority to drug information and patient counseling, pharmaceutical services and the pharmacy's internal processes than did their male colleagues. The influence of the respondent's age was seen in the preference ratings for drug information and patient counseling, inter-professional collaboration and pharmaceutical services. There was a tendency for those aged 50-59 years to prefer these functions and to see them as more important than did either younger or older owners. The size of the pharmacy had a minor association with respondents' priorities. Owners of large pharmacies (over 60,000 prescriptions per year) identified some items with regard to drug information, patient counseling categories, and from internal processes of the pharmacy as being more important than did the owners of the small pharmacies. Medication safety was an area of agreement where respondents had similar, high opinions on the importance of these IT tools regardless of their gender, age and size of the pharmacy.

## **9.2 Opinion comparison concerning IT system in Finnish community pharmacies (II)**

A total of 308 responses were received from the pharmacy owners (response rate 53%) and 373 responses from the staff pharmacists (response rate 22%). Of these, 34% had a M.Sc. degree (n=128), 63% had a B.Sc. degree (n=234) and 3% were pharmacy students (n=11). The staff pharmacists with the M.Sc. degree were more active responders than B.Sc. pharmacists (Table 9). Also the owners and pharmacists working in large pharmacies were more active responders.

More than half (52%) of the potential features for future IT system listed in the survey questionnaire (Tables 11 and 12) resulted in different responses from the community pharmacy managers and staff pharmacists. The features related to the pharmacy's internal processes, such as financial management, sales and

marketing management and stock, were ranked significantly higher by the owners and managers, while the personnel prioritized the features supporting pharmaceutical service provision and personnel management. Managers and personnel had similar opinions on the importance of features supporting drug information, patient counseling, medication safety and interprofessional collaboration. Owners and managers gave the highest ranking for features related to stock control (tracking product expiration, ability to generate orders based on sales, and managing stock holding), electronic prescribing and online reimbursement service (Table 11). Correspondingly, the staff pharmacists working in customer service ranked online access to national reference book, documentation of medication misuse, disease management for asthma and program to support work orientation the highest (Table 12).

**Table 11** *The features prioritized significantly higher by the managers (owners, n=234 and M.Sc., n=128) for the community pharmacy IT system in Finland (p-values of Likert scale, Chi square test). The percentual results are presented as a combination of Very important and Quite important responses.*

	Managers B.Sc.		
	%	%	p
<b>Drug information and patient counselling (none of 11 items)</b>			
<b>Medication safety (1 of 10 items)</b>			
Reporting the substandard products to the wholesaler	77	61	<0.001
<b>Interprofessional collaboration (2 of 10 items)</b>			
Online reimbursement service	92	81	<0.001
Online contacts with the insurance companies	63	49	0.002
<b>Pharmaceutical services (8 of 27 items)</b>			
ePrescribing	92	85	<0.001
Methadone program	34	30	0.001
Automated dose dispensing	72	50	<0.001
Online drug order from customer to the pharmacy	50	38	<0.001
Patient's medication cost report	55	46	<0.001
Product reorder alert based on customer	69	56	0.002
Remindments of medication by e-mail or text message	48	35	0.004
Online purchase of non-prescription items	29	9	<0.001
<b>Pharmacy's internal processes (20 of 31 items)</b>			
<b><i>Financial management (7 of 7 items)</i></b>			
Accounting	76	30	<0.001
Budgeting	63	24	<0.001
Salary calculations	72	38	<0.001
Credit control	56	23	<0.001
Short-time financial planning	47	17	<0.001
Ability to generate electronic invoices	77	30	<0.001
Financial forecasts	55	20	<0.001
<b><i>Personnel (none of 10 items)</i></b>			
<b><i>Sales and marketing management (8 of 8 items)</i></b>			
Space management	68	63	<0.001
Marketing	70	65	<0.001
Calendar for campaigns	74	61	<0.001
Planning the assortment	77	68	<0.001
Customer analyses	69	47	<0.001
Complaints handling	74	59	<0.001
Electronic cold facilities monitoring	69	61	<0.001
Electronic forms for pharmacy	76	63	<0.001
<b><i>Stock (5 of 6 items)</i></b>			
Ability to generate orders based on sales	94	84	<0.001
Tracking product expiry	100	93	<0.001
Managing stock holding	94	87	<0.001
Following the delivery assurance of other companies	78	67	<0.001
Analysis of stock moving speed	80	64	<0.001

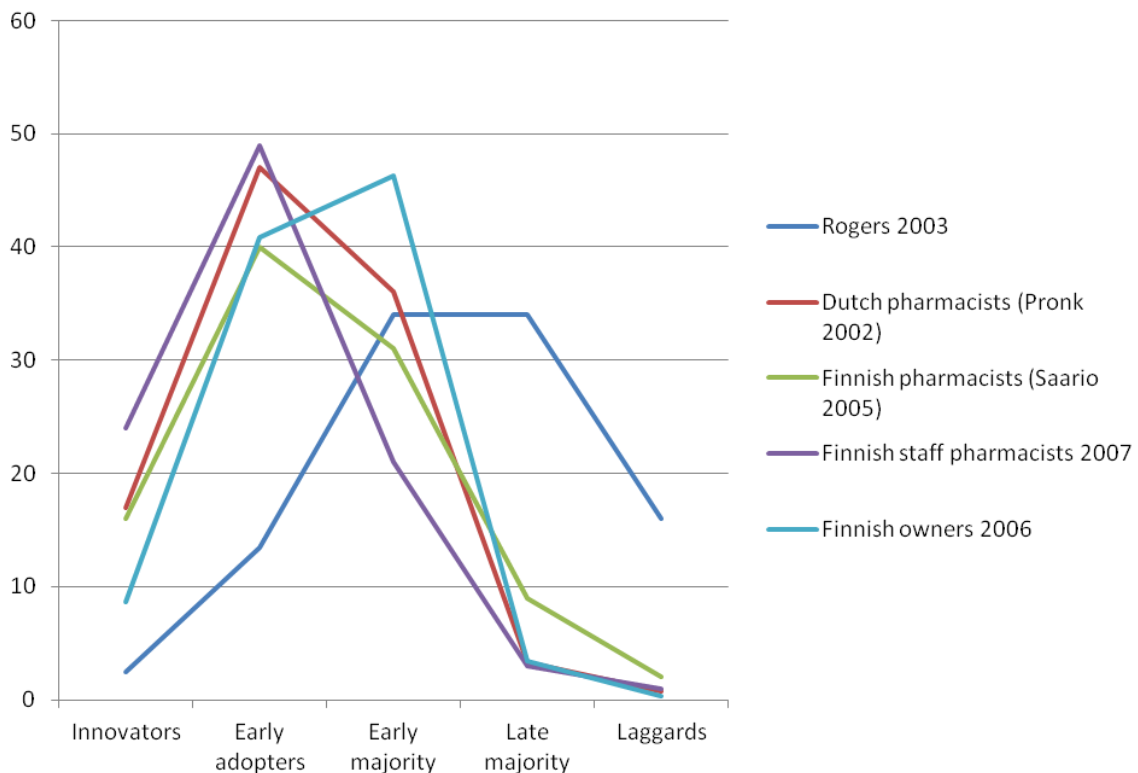
**Table 12** *The features prioritized significantly higher by the staff pharmacists (n=234) than by the managers for the community pharmacy IT system (p-values of Likert scale, Chi square test). The percentual results are presented as a combination of Very important and Quite important responses.*

	B.Sc. Managers		
	%	%	p
<b>Drug information and patient counselling (1 of 11 items)</b>			
Online national reference book	97	96	<0.001
<b>Medication safety (1 of 10 items)</b>			
Documentation of medication misuse	80	73	0.004
<b>Interprofessional collaboration (1 of 10 items)</b>			
Online network between disease management pharmacists	69	60	0.001
<b>Pharmaceutical services (5 of 27 items)</b>			
Medication compounding program	62	51	<0.001
Pricing program for extemporaneous products	75	71	<0.001
Disease management program for asthma	80	74	0.044
Peak Flow measurement (documentation for follow-up)	47	47	0.012
Smoking cessation program	65	56	0.003
<b>Pharmacy's internal processes (7 of 31 items)</b>			
<i>Financial management (none of 7 items)</i>			
<i>Personnel (7 of 10 items)</i>			
Staff roster	79	74	0.006
Staff workflow	55	51	0.004
Vacation roster	73	65	0.002
Managing staff expertise of personnel	66	58	0.001
Recruitment	48	39	<0.001
Orientation	80	74	0.001
Termination of an employment	45	44	<0.001
<i>Sales and marketing management (none of 8 items)</i>			
<i>Stock (none of 6 items)</i>			

### 9.3 Perception of Finnish community pharmacy practitioners' innovativeness (I-II)

The results of the subjective innovativeness of the survey respondents were compared to the earlier studies conducted by Pronk in the Netherlands in 2002, Saario in Finland 2005 and Rogers in the US (Figure 16). The shapes of the diffusion curves generally followed the bell distribution reported by Rogers in 2003. However, the pharmacists' curves were skewed more towards the innovator than laggard categories, which deviated from Rogers' generic model (Rogers 2003). One interviewee described pharmacy and innovations as follows:

*“On the field of pharmacy there has not been very strong tradition for the generation of innovations, at least in Finland, hardly anywhere. Maybe lately there have been some trends that people have set up firms to do something brand new, but there have not been strong traditions for that.”*



**Figure 16** Self-reported innovativeness of Finnish and Dutch pharmacists compared to Rogers' innovativeness curve (Pronk et al.2002, Rogers 2003, Saario 2005).



## **9.4 Visions of the pharmaceutical care and the IT systems for the community pharmacies (III)**

### **9.4.1 Visions on Community Pharmacy Services and IT Support**

The majority of the interviewees strongly supported the patient care service orientation of community pharmacy (Table 13). Their vision was that pharmaceutical care services will be recognized and that reimbursement will be provided to pharmacists providing services. This development was seen as a logical extension of the community pharmacists' professional role in health care. The interviewees emphasized that pharmacists should concentrate on what their professional education prepared them to do. Visions related to IT included optimization of the work, IT-based documentation and follow-up of the medical therapy, shared patient data, access to evidence-based information and guidelines, and technological solutions, such as electronic prescribing. The interviewees agreed that the presence of IT is an essential tool for community pharmacists' pharmaceutical care services provision.

The experts also expressed concerns about or raised issues related to pharmacists' involvement in patient care (Table 14). These issues related to increasing commercialism, differentiation of pharmacies, the public image of pharmacies, and political decisions. Experts were concerned that IT will be solely used for accelerating the dispensing process rather than facilitating greater allocation of resources to provision of patient care service.

**Table 13** *Future visions on patient care services and information technology in community pharmacies.*

<b>Visions on patient care services</b>	
Acting as a part of the health care	<i>"They (pharmacies) should be point of health care for patients."</i> (professor)
Emphasis more in service provision	<i>"...Pharmacies will start not only dispensing medication but also delivering services. I hope that they start being payed and recognized for these services."</i> (manager)
Consultative role	<i>"...When we think the educational background, the role will probably be more consultative than these days. Today we are concentrated on selling products."</i> (IT-expert)
Treatment follow-up services	<i>"If today we are talking more about diabetes, hypertension, ashtma, maybe in five years we will have much more health related issues..."</i> (manager)
Collaboration with physicians	<i>"I hope the relationship between the physicians and pharmacies will get closer. They are just trying to take the first steps now."</i> (manager)
Individual patient focus	<i>"Trying to help the patient with your knowledge takes more time than just selling drugs, but I think the patient is looking for this. He doesn't want to be one patient among a lot of patients, when you are in face-to-face situation, he is THE patient."</i> (owner)
Professional specialization and outsourcing	<i>"The pharmacists will be more specialized."</i> (IT-expert)
<b>Visions on information technology</b>	
Optimization of the work	<i>"Stop doing so much the technical work like labelling and all of that and to do for technicians or machines."</i> (researcher)
IT-based documentation and follow-up	<i>"Two of the important cornerstones in pharmaceutical care are documentation and follow up. And it is very hard to make the follow ups in patients' visits if you don't have any IT-based documentation. So I think these are necessary tools to be able to conduct pharmaceutical care in its original meaning."</i> (researcher)
Shared patient data	<i>"The professional organizations, the doctors, the pharmacists but also the patient groups should have shared vision in order to share the patient data, because of patient safety."</i> (researcher)
Access to evidence-based information and guidelines	<i>"If we think the consultative role, the idea in this is the critical evaluation and combining of the information, which is from different sources and that is exactly the area where we are good at. In order to work there has to be an information technology system supporting that."</i> (IT-expert)
New technology solutions available	<i>"I think in ten years we will have ePrescribing and we will have a system for access in the patient data from any pharmacy."</i> (researcher)

**Table 14** *Future concerns on patient care services and information technology in community pharmacies.*

<b>Concerns on patient care services</b>	
Business interest	<i>"Many individual owners of wider pharmacies focus on their businesses and are not interested in the future of the profession."</i> (researcher)
Differentiation of pharmacies	<i>"There is a worldwide movement for community pharmacies to differentiate themselves. So what we will see is some pharmacies moving more to health while we see other pharmacies moving more to look like supermarkets etc."</i> (professor)
Public image	<i>"...The image that pharmacy put to the public is also a place where you can buy all sort of commercial items; hair dye, shampoo, everything, nappies, and not so much a place for health and a place where you get health services."</i> (researcher)
Insufficient patient outcomes	<i>"They (pharmacists) did not yet take their responsibilities seriously enough in order to be responsible for patient outcomes."</i> (professor)
Competition with other health care providers	<i>"...We have a competition with other health care providers, nurses are doing case managements, positions they don't want to let go, diagnosis, prescribing, it is that rational and political..."</i> (professor)
Political decisions	<i>"As a profession we have got in some way limited opportunities to affect the things, which will happen."</i> (owner)
Sustainable economics	<i>"...If they (pharmacists) want to keep the profits moderate, they have think what is the central issue and concentrate on that."</i> (IT-expert)
<b>Concerns on information technology</b>	
Effectiveness	<i>"...You have to use the time you have won by good IT-solutions to develop more time for the patients instead of maybe serving more patients per hour."</i> (researcher)
Data protection	<i>"IT actually is providing information about new competition interaction check or to patient's complex history of drugs or the shared file. You need for this a very secured way because of the data protection."</i> (owner)

#### **9.4.2 Opportunities and threats to achieve the vision**

IT was identified as providing an opportunity to help achieve the vision to provide patient care services (Table 15). Professional skills were considered essential to better use of IT and clinical knowledge in provision of services. The new generation of pharmacists was described as having improved skills and attitude in relation to patient care and the use of IT.

Nine different threats to utilizing IT to support for patient care were described; the most common was the cost associated with developing new IT applications that could be incurred by independent pharmacy owners or governments. Another threat raised was that IT applications are not available to meet the needs of community pharmacists'. Community pharmacists not having a patient-oriented attitude was also cited as a threat. Collaboration with other health care providers, privacy protection and time constraints were also mentioned.

#### **9.4.3. Strengths and weaknesses of the current IT systems**

Some of the experts regarded the reliability of the current IT systems to be strength. The current IT systems were perceived as facilitating low cost standard dispensing of prescriptions. A strength mentioned by one expert was that the need for change has been recognized by the profession. Another strength was that technological capability exists to manage patient care, even if these features are not widely used in pharmacy practice. The most often mentioned weakness was that IT is presently focused on dispensing rather than on supporting patient care. Underuse of the current systems was described as partially resulting from a lack of IT skills.

**Table 15** *Internal and external factors related to patient care services and IT support in community pharmacies (SWOT analysis of expert opinions, n=14).*

<p><b>Strengths</b></p> <p>Current IT systems are useful (n=2)          Cost effectiveness (n=1)          The need for change is recognised (n=1)          Reliability (n=1)          Technological capability exists, even if it is not used much (n=1)          The system is very sophisticated (n=1)</p>	<p><b>Weaknesses</b></p> <p>IT is focused on the dispensing process rather than supporting patient care services (n=6)          Pharmacists' attitude against change (n=4)          Underuse of the current systems (n=2)          The poor quality of the systems (n=1)          The lack of patient safety (n=1)          The lack of vision (n=1)          The lack of competition between the system vendors (n=1)          The systems are out of time (n=1)</p>
<p><b>Opportunities and facilitators</b></p> <p>IT solutions (n=10)          Professional skills (n=5)          New generation of the pharmacists (n=3)          Interprofessional collaboration (n=2)          Patient oriented attitude (n=2)          The fee policy (n=1)          The evidence of patient outcome (n=1)          The consistency of the profession (n=1)          The management change (n=1)</p>	<p><b>Threats and barriers</b></p> <p>Costs (n=9)          Attitude (n=4)          The IT solutions are not available (n=4)          Competition with other health care providers (n=3)          The behavioural changing process (n=2)          Privacy protection against information sharing (n=2)          Lack of integration of professional services with the economics and pharmacy (n=1)          Time constrains (n=1)          Quality of information shared through internet by industry (n=1)</p>

## 9.5 The processes for generating community pharmacy practice IT innovations (IV)

The interviewed experts collectively named 14 different key IT innovations which can be classified in three main categories (Figure 17). Each respondent named 0-5 different innovations, of which electronic prescribing and other IT systems supporting electronic health data management were most often mentioned. Some interviewees had difficulty in naming specific IT innovations.

