UNIVERSIDADE NOVA DE LISBOA

INSTITUTO DE HIGIENE E MEDICINA TROPICAL

DESIGN, IMPLEMENTATION AND EVALUATION OF A NEW eHEALTH PHARMACEUTICAL SERVICE FOR COOPERATIVE DISEASE MANAGEMENT USING AN INTERACTIVE PLATFORM: OPPORTUNITIES TO IMPROVE HEALTH SYSTEMS PERFORMANCE

JOÃO GREGÓRIO

DISSERTAÇÃO PARA A OBTENÇÃO DO GRAU DE DOUTOR EM SAÚDE INTERNACIONAL
ESPECIALIDADE DE POLÍTICAS DE SAÚDE E DESENVOLVIMENTO

DEZEMBRO, 2016

UNIVERSIDADE NOVA DE LISBOA

Instituto de Higiene e Medicina Tropical

Design, implementation and evaluation of a new eHealth pharmaceutical service for cooperative disease management using an interactive platform: opportunities to improve health systems performance

Autor: João Pedro Bernardo Gregório

Orientador: Professor Doutor Luís Velez Lapão

Coorientador: Professor Doutor Afonso Miguel Cavaco

Dissertação apresentada para cumprimento dos requisitos necessários à obtenção do grau de Doutor em Saúde Internacional, especialidade em Políticas de Saúde e Desenvolvimento, nos termos do artigo 11º, alínea b, do Regulamento Geral do 3.º Ciclo de Estudos Superiores Conducentes à Obtenção do Grau de Doutor pelo IHMT/UNL, publicado no Diário da República (Regulamento n.º 474/2012 (2.ª série, n.º 223, de 19 de novembro de 2012)

SCIENTIFIC PUBLICATIONS AND COMMUNICATIONS

This thesis is based on the following papers, which are referred to in the text by their Roman numerals (I-IV):

Published papers:

I GREGÓRIO, João; CAVACO, Afonso; LAPÃO, Luís Velez. A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal. *Human resources for health*, 2014, 12.1: 1. DOI: 10.1186/1478-4491-12-58

II GREGÓRIO, João; CAVACO, Afonso Miguel; LAPÃO, Luís Velez. How to best manage time interaction with patients? Community pharmacist workload and service provision analysis. *Research in Social and Administrative Pharmacy*, 2016. (in press)

III GREGÓRIO, João; RUSSO, Giuliano; LAPÃO, Luís Velez. Pharmaceutical services cost analysis using time-driven activity-based costing: A contribution to improve community pharmacies' management. *Research in Social and Administrative Pharmacy*, 2016, 12.3: 475-485. DOI:10.1016/j.sapharm.2015.08.004

IV LAPÃO, Luís Velez; MIRA DA SILVA, Miguel; GREGÓRIO, João; Implementing an Online Pharmaceutical Service using Design Science Research. *BMC Medical Informatics and Decision-Making* (Paper submitted on 23/05/2016)

Communications (oral and poster presentations):

- GREGÓRIO, J. & LAPÃO, L. 2012, E-Health e a Prestação de Cuidados Farmacêuticos: Contributo para a melhoria da qualidade da prestação de serviços de saúde. In: Congresso Nacional dos Farmacêuticos, 2012, Lisboa. (poster presentation – best poster award)

- GREGÓRIO, J., CAVACO, A., DA SILVA,M.M., LOVIS,C., LAPÃO, L. 2013. Challenges of Information Technologies Adoption to enable Community Pharmacies eHealth services. Abstracts 8th working conference of the

pharmaceutical care network Europe, 6–8 February 2013, Berlin, Germany. International Journal of Clinical Pharmacy Volume 35, Issue 3, pp 488-506 (poster presentation).

- GREGÓRIO, J., LAPÃO, L. 2013. Uso de cenários estratégicos para planeamento de recursos humanos em saúde: os farmacêuticos comunitários em Portugal, 2010-2020. 2º Congresso de Medicina Tropical, Instituto de Higiene e Medicina Tropical, Lisboa, Portugal. (oral communication)

- LAPÃO,L.V., GREGÓRIO,J., CAVACO,A., DA SILVA,M.M., LOVIS,C.,. Implementing eHealth Services for Enhanced Pharmaceutical care Provision: Opportunities and Challenges. 2nd International Conference on Serious Games and Applications for Health, SeGAH 2013, Vilamoura. (oral communication)

- GREGÓRIO, J., FERREIRA,T., CAVACO, A., DA SILVA,M.M., LOVIS,C., LAPÃO, L. 2013. Community Pharmacies and eHealth Services: Barriers and Opportunities for Real Primary Healthcare Integration. In: 26th IEEE International Symposium on Computer-Based Medical Systems, Porto. (oral communication)

- GREGÓRIO, J., FERREIRA, T., LAPÃO, L. 2013. Developing eHealth services for pharmaceutical care using Design Science Research Methodology. In: European Health Management Association (EHMA) Annual Conference - What healthcare can we afford? Better, quicker, lower cost health services, Milan. (poster presentation)

- GREGÓRIO, J., LAPÃO, L., 2013. eHealth technologies to support primary healthcare integration with community pharmacies. In: 20th WONCA World Conference on Family Medicine, Prague; Czech Republic. (oral communication)

- GREGÓRIO, J., LAPÃO, L. 2013. Developing eHealth services to support Community Pharmacist's provision of Pharmaceutical Care. In: Seminário Internacional Brasil-Portugal "Trabalho em Saúde, Desigualdades e Políticas Públicas", Instituto de Ciências Sociais, Universidade do Minho. Braga. (oral communication)

- GREGÓRIO, J., LAPÃO, L., 2013. Using Strategic Scenarios for Human Resources Planning – The case of Portuguese community pharmacists. In: Seminário Internacional Brasil-Portugal "Trabalho em Saúde, Desigualdades e Políticas Públicas", Instituto de Ciências Sociais, Universidade do Minho. Braga. (oral communication)

- GREGÓRIO, J., LAPÃO, L., 2013. Pharmaceutical services costing using time-driven activity based costing. In: 13th Annual International Conference on Health Economics, Management & Policy: Athens, Greece. (oral communication)

- GREGORIO, J., RUSSO, G., & LAPAO, L. (2015, April). Pharmaceutical services cost analysis using time-driven activity based costing in a sample of Portuguese community pharmacies. Abstracts 9th working conference of the pharmaceutical care network Europe, 4-6 February 2015, Mechelen, Belgium. International Journal of Clinical Pharmacy (Vol. 37, No. 2, pp. 403-404). (poster presentation)

- GREGÓRIO, J., PIZARRO, Â., CAVACO, A., WIPFLI, R., LOVIS, C., MIRA, D. S. M., & LAPÃO, L. V. (2014). Online Pharmaceutical Care Provision: Full-Implementation of an eHealth Service Using Design Science Research. Studies in health technology and informatics, 210, 261-265. 26th Medical Informatics Europe Conference, MIE 2015, Madrid, Spain. (oral communication)

- GREGÓRIO, J., PIZARRO, Â., CAVACO, A., WIPFLI, R., LOVIS, C., MIRA, D. S. M., & LAPÃO, L. V. (2015). Implementation of a chronic care eHealth pharmaceutical service using design science. In: Congresso Nacional dos Farmacêuticos, 2015, Lisboa. (poster presentation)

ACKNOWLEDGMENTS

Firstly, I would like to express my sincere gratitude to my supervisor Prof. Luís Lapão, for the continuous support of my PhD study and related research, for his patience, motivation, creativity and knowledge. I would like to thank for encouraging my research and for allowing me to grow as a research scientist.

Besides my supervisor, I would like to thank Prof. Afonso Cavaco and Prof. Miguel Mira da Silva for their insightful comments and encouragement, but also for the questioning which led me to address my research from various perspectives.