*“I don’t think we have many... ..I don’t personally keep them particularly innovative, they tend to target to what pharmacist are used to using, so they have made the program very simple, very basic.”*

Figure 18 presents typical characteristics found in the qualitative analysis which stimulated innovations in IT development in community pharmacy. According to the interviewees, the stimuli for IT development to support medication management in community pharmacies were: Patient Safety; Support for a New Service Model; Patient Care Responsibilities; International Trends; Business Ideas of a Commercial Company; Legislation to Enhance Electronic Services; Low Profits for Pharmaceuticals; and Consequence of Another Innovation. Most interviewees reported patient safety as the catalyst for IT development, and electronic prescribing was the most often mentioned innovation to address patient safety. Patient care orientation emerged as an international trend that was pushing new services whose performance required IT support. Alternatively, several experts mentioned economic pressures as a driving force for IT innovations. Some reported patients’ healthcare needs, such as smoking cessation, as initiators.

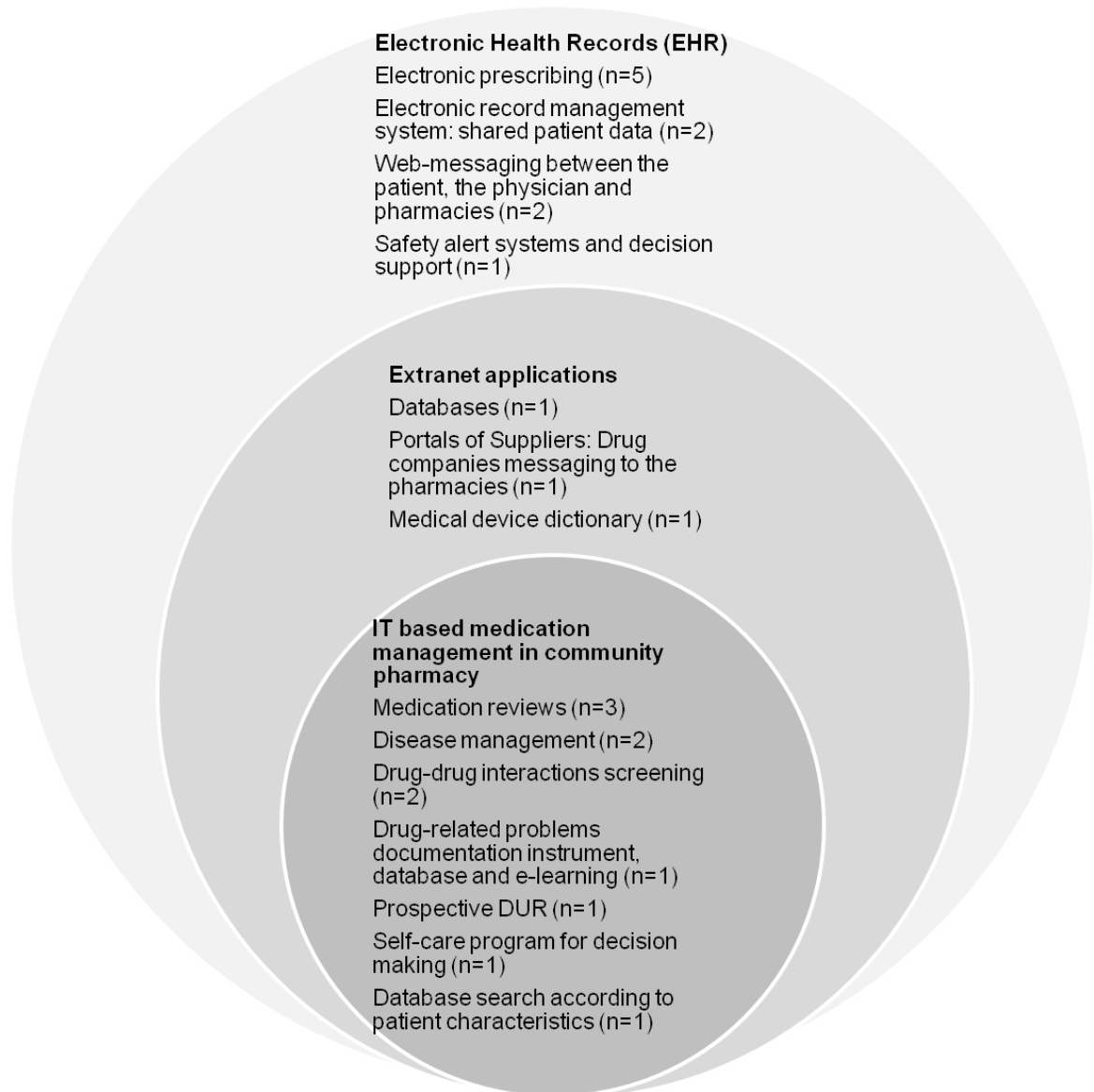
*“...there has been the decision somewhere that either there will be payment for service that some is developing the structure or program that will deliver that service... They don’t seem to be the developing program to help people work*

*through the process. In the ones I have seen, the IT decision is driving the change rather than the change [needs] driving the IT.”*

Many of the innovations mentioned by the experts actually lacked research as a starting point. Less than half were developed from systematic research or even pilot research. One interviewee mentioned research in general: there is lots of research on large-scale development projects concerning health information technology, electronic health records including electronic prescribing and integration of the health care providers' IT systems. Some experts were unaware of explicit research initiatives. In most of the IT development processes described by the experts, the coordinator of the process was the government, and only in few processes it was a private company. The development processes had taken from 5-6 to even 25 years. Leadership was mentioned as a very important factor and lack of leadership had been a problem.

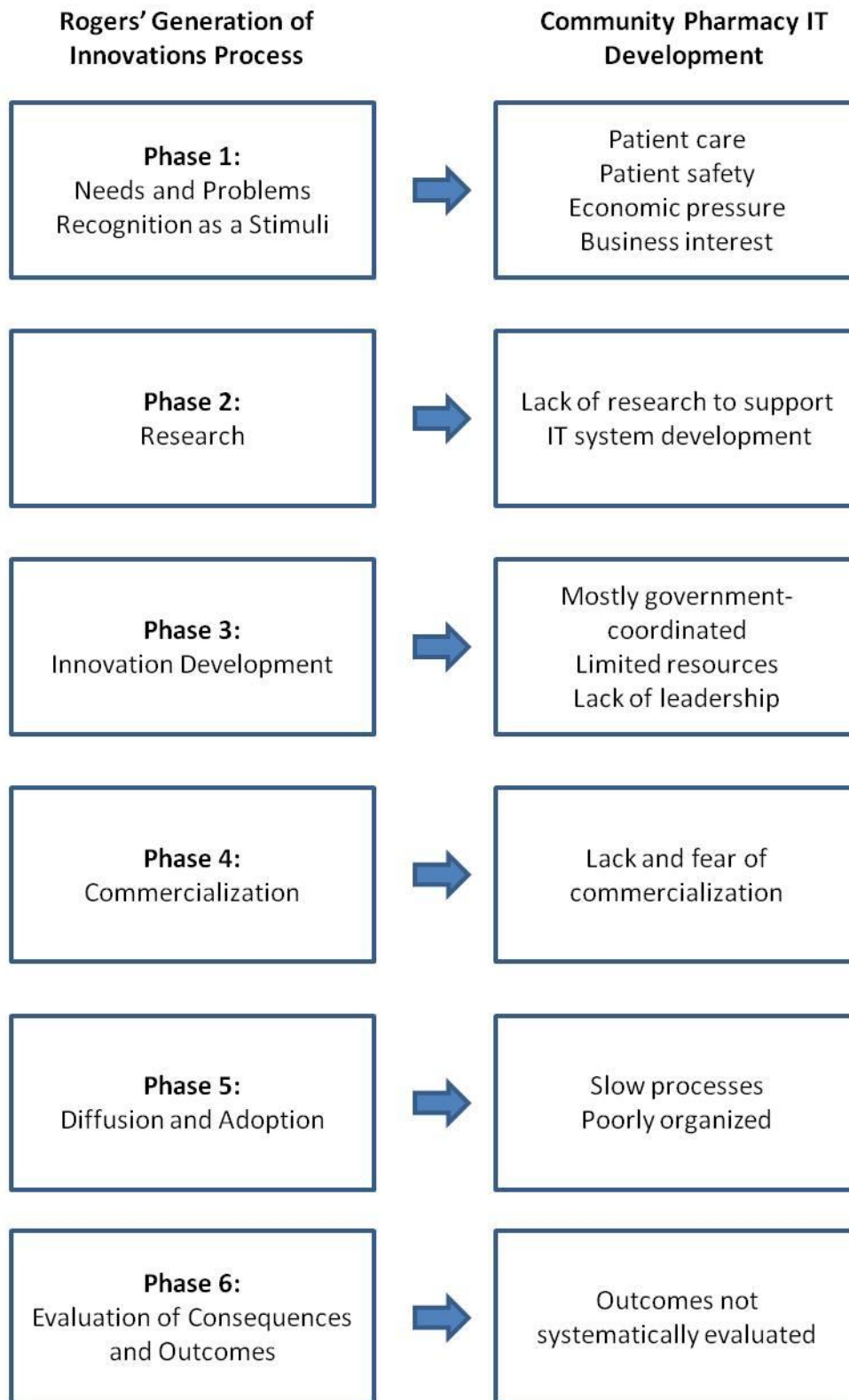
*“The will of the politicians has been that the projects start, but there has not actually been any coordinator and this is the first big problem of the whole project.”*

Only one expert described the development process as team work, and this respondent noted a governmental role. In this process there was cooperation between the technologists and the pharmacists who defined the software functionalities needed in the pharmacies. Some of the innovations described by the interviewees were still in the development process while others had been commercialized and were being sold to users.



**Figure 17** *Key community pharmacy IT innovations according to the study participants (n=14).*





**Figure 18** *Key features of community pharmacy IT innovation development processes compared to the Rogers theory of Generation of Innovations (Rogers 2003).*

Many of the interviewees seemed to have a critical attitude towards commercial companies and emphasized the role of the national governments in IT projects. However, a few noted an innovation which had been developed as a public project led by the government, but was commercialized and delivered by private providers. Interviewees were queried as to whether the IT innovation's diffusion process had been planned and organized. This was a difficult question for most of the respondents. One described the matter as a leadership issue spanning 25 years of attempts to organize the process. One stated that the diffusion process was not organized at all, but occurred organically. Interviewees also described the users' adoption of the innovation. Some thought users were receptive to the innovation. Only one had experience with Rogers' adopters' taxonomy:

*“There has been a big variation... you know you have these early innovators and the laggards. In almost every pharmacy you find these. One very important thing is the attitude of the pharmacy manager, if he or she finds it important or not. And also to have coaches, fire soldiers, someone who really fond of and enjoys and finds it very important to do something, is enthusiastic and committed.”*

Consequences of IT innovations were systematically evaluated in only a few cases; most of the opinions were based on interviewees' own estimations. According to users' feedback, some interviewees reported that an IT innovation had met the needs and expectations of its users and had improved quality of care or patient safety. Some interviewees were also satisfied with an innovation, but felt that pharmacists always want more to be done to support pharmaceutical services in community pharmacies. One interviewee could not discuss benefits of an innovation, as there had not been evaluative research on it. Another thought that an innovation has not met the needs and expectations of its users or improved the quality of care. However, interviewees could clearly see that innovation stimulated further innovations. The following example describes how Medication Review led to other innovations:

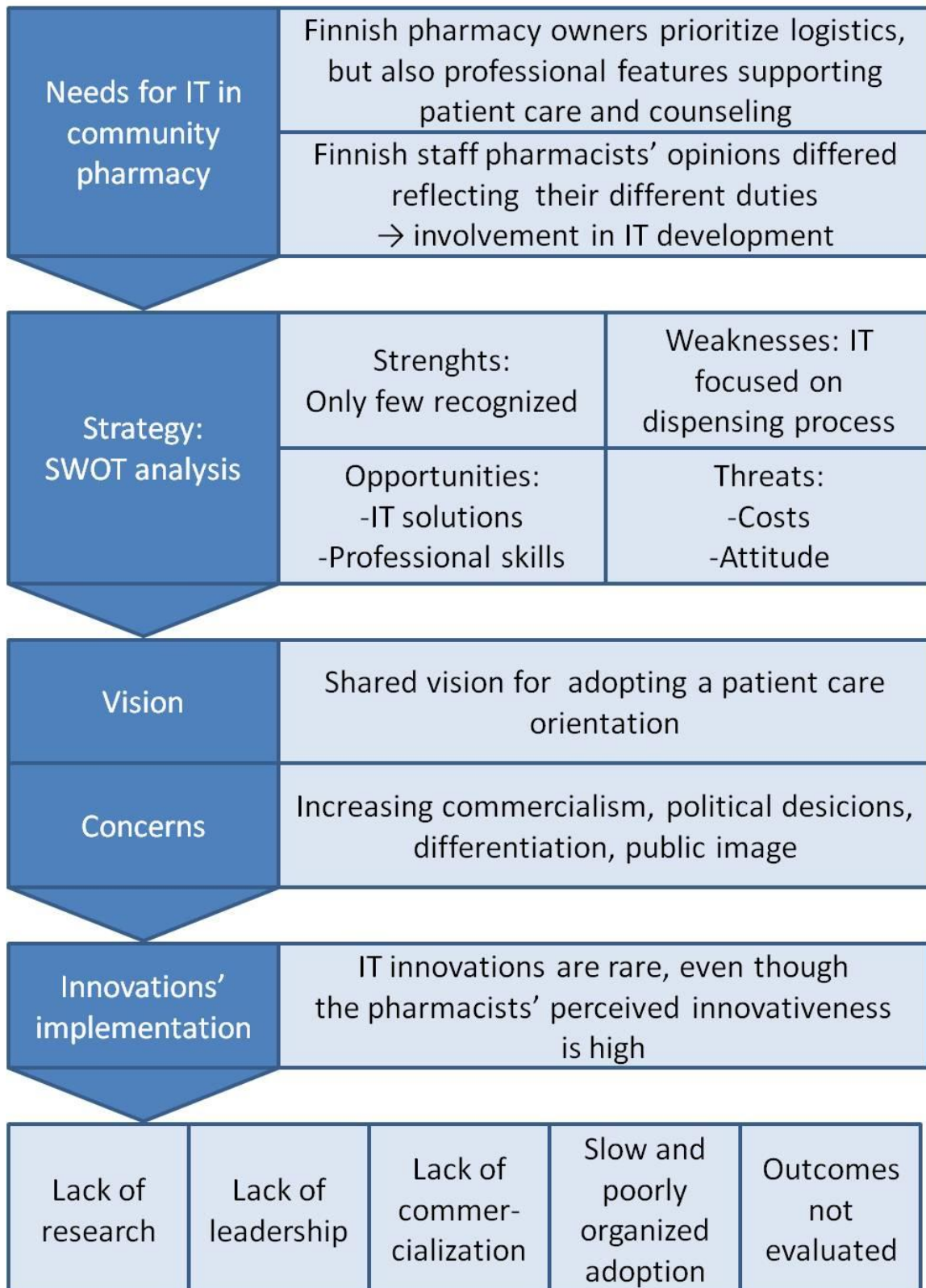
*“...Most of the pharmacists can tell you about the community services, they understand that. So, if you look the time before home medication review (HMR), it really started with residential care and then it went to HMR then it went to drug information then it went to disease state management. So you can see, how the innovation over time is spreading.”*

Interviewees were asked to identify barriers to innovation and practices that supported innovation. Barriers included: Funding; Priorities Set by the Management; Technical Issues; Market Competition; and Privacy Protection. Practices facilitating innovation included: Good Management; Attitude and Will; Funding; Good Quality of the Technical Solutions; Information; and Collaboration Between Organizations. The interviewees were also asked to identify issues that should be taken into account in the development of new IT systems. Some thought that the system should be simple and modular so that new functionalities could be added. Others believed the most important element would be to listen to end users during the development process. A good consultation process was also mentioned, as was research to assess the effectiveness of new technologies for improving appropriateness of drug use before a system's implementation.

*“We have to go forward just to decide when and how to do it. And then all the barriers and strengths are to show up and of course on the bottom line people say: “Well, it is a good idea, but we cannot do it for several reasons. ... So it is part of leadership here, it is part of making the vision real. But people will have to do it! So it is mobilizing the innovation.”*

## 10 SUMMARY OF KEY FINDINGS

A summary of key findings of this study is presented in a Figure 19. Finnish independent community pharmacy owners gave priority to logistical functions and also to those functions related to medication information and patient care. The managers and staff pharmacists have different views of the importance of IT functions, reflecting their different professional duties in the community pharmacy. This indicates a need to involve different occupation groups working in community pharmacies in planning the new IT systems. A majority of the international experts shared the vision for community pharmacy adoption of a patient care orientation; supported by IT-based documentation, new technological solutions, access to information, and shared patient data. Opportunities to achieve this vision included IT solutions, professional skills, and inter-professional collaboration. Threats included costs, pharmacists' attitudes, and the absence of IT solutions. Community pharmacy IT innovations were rare, which is paradoxical because owners' and staff pharmacists' self-perception of their innovativeness was indicated to be high. Community pharmacy IT systems development processes usually had not undergone systematic research for needs assessment before development or evaluation after implementation, and were most often coordinated by governments without subsequent commercialization. Specifically, community pharmacy IT development lacks research, organization, leadership and user involvement in the process.



**Figure 19** Conclusion based on the results.

# 11 DISCUSSION

## 11.1 Finnish community practitioners needs for IT system

Finnish independent community pharmacy owners have an economic responsibility for the company and also are responsible for designing and financing pharmacy services, and the IT system supporting them. Thus, their professional and business visions and strategies are crucial for development and implementation of IT systems. They rated IT applications supporting logistics and performing basic cognitive pharmaceutical services, such as providing patient counseling, drug-drug interaction checks and medication reviews equally highly. Survey respondents gave high priority to those features of a new IT system that supported logistics. Such IT systems' features support managers in optimizing stock control and are key components of good business planning. Efficient stock control is critical to financial viability, particularly under the pressures to decrease the national drug budget.

Respondents rated patient care features as highly as those features related to logistics, suggesting that they are committed to the pharmacy profession and not only a business strategy for community pharmacy. Female pharmacy owners considered features related to cognitive pharmaceutical services somewhat more important than did their male colleagues. Similar gender related differences have been reported in Canada, where the female pharmacy managers spent more time in direct patient contact, indicating the importance they placed on a service orientation (Cockerill et al. 1999). Furthermore, Canadian female pharmacy managers were more supportive of strategies that promote additional patient counseling. Finnish pharmacy owners rated medication safety and related features highly, such as computerized documentation of medication and dispensing errors, as well as documentation of drug related problems (DRP), e.g., drug-drug interactions and adverse drug reactions. This was consistent, regardless of the pharmacy's size or the owner's age or gender. They also gave high ratings to tools

such as brief and comprehensive medication reviews. These findings indicate that pharmacy owners are aware of the importance of medication safety although they may not currently have any actual documentation and follow-up tools.

In the second survey study (II) the reference group was included: data of the community pharmacy owners and the M.Sc. pharmacists working as managers which was combined and compared with data of B.Sc. pharmacists working mainly in direct customer contact with customers. The features related to access to databases and facilitating disease management, such as asthma management and smoking cessation, were ranked significantly higher than owners by staff pharmacists. They also expressed a need for a national online network for pharmacists, who are specially trained contact persons to treat and prevent Finland's most common major chronic diseases in community pharmacies. Community pharmacy owners strongly supported IT features related to pharmacy management processes. The study results indicate that pharmacists in different occupation groups have different preferences with regard to the importance of IT features, depending on their duties in community pharmacies. This indicates that if the perspectives of pharmacists working in actual customer service are not taken into account it might misdirect IT application design with regard to limiting features essential for cognitive services.

The study results indicate that a high importance was given to applications which were familiar to the users. The Bachelors were not able to comment on the importance of the features they were not familiar with, such as financial management. Similar findings have been reported in a study concerning community pharmacists' attitudes towards medication management (MTM) services (MacIntosh et al. 2009). The key factor was the familiarity with the services whether pharmacists chose to contract to provide MTM services. The challenge for the future community pharmacies will be combining the cognitive aspects of pharmaceutical care and the economic aspects for profitable business. The results of our study indicate that there is a need for taking notice of different occupation groups' hopes while planning the new IT systems for community pharmacy settings. Community pharmacy practitioners who work with different

tasks have also varied and limited views of the IT needs for all aspects of pharmacy operation. This study provides insight into potential needs of a new IT system that have the strategic priority among pharmacy managers and staff personnel in Finland. An iterative developmental process of community pharmacy IT systems development will include practitioners' needs and will facilitate their adoption. The development of IT systems and applications to meet the demands of pharmacists with different duties in the community pharmacies will be crucial to success in the future.

In European Union (EU) countries, the directives, regulations and decisions of the EU guide the development along with the national laws and standards (Wahlroos 2003, Väänänen 2008). In Finland, community pharmacies' main functions are to ensure an adequate supply, and safe and appropriate use of medications, by law (Medicines Act 395/1987). However, there are no standards for the quality of dispensing, as well as patient care and pharmaceutical care services in the Finnish community pharmacy practice except with regard to medication review (Leikola et al. 2009). Because Finnish community pharmacy owners have the responsibility of providing services, they can choose whether to invest in the IT systems supporting professional services, such as interaction screening program, or not. As a result polarization has increased also in Finland (Kansanaho et al. 2005, Tippa Project 2005): some community pharmacy owners are committed to develop professional services while some are not. International Pharmaceutical Federation (FIP) has suggested that in order to promote the main elements of Good Pharmacy Practice (GPP) national standards are essential (FIP 1997):

*“For each of the four main elements of GPP, national standards covering processes and necessary facilities should be established and promoted to the profession.”*



## **11.2 The future of pharmacy practice – visions, concerns and strategies**

The experts in the international strategic study represented their own countries with different national health care and IT systems. Despite their different backgrounds, the results indicate similar opinions and a common vision for developing IT systems to support the provision of patient care service in community pharmacies. The interviewed experts shared the expectation that community pharmacies will be more involved in the provision of patient care services and their consultative role will increase. This was in line with international trends and what is happening in the United States (US) and Europe (Christensen and Farris 2006, Hughes et al. 2010). The opinion of the experts was that IT applications are necessary tools in the provision of patient care services, and an essential component in the implementation of increased professionalism in community pharmacy. IT was seen as particularly necessary in facilitating access to information such as clinical patient data, guidelines, and evidence-based data needed in patient care. Community pharmacy IT systems are most likely to be successful in optimizing patient care if they are developed in conjunction with other health-related IT applications. Improving standardization of systems across multiple institutions may be important for the wider adoption of IT to prevent medication errors (Agrawal 2009).

Although there was consensus among the interviewed experts regarding the desired direction of strategic development they raised concerns about the future. These concerns revolved around increasing commercialism and its corresponding influence on the functions and public image of community pharmacy. The challenge of integrating patient care services into current and emerging business models has been described in the literature (Feletto et al. 2010). In this respect, some of the interviewed experts were worried about the differentiation between community pharmacies. Some pharmacies will focus their business on increasing dispensing and sales, while other pharmacies may choose to develop their business by strengthening their professional role through the provision of pharmaceutical care service. This differentiation has been reported previously (Doucette et al. 2006).

The impact of political decisions being imposed on the pharmacy profession was seen as a concern by the experts. This occurred in Iceland, which was the first of the Scandinavian countries to make dramatic regulatory changes in the mid-1990s, which resulted in a deregulated community pharmacy system (Morgall and Almarsdottir 1999). Political decisions may also strongly influence the economic viability of community pharmacies. The interviewed experts perceived costs and needing to maintain economic viability as a threat to strategic development of IT applications. Thus, they called for sustainable reimbursement to pharmacies to support provision of pharmaceutical care services and IT applications needed to do it. In a national survey Finnish community pharmacy owners gave high priority to those features of a new IT system that were supporting logistics. Efficient stock control is critical to financial viability. Different remuneration models are possible, but the political will to change must be preceded by pharmacists formulating an explicit and proactive strategy to demonstrate the added value and the quality of patient care services (Bernsten et al. 2010). This kind of evidence is needed to inform IT development and for justifying allocation of community pharmacists' time to service provision. Time constraints were mentioned in the current study as a threat, and this was consistent with several previous studies of barriers to service provision in community pharmacies (Montgomery et al. 2007, Blake et al. 2009, Blake and Madhavan 2010, Kritikos et al. 2010, Paydyaal et al. 2010).

The interviewed experts referred to professional skills and attitudes of community pharmacists as both weaknesses and opportunities. Pharmacists' resistance to change were perceived as a weakness, but their interest in patient-oriented care was seen as an opportunity. The new generation of pharmacists and their increased professional skills were seen as opportunities. Professional skills were associated with both IT use and provision of patient care service. Underuse of the current IT systems was seen as a weakness. To prevent medication errors using IT it is not only the technological capabilities of the IT that are important but also their implementation and use (Agrawal 2009). Previous studies have also reported that the lack of skills among community pharmacists may limit the implementation of new technologies to provide patient care (Latif and Boardman 2008). Additional

research is needed to assess theoretical and practical competency needs of community pharmacists.

Countries involved in our study had similar intent, but the poor quality of the current IT systems and limited resources to develop more sophisticated systems were seen as problems. One way to get more resources is to enhance international cooperation between parties involved in community pharmacy IT development. Even though the international cooperation was identified by the interviewees as being quite low, limited to participation in congresses and symposiums instead of having actual joint IT development projects, no one mentioned international cooperation as a strategic opportunity. In 2007, the French government invited The Office of the National Coordinator for Health Information Technology (ONC) from the US to collaborate with the European Union in conducting a conference *International Challenges in eHealth and Health IT: Managing Toward a common Goal*, held in Paris in 2008 (Friedman et al. 2009). Three areas were identified as highest priority for international collaboration in future: 1) Health data security ; requiring new policies and technology applications to managing access and governing sharing health data 2) Ensuring healthcare professionals' acceptance of HIT tools, measuring the actual usage of the tools would better inform and guide policy development 3) Interoperability; establishing standards and clear guidelines for their implementation. The implementation of these recommendations requires strong leadership of the national governments and health care businesses (Friedman et al. 2009). There still is lack of standardization concerning software interfaces to enable communication between systems; pharmacists need communication standards to electronically communicate with the physicians, hospitals, patients and caregivers (Webster and Spiro 2010). Cooperation can generate more ideas, more opportunities, more alternatives and more ways for implementation when new IT systems for community pharmacies are developed. International, cooperative IT development can also reduce costs. E.g., the FIP Pharmacy Information Section could provide a platform for discussion and more coordinated actions in IT development.

### **11.3 Paradox between innovativeness and innovations**

According to this study, the processes for generating community pharmacy IT innovations only partially follow the six phases described by Rogers' theory. The most neglected phase was performing systematic research before proceeding to IT system development. The next common gap was with evaluation of results after implementation. Lack of research in the process was more evident when the entity responsible was a private company. This failure to perform a systematic needs assessment may lead to a very limited understanding of the user's perspective. This inadequate understanding may then influence the evolution of subsequent innovations (Rogers 2003).

A majority of the community pharmacy IT development processes described by the experts were coordinated by governments and lacked commercialization as of the time of this study. Although there are private business solutions for community pharmacy services in most of the countries involved in the study (Rigby 2004, Jackson et al. 2006, McMahan 2008), the interviewees emphasized the role of national governments in the development phase. National governments' development processes though generally organized and controlled also seem to be slow and bureaucratic. The expert interviews attribute this to a lack of leadership and funding throughout the innovation process. Lack of leadership subsequently led to development processes that were not well-planned and implemented. Similar leadership challenges were found with government-led processes in the adoption phase. Our findings are consistent with previous implementation studies of community pharmacy residency programs in the US (Schommer et al. 2010), and electronic health records systems in multiple countries (Deutsch et al. 2010). These studies have concluded that strategic, organizational and human challenges are more complex and more difficult to cope with than is the technology alone (Deutsch et al. 2010). It may be possible that governmental coordination correlate to the present situation in which there have been few innovations in community pharmacy IT. The study results suggest that

the pharmacy profession should assume more responsibility for development of the IT tools that support their practise.

This study indicated that community pharmacists in Finland and in the Netherlands have a similar willingness to adopt innovations as they are subjectively measured by Rogers' instruments. Their self-reported innovativeness is much higher than that of populations included in Rogers' classical studies, which may indicate a real but as yet unrealized difference in innovativeness favoring community pharmacists. Rogers' theory and his adopters curve (Figure 11) are based on observational data gathered in the 1950s (Rogers 1958). Both community pharmacists' studies are based on surveys that assess self-perception of innovativeness. Another explanation for the difference in findings between Rogers early work and the present study may be the time frame; it is possible that nowadays change occurs faster and the social pressure to adopt innovations is higher. As a consequence, the bell shape of the adopters curve would move in the direction of the innovators category, even if the theoretical underpinnings do not change. This specific development should be explored with broader populations than community pharmacists alone; to see if this has been shifting the adopter curve.

According to this study, both Finnish pharmacy owners and employed pharmacists define themselves as innovators who are willing to adopt IT innovations. However, it is a paradox that the actual rate of IT systems innovations has been slow in Finnish community pharmacies. Is this a consequence of authorities having strict control over community pharmacies, resulting in more constrained resources being available for implementing innovative IT systems and programs? The currently implemented Finnish IT systems for community pharmacies' professional needs have been mostly developed in the 1990s. The existing software does not contain modules devoted to medication safety, nor do ones to support cognitive pharmaceutical services, even if the need for such features has been recognized. However, development of community pharmacy IT is also a health policy issue as well a leadership issue. Collectively, these forces and professionals provide the driving force, strategy and coordination required to achieve or delay the development and implementation of innovative IT systems.

## 11.4 Methodological considerations

None of the study methods are absolutely accurate or non-biased. In this study, method triangulation was used to strengthen the study methods employed and to ensure the comprehensiveness of the study (Pope and Mays 1995, Smith 2002). Triangulation was found to be particularly useful for the following reasons: 1) the use of quantitative methods (STUDIES I-II) enabled receiving nationally generalizable results, 2) quantitative studies (STUDIES I-II) enabled comparison between different occupational groups working in community pharmacies, 3) the quantitative perceived innovativeness (STUDY IV) enabled comparison with earlier studies in Finland, The Netherlands and in the US, 4) the qualitative methods (STUDIES III-IV) provided deeper understanding of the visions, strategies and the IT innovations development processes concerning IT to support medication management.

Scientific rigour and quality of the research are assessed in terms of reliability, validity, and generalizability of the results (Smith 2002). Reliability relates to the repeatability and internal consistency of the research. Validity refers to the extent to which an instrument or method measures what it is supposed to measure. Validity can be divided into external and internal validity (Tuomi and Sarajärvi 2003, Roberts and Priest 2006). Internal validity could be increased by piloting the questions (content validity), comparing the questionnaire with other validated measurements of the subject (criterion validity) and by demonstrating the relationship between the concepts under study and the theory (construct validity). Factors that could decrease the validity include small sample size and errors during different study periods. The generalizability (referred also as external validity) is concerned with the extent to which the findings can be applied more widely to other settings or populations. The following section discusses the reliability, validity, and generalizability of the studies I-IV.

### 11.4.1 Quantitative studies I-II

Surveys are widely used to obtain data from a large group of people and to generalize the findings to larger populations (Smith 2002). This method has been used for gathering information concerning views and attitudes which are often seen as determinants of practice and indicators of the feasibility of change. Most surveys focus on issues that are important to a profession and its development. Usually, the object of the survey is to provide information about the change and to facilitate its progress (Smith 2002).

These sub-studies were based on data received from the national surveys conducted in Finland. The survey studies were targeted to all Finnish independent pharmacy owners (n=580) (STUDY I) and staff pharmacists with Bachelor' (B.Sc.) and Master's (M.Sc.) degree working in Finnish independent community pharmacies (n=1709) (STUDY II) with a registered and valid e-mail address and who had given permission to their professional associations to make available their e-mail addresses for research purposes. The survey instrument was customized to be applicable to the Finnish pharmacy system and, therefore, the results may have limited direct generalizability to other countries. Both surveys applied the same survey instrument. The survey instrument was piloted in a convenience sample of 14 pharmacy practitioners for the face validity determination and the comprehensiveness was further refined. The IT system features included in the survey instrument reflect the Finnish health care and medication management system could you omit this phrase. Thus, the survey instrument may not be applicable to other countries as such. This also limits the generalizability of the results to other countries and systems.

A total of 308 responses were received from the pharmacy owners (response rate 53%) and 373 responses from the staff pharmacists (response rate 22%). Of these, 34% had a M.Sc. degree (n=128), 63% had a B.Sc. degree (n=234) and 3% were pharmacy students (n=11). The most significant limitation of this nationwide study is the low response rate and the non-response bias caused by it,

particularly among staff pharmacists. The data available did not enable the analysis of respondents vs. non-respondents. It is possible that those who were less interested in IT were less likely to respond. It is widely accepted that survey data may be affected by the characteristics of respondent (e.g. knowledge; experience; and motivation). All respondents may not interpret the questions as intended by the researcher. On the other hand, the low response rate among staff pharmacists may be partly due to the data collection via the Internet. Our previous studies have shown that Finnish community pharmacists are not used to responding to Internet surveys and it has been typical that the response rate is 20-30% even after 1-2 reminders. The normal response rate for mail surveys among community pharmacists has been 50-60% (Kansanaho et al. 2004, Kansanaho et al. 2005, Puumalainen et al. 2005, Teinilä et al. 2008). It is also noteworthy that the data were collected by a mail survey among community pharmacy owners (response rate 53%), but the survey instrument was the same.