My sincere thanks also goes to all the pharmacies' staffs who provided me an opportunity to access their facilities and permitted the observation of their daily work practices. Without they precious collaboration it would not be possible to conduct this research. Also, the collaboration of Dr. Tiago Ferreira, Dr. Paulo Abreu in the programming of the platform must be acknowledge as is the collaboration of Dr. Diogo Mello in the design of the Service Experience Blueprint and Drª. Ângela Pizarro for conducting the demonstration stage of the platform.

I thank my fellow PhD and department colleagues, for the stimulating discussions and for the decompression lunch talks that yielded so much fun and new ideas.

Last but not the least, I would like to thank my family: my parents, my brother and my girlfriend, for encouraging me to pursue a new career path, for supporting me throughout the writing of this thesis and my life in general. A special word also to my friends and band mates, for providing me a much appreciated source of inspiration and space for creativity.

RESUMO

Introdução: As doenças crónicas são a principal causa de mortalidade em toda a Europa. O aumento da prevalência de doenças crónicas está a gerar a necessidade de reformas nos sistemas de saúde. Estas reformas abordam a gestão de doenças crónicas com base em equipas multidisciplinares, com novos papéis atribuídos a profissionais não-médicos, como enfermeiros e farmacêuticos comunitários (CP). A comunicação entre profissionais e cidadãos é fundamental em todos os modelos multidisciplinares, o que torna o uso de Sistemas e Tecnologias de Informação (IST) cada vez mais indispensável. É de extrema importância para a ciência e a sociedade entender como serviços suportados por IST - eHealth - podem ser desenvolvidos e utilizados para enfrentar os constrangimentos e desafios dos futuros sistemas de saúde.

Objetivo: O objetivo principal deste projeto foi o de desenvolver, implementar e avaliar um serviço farmacêutico de gestão de doença suportado por IST, no contexto da farmácia comunitária, utilizando a metodologia Design Science Research (DSRM) como metodologia de investigação.

Métodos: A aplicação de DSRM decorre em seis fases, desde a definição e caracterização do problema até à avaliação da solução (ou artefacto). A primeira fase foi constituída por um exercício de cenarização, um estudo observacional de tempo e movimento e um questionário de preenchimento *online*, para avaliar as futuras possibilidades para os farmacêuticos comunitários no sistema de saúde, e a atual prestação de serviços farmacêuticos suportados por IST em farmácia comunitária. Na segunda fase, foram realizadas entrevistas qualitativas com utentes de serviços de saúde. Estas duas fases informaram o desenho da plataforma *web* de suporte ao serviço, que foi o objetivo da terceira fase. De seguida, nas duas etapas seguintes, a plataforma *web* foi testada e a usabilidade avaliada através de um estudo de caso com utentes selecionados numa universidade sénior.

Resultados: A partir do exercício de cenarização, foi possível identificar as incertezas críticas que serão os "motores da mudança" para os farmacêuticos comunitários. Estas são a "capacidade de inovar e desenvolver serviços" e o "ambiente legislativo". Tanto no estudo observacional como no inquérito, verificou-se que todas as farmácias utilizam os IST para a dispensa de medicamentos e tarefas administrativas; apenas 15% das farmácias respondentes usam os IST para responder a questões de saúde dos utentes; 50% do tempo diário do farmacêutico é despendido em interação com os utentes da farmácia e 38% em tarefas administrativas. Em média, os farmacêuticos observados têm 54 minutos de tempo livre por dia, maioritariamente em micropausas distribuídas pelo dia de trabalho. Os custos calculados para os serviços farmacêuticos observados foram muito semelhantes nas três farmácias. O custo médio do serviço de dispensa de medicamentos foi de €3,66 e do serviço de aconselhamento €1,34. Dos utentes entrevistados, 46% admitiram que procuraram o farmacêutico para informações sobre questões de saúde ligeiras antes de ir a um médico, enquanto a entrega de medicamentos ao domicílio foi o novo serviço mais solicitado. Na fase de demonstração da plataforma, verificou-se que o registo, monitorização e armazenamento de dados bioquímicos e fisiológicos, tanto pelo utente como pelo farmacêutico, contribuiu para aumentar o interesse comum na gestão da doença, o que poderá permitir uma melhoria nos resultados da saúde. Na avaliação de usabilidade, verificou-se a necessidade de melhorar o acesso rápido à informação, bem como a

necessidade de melhorar a legibilidade da informação para melhorar a experiência de utilização dos utentes seniores.