The characteristics of the respondents were similar to those of the target population especially by age and gender, which indicates achieved generalizability nationally. The staff pharmacists with the M.Sc. degree were more active responders than B.Sc. pharmacists. Also the owners and pharmacists working in large pharmacies were more frequent responders. Even if the response rates were quite low, particularly among staff pharmacists, the shapes of the curves concerning perceived innovativeness followed the bell shape reported by Rogers in 2003. However, the pharmacists' curves were more towards the innovator than towards the laggard, which was slightly different from Rogers theory (Rogers 2003), but more similar to the results of the earlier studies (Pronk 2002, Saario 2005) conducted in the Netherlands and Finland.

#### **11.4.2 Qualitative studies III-IV**

The qualitative semi-structured interviews (STUDIES III-IV) were conducted to explore the experiences of internationally recognized experts (n=14) in relation to



their visions; and strategies (STUDY I); as well as development and implementation of IT (STUDY II) to support medication management in community pharmacy setting. The method was selected because it allowed the interviewer to re-word, re-order and clarify each question based on the responses of the participants (Tong 2007). The study was designed in accordance with the RATS guidelines for conducting and reviewing qualitative research (Clark 2003).

The interview guide was pre-tested for face-validity by conducting one pilot interview. No modifications were deemed necessary. Data from the pilot interview were not included in the final analyses. A purposive sampling strategy was employed. The final sample size was defined by the point when data saturation occurred (when no new categories, themes or explanations emerged). Qualitative research studies do not necessarily require a large random sample because generalizability is not the objective (Marshall 1996). Therefore, the results are not intended to be generalized. Saturation of the data was achieved, which indicates that a comprehensive description of the phenomena studied was possible to construct. However, including more experts may have increased the richness of the data and reliability of the findings. Furthermore, the results are based on findings from developed countries within well-organized healthcare environments. The development needs may be different in developing countries and countries with different kinds of health systems. The part II of the interview study (STUDY IV) was intended to gather knowledge about the community pharmacy IT development processes to support patient care services. One limitation is that some of the respondents could not give all the information needed, because they did not know all the details of the processes.

#### **11.4.3 Ethical considerations**

All the study procedures were conducted in accordance with good ethical practice and when relevant, in accordance with the World Medical Association Declaration of Helsinki. Support for conduct the study was sought and obtained from the

Association of Finnish Pharmacies (mailing costs for the survey study for the Finnish owners and the participation of the FIP congress in China for conducting the interview study). The identities of individual survey respondents were not recorded as part of the data collect processes. Reading the cover letter and returning the completed survey was considered to be informed consent for participation in the survey. Prior to the interviews, potential participants were invited to participate by e-mail. The participants were well-informed about the study procedures, both orally by the researcher and with a written information sheet. In this information sheet, participants were informed that the interviews will be tape-recorded and confidentiality was emphasized. A consent form was signed by all participants at the beginning of the interview. Participants could refuse to participate at any time. The data were processed confidentially and the results are expressed so that individuals cannot be identified.

## 12 CONCLUSIONS

### 12.1 Implications in practice

Based on the results of the study, the following conclusions can be drawn:

1. In strategic planning for a future IT system in community pharmacies, pharmacy owners ranked logistical functions most highly but included features that would facilitate cognitive pharmaceutical services and patient care in that category. The results of this survey indicate pharmacy owners' commitment to implementing cognitive pharmaceutical services and health policy goals along with further development of their business capabilities. This dual professional and business orientation exists despite their responsibility for financing development of IT system.
2. The managers and staff pharmacists have different views on the importance of IT features, reflecting their different professional duties in the community pharmacy. A high priority was given for the features familiar to the users and needed in their daily practice. This indicates the need for involving different occupation groups in planning the new IT systems for community pharmacies. An iterative developmental process will include practitioners' needs and will facilitate adoption.
3. Those responsible for IT development in community pharmacy sector should create long-term IT development strategies that are in line with community pharmacy service development strategies.
4. The development processes for IT and related community pharmacy innovations do not entirely follow theoretical framework on the diffusion of innovations. Specifically, community pharmacy IT developments lack research, organization, leadership and user involvement in the process.

5. Community pharmacy IT innovations were rare and focus on limited areas. This is paradoxical because community pharmacists' self-reported innovativeness was perceived to be high.

## **12.2 Further research**

More research should be focused on strategic planning of community pharmacy services and related IT applications within a wider health system context. The pharmacy profession's own visions and strategies concerning patient care services should guide this research and development. Despite the importance of these services and the supportive IT systems, there has been only little research in community pharmacies setting on the operation of patient care services and how IT is used in providing these services. More research should focus on assessing theoretical and practical competency needs of community pharmacists with a strategic perspective. Diffusion of innovations framework could provide systematic guidance for future projects to ensure that potential innovations are based on a sufficient understanding of the pharmacy practice problem that they are to solve.

## 13 REFERENCES

Abarca J, Malone DC, Armstrong EP, Grizzle AJ, Hansten PD, Van Bergen AC, Lipton RB. Concordance of severity ratings provided in four drug interaction compendia. *J Am Pharm Assoc* 2004;44(2):136-141.

Abarca J, Colón LR, Wang VS, Malone DC, Murphy JE, Armstrong EP. Evaluation of the performance of drug-drug interaction screening software in community and hospital pharmacies. *J Man Care Pharm* 2006;12(5):383-389.

Abookire SA, Teich JM, Sandige H, Paterno MD, Martin MT, Kuperman GJ, Bates DW. Improving allergy alerting in a computerized physician order entry system. *Proc AMIA Symp* 2000:2-6.

Adams S. Revisiting the online health information reliability debate in the wake of “web 2.0”: An inter-disciplinary literature and website review. *Int J Med Inform* 2010;79(6):391-400.

Agency for Health Care Research and Quality. Available at: <http://www.ahrq.gov/> (July 20, 2011).

Agrawal A. Medication errors: prevention using information systems. *Br J Clin Pharmacol* 2009;67(6):681-686.

Ahearn MD, Kerr SJ. General practitioners' perceptions of the pharmaceutical decision-support tools in their prescribing software. *Med J Aust* 2003;179:34-37.

Ahmad F, Hudak PL, Bercovitz K, Hollenberg E, Lewinson W. Are physicians ready for patients with Internet-based health information. *J Med Internet Res* 2006;8(3):e22.

Alvarez de Toledo F, Arcos González P, Eyaralar Riera T, Abal Ferrer FF, Dago Martínez A, Cabiedes Miragaya L, Sánchez Posada I, Alvarez Sánchez G. Pharmaceutical care in people who have had acute coronary episodes (TOMCOR study). *Rev Esp Salud Pública* 2001;75:375-387.

American College of Clinical Pharmacy. The definition of clinical pharmacy. *Pharmacother* 2008;28(6):816-817.

American Pharmacists Association. MTM Services Working Group, Medication Therapy Management Services Definition and Program Criteria 2004. Available at: <http://www.aacp.org/resources/historicaldocuments/Documents/MTMServicesDefinitionandProgramCriteria04.pdf> (June 28, 2011).

American Pharmacists Association and the National Association of Chain Drug Stores Foundation. Medication therapy management in pharmacy practice: core elements of an MTM service model (version 2.0). *J Am Pharm Assoc* 2008;48:341-353.

American Pharmacists Association. Available at: [http://www.pharmacist.com/Content/NavigationMenu3/MTM/Circle\\_Image\\_descrip.htm](http://www.pharmacist.com/Content/NavigationMenu3/MTM/Circle_Image_descrip.htm) (June 28, 2011).

American Society of Hospital Pharmacists. ASHP guidelines on preventing medication errors in hospitals. *Am J Hosp Pharm* 1993;50:305-314.

Angaran DM, Hepler CD, Bjornson DC, Hadsall RS. Career patterns of pioneer clinical pharmacists. *Am J Hosp Pharm* 1988;45:101-108.

Apoteket, AB, Guide - LRPi ATS. (Guide - Drug Related Problems in ATS, the Swedish pharmacy computer system) (In Swedish) Apoteket AB; Feb, 2001.

Armstrong E.P, Markson T.J. On-line DUR messages: Pharmacists' attitudes and actions in response. *J Am Pharm Assoc* 1997;37(3):315-320.

Ash J, Berg M, Coiera E. Some unintended consequences of information technology in health care: The nature of patient care information systems related errors. *J Am Med Inform Assoc* 2004;11(2):104-112.

The Association of Finnish Pharmacies. Guidelines for a Professional Community Pharmacy in Finland. Publications of the Association of Finnish Pharmacies 1997;33.

The Association of Finnish Pharmacies. Annual Review 2007. Available at: [http://www.apteekkariliitto.fi/media/pdf/annual\\_report\\_2007.pdf](http://www.apteekkariliitto.fi/media/pdf/annual_report_2007.pdf) (July 20, 2011).

The Association of Finnish Pharmacies. Annual Review 2009. Accessed at: [http://www.apteekkariliitto.fi/Documents/Vuosikatsaus\\_2009\\_englanti.pdf](http://www.apteekkariliitto.fi/Documents/Vuosikatsaus_2009_englanti.pdf)

Ax F, Ekedahl A. Electronically transmitted prescriptions not picked up at pharmacies in Sweden. *Res Social Adm Pharm* 2010;6:70-77.

Balen RM, Jewesson PJ. Pharmacist computer skills and needs assessment survey. *J Med Internet Res* 2004;6(1):e11.

Balfour DC 3<sup>rd</sup>, Evans S, Januska J, Lee HY, Lewis SJ, Nolan SR, Noga M, Stemple C, Thapar K. Health information technology – results from a round table discussion. *J Manag Care Pharm* 2009;15(1 Suppl A):10-17.

Barbanel D, Eldridge S, Griffiths C. Can a self-management programme delivered by a community pharmacist improve asthma control? A randomised trial. *Thorax* 2003;58(10):851–854.

Barla C, Mignot G, Chichmanian RM. Comparative study of data banks on drug interactions [in French]. *Therapie* 1992;47(5):449-453.

Barnett MJ, Frank J, Wehring H, Newland B, Vonmuenster S, Kumbera P, Halterman T, Perry PJ. Analysis of pharmacist-provided medication therapy management (MTM) services in community pharmacies over 7 years. *J Manag Care Pharm* 2009;15(1):18-31.

Barrons R. Evaluation of personal digital assistant software for drug interactions. *Am J Health Syst Pharm* 2004;61(4):380-385.

Bates DW, Leape LL, Cullen DJ, Laird N, Petersen LA, Teich JM, Burdick E, Hickey M, Kleefield S, Shea B, Vander Vliet M, Sger DL. Effect of computerized physician order

entry and a team intervention on preventing of serious medication errors. *JAMA* 1998;280:1311-1316.

Bates DW, Teich JM, Lee J, Seger D, Kuperman GJ, Ma'luf N, Boyle D, Leape L. The impact of computerized physician order entry system on medication error prevention. *J Am Med Inform Assoc*. 1999;6:313-321.

Bates DW, Cohen M, Leape L, Overhage JM, Shabot M, Sheridan T. Reducing the frequency of errors in medicine using information technology. *J Am Med Inform Assoc* 2001;8(4):299-308.

Bates DW, Kuperman GJ, Wang S, Gandhi T, Kittler A, Volk L, Spurr C, Khorasani R, Tanasijevic M, Middleton B. Ten commandments for effective clinical decision support: making the practice of evidence-based medicine a reality. *J Am Med Inform Assoc* 2003a;10:523-530.

Bates DW, Gawande AA. Improving safety with information technology. *N Engl J Med* 2003b;348:2526-2534.

Becker ML, Kallewaard M, Caspers PW, Schalekamp T, Stricker BH. Potential determinants of drug-drug interaction associated in dispensing in community pharmacies. *Drug Saf* 2005;28(5):371-378.

Bheekie A, Syce JA, Weinberg EG. Peak expiratory rate and symptom self-monitoring of asthma initiated from community pharmacies. *J Clin Pharm Ther* 2001;26:287-296.

Berardo DH, Kimberlin CL, McKenzie LC, Pendergast JF. Community pharmacists' documentation of intervention on drug related problems of elderly patients. *J Soc Adm Pharm* 1994;11(4):182-193.

Berenguer B, La Casa C, de la Matta MJ, Martín-Calero MJ. Pharmaceutical care: Past, present and future. *Curr Pharm Des* 2004;10:3931-3946.

Berger M, Wagner TH, Baker LC. Internet use and stigmatized illness. *Soc Sci Med* 2005;61:1821-1827.

Bernstam EV, Shelton DM, Walji M, Meric-Bernstam F. Instruments to assess the quality of health information on the world wide web: what can our patients actually use? *Int J Med Inf* 2005;74(1):13-19.

Bernsten C, Andersson K, Garipey Y, Simoens S. A comparative analysis of remuneration models for pharmaceutical professional services. *Health Policy* 2010;95(1):1-9.

Bessell TL, Silagy CA, Anderson JN, Hiller JE, Sansom LN. Quality of global e-pharmacies: can we safeguard consumers? *Eur J Clin Pharmacol* 2002;58(9):567-572.

Bezolt C, Halperin JA, Eng JL (Eds.): 2020 Visions: Health Care Information Standards and Technologies. Rockville, USPC 1993.

Bindoff IK, Tenni PC, Peterson GM, Kang BH, Jackson SL. Development of an intelligent decision support system for medication review. *J Clin Pharm Ther* 2007;32:81-88.

Björkman IK, Sanner MA, Bernstein CB. Comparing 4 classification systems for drug-related problems: processes and functions. *Res Social Adm Pharm* 2008;4(4):320-331.

Blake KB, Madhavan SS, Scott VG, Meredith Elsewick BL. Medication therapy management services in West Virginia: pharmacists' perceptions of educational and training needs. *Res Social Adm Pharm* 2009;5(2):182-188.

Blake KB, Madhavan SS. Perceived barriers to provision of medication therapy management services (MTMS) and the likelihood of a pharmacist to work in a pharmacy that provides MTMS. *Ann Pharmacother* 2010;44(3):424-431.

Blumenthal D, DesRoches C, Donelan K. Health Information technology in the United States: the information base for progress, Robert Wood Johnson Foundation, 2006.

Bluml BM, McKenney JM, Cziraky MJ, Elswick RK Jr. Interim report from project ImPACT: hyperlipidemia. *J Am Pharm Assoc* 1998;38:529-534.

Bluml BM. Definition of medication therapy management: Development of professionwide consensus. *J Am Pharm Assoc* 2005;45:566-572.

Boeije H. A purposeful approach to the constant comparative method in the analysis of qualitative interviews. *Qual Quant*. 2002;36:391-409.

Bond C, Matheson C, Williams S, Williams P, Donnan P. Repeat prescribing: A role for community pharmacists in controlling and monitoring repeat prescriptions. *Br J Gen Pract* 2000;50(453):271-275.

Boudreau DM, Capoccia KL, Sullivan SD, Blough DK, Ellsworth AJ, Clark DL, Katon WJ, Walker EA, Stewens NG. Collaborative care model to improve outcomes in major depression. *Ann Pharmacother* 2002;36(4):585-591.

Boulos MN, Maramba I, Wheeler S. Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. *BMC Med Educ* 2006;6:41.

Boyd DM, Ellison NB. Social network sites: Definition, history and scholarship. *Journal of computer-mediated communication*. 2008;13(1):210-230.

Brett AS. Computerized alerts can influence drug prescribing. *Journal Watch, Massachusetts Medical Society*, 11/20/2009.

Brodie DC, Parish PA, Poston JW. Societal needs for drugs and drug-related services. *Am J Pharm Educ* 1980;44:276-278.

Brook OH, Van Hout HP, Nieuwenhuysen H, De Haan M. Effects of coaching by community pharmacists on psychological symptoms of antidepressant users: A randomised controlled trial. *Eur Neuropsychopharmacol* 2003;13(5):347-354.

Brown D. Intranet can enhance speed, flow of communications among employees at work. *Cap Dist Bus Rev* 1996;7(Oct).



Bruckel K and Capozzoli EA. Internet pharmaceutical sales: attributes, concerns, and future forecast. *J Hosp Mark Public Relations* 2003;15(1):61-76.

Bu D, Pan E, Walker J, Adler-Milstein J, Kendrick D, Hook JM, Cusack CM, Bates DW, Middleton B. Benefits of information technology-enabled diabetes management. *Diabetes Care* 2007;30:1137-1142.

Bundesministerium fuer Gesundheit – Gesundheitskarte, Berlin. Available at: <http://www.die-gesundheitskarte.de> (June 28, 2011).

Bunting BA, Cranor CW. The Asheville Project: long-term clinical, humanistic, and economic outcomes of a community-based medication therapy management program for asthma. *J Am Pharm Assoc* 2003;46:133-147.

BusinessDictionary. Available at: <http://www.businessdictionary.com/> (July 20, 2011).

Böttiger Y, Laine K, Andersson ML, Korhonen T, Molin B, Ovesjö ML, Tirkkonen T, Rane A, Gustafsson LL, Eierman B. Sfinx – a drug-drug interaction database designed for clinical decision support systems. *Eur J Clin Pharmacol* 2009;65(6):627-633.