Conclusão: Atualmente, o uso de IST nas farmácias comunitárias portuguesas está principalmente focado na dispensa de medicamentos. Parece existir uma necessidade de reorganização interna das farmácias de forma a permitir aumentar a eficiência da prestação de serviços farmacêuticos e permitir a prestação de serviços farmacêuticos de eHealth. Para os serviços farmacêuticos de eHealth estarem mais integrados no modelo de negócio atual, é necessário melhorar o marketing do serviço, de forma a aumentar o recrutamento de utentes e demonstrar o valor do serviço para os doentes crónicos e médicos. A qualidade e usabilidade da plataforma eHealth é fundamental. No entanto, também o acompanhamento por um profissional de saúde e a integração dos serviços farmacêuticos com os cuidados de saúde primários são importantes para uma melhor gestão da doença. A DSRM demonstrou ser útil no desenvolvimento e implementação de serviços de eHealth, proporcionando um maior envolvimento dos utilizadores, aumentando a utilidade percebida do serviço. No próximo ciclo de DSRM, vão ser necessários os *inputs* de médicos de cuidados primários e outros profissionais de saúde, de modo a desenvolver um novo artefacto, para testar e avaliar o valor clínico e económico dos serviços farmacêuticos eHealth.

Palavras-chave: Serviços farmacêuticos; eHealth; *Design Science Research*; Cuidados de Saúde Primários;

ABSTRACT

Background: Chronic diseases are the main cause of mortality throughout Europe. The increasing prevalence of chronic diseases is leading to the necessity of health system reforms. These reforms address chronic-disease management based on multidisciplinary teams, with major roles for non-physicians, such as nurses and community pharmacists (CP). A cornerstone on every multidisciplinary model is the communication between stakeholders, for which the use of Information Systems and Technologies (IST) is increasingly indispensable. It is of importance to science and society to understand how IST supported services – eHealth - could be developed and used to address the challenges and constrains of future health systems.

Aim: The main goal of this project was to design, implement and evaluate a disease management web-based interactive pharmaceutical service, within a community pharmacy setting, using Design Science Research Methodologies (DSRM).

Methods: The application of DSRM six stages' is described, from the definition and characterization of the problem to the evaluation of the artefact. The first stage consisted of a scenario exercise, a time and motion observational study and an online survey, to assess future roles for community pharmacists and current pharmaceutical services provision supported by IST in community pharmacy. In the second stage, qualitative interviews with health services' users were performed. These two stages helped to inform the design of the web-platform, which was the goal in the third stage. After this, the web-platform was tested and the usability evaluated in the two following stages, through a case study with selected patients from the participant pharmacies and from a senior university.

Results: The scenario exercise allowed to identify the critical uncertainties that will be the drivers of change for the Community Pharmacists. These were found to be the "Ability to develop Services", and the "Legislative Environment". From both the survey and observational study, it was found that pharmacies' IST is mainly used for dispensing medicines and administrative tasks with only 15% of the respondent pharmacies using IST to answer patients' queries; 50% of pharmacists daily time is spent with patients, 38% on administrative tasks, while still having an average of 54 minutes of idle time spread through the day, mainly in micro-pauses. The overall costs of Pharmaceutical services across three pharmacies were found to be very similar, with the average dispensing service cost at €3.66 and €1.34 for the counselling service; 46% of the interviewed users admitted that they sought healthcare provision with the CP for minor issues before going to a physician, while home delivery was the most requested new service. In the demonstration stage, we found that the registration, monitoring and storage of biochemical and physiological data, recorded by the CP and the patients in the platform, contributed to a common interest that may allow an improvement in patients' health outcomes. From the usability evaluation, concerns about the quick access to information were perceived as well as the need to improve legibility, addressing senior users' difficulties.

Conclusion: The current state of IST usage in Portuguese community pharmacies is mainly focused on medicine dispensing. There seems to exist a need for internal reorganization of pharmacies allowing for more efficient pharmaceutical services provision and to enable eHealth pharmaceutical services provision. To make eHealth

pharmaceutical services more integrated in the current pharmacy daily business, marketing efforts need to be done, to recruit and demonstrate value to the chronic patients and physicians. The quality and usability of the web-based platform is critical, as is the close professional follow-up and integration of pharmacy and primary care services focused in disease management. DSRM helps in developing and implementing eHealth services through a higher involvement of the stakeholders, increasing the perceived usefulness of the service. The next DSRM cycle will need to use the input of primary care physicians and other health professionals in order to develop an artifact to test and evaluate the clinical and economic value of eHealth pharmaceutical services.

Keywords: Pharmaceutical services; eHealth; Design Science Research; Primary Healthcare;

TABLE OF CONTENTS

SCIENTIFIC PUBLICATIONS AND COMMUNICATIONS ..... **i**

ACKNOWLEDGMENTS ..... **iv**

RESUMO ..... **v**

ABSTRACT ..... **vii**

TABLE OF CONTENTS ..... **ix**

LIST OF FIGURES ..... **xi**

LIST OF TABLES AND BOXES ..... **xii**

ABBREVIATIONS ..... **xiii**

1. INTRODUCTION **1**

1.1. BACKGROUND AND STATE OF THE ART 2

1.1.1. Community Pharmacists' new role – Pharmaceutical care and Pharmaceutical services 3

1.1.2. The Pharmaceutical care movement in Community Pharmacy 5

1.1.2.1. The Dáder methodology 6

1.1.2.2. Pharmaceutical services 7

1.1.3. Integrating pharmacists in the Primary Healthcare team 9

1.1.4. Community Pharmacy system in Portugal 12

1.1.5. Information Systems and Information Technologies in Healthcare 14

1.1.5.1. Information systems and technologies in Community Pharmacy 15

1.1.6. Pharmaceutical services remuneration models 17

1.1.6.1. Financial incentives in Community Pharmacy 20

1.2. AIM OF THESIS 22

1.3. METHODOLOGY 24

1.4. SUMMARY OF STUDY DESIGNS 27

1.5. REFERENCES 30

2. RESULTS **41**

2.1. PAPER I 41

2.2. PAPER II 55

2.3. PAPER III 71
2.4. PAPER IV 83

3. DISCUSSION 112

3.1. SUMMING UP THE RESULTS 112
3.1.1. Paper I 112
3.1.2. Paper II 113
3.1.3. Paper III 114
3.1.4. Paper IV 114
3.2. IMPLICATIONS FOR PRACTICE AND POLICY 116
3.2.1. Role definition inside Community Pharmacy 116
3.2.2. Role of Information Systems and Technologies 118
3.2.3. Envisioning remuneration models for Portuguese Community Pharmacists 121
3.3. HEALTH INFORMATION SYSTEMS INTEGRATION: A MODEL OF DIMENSIONS TO ASSESS 124
3.4. LIMITATIONS 125
3.5. REFERENCES 127

4. CONCLUSION 130

4.1. FUTURE RESEARCH 131

5. APPENDIXES 133

5.1. INITIAL SURVEY ON PHARMACY DESCRIPTION, PHARMACEUTICAL SERVICE PROVISION AND USE OF INFORMATION SYSTEMS AND TECHNOLOGIES. 133
5.2. OBSERVATIONAL STUDY PROTOCOL 146
5.3. OBSERVATIONAL STUDY DATA COLLECTION GRID 152
5.4. ACTIVITY 2 INTERVIEW SCRIPT 153
5.5. WEB-PLATFORM PROTOTYPE DEMONSTRATION PROTOCOL 154
5.6. INFORMED CONSENT FORM 161
5.7. USABILITY TEST RESULTS 162