Cain J. Online social networking issues within academia and pharmacy education. *Am J Pharm Educ* 2008;72:10.

Cain J, Fox BI. Web 2.0 and medical education. *Am J Pharm Educ* 2009;73:120.

Cain J, Romanelli F, Fox B. Pharmacy, social media, and health: Opportunity for impact. *J Am Pharm Assoc* 2010;50(6):745-751.

Calabretto J-P, Warren J, Bird L. Pharmacy decision support: where is it? A systematic review. *Int J Pharm Pract* 2005;13.

Caleo S, Benrimoj S, Collins D, Lauchlan R, Stewart K. Clinical evaluation of community pharmacists' interventions. *Int J Pharm Pract* 1996;4:221–227.

Canada Health Infoway, 2015 advancing Canada's next generation of healthcare at a glance, Canada Health Infoway, 2006. Available at: [http://www2.infoway-inforoute.ca/Documents/Vision\\_2015\\_Advancing\\_Canadas\\_next\\_generation\\_of\\_healthcare\[1\].pdf](http://www2.infoway-inforoute.ca/Documents/Vision_2015_Advancing_Canadas_next_generation_of_healthcare[1].pdf) (June 28, 2011).

Canada Health Infoway. Reporting to Canadians, Annual report 2009-2010. Available at: [http://www.infoway-inforoute.ca/flash/lang-en/ar2009-2010/docs/CHI\\_AnnualReport\\_2009-2010\\_ENG.pdf](http://www.infoway-inforoute.ca/flash/lang-en/ar2009-2010/docs/CHI_AnnualReport_2009-2010_ENG.pdf) (June 28, 2011).

Canaday, BR. OBRA '90: A practical guide to effecting Pharmaceutical Care. American Pharmaceutical Association, 1994.

Canberra, Department of Health and Ageing, Australia. The National Strategy for Quality Use of Medicines, in a book *Health and Ageing* 2002.

Capoccia KL, Boudreau DM, Blough DK, Ellsworth AJ, Clark DR, Stevens NG, Katon WJ, Sullivan SD. Randomized trial of pharmacist interventions to improve depression care and outcomes in primary care. *Am J Health-System Pharm* 2004;61(4):364–372.

Care Continuum Alliance. Available at: [http://www.carecontinuum.org/dm\\_definition.asp](http://www.carecontinuum.org/dm_definition.asp). (June 28, 2011).

Carter BL, Chrischilles EA, Scholz D, Hayase N, Bell N. Extent of services provided by pharmacists in the Iowa Medicaid pharmaceutical case management program. *J Am Pharm Assoc* 2003;43:24-33.

Casebeer A. Application of SWOT analysis. *Br J Hosp Med* 1993;49(6):430-431.

Chai K, Potdar V, Dillon T. Content quality assessment related frameworks for social media. *ICCSA* 2009;5593:791-805.

Chaudry B, Wang J, Wu S, Maglione M, Mojica W, Roth E, Morton SC, Shekelle PG. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med* 2006;144(10):742-752.

Chen TF, Crampton M, Krass I, Benrimoj SI. Collaboration between community pharmacists and general medical practitioners – the medication review process. *J Soc Admin Pharm* 1999;16:145-146.

Chen T, Casson C, Krass I, Benrimoj S. Medication regimen review process. A guide for community pharmacists. *Aust Pharm* 1996;15(11):681–685.

Chui MA, Rupp MT. Evaluation of online prospective DUR programs in community pharmacy practice. *J Manag Care Pharm* 2000;6:27-32.

Chrischilles EA, Fulda TR, Byrns PJ, Winckler SC, Rupp MT, Chui MA. The Role of Pharmacy Computer Systems in Preventing Medication Errors. *J Am Pharm Assoc* 2002;42(3):439-448.

Christensen D, Trygstad T, Sullivan R, Garmise J, Wegner SE. A pharmacy management intervention for optimizing drug therapy for nursing home patients. *Am J Geriatr Pharmacother* 2004;2:248-256.

Christensen DB, Farris KB. Pharmaceutical care in community pharmacies: practice and research in the US. *Ann Pharmacother* 2006;40(7-8):1400-1406.

Cipolle RJ, Strand LM, Morley PC. *Pharmaceutical Care Practice*. USA, McGraw-Hill Companies Inc.; 1998.

Cipolle RJ, Strand LM, Morley PC. *Pharmaceutical care practice: the clinician's guide*. 2<sup>nd</sup> ed. New York, McGraw-Hill, 2004.

Clark JP. Qualitative research review guidelines – RATS. Adapted from *How to peer review a qualitative manuscript*. In *Peer Review in Health Sciences*. Second edition. Edited by Godlee F, Jefferson T. London: BMJ Books; 2003:219-235.

Clauson KA, Polen HH, Boulos MN, Dzenowagis JH. Scope, completeness, and accuracy of drug information in Wikipedia. *Ann Pharmacother* 2008;42:1814-1821.

Clauson KA, Vidal DM. Overview of biomedical journal podcasts. *Am J Health-Syst Pharm* 2008;65:2155-2158.

Clauson KA, Seamon MJ, Fox BI. Pharmacists' duty to warn in the age of social media. *Am J Health-Syst Pharm* 2010;67:1290-1293.

Clauson KA, Alkhateeb FM, Lugo KD, Khanfar NM. E-prescribing: attitudes and perceptions of community pharmacists in Puerto Rico. *Int J Electron Healthc* 2011;6(1):34-46.

Clifford RM, Davis WA, Batty KT, Davis TM. Effect of a pharmaceutical care program on vascular risk factors in type 2 diabetes: The Fremantle Diabetes Study. *Diabetes Care* 2005;28(4):771-776.

Cockerill R, Tanner J, Barnsley J, Williams AP. Women and men managers in pharmacy: gender issues. *J Health Adm Educ* 1999;17(3):199-210.

Coiera E, Westbrook JI, Wyatt JC. The safety and quality of decision support systems. *IMIA Yearbook of Medical Informatics* 2006;20-25.

Coloma PM, Schuemie MJ, Trifirò G, Gini R, Herings R, Hippisley-Cox J, Mazzaglia G, Giaquinto C, Corrao G, Pedersen L, van der Lei J, Sturkenboom M; EU-ADR Consortium. Combining electronic healthcare databases in Europe to allow for large-scale drug safety monitoring: the EU-ADR Project. *Pharmacoepidemiol Drug Saf* 2011;20(1):1-11.

Compilation of patient protection and Affordable Care Act 2010. Available at: <http://docs.house.gov/energycommerce/ppacacon.pdf> (July 16, 2011).

Consensus Committee. Second Consensus of Granada on Drug Therapy Problems. *Ars Pharm* 2002;43(3-4):175-184.

Cordina M, McElnay JC, Hughes CM. Assessment of a community pharmacy-based program for patients with asthma. *Pharmacotherapy* 2001;21:1196-1203.

Coombes ID, Stowasser DA, Mitchell CA, Varghese P. Effect of computerised prescribing on use of antibiotics. *Med J Aust* 2004;180(3):140-141.

Council of Europe. Expert Group on Safe Medication Practices. Creation of a better medication safety culture in Europe - Building up safe medication practices. Published March 2007. Available at: [http://www.coe.int/t/e/social\\_cohesion/soc-sp/Medication%20safety%20culture%20report%20E.pdf](http://www.coe.int/t/e/social_cohesion/soc-sp/Medication%20safety%20culture%20report%20E.pdf) (June 28, 2011).

Cranor CW, Christensen DB. The Asheville Project: short-term outcomes of a community pharmacy diabetes care program. *J Am Pharm Assoc* 2003a;43(2):149-159.

Cranor CW, Bunting BA, Christensen DB. The Asheville Project: long-term clinical and economic outcomes of a community pharmacy diabetes care program. *J Am Pharm Assoc* 2003b;43(2):173-184.

Cusack CM. Electronic health records and electronic prescribing: promise and pitfalls. *Obstet Gynecol Clin North Am* 2008;35(1):63-79.

Danish Centre for Health Telematics, Synergy across borders, Odense, 2008. Available at: <http://www.medcom.dk/dwn406> (June 28, 2011).

Department of Health and Human Services, Health Care Financing Administration: 42 CFR Part 456. Medicaid Program; Drug Use Review Program and Electronic Claims Management System for Outpatient Drug Claims. 1992.

Deutsch E, Duftschmid G, Dorda W. Critical areas of national health record programs – Is our focus correct? *Int J Med Inform* 2010;79(3):211-222.

Donyai P, O'Grady K, Jacklin A, Barber N, Franklin BD. The effects of electronic prescribing on the quality of prescribing. *Br J Clin Pharmacol* 2008;65(2):230-237.

Doucette WR, Kreling DH, Schommer JC, Gaither CA, Mott DA, Pedersen CA. Evaluation of community pharmacy service mix: evidence from the 2004 National Pharmacist Workforce Study. *J Am Pharm Assoc* 2006;46(3):348-355.

eHealth Initiative. Executive summary. Electronic Prescribing: Toward maximum value and rapid adoption. A report of the Electronic Prescribing Initiative, Washington D.C. April 14, 2004.

Edwards RI, Aronson JK. Adverse Drug reactions: definitions, diagnosis, and management. *The Lancet* 2000;356:1255-1259.

Ellis SL, Carter BL, Malone DC, Billups SJ, Okano GJ, Valuck RJ, Barnette DJ, Sintek CD, Covey D, Mason B, Jue S, Carmichael J, Guthrie K, Dombrowski R, Geraets DR, Amato M. Clinical and economic impact of ambulatory care clinical pharmacists in management of dyslipidemia in older adults: The IMPROVE study. *Pharmacotherapy* 2000;20:1508-1516.

Emblen G, Miller E. Home medicines review. The how and why for GPs. *Aust Fam Physician* 2004;33(1-2):49-51.

e-Receipt Stockholm. Available at: [www.ereceptstockholm.se](http://www.ereceptstockholm.se) (June 28, 2011).

Ernst ME, Doucette WR, Dedhiya SD, Osterhaus MC, Kumbera PA, Osterhaus JT, Townsend RJ. Use of point-of-service health status assessments by community pharmacists to identify and resolve drug-related problems in patients with musculoskeletal disorders. *Pharmacotherapy* 2001;21:988-997.

Ernst ME, Iyer SS, Doucette WR. Drug-related problems and quality of life in arthritis and low back pain sufferers. *Value Health* 2003;6:51-58.

The European Court of Justice, Court in case C-322/01, 2004. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2004:047:0005:0006:FI:PDF> (June 28, 2011).

EuroPharm Forum. Available at: <http://www.europarmforum.org/> (June 28, 2011).

Evans RS, Pestotnik SL, Classen DC, Clemmer TP, Weaver LK, Orme JF Jr, Lloyd JF, Burke JP. A computer-assisted management program for antibiotics and other antinfective agents. *N Engl J Med* 1998;338(4):232-238.

Eysenbach G, Diepgen TL. Towards quality management of medical information on the internet: evaluation, labeling and filtering of information. *BMJ* 1998;317:1496–1500.

Eysenbach G. Infodemiology: the epidemiology of (mis-)information. *Am J Med* 2002;113(9):763–765.

Eysenbach G, Powell J, Kuss O, Sa E. Empirical studies assessing the quality of health information for consumers on the World Wide Web. A systematic review. *JAMA* 2002;287:2691-2700.

Feldstein A, Simon SR, Schneider J, Krall M, Laferriere D, Smith DH, Sittig DF, Soumerai SB. How to design computerized alerts to safe prescribing practices. *Jt Comm J Qual Saf* 2004;30:602-613.

Feletto E, Wilson LK, Roberts AS, Benrimoj SI. Building capacity to implement cognitive services: Quantifying the needs of community pharmacies. *Res Social Adm Pharm* 2010;6(3):163-173.

Felkey BG, Fox BI. Using the Internet to Enhance Pharmacy-Based Patient Care services. *J Am Pharm Assoc* 2001;41(4):529-538.

FIP. Standards for Quality of Pharmacy Services. FIP Guidelines for Good Pharmacy Practice. FIP, 1993. Revised version FIP/WHO, 1997. Available at: [http://www.fip.org/www/uploads/database\\_file.php?id=261&table\\_id=](http://www.fip.org/www/uploads/database_file.php?id=261&table_id=) (June 28, 2011).

FIP. Draft Joint FIP/WHO Guidelines on Good Pharmacy Practice: Standards for Quality of Pharmacy Services. FIP, 2010. Available at: <http://www.sefig.org/documentos/noticias/FinaldraftFIPWHOGPPguidelinesforreview.pdf> (June 28, 2011).

FIP. FIP Statement of professional standards on electronic prescriptions. FIP, 2001. Available at: [http://www.fip.org/www/uploads/database\\_file.php?id=225&table\\_id=](http://www.fip.org/www/uploads/database_file.php?id=225&table_id=) (June 28, 2011).

FIP. FIP Statement of Policy on the Role Of The Pharmacist In the Prevention And Treatment Of Chronic Disease. FIP, 2006. Available at: [http://www.fip.org/www/uploads/database\\_file.php?id=274&table\\_id=](http://www.fip.org/www/uploads/database_file.php?id=274&table_id=). (June 28, 2011).

Forman RF, Marlowe DB, McLellan AT. The internet as a source of drugs of abuse. *Curr Psychiatry Rep* 2006;8(5):377-382.

Friedman CP, Iakovidis I, Debenetti L, Lorenzi NM. Across the Atlantic cooperation to address international challenges in eHealth and health IT: Managing toward a common goal. *Int J Med Inform* 2009;78:778-784.

Fulda TR, Hass SL. Medicaid Drug Utilization Review Under OBRA 1990. Current Issues and Future Directions. *Pharmacoeconomics* 1992;2(5):363-370.

Fulda TR, Baluck RJ, Vander Zanden J, Parker S, Byrns PJ. Disagreement among drug compendia on inclusion and ratings of drug-drug interactions. *Curr Ther Res* 2000;61(8):540-548.

Fulda TR, Lyles A, Pugh MC, Christensen DB. Current status of prospective drug utilization review. *J Manag Care Pharm* 2004;10(5):433-441.

Fulda TR, Wertheimer AI. *Handbook of Pharmaceutical Public Policy*. The Haworth Press, Inc., Binghamton, NY, 2007.

Gammaitoni AR, Gallagher RM, Welz M, Gracely EJ, Knowlton CH, Voltis TO. Palliative pharmaceutical care: A randomized, prospective study of telephone-based prescription and medication counseling services for treating chronic pain. *Pain Medicine* 2000;1:317-331.

Garg AX, Adhikari NK, McDonald H, Rosas-Arellano MP, Devereaux PJ, Beyene J, Sam J, Haynes RB. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes. *JAMA* 2005;293:1223-1238.

Garcao JA, Cabrita J. Evaluation of a pharmaceutical care program for hypertensive patients in rural Portugal. *J Am Pharm Assoc* 2002;42:858-864.

Garrett D, Bluml B. Patient self-management program for diabetes: first-year clinical, humanistic, and economic outcomes. *J Am Pharm Assoc* 2005;45:130-137.

Gastelurrutia MA, Benrimoj SI, Castrillon CC, de Amezua MJ, Fernandez-Llimos F, Faus MJ. Facilitators for practice change in Spanish community pharmacy. *Pharm World Sci* 2009;31(1):32-39.

Gematik. Available at: <http://www.gematik.de> (June 28, 2011).

Gesellschaft fuer Telematikanwendungen der Gesundheitskarte mbH, Berlin. Available at: <http://www.gematik.de> (June 28, 2011).

Ghodse H. Watching internet pharmacies. *Br J Psychiatry* 2010;196:169-170.

Ghoshal M, Waiji MF. Quality of medication information available on retail pharmacy Web sites. *Res Social Adm Pharm* 2006;2:479-498.

Gibis B, Artiles J, Corabian P, Meiesaar K, Koppel A, Jacobs P, Menon D. Application of strengths, weaknesses, opportunities and threats analysis in the development of a health technology assessment program. *Health Policy* 2001;58(1):27-35.

Gilbert AL, Roughead EE, Beilby J, Mott K, Barratt JD. Collaborative medication management services: improving patient care. *Med J Aust* 2002;177(4):189-192.

Glassman PA, Simon B, Belperio P, Lanto A. Improving recognition of drug interactions: benefits and barriers to using automated drug alerts. *Med Care* 2002;40:1161-1171.

Goedert J. A different type of PHR. Available at: [http://www.healthdatamanagement.com/issues/2009\\_67/28274-1.html](http://www.healthdatamanagement.com/issues/2009_67/28274-1.html) (June 28, 2011).

Gold S. EHRs: Who is setting records? Available at: <http://www.smarthealthcare.com/electronic-health-records-cerner-isoft-emis-10mar10> (June 28, 2011).

Gonzalez-Martin G, Joo I, Sanchez I. Evaluation of the impact of a pharmaceutical care program in children with asthma. *Patient Educ Couns* 2003;49(1):13–18.

Goode JV, Swiger K, Bluml BM. Regional osteoporosis screening, referral, and monitoring program in community pharmacies: findings from project ImPACT: Osteoporosis. *J Am Pharm Assoc* 2004;44(2):152-160.