LIST OF FIGURES

Figure 1 - Pharmaceutical Services Maturity Framework 8
Figure 2 –Information systems main components (Source: (Silver et al., 1995)) 14
Figure 3 - Interconnectedness of Health Systems' building blocks 15
Figure 4 - International comparison of remuneration models for community pharmacies (source: (Bernsten et al., 2009)) 18
Figure 5 - Conceptual model for the use of IST in the Community Pharmacy setting (adapted from ePharmacare Project (PTDC/CCI-CIN/122690/2010)) 23
Figure 6 – DSRM cycle (adapted from (Peffers et al., 2007) 25
Figure 7 - Conceptual model for the integration of Health Information Systems in Primary Healthcare 125

LIST OF TABLES AND BOXES

Table 1 - Definition of drug related problems (DRP) according to the Consensus of Granada (adapted from: Martínez-Romero et al. 2001; Panel de Consenso 1999) 6
Table 2 - Dimensions and levels of GP-pharmacist integration (adapted from (Bradley et al., 2012)) 11
Table 3 - Design Science Research activities and tasks to perform 26

Box 1 - Chronic diseases prevalence in Portugal 3
Box 2 - External factors with influence in Community Pharmacists' role 5
Box 3 – Description of the six activities of DSRM, according to Peffers and colleagues (Peffers et al., 2007) 25

ABBREVIATIONS

AFP - Portuguese Association of Pharmacies

ANF - National Association of Pharmacies

CP - Community Pharmacist

CCM - Chronic Care Model

DRP - Drug Related Problems

DSRM - Design Science Research Methodology

ERS - Portuguese Health Regulation Authority

GP - General Practitioner

HIS - Health Information Systems

INFARMED - National Authority of Medicines and Health Products

IS - Information Systems

IST - Information Systems and Technologies

NHS - National Health Service

OF - Portuguese Pharmaceutical Society

OTC - Over-the-Counter medicines

SEB - Service Experience Blueprint

WHO - World Health Organization

1. INTRODUCTION

The study reported in this thesis centres itself in the development and implementation of a new pharmaceutical service supported by Information Systems and Technologies (IST), using Design Science Research Methodology (DSRM). The project that originated this thesis – ePharmacare Project– was financially supported by the Portuguese Foundation for Science and Technology (Ref: PTDC/CCI-CIN/122690/2010). During the DSRM process, it was expected that several findings would be made, shedding new light on the development of new roles for community pharmacists in future health systems.

This work is divided in three main sections.

In the first section, the literature review of the thesis describes a contextual framework for the study, from the trends affecting health systems to the development of the community pharmacist profession and use of Health Information Systems (HIS) (chapter 1.1). The search strategy for this literature review was to identify studies related to health system context, both national and international, community pharmacists' new role, and IST supporting community pharmacies' services. The main database used was PubMed, with Google® Scholar being used to aid the search for additional papers on the subjects. The goal of this literature review was to provide a framework to understand the implications of new pharmaceutical services supported by IST in the context of future health systems. In the final chapters of this initial section (chapter 1.2 – chapter 1.4), the aim of this study is stated, a conceptual framework with an explanation of the DSRM and a short summary of the papers to be presented in the Results section are provided. The Introduction closes with the list of bibliographic references used to support the section.

The second section is the Results section, which is constituted by the four papers previously mentioned (see page i - Scientific publications and communications).

The third section contains the Discussion. It begins with a summary of the results reported in the four papers (chapter 3.1), followed by a section with implications for practice, research and policy (chapter 3.2), that will highlight the implications of IST to professional development and community pharmacists' integration in primary healthcare.

An outline of possible remuneration models is provided in section 3.2.3. The Discussion section closes with the proposal of a conceptual framework for Health Information Systems research in community pharmacy and primary healthcare (chapter 3.3) and an overview of the research limitations. After this, the thesis closes with a final Conclusion section, where the main findings and future research directions are stated.