Gottlieb S. Health information on the internet is often unreliable. *BMJ* 2000;321:136.

Goundrey-Smith S. Electronic prescribing – experience in the UK and system design issues. *The Pharmaceutical Journal* 2006;277:485-489.

Graber M. The safety of computer-based medication systems. *Arch Intern Med* 2004;164(3):339-340.

Graham AL, Cobb NK, Raymond L, Sill S, Young J. Effectiveness of an internet-based worksite smoking cessation intervention at 12 months. *J Occup Environ Med* 2007;49:821-828.

Grossman JM, Gerland A, Reed MC, Fahlman C. Physicians' experiences using commercial e-prescribing systems. *Health Aff* 2007;(3):w393-w404.

Grossman JM, Boukus ER, Cross DA, Cohen GR. Physician practices, e-prescribing and accessing information to improve prescribing decisions. *Research Brief No. 20*, May 2011.

Gunter TD, Terry NP. The emergence of National Electronic Health Record Architectures in the United States and Australia: Models, costs, and questions. *J Med Internet Res* 2005;7(1):e3.

Haider M, Kreps GL. Forty years of Diffusion of Innovations: Utility and Value in Public Health. *J Health Commun* 2004;9:3-11.

Hakkarainen K. Models of pharmacist-conducted medication review – an international comparison. Master Thesis 2008, University of Helsinki.

Hartikainen O: Apteekin lainsäädännölliset mahdollisuudet ja velvollisuudet osallistua lääkeneuvontaan Euroopan maissa. Master Thesis 1999, University of Kuopio (In Finnish).

Hawn C. Take two aspirin and tweet me in the morning: how Twitter, Facebook, and other social media are reshaping health care. *Health Aff* 2009;28:361-368.

Hazlet TK, Lee TA, Hansten PD, Horn JR. Performance of community pharmacy drug interaction software. *J Am Pharm Assoc* 2001; 41:200-204.

Heidelberg AT. Germany plans to introduce electronic health card. *BMJ* 2004;329-131.

Hepler CD. Pharmacy as a clinical profession. *Am J Hosp Pharm* 1985;42:1298-1306.

Hepler CD. The third wave in pharmaceutical education and the clinical movement. *Am J Pharm Educ* 1987;51:369-385.

Hepler CD, Strand LM. Opportunities and responsibilities in Pharmaceutical Care. Am J Pharm Educ 1989; 53:7s-15s.

Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. Am J Hosp Pharm 1990;47:533-543.

Hepler CD. Pharmaceutical care. Pharm World Sci 1996;18:233-236.

Herborg H, Soendergaard B, Froekjaer B, Fonnesbaek L, Jorgensen T, Hepler CD, Grainger-Rousseau TJ, Ersboell BK. Improving drug therapy for patients with asthma-part 1: patient outcomes. J Am Pharm Assoc 2001;41:514-550.

Health Information Management Systems Society. HIMMS'PHR, ePHR definition. Available at: [http://www.himss.org/ASP/topics\\_FocusDynamic.asp?faid=228](http://www.himss.org/ASP/topics_FocusDynamic.asp?faid=228) (June 28, 2011).

Hines LE, Saverno KR, Warholak TL, Taylor A, Grizzle AJ, Murphy Je, Malone DC. Pharmacists' awareness of clinical decision support in pharmacy information systems: An exploratory evaluation. Res Social Adm Pharm 2011; Apr 27,1-10.

Holmes ER, Desselle SP, Nath DM, Markuss JJ. Ask the pharmacists: an analysis of online drug information services. Ann Pharmacother 2005;39:662-667.

House of commons Committee of Public Accounts, Department of Health: The National Programme for IT in the NHS, Benefit Statement 2006/07, published 2007. Available at: <http://www.publications.parliament.uk/pa/cm200607/cmselect/cmpubacc/390/390.pdf> (June 28, 2011).

Hughes CM, Hawwa AF, Scullin C, Anderson C, Bernsten CB, Björnsdóttir I, Cordina MA, da Costa FA, De Wulf I, Eichenberger P, Foulon V, Henman MC, Hersberger KE, Schaefer MA, Søndergaard B, Tully MP, Westerlund T, McElnay JC. Provision of pharmaceutical care by community pharmacists: a comparison across Europe. Pharm World Sci 2010;32(4):472-487.

Hynninen JT. Tietotekniikka suomalaisessa apteekkityössä tänään ja huomenna. Master Thesis 2007, University of Helsinki (in Finnish).

iHealthBeat. CDC to tap social media tools to spread H1N1 flu virus information. Available at: <http://www.ihealthbeat.org/Articles/2009/8/25/CDC-To-Tap-Social-Media-Tools-To-Spread-H1N1-Flu-Virus-Information.aspx> (June 28, 2011).

Impicciatore P, Pandolfini C, Casella N, Bonati M. Reliability of health information for the public on the world wide web: systematic survey of advice on managing fever in children at home. BMJ 1997;314:1875–1881.

Institute for Healthcare Improvement. Overview of the Chronic Care Model. Available at: [www.ihl.org/IHI/Topics/ChronicConditions/AllConditions/changes/](http://www.ihl.org/IHI/Topics/ChronicConditions/AllConditions/changes/) (June 28, 2011).

Institute for Safe Medical practices. White paper: a call to action: eliminate handwritten prescriptions within 3 years! Available at: <http://www.ismp.org/newsletters/acutecare/articles/whitepaper.asp> (July 19,2011).



Institute of Medicine. Crossing the quality chasm: A new health system for 21<sup>st</sup> century. March 2001. Available at: [http://www.nap.edu/html/quality\\_chasm/reportbrief.pdf](http://www.nap.edu/html/quality_chasm/reportbrief.pdf) (October 2, 2011).

Isetts BJ, Schondelmeyer SW, Artz MB, Lenarz LA, Heaton AH, Wadd WB, Brown LM, Cipolle RJ. Clinical and economic outcomes of medication therapy management services: The Minnesota experience. *J Am Pharm Assoc* 2008;48(2):203-211.

Ivanitskaya L, Brookins-Fisher J, O Boyle I, Vibbert D, Erofeev D, Fulton L. Dirt cheap and without prescription: how susceptible are young US consumers to purchasing drugs from rogue internet pharmacies? *J Med Internet Res* 2010;12(2)e11.

Jackson CL, Bolen S, Brancati FL, Batts-Turner ML, Gary TL. A systematic review of interactive computer-assisted technology in diabetes care. *J Gen Intern Med* 2006;21:105-110.

Jackson SL, Peterson GM, Vial JH, Jupe DM. Improving the outcomes of anticoagulation: An evaluation of home follow-up of warfarin initiation. *J Intern Med* 2004;256(2):137-144.

Jamal A, McKenzie K, Clark M. The impact of health information technology on the quality of medical and health care: a systematic review. *Health Information Management Journal* 2009;38(3):26-37.

Jankel CA, Martin BC. Evaluation of six computerized drug interaction screening programs. *Amer J Hosp Pharm* 1992;49(6):1430-1435.

Jansen A. Informaatiotulva järjestykseen omien intranet-sivujen avulla. *Apteekkari* 2004;9 (In Finnish).

John EJ, Vavra T, Farris K, Currie J, Doucette W, Button-Neumann B, Osterhaus M, Kumbera P, Halterman T, Bullock T. Workplace-based cardiovascular risk management by community pharmacists: impact on blood pressure, lipid levels, and weight. *Pharmacother* 2006;26(10):1511-1517.

Kansanaho HM, Puumalainen II, Varunki MM, Airaksinen MS, Aslani P. Attitudes of Finnish community pharmacists toward concordance. *Ann Pharmacother*. 2004;38(11):1946-1953.

Kansanaho H, Puumalainen I, Varunki M, Ahonen R, Airaksinen M. Implementation of a professional program in Finnish community pharmacies in 2000-2002. *Patient Educ Couns* 2005;57(3):272-279.

Kansanaho H. Implementation of the principles of patient counselling into practice in Finnish community pharmacies. Doctoral dissertation, University of Helsinki, 2006. Available at: <http://urn.fi/URN:ISBN:952-10-2877-7> (June 28, 2011).

Keski-Hallila S. *Taloustutkimus Oy* 6/2007.

Kiley R. Quackery on the Web. *Health Information on the Internet*. 2000;June:9-10.

Kiley R. Some evidence exists that the internet does harm health. *BMJ* 2002;324:238.

Kivelä S-L. Development of geriatric care and elderly care. Reports of the Ministry of Social Affairs and Health 2006:30 (in Finnish, summary in English). Available at: <http://pre20090115.stm.fi/hl1150272501953/passthru.pdf> (July 20, 2011).

Klimek JS. MTM services standards improve patient safety. Medication therapy management safeguards, systems and services can reduce the total number of medication-related complications. *Health Manag Technol* 2009;30(7):20-21.

Kohn L, Corrigan J, Donaldson MS. To err is human: building a safer health system. Washington, DC. National Academy Press, 1999.

Kozma CM, Reeder CE, Schulz RM. Economic, clinical, and humanistic outcomes: a planning model for pharmaco-economic research. *Clin Ther* 1993;15(6):1121-1132.

Krass I, Armour CL, Mitchell B, Brillant M, Dienaar R, Hughes J, Lau P, Peterson G, Stewart K, Taylor S, Wilkinson J. The Pharmacy Diabetes Care Program: assessment of a community pharmacy diabetes service model in Australia. *Diabet Med* 2007;24:677-683.

Kritikos VS, Reddel HK, Bosnic-Anticevich SZ. Pharmacists' perceptions of their role in asthma management and barriers to the provision of asthma services. *Int J Pharm Pract* 2010;18(4):209-216.

Krska J, Cromarty JA, Arris F, Jamieson D, Hansford D, Duffus PR, Downie G, Seymour DG. Pharmacist-led medication review in patients over 65: a randomized, controlled trial in primary care. *Age Ageing* 2001;30(3):205-211.

Kuperman GJ, Teich JM, Gandhi TK, Bates DW. Patient safety and computerized medication ordering at Brigham and Women's Hospital. *Jt Comm J Qual Improv* 2001;27:509-521.

Kuperman GJ, Bobb A, Payne T, Avery AJ, Gandhi TK, Burns G, Classen DC, Bates DW. Medication-related clinical decision support in computerized provider order entry systems: A review. *J Am Med Inform Assoc* 2007;14(1):29-131.

Labberton L, Leikola S, Pohjanoksa-Mäntylä M, Bulajeva A, de Gier H, Airaksinen M. Collaborative Medication Review Practices in Europe. FIP Abstract, 2011.

Landerdahl M. Overview of the utilization of automated decision support tools at dispensing in the pharmacies in the European countries. Master Thesis 2010, University of Gothenburg, Sweden.

Latif A, Boardman H. Community pharmacists' attitudes towards medicines use reviews and factors affecting the numbers performed. *Pharm World Sci* 2008;30(5):536-543.

Law on changing Medicines Act 1112/2010. Available at: [www.edilex.fi](http://www.edilex.fi) (July 16, 2011).

Lazarou J, Pomeranz BH, Corey PN. Incidence of adverse drug reactions in hospitalized patients: a meta-analysis of prospective studies. *JAMA* 1998;279(15):1200-1205.

Leikola SN, Tuomainen L, Ovaskainen H, Peura S, Sévon-Vilkman N, Tanskanen P, Airaksinen MS. Creating Comprehensive Medication Review Competencies for

Collaboration between Pharmacy Practitioners and Physicians. *Am J Pharm Educ* 2009;73(6):108.

Lesar TS, Briceland L, Stein DS. Factors related to errors in medication prescribing. *JAMA* 1997;277:312-317.

The Levin Group (2005). Medication therapy management services: a critical review. *J Am Pharm Assoc* 2005;45(5):580-587.

Lipton HL, Bird JA. Drug utilization review in ambulatory settings: state of science and directions for outcomes research. *Med Care* 1993;31:1069-1082.

Liu Y, Nevins JC, Carruthers KM, Doucette WR, McDonough RP, Pan X. Osteoporosis risk screening for women in a community pharmacy. *J Am Pharm Assoc* 2007;47(4):521-526.

LogisticsWorld. Available at: <http://www.logisticsworld.com/> (July 20, 2011).

Lukes CA. Social media. *AAOHN J* 2010;58(10):415-417.

Lyles A, Zuckerman IH, DeSipio SM, Fulda TR. When warning are not enough: Primary prevention through Drug Use Review. *Health Aff* 1998;17(5):175-183.

Lyles A, Sleath B, Fulda TR, Collins TM. Ambulatory drug utilization review: opportunities for improved prescription drug use. *Am J Manag Care* 2001;7(1):75-81,quiz 82-83.

MacIntosh C, Weiser C, Wassimi A, Reddick J, Scovis N, Guy M, Boesen K. Attitudes toward and factors affecting implementation of medication therapy management services by community pharmacists. *J Am Pharm Assoc* 2009;49(1):26-30.

Magnus D, Rodgers S, Avery AJ. GPs' views on computerized drug interaction alerts: questionnaire survey. *J Clin Pharm Ther* 2000;27:377-382.

Major K, Shabot MM, Cunneen S. Wireless clinical alerts and patient outcomes in the surgical intensive care unit. *Am Surg* 2002;68:1057-1060.

Malone DC, Carter BL, Billups SJ, Valuck RJ, Barnette DJ, Sintek CD, Okano GJ, Ellis S, Covey D, Mason B, Jue S, Carmichael J, Guthrie K, Sloboda L, Dombrowski R, Geraets DR, Amato MG. Can clinical pharmacists affect SF-36 scores in veterans at high risk for medication-related problems? *Med Care* 2001;39(2):113-122.

Mandl KD, Szolovits P, Kohane IS. Public standards and patients' control: how to keep electronic medical records accessible but private. *BMJ* 2001;322(7281):283-287.

Manley HJ, Drayer DK, McClaran M, Bender W, Muther RS. Drug record discrepancies in an outpatient electronic medical record: frequency, type, and potential impact on patient care in a hemodialysis center. *Pharmacotherapy* 2003;23:231-239.

Marchibolda JM. The impact of health information technology on collaborative chronic care management. *J Manag Care Pharm* 2005;14(2):S3-S11.

Markwell D. Commentary: A patient's viewpoint. *BMJ* 2001;32?.

Marshall MN. Sampling for qualitative research. *Fam Pract* 1996;13:522-525.

McGivney MS, Meyer SM, Duncan-Hewitt W, Hall DL, Goode JV, Smith RB. Medication therapy management: its relationship to patient counseling, disease management and pharmaceutical care. *J Am Pharm Assoc* 2007;47(5):620-628.

McGovern EM, Mackay C, Hair A, Lindsay H, Bryson SM. Pharmaceutical care needs of patients with angina. *Pharm World Sci* 2001;23:175-176.

McMahan R. Operationalizing MTM through the use of Health Information Technology. *J Manag Care Pharm* 2008;14(2):S18-S21.

MedCom. Available at: <http://www.medcom.dk/> (June 28, 2011).

Medicare Prescription Drug, Improvement, and Modernization Act of 2003. Pub. L. No, 108-173, 117 Stat 2066 (January 7, 2003). Available at: <http://www.cms.hhs.gov/MMAUpdate/downloads/hrl.pdf> (June 28, 2011).

Medication Management Review Implementation Steering Group: Framework document for domiciliary medication management reviews, 2001. Available at: <http://www.psa.org.au/site.php?id=38> (June 28, 2011).

Medicines Act 395/1987. Available at: [www.edilex.fi](http://www.edilex.fi) (June 28, 2011).

Medsmanagement. Available at: [www.medsmanagement.com](http://www.medsmanagement.com) (July 20, 2011).

Mehos BM, Saseen JJ, MacLaughlin EJ. Effect of pharmacist intervention and initiation of home blood pressure monitoring in patients with uncontrolled hypertension. *Pharmacotherapy* 2000;20(11):1384–1389.

Mekhjian HS, Kumar RR, Kuehn L, Bentley TD, Teater P, Thomas A, Payne B, Ahmad A. Immediate benefits realised following implementation of physician order entry at an academic medical center. *J Am Med Inform Assoc* 2002;9:529-539.

Meredith S, Feldman P, Frey D, Giammarco L, Hall K, Arnold K, Brown NJ, Ray WA. Improving medication use in newly admitted home healthcare patients: A randomized controlled trial. *J Am Geriatr Soc* 2002;50(9):1484–1491.

Meric F, Bernstam EV, Mirza NQ, Hunt KK, Ames FC, Ross MI, Kuerer HM, Pollock RE, Musen MA, Singletary SE. Breast cancer on the world wide web: cross sectional survey of quality of information and popularity of websites. *BMJ* 2002;324:577–581.

Mikael RL, Brown TR, Lazarus HL, Vinson MC. Quality in pharmaceutical care in hospitals. *Am J Hosp Pharm* 1975;32:567-574.

Millis JS. *Pharmacists for the future: the report of the Study Commission on Pharmacy*. Ann Arbor: Health Administration Press, 1975.

Millonig MK. Mapping the route to medication therapy management documentation and billing standardization and interoperability within the health care system: meeting proceedings. *J Am Pharm Assoc* 2009;49(3):372-382.