1.1. BACKGROUND AND STATE OF THE ART

An ageing population in OECD countries, with increasing prevalence of chronic diseases (see box 1 for national details), the associated rising costs of care and lack of human resources for health have long been considered the main threats to the sustainability of global health systems (Sacco et al., 2013; WHO, 2010). Adding to this epidemiologic profile, the current economic crisis affecting some countries became another driver pressing health systems to ration expenditures while preserving quality and access to health care services (Leopold et al., 2014). These factors are inspiring political decisions to implement health system reforms, with a greater emphasis in Universal coverage, de-regulation and pro-competitive policies across health systems (Barros, 2012; Campbell et al., 2014; Carrin et al., 2008; Frenk et al., 1997; Vogler et al., 2014)

Underlining this trend, the World Health Organization (WHO) published a paradigm-shifting report in 2008, emphasizing the importance of primary healthcare, already a priority in International Health since the Alma-Ata Conference in 1978 (WHO, 2008). To achieve primary healthcare coverage, health system focus turned to people-centred care. This would require health services to be organized accordingly, with multidisciplinary teams that are responsible for defined populations, that collaborate with social services and other sectors, and coordinate the contributions of hospitals, specialists and community organizations (WHO, 2008). Primary healthcare can be defined as "(…)*the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients and practicing within the context of family and community*" (Rothman and Wagner, 2003). The value of primary healthcare lies on being a social and political process that involves people, enabling them to take more control

over their own health (Seventh Consultative Committee on Primary Health Care Systems for the 21st Century, 1997).

To address the challenges of chronic diseases and universal primary healthcare coverage, interprofessional models emerged. One of these models is the Chronic Care Model (CCM), developed by Bodenheimer, Wagner and colleagues (Bodenheimer et al., 2002). The aim of the CCM is to transform the daily care for patients with chronic illnesses from acute and reactive to a proactive, planned, and population-based approach. This emergence of interprofessional models of practice has brought human resources for health issues into the international agenda for health systems strengthening and public health policies (Campbell et al., 2014; Dussault and Ferrinho, 2007).

Box 1 - Chronic diseases prevalence in Portugal

In Portugal, the prevalence of diabetes, hypertension, asthma and chronic pain has been increasing in the last years. The prevalence of diabetes in the general population is 11.7% (Gardete-Correia et al., 2010), the prevalence of hypertension is 42.1% (Macedo et al., 2007), the prevalence of asthma 6.8% (Sa-Sousa et al., 2012) and chronic pain, an incapacitating condition, affects 37.0% of the Portuguese population (Azevedo et al., 2012).

Most people with major chronic illnesses such as diabetes, hypertension, or asthma are already receiving care from primary care physicians or nurses (Bodenheimer et al., 2002). Extending the definition of primary care professionals beyond "clinicians", several studies have shown that non-physician professionals, such as community pharmacists, may be critical components of effective chronic disease care teams (Cranor et al., 2003; Makowsky et al., 2009; Willis et al., 2014).

1.1.1. COMMUNITY PHARMACISTS' NEW ROLE – PHARMACEUTICAL CARE AND PHARMACEUTICAL SERVICES

At the beginning of the 20th century, community pharmacists were responsible for the preparation, provision and assessment of the medicines used in the treatment of diseases. Their main obligation was to certify that the products were pure and properly prepared, although counselling was another important function. This role began to disappear between 1930 and 1970 in more industrialized countries, when the magisterial formulas were rapidly replaced by industrially prepared formulas (Anderson, 2002).

Nowadays, community pharmacists are playing a growing part in primary healthcare by fulfilling an increasing range of roles and responsibilities, while retaining the classical role of medicines' supplier (Kennie-Kaulbach et al., 2012). Community pharmacists' activity is characterized by an easy accessibility and affordability, which is a valuable asset in a health system (Chisholm-Burns et al., 2010). Often a first point of contact with the health system, community pharmacists can play a similar role to primary care physicians' gatekeeping, referring patients to their primary care physician when needed. The term "gatekeeping" in healthcare generally refers to a professional "*positioned at an entry point, or gate, through which patients must pass to receive care or services*" (Riley and Manias, 2009). Physician gatekeepers identify patients' healthcare needs and, jointly deciding with the patient, choose services that effectively meet those needs (Forrest, 2003). Assuming this role, pharmacists can simultaneously satisfy patients' need for a closer professional follow-up in disease management (Osterberg and Blaschke, 2005). This referral process is already a feature of Portuguese community pharmacist daily activity but most of the times it is done informally, with no remuneration associated (Barros et al., 2012).