Ministry of Social Affairs and Health. Memorandum of the Pharmacy Working Group, 45/2007 Available at: [http://www.stm.fi/c/document\\_library/get\\_file?folderId=28707&name=DLFE-3533.pdf&title=Apteekkityoryhman\\_muistio\\_fi.pdf](http://www.stm.fi/c/document_library/get_file?folderId=28707&name=DLFE-3533.pdf&title=Apteekkityoryhman_muistio_fi.pdf) (June 28, 2011).

Ministry of Social Affairs and Health. Lääkepolitiikka 2020 (In Finnish). Available at: [http://www.stm.fi/c/document\\_library/get\\_file?folderId=2765155&name=DLFE-14405.pdf](http://www.stm.fi/c/document_library/get_file?folderId=2765155&name=DLFE-14405.pdf) (June 28, 2011).

Monane M, Matthias DM, Nagle BA, Kelly MA. Improving prescribing patterns for the elderly through an online drug utilization review intervention. *JAMA* 1998;280:1249-1252.

Montoya ID, Jano E. Online pharmacies: safety and regulatory considerations. *Int J Health Serv.* 2007;37(2):279-289.

Montoya ID. The root cause of patient safety concerns in an Internet Pharmacy. *Expert Opin Drug Saf.* 2008;7(4):337-341.

Montgomery AT, Kälvemarm-Sporrong S, Henning M, Tully MP, Kettis-Lindblad A. Implementation of a pharmaceutical care service: prescriptionists', pharmacists' and doctors' views. *Pharm World Sci* 2007;29(6):593-602.

Mossialos E, and Srivastava D. Pharmaceutical policies in Finland: challenges and opportunities. Observatory studies series no. 10. The European Observatory on Health Systems and Policies. Copenhagen, Denmark, 2008. Available at: [http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0020/80651/E91239.pdf](http://www.euro.who.int/__data/assets/pdf_file/0020/80651/E91239.pdf) (June 28, 2011).

Motulsky A, Winslade N, Tamblyn R, Sicotte C. The impact of electronic prescribing on the professionalization of community pharmacists: a qualitative study of pharmacists' perception. *J Pharm Sci* 2008;11(1):131-146.

Morgall JM, Almarsdottir AB. No struggle, no strength: how pharmacists lost their monopoly. *Soc Sci Med* 1999;48(9):1247-1258.

Morris CJ, Savelyich BSP, Avery AJ, Cantrill JA, Sheikh A. Patient safety features of clinical computer systems: questionnaire survey of GP views. *Qual Saf Health Care* 2005;14:164-168.

Murdaugh C. Health-related quality of life as an outcome in organizational research. *Med Care* 1997;35:NS 41-18.

NCC MERP. Recommendations to Enhance Accuracy of Dispensing Medications. Revised 6/2/2005. Available at: <http://www.nccmerp.org/council/council1999-06-29.html> (June 28, 2011).

NHS. National Programme for IT in the NHS, Benefits Statement 2006/07. Available at: <http://www.epractice.eu/files/media/media1919.pdf> (July 20, 2011).

NHS. Connecting for Health, Status Summary 2007, 2007.

Nielsen S, Barratt MJ. Prescription drug misuse: is technology friend or foe? *Drug Alcohol Rev* 2009;28(1):81-86.

Niquille A, Bugnon O. Relationship between drug-related problems and health outcomes: a cross-sectional study among cardiovascular patients. *Pharm World Sci* 2010;32(4):512-519.

Nkansah N, Mostovetsky O, Yu C, Chheng T, Beney J, Bond CM, Bero L. Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns (Review). The Cochrane Collaboration. Published by John Wiley & Sons, Ltd, The Cochrane Library 2010, Issue 7.

Nola KM, Gourley DR, Portner TS, Gourley GK, Solomon DK, Elam M, Regel B. Clinical and humanistic outcomes of a lipid management program in the community pharmacy setting. *J Am Pharm Assoc* 2000;40:166-173.

Närhi U. Implementing the philosophy of pharmaceutical care into community pharmacy services – experiences with asthma patients in Finland. (Doctoral dissertation) Kuopio University Publications A. Pharmaceutical Sciences 54. University of Kuopio, 2001. Available at: [http://epublications.uef.fi/pub/urn\\_isbn\\_951-781-152-7/urn\\_isbn\\_951-781-152-7.pdf](http://epublications.uef.fi/pub/urn_isbn_951-781-152-7/urn_isbn_951-781-152-7.pdf) (June 28, 2011).

Odegard PS, Goo A, Hummel J, Williams KL, Gray SL. Caring for poorly controlled diabetes mellitus: A randomised pharmacist intervention. *Ann Pharmacother* 2005;39(3):433–440.

Ohio Medicaid. Available at: <http://jfs.ohio.gov/ohp/bhpp/dur/phases.stm> (July 20, 2011).

O'Reilly T. What is Web 2.0? Design patterns and business models for the next generation of software. Available at: <http://www.oreillynet.com/lpt/a/6228> (June 28, 2011).

Palmer I, Roberts A, Dunphy DC, Benrimoj SI. Community pharmacy: Strategic Change Management. McGraw-Hill, Australia, 2007.

Park JJ, Kelly P, Carter BL, Burgess PP. Comprehensive pharmaceutical care in the chain setting. *J Am Pharm Assoc* 1996;NS36(7):443–451.

Paulos CP, Nygren CE, Celedon C, Carcamo CA. Impact of a pharmaceutical care program in a community pharmacy on patients with dyslipidemia. *Ann Pharmacother* 2005;39(5):939–943.

Paudyal V, Hansford D, Scott Cunningham IT, Stewart D. Cross-sectional survey of community pharmacists' views of the electronic Minor Ailment Service in Scotland. *Int J Pharm Pract* 2010;18(4):194-201.

PCNE Classification for the drug-related problems V 4.00, revised 2003-04-22. Available at: <http://www.pcne.org/documenter/PCNE%20scheme%20V4.00pdf> (June 28, 2011).

Pellegrino AN, Martin MT, Tilton JJ, Touchette DR. Medication therapy management: definitions and outcomes. *Drugs* 2009;69(4):393-406.

Perrin Y, Buclin T, Biollaz J. Drug interaction computer programs: which choice? [in French]. *Schweiz Rundsch Med Prax* 2004;93(23):991-996.

Peterson GM, Fitzmaurice KD, Naunton M, Vial JH, Stewart K, Krum H. Impact of pharmacist-conducted home visits on the outcomes of lipid-lowering drug therapy. *J Clin Pharm Ther* 2004;29(1):23–30.

Peterson G, Tenni P. Identifying prioritising and documenting drug-related problems. *Aust Pharmacist* 2004;23:706-709.

Peterson GM, Fitzmaurice KD, Kruup H, Jackson SL, Rasiah RL. Cardiovascular risk screening program in Australian community pharmacies. *Pharm World Sci* 2010;32:373-380.

Peura S, Hakkarainen K, Ovaskainen H, Tanskanen P, Lehtonen A, Sevón-Vilkman N, Wiberg I, Tuomainen L, Airaksinen M. Lääkehoidon kokonaisarviointi lääkärin ja lääkealan ammattilaisen yhteistyönä - kokemuksia toimintamallin kehittamisestä . With English summary: Comprehensive medication review involving collaboration between pharmacists and physicians - experiences of developing the procedure in Finland. *Dosis* 2007;23(1):20-28.

The Pharmacy Guild of Australia. Review of DMMR Software. The Pharmacy Guild of Australia, 2002. Available at: [http://www.guild.org.au/uploadedfiles/Research\\_and\\_Development\\_Grants\\_Program/Funding\\_Opportunities/Tenders/Closed\\_Tenders/2002-504\\_rft.pdf](http://www.guild.org.au/uploadedfiles/Research_and_Development_Grants_Program/Funding_Opportunities/Tenders/Closed_Tenders/2002-504_rft.pdf) 31.10.2010

Pohjanoksa-Mäntylä M, Antila J, Eerikäinen S, Enäkoski M, Hannuksela O, Pietilä K, Airaksinen M. Utilization of a community pharmacy operated national drug information call-center in Finland. *Res Social Adm Pharm* 2007;4:144-152.

Pohjanoksa-Mäntylä MK, Kulovaara H, Bell JS, Enäkoski M, Airaksinen MS. Email medication counseling services provided by Finnish community pharmacies. *Ann Pharmacother* 2008;42:1782-1790.

Pohjanoksa-Mäntylä M, Bell JS, Helakorpi S, Närhi U, Pelkonen A, Airaksinen MS. Is the Internet replacing health professionals? A population survey on sources of medicines information among people with mental disorders. *Soc Psychiat Epidemiol* 2009;Mar 12.

Pohjanoksa-Mäntylä M. Medicines information sources and services for consumers: A special focus on the Internet and people with depression. (Doctoral dissertation) Division of Social Pharmacy, Faculty of Pharmacy, University of Helsinki, 2010. Available at: <https://helda.helsinki.fi/handle/10138/19137> (June 28, 2011).

Poirier S, Garipey Y. Compensation in Canada for resolving drug-related problems. *J Am Pharm Assoc* 1996;36(2):117–122.

Pope C, Mays N. Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. *BMJ* 1995;311:42-45.

Powell J, McCarthy N, Eysenbach G. Cross-sectional survey of users of Internet depression communities. *BMC Psychiatry* 2003;10;3:19.

Pronk MCM, Blom LThG, Jonkers R, Rogers EM, Bakker A, de Blaey KJ. Patient oriented activities in Dutch community pharmacy: diffusion of innovations. *Pharm World Sci* 2002;24(4):154-161.

Puumalainen I, Kansanaho H, Varunki M, Ahonen R, Airaksinen M. Usefulness of the USP Medication Counselling Behavior Guidelines. *Pharm World Sci* 2005;27(6):465-8.

Puumalainen I. Development of instruments to measure the quality of patient counselling. (Doctoral dissertation) Kuopio University Publications A. Pharmaceutical Sciences 83. University of Kuopio, 2005. Available at: <http://www.uku.fi/tutkimus/vaitos.shtml> (June 28, 2011).

Quality Interagency Coordination Task Force (QuIC) to the President 2011. Doing what counts for patient safety: federal actions to reduce medical errors and their impact. Available at: <http://www.quic.gov/report/mederr3.htm> (July 19, 2011).

Quon BS, Firszt R, Eisenberg MJ. A comparison of brand-name drug prices between Canadian-based Internet pharmacies and major U.S. drug chain pharmacies. *Ann Intern Med* 2005;143(6):397-403.

Ramalho de Oliveira D, Brummel AR, Miller DB. Medication Therapy Management: 10 years of experience in a large integrated health care system. *J Manag Care Pharm* 2010;16(3):185-195.

Rashbass J. The patient-owned, population-based electronic medical record: revolutionary resource for clinical medicine. *JAMA* 2001;285(13):1769.

Raynor DK, Nicolson M, Nunney J, Petty D, Vail A, Davies L. The development and evaluation of an extended adherence support programme by community pharmacists for elderly patients at home. *Int J Pharm Pract* 2000;8:157-164.

Reeve JF, Tenni PC, Peterson GM. An electronic prompt in dispensing software to promote clinical interventions by community pharmacists: a randomized controlled trial. *Br J Clin Pharmacol* 2008;65(3):377-385.

Reis AMM, Cassiani SHDB. Evaluation of three brands of drug interaction software for use in intensive care units. *Pharm World Sci* 2010;32(6):822-828.

Rickles NM, Svarstad BL, Statz-Paynter JL, Taylor LV, Kobak KA. Pharmacist telemonitoring of antidepressant use: Effects on pharmacist-patient collaboration. *J Am Pharm Assoc* 2005;45(3):344-353.

Rigby D. MMR software packages reviewed. *Australian Pharmacist* 2004;23(7):510-512.

Rind DM, Safran C, Phillips RS, Wang Q, Calkins DR, Delbanco TL, Bleich HL, Slack WV. Effect of computer-based alerts on the treatment and outcomes of hospitalised patients. *Arch Intern Med* 1994;154:1511-1517.

Roberts AS, Benrimoj SI, Chen TF, Williams KA, Hopp TR, Aslani P. Understanding practice change in community pharmacy: a qualitative study in Australia. *Res Social Adm Pharm* 2005;1(4):546-564.

Roberts P, Priest HM. Reliability and validity in research. *Nurs Stand* 2006;20(44):41-45.

Roberts AS, Benrimoj SI, Chen TF, Williams KA, Aslani P. Practice change in community pharmacy: quantification of facilitators. *Ann Pharmacother* 2008;42(6):861-868.



Robertson J, Walkom E, Pearson SA, Hains I, Williamson M, Newby D. The impact of pharmacy computerized clinical decision support on prescribing, clinical and patient outcomes: a systematic review of the literature. *Int J Pharm Pract* 2010;18:69-87.

Rogers EM: Diffusion of Innovations. Fifth edition. The Free Press, New York 2003.

Rossing C. The Practice of Pharmaceutical Care in Denmark – a Quantitative Approach. (Doctoral dissertation) Department of Social Pharmacy, The Danish University of Pharmaceutical Sciences, 2003.

Roten I, Marty S, Beney J. Electronic screening of medical records to detect inpatients at risk of drug-related problems. *Pharm World Sci* 2010;32:103-107.

Rupp MT, Warholak TL. Evaluation of e-prescribing in chain community pharmacy: best-practice recommendations. *J Am Pharm Assoc* 2008;48(3):364-370.

Saario H. Diffusion of innovations in community pharmacies – a questionnaire based survey. Master Thesis 2005, University of Helsinki (in Finnish).

Saini B, Filipovska J, Bosnic-anticevich S, Taylor S, Krass I, Armour C. An evaluation of a community pharmacy-based rural asthma management service. *Aust J Rural Health* 2008;16(2):100-108.

Saleem JJ, Patterson ES, Militello L, Render ML, Orshansky G, Asch SM. Exploring barriers and facilitators to the use of computerized clinical reminders. *J Am Med Inform Assoc* 2005;12:438-447.

Sarkadi A, Rosenqvist U. Experience-based group education in Type 2 diabetes: A randomised controlled trial. *Patient Education and Counseling* 2004;53(3):291–298.

Saverno KR, Hines LE, Warholak TL, Grizzle AJ, Babits L, Clark C, Taylor AM, Malone DC. Ability of pharmacy clinical decision-support software to alert users about clinically important drug-drug interactions. *J Am Med Inform Assoc* 2011;18(1):32-37.

Schaefer M. Discussing basic principles for coding system of drug-related problems: the case of PI-Doc. *Pharm World Sci* 2002;24:120-127.

Schatz R, Belloto RJ Jr, White DB, Bachamann K. Provision of drug information to patients by pharmacists: the impact of the Omnibus Budget Reconciliation Act of 1990 a decade later. *Am J Ther* 2003;10:93-103.

Schiff GD, Rucker TD. Computerized prescribing: Building the electronic infrastructure for better medication usage. *JAMA* 1998;279(13):1024-1029.

Schiff GD. Computerized prescriber order entry: Models and hurdles. *Am J Health-Syst Pharm* 2002;59:1456-1460.

Schneider PJ, Larrimer JN, Visconti JA, Miller WA. Role effectiveness of a pharmacist in the maintenance of patients with hypertension and congestive heart failure. *Contemp Pharm Pract* 1982;5(2):74–79.

Schoen C, Osborn R, Huynh PT, Doty M, Peugh J, Zapert K. On the front lines of care: primary care doctors' office systems, experiences and views in seven countries. *Health Aff* 2006;25(6):555-571.

Schommer J, Bonnarens J, Brown L, Goode J. Value of community pharmacy residency programs: College of pharmacy and practice site perspectives. *J Am Pharm Assoc* 2010;22:e72-e88.

Schweim JK, Schweim HG. Internet pharmacies and counterfeit drugs. [Article in German]. *Med Klin (Munich)* 2009;104(2):163-169.

Segal R. Therapeutic outcomes monitoring: a method for implementing pharmaceutical care. In: Escovitz A Pathak DS, eds. *Health outcomes and pharmaceutical care: measurement, application, and initiatives*. Birmingham, NY: The Haworth Press, 1996; 194.

Shaw J, Seal R, Pilling M. Room for review - A guide to medication review: The agenda for patients, practitioners and managers, 2002. Available at: [http://www.npc.nhs.uk/review\\_medicines/intro/resources/room\\_for\\_review.pdf](http://www.npc.nhs.uk/review_medicines/intro/resources/room_for_review.pdf) (June 28, 2011).

Shulman R, Singer M, Goldstone J, Bellingan G. Medication errors: a prospective cohort study of hand-written and computerized physician order entry in the intensive care unit. *Crit Care* 2005;9(5):R516-R521.

Silverman D. *Doing Qualitative Research. A Practical Handbook*. SAGE Publications Ltd, 2000, The Cromwell Press Ltd. Trowbridge, Wiltshire.

Smith F. *Research methods in pharmacy practice*, Pharmaceutical Press, London 2002.

Solomon DK, Portner TS, Bass GE, Gourley DR, Gourley GA, Holt JM, Wicke WR, Braden RL, Eberle TN, Self TH, Lawrence BL. Clinical and economic outcomes in the hypertension and COPD arms of a multicenter outcomes study. *J Am Pharm Assoc* 1998;38(5):574-585.

Sookaneknun P, Richards RM, Sanguansermisri J, Teerasut C. Pharmacist involvement in primary care improves hypertensive patient clinical outcomes. *Ann Pharmacother* 2004;38(12):2023-2028.

Soumerai SB, Lipton HL. Computer-based drug-utilization review: risk, benefit, or boondoggle? *New Engl J Med* 1995;332:1641-1645.

Spencer DC, Leininger A, Daniels R, Granko RP, Coeytaux RR. Effects of computerized prescriber order entry system on reported medication errors. *Am J Health-System Pharm* 2005;62:416-419.

Stoner SC, Worrel JA, Jones MT, Farrar CA, Ramlatchman LV. Pharmacist-designed and implemented pharmaceutical care plan for antipsychotic-induced movement disorders. *Pharmacotherapy* 2000;20:583-588.

Stergachis A, Gardner JS, Anderson MT, Sullivan SD. Improving pediatric asthma outcomes in the community setting: does pharmaceutical care make a difference? *J Am Pharm Assoc* 2002;42:743-752.

Strand LM, Cipolle RJ, Morley PC. Documenting the clinical pharmacist's activities: back to basics. *Drug Intell Clin Pharm* 1988; 22: 63-67.

Strand LM, Morley PC, Cipolle RJ, Ramsey R, Lamsam GD. Drug-related problems: their structure and function. *DICP* 1990; 24:1093-1097.

Surescripts. Available at: <http://www.surescripts.com> (July 21, 2011).

Sweeney MA. Physician-pharmacist collaboration: A millennial paradigm to reduce medication errors. *Clinical Practice JAOA* Vol 102, No 12, 2002

Taylor CT, Byrd DC, Krueger K. Improving primary care in rural Alabama with a pharmacy initiative. *Am J Health-System Pharm* 2003;60(11):1123–1129.

Teinilä T, Grönroos V, Airaksinen M. A system approach to dispensing errors: a national study on perceptions of the Finnish community pharmacists. *Pharm World Sci* 2008;30(6):823-833.

Teräsalmi E. Apteekit tarvitsevat kokonaan uuden tietojärjestelmän. *Apteekkari* 2006;12 (in Finnish).

TIPPA Project. Inter Report 2002.

TIPPA Project. Final Report 2005 (unpublished).

Titley-Lake C, Barber N. Drug-related problems in the elders of the British Virgin Islands. *Int J Pharm Pract* 2000;8:53–59.

Tomechko MA, Strand LM, Morley PC, Cipolle RJ. Q and A from the pharmaceutical care project in Minnesota. *Am Pharm* 1995;NS35:30-39.

Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349-359.

Tsai CC, Starren J. Patient participation in electronic medical records. *JAMA* 2001;285(13):1765.

Tsuyuki RT, Johnson JA, Teo KK, Ackman ML, Biggs RS, Cave A, Chang WC, Dzavik V, Farris KB, Galvin D, Semchuk W, Simpson SH, Taylor JG. Study of Cardiovascular Risk Intervention by Pharmacists (SCRIP): A randomized trial design of the effect of a community pharmacist intervention program on serum cholesterol risk. *Ann Pharmacother* 1999;33(9):910–919.

Tsuyuki RT, Johnson JA, Teo KK, Simpson SH, Ackman ML, Biggs RS, Cave A, Chang WC, Dzavik V, Farris KB, Galvin D, Semchuk W, Taylor JG. A randomized trial of the effect of community pharmacist intervention on cholesterol risk management: The Study

of Cardiovascular Risk Intervention by Pharmacists (SCRIP). *Arch Intern Med* 2002;162(10):1149–1155.

Tuomi J, Sarajärvi A. Laadullinen tutkimus ja sisällönanalyysi. Gummerus Kirjapaino Oy, Jyväskylä, 2003 (in Finnish).

US Pharmacopeia. Drug utilization review. In a book: USP drug information update Vol. 1. and 2., pp. 72-82, 1996.

US Pharmacopeia. Drug Utilization Review. USP DI Update Volumes I and II. The United States Pharmacopeial Convention Inc., 91-101, 1997.

US Pharmacopeia. MEDMARX: 5th Anniversary Data Report: A Chartbook of 2003 Findings and Trends 1999-2003, 2005.

Van C, Mitchell B, Krass I. General practitioner-pharmacist interactions in professional pharmacy services. *J Interprof Care* 2011;Jun 9 [epub ahead of print].

Van der Linden H, Kalra D, Hasman A, Talmon J. Inter-organizational future proof EHR systems. A review of the security and privacy related issues. *Int J Med Inform* 2009;78(3):141-160.

Van Mil JWF, McElroy J, Van der Berg LWDJ, Tromp DFJ. The challenges of defining pharmaceutical care on an international level. *Int J Pharm Pract* 1997;2:202-208.

Van Mil JWF, Schulz M, Tromp TFJ. Pharmaceutical care, European developments in concepts, implementation, teaching and research: a review. *Pharm World Sci* 2004a;26:303-311.

Van Mil JWF, Westerlund LOT, Hersberger KE, Schaefer MA. Drug-related problem classification systems. *Ann Pharmacother* 2004b;38:859-867.

Veronin MA. Canadian Internet pharmacies: Price, policy, and perspective. *Res Social Adm Pharm* 2007;3(2):236-248.

Virk P, Bates DW, Halamka J, Fournier GA, Rothschild JM. Analyzing Transaction Workflows in an ePrescribing System. American Medical Informatics Association, Annual Symposium Proceedings Archive. 2006:1129.

Volume CI, Farris KB, Kassam R, Cox CE, Cave A. Pharmaceutical care research and education project: patient outcomes. *J Am Pharm Assoc* 2001;41(3):411-420.

Vonbach P, Dubied A, Krähenbühl S, Beer JH. Evaluation of frequently used drug interaction screening programs. *Pharm World Sci*. 2008;30:367-374.

Väänänen M. Community Pharmacies and the Needs of Mobile EU Citizens – A Study on Finns living in Spain. (Doctoral dissertation) Division of Social Pharmacy, Faculty of Pharmacy, University of Helsinki, 2008. Available at: <https://oa.doria.fi/bitstream/handle/10024/38092/communit.pdf?sequence=1> (June 28, 2011).

Wagner EH. Chronic disease management: What will it take to improve care for chronic illness? *Eff Clin Pract* 1998;1:2-4.

Wagner EH, Austin BT, Davis C, Hindmarsh M, Schaefer J, Bonomi A. Improving Chronic Illness Care: Translating evidence into action. *Health Aff* 2001;20(6):64-78.

Wahlroos H. Evolution of Pharmaceuticals regulation in the European Union and drug information – Internal market or public health? Kuopio University Publications A. Pharmaceutical Sciences 63. University of Kuopio, 2003 (in Finnish with English summary). Summary in Finnish available at: <http://www.uku.fi/vaitokset/2003/ISBN951-781-281-7hwahlroos.htm> (July 20, 2001).

Wanscher CE, Pederson CD, Jones T. Descriptive report on site study results: MedCom, Denmark – Danish Health Data Network (DHDN), Empirica, Bonn, 2006. Available at: [http://www.ehealth-impact.org/case\\_tool/data/binary/d60e84cfe6b82cf66c5c9443defcccb0.pdf](http://www.ehealth-impact.org/case_tool/data/binary/d60e84cfe6b82cf66c5c9443defcccb0.pdf) (June 28, 2011).

Webster L, Spiro RF. Health information technology: A new world for pharmacy. *J Am Pharm Assoc* 2010;50(2):e20-31,quiz e32-34.

Webster's New World College Dictionary. Available at: <http://www.engadget.com/tag/websters+new+world+college+dictionary/> (July 20, 2011).

Weinberger M, Murray MD, Marrero DG, Brewer N, Lykens M, Harris LE, Seshadri R, Caffrey H, Roesner JF, Smith F, Newell AJ, Collins JC, McDonald CJ, Tierney WM. Effectiveness of pharmacist care for patients with reactive airways disease: A randomized controlled trial. *JAMA* 2002;288(13):1594–1602.

Weiss AM. Buying prescription drugs on the internet: promises and pitfalls. *Cleve Clin J Med* 2006;73(3):282-288.

Wermeille J, Bennie M, Brown I. Integrating the community pharmacist into the diabetes team: evaluation of a new care model for patients with Type 2 diabetes mellitus. *Int J Pharm Pract* 2001;9 (suppl):R60.

Westerling A, Haikala V, Airaksinen M. Toiveiden tynnyristä työkaluksi – Apteekin tietojärjestelmät kaipaavat kehittämistä, *Apteekkari*, Maaliskuu 2007 (in Finnish).

Westerling A, Haikala V, Hynninen J, Airaksinen M. Tietojärjestelmiltä vaaditaan yhä enemmän. *Apteekkari* 7-8/2010 (in Finnish).

Westerlund LOT, Almarsdottir AB, Melander A. Drug related problems and pharmacy interventions in community practice. *Int J Pharm Pract* 1999;7:40-50.

Westerlund LT, Marklund BR, Handl WH, Thunberg ME, Allebeck P. Nonprescription drug-related problems and pharmacy interventions. *Ann Pharmacother* 2001;35:1343-1349.

Westerlund T. Drug-related problems: Identification, Characteristics and pharmacy interventions (Doctoral dissertation). Department of Social Medicine, Göteborg University, Göteborg, Sweden, 2002.

The White House. Transforming and Modernizing America's Health Care System 25 February 2009. Available at: [http://www.whitehouse.gov/omb/fy2010\\_issue\\_healthcare](http://www.whitehouse.gov/omb/fy2010_issue_healthcare) (June 28, 2011).

WHO. International drug monitoring-the role of the hospital. A WHO report. *Drug Intell Clin Pharm* 1970;4:101-110.

WHO. Drugs and medicines policy. WHO, 1993. Available at: <http://www.who.int/> (June 28, 2011).

WHO. How to develop and implement a national drug policy. WHO, 2001.

WHO. Adherence to long-term therapies: Evidence for action. WHO, 2003. Accessed at: [http://www.who.int/chp/knowledge/publications/adherence\\_introduction](http://www.who.int/chp/knowledge/publications/adherence_introduction) (June 28, 2011).

WHO in collaboration with FIP. *Developing pharmacy practice: A focus on patient care*. Handbook, 2006:WHO/PSM/PAR/2006.5.

Wood A, Smith M. Online communication. Linking technology, identity & culture, 2 edn, Lawrence Erlbaum Associates, London, 2005.

Wubben DP, Vivian EM. Effects of pharmacist outpatient interventions on adults with diabetes mellitus: a systematic review. *Pharmacother* 2008;28(4):421-436.

Wyne K. Information technology for the treatment of diabetes: Improving Outcomes and controlling costs. *J Manag Care Pharm* 2008;14(2):S12-S17.

Zehnder S, Bruppacher R, Ruppacher FH, Hersberger KE. Swiss community pharmacies' on the Web and pharmacists' experiences with E-commerce: longitudinal study and Internet-based questionnaire survey. *J Med Internet Res* 2004;6:e9.

Åstrand B. ePrescribing Studies in Pharmaco-informatics (Doctoral dissertation). University of Kalmar; SE-391 82, Kalmar, Sweden 2007.

## APPENDICES

**Appendix 1.** The potential features for the future community pharmacy IT systems included in the study.

### **Drug information and patient counseling (11 items)**

- Online national reference book
- A checklist-type drug information database to support medication counseling
- Drug-drug interaction program
- Patient's health profile
- National current care guidelines
- Pharmacy protocol for medication counseling
- Link to a health information portal
- Electronic information from pharmaceutical companies
- Self-medication guidelines
- Demonstration program for drug administration technique
- Hospital discharge summary

### **Medication safety (10 items)**

- Documentation of dispensing errors
- Documentation of prescribing errors
- Documentation of drug related problems
- Documentation of adverse drug reactions
- Documentation of drug-drug interactions
- Documentation of medication misuse
- Documentation of adherence
- Electronic notification of product failure
- Reporting system for the substandard products to the pharmaceutical wholesaler
- Electronic notification of ADRs to the National Agency for Medicines

### **Interprofessional collaboration (10 items)**

- Online prescription refill
- Medication availability request from physician
- Reporting the prescriptions to the physician
- Prescribing feedback to the physician
- Online contacts to the physicians
- Online contacts to the age care facilities
- Online reimbursement service
- Online contacts with the insurance companies
- Medication review integrated to other healthcare IT systems
- National online network between disease management pharmacists

### **Pharmaceutical services (27 items)**

- ePrescribing
- Medication compounding program
- Pricing program for extemporaneous products
- Brief medication review
- Comprehensive medication review
- Rehabilitation contract for drug addiction
- Methadone program
- Automated dose dispensing
- Disease management program for asthma
- Peak Flow measurement (documentation for follow-up)
- Disease management program for diabetes
- Smoking cessation program
- Patient counseling appointment program
- Online drug order from customer to the pharmacy
- Checking the customer's medicine cabinet

Home delivery of medication  
Healthy lifestyle service concepts  
Following and optimizing the customer's costs of the medicines  
Patient's medication cost report  
Patient's health information record  
Following the laboratory test results related to the medication  
Medication counseling by telephone  
Medication counseling by internet  
Product reorder alert based on customer  
Reminders of medication by e-mail or text message  
Measure and vaccination services  
Online purchase of non-prescription items

### **Pharmacy's internal processes (31 items)**

#### ***Financial management (7 items)***

Accounting  
Budgeting  
Salary calculations  
Credit control  
Short-time financial planning  
Ability to generate electronic invoices  
Financial forecasts

#### ***Personnel (10 items)***

Staff roster  
Daily job responsibilities  
Vacation roster  
Log book for continuing professional development  
Tool for staff communication  
Managing staff expertise of personnel  
Staff workflow  
Recruitment  
Orientation  
Termination of an employment

#### ***Sales and marketing management (8 items)***

Space management  
Marketing  
Calendar for campaigns  
Planning the assortment  
Customer analyses  
Complaints handling  
Electronic cold facilities monitoring  
Electronic forms for pharmacy

#### ***Stock (6 items)***

Ability to generate orders based on sales  
Tracking product expiry  
Managing stock holding  
Following the delivery assurance of other companies  
Updated product information for pharmacists  
Analysis of stock moving speed



## **Appendix 2.**

### INNOVATIVENESS

Which of following choices describes best your own attitude to the changes and new function models?

1. I want to be involved in testing and developing immediately
2. I take the innovations in use quicker than average and I am pleased to tell about them to other people
3. I do not take the innovations in use until the benefits are shown
4. I need time to considering and support
5. I do not wish changes, I am happy with the situation nowadays and I like routines
6. Do not know

## **Appendix 3.**

### **Community Pharmacy Information Technology Systems – Visions and Innovations**

#### **Part I**

##### DEMOGRAPHIC DATA

Please describe your special expertise areas in information technology (IT), with special reference to the community pharmacy and medicine management systems. Please describe briefly your professional history with IT and your contribution to the systems, specifically in community pharmacies and medicines management.

- National/international experience

##### VISIONS FOR THE FUTURE COMMUNITY PHARMACY SERVICE AND IT

What is your vision for the community pharmacy services?

- What are the key functions for the community pharmacies in relation to the health care and how could IT support that work?
- In a) 5 or b) 10 years' perspective?
- Which factors and opportunities can facilitate the vision to come true?
- Which would be the barriers or threats in the process of the vision to come true?

What is your vision for the community pharmacy IT system in the future?

- In a) 5 or b) 10 years' perspective?
- Which factors and opportunities can facilitate the vision to come true?
- Which would be the barriers or threats in the process of the vision to come true?

##### CURRENT SYSTEMS

What are the strengths and weaknesses of the current IT systems?

## Part II

### GENERATION OF INNOVATIONS

What led to the development process of the innovations you described?

- Patient safety/regulatory affairs/medical issues/business interests

Was there any research before the development process started?

Please select one most important innovation and describe briefly the development process.

- What was the driving force of its development process?
- Who was the coordinator of the development process?
- How much the health policy was related to its development process?
- How long did the development process take?
- Were there any barriers in the development process?
- In general, which factors facilitate or drive development of IT concerning medicine management and pharmaceutical care services in community pharmacies?

Was the above discussed most important innovation commercialized, or will it be?

How did the users adopt the innovation?

- Was it easy to get the users to adopt the innovation?
- Were there any barriers in the diffusion process? By diffusion I mean...
- Which factors can facilitate the diffusion process?
- How was the diffusion process organized?

What are the consequences of the innovation: has it met the needs and expectations of its users? Has it improved quality of care or patient safety?

- Has the innovation brought any further innovations?

On the basis of your expertise, could you give some general recommendations what kind of things should be taken into account when a new IT system is going to be developed for the community pharmacy?

How the health policy goals should be considered in the development of community pharmacy IT?

Can you identify further needs for innovation development in the community pharmacy IT systems?

Do you have any other comments?

**ORIGINAL PUBLICATIONS**