Community pharmacists' skills have led to their growing public recognition as a health professional (Anderson, 2002). However, the initial promise of community pharmacists' integration in the primary healthcare team is coming to a stall. The worldwide change in community pharmacists' practices and roles is occurring at a slower pace than first envisioned, with different speeds across countries, influenced by several external factors and also pharmacists' personal and professional barriers (Box 2). Change processes often take longer than expected due to lack of awareness or the many challenges it implies.

In a 2005 review, Roberts et al. (2006), found an extensive list of individual and organizational facilitators to practice change, that usually match an equally long list of barriers. One of the consequences of such barriers is that, despite the development of different services, the evidence regarding their implementation, effectiveness and sustainability is scarce (Mossialos et al., 2015). Notwithstanding, some countries have implemented national pharmaceutical policies, designing incentives that demand more from community pharmacists than just dispensing medicines (Bernsten et al., 2010).

Box 2 - External factors with influence in Community Pharmacists' role

Main External Factors Influencing Community Pharmacists' role:
• Economic and legislative context • Commercial pressures • Government politics • Technological innovations • New therapies • Support from other professionals • Integration in the primary healthcare system

Adapted from: (Anderson, 2002; Maddux et al., 2000; Roberts et al., 2005; Van Mil et al., 2004; Zellmer, 2010)

1.1.2. THE PHARMACEUTICAL CARE MOVEMENT IN COMMUNITY PHARMACY

After Alma Ata's conference and the onset of the primary healthcare movement, the pharmacy profession started to experience several attempts for an expansion of its role. This role expansion has its roots in the clinical pharmacy movement, which started during the 1960s in some north-American hospitals, where the foundations for the level and scope of practice of a patient-oriented pharmacy practice were laid (Berenguer et al., 2004). Several progresses were made in the following decades until 1989, when Charles Hepler and Linda Strand published the breakthrough work in pharmaceutical care: "Opportunities and responsibilities in Pharmaceutical Care" (Hepler and Strand, 1990). In their words, pharmaceutical care is "*the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life*". It involves a "*process through which a pharmacist cooperates with a patient and other professionals in designing, implementing and monitoring a therapeutic plan that will produce specific therapeutic outcomes for the patient*". These outcomes are the cure of a disease; elimination of a patient's symptoms; and slowing a disease process or preventing it. To do so, Pharmaceutical Care relies on three main tasks: identifying, resolving and preventing potential drug-related problems (Hepler and Strand, 1990).

Due to the complexity of resolving drug related problems (DRPs), some professionals started to discuss ways to teach and implement pharmaceutical care practices almost immediately after the work of Hepler and Strand. The first system developed by Strand's research group of the University of Minnesota consisted in eight categories of DRPs (Strand et al., 1990). In 1998, the research group in Pharmaceutical

Care of the University of Granada held a meeting for professionals and groups working on the identification and resolution of DRPs. In this meeting, the reduction to six categories of DRPs was agreed, on what has come to be known as the Consensus of Granada (table 1) (Panel de Consenso, 1999).

1.1.2.1. THE DÁDER METHODOLOGY

Recognizing the necessity to train graduated pharmacists on the emerging new practices, the University of Granada developed post-graduate activities and training courses in Pharmaceutical Care, the Dáder Program on drug therapy follow up, that would give way to what is now known has Dáder Methodology (Martínez-Romero et al., 2001). At the time, it was defined that the provision of follow-up based on Dáder methodology could not need computer applications, it should only be based on a simple system for documentation of processes and results. Neither any special previous pharmacological or pharmacotherapy advanced knowledge was necessary. This was done to avoid barriers to pharmaceutical care provision that at the time were beginning to be described in the literature (Mil et al., 2001).

Table 1 - Definition of drug related problems (DRP) according to the Consensus of Granada (adapted from: Martínez-Romero et al. 2001; Panel de Consenso 1999)

DRP classification		Description
Necessity	DRP 1	The patient does not use a medicine that is needed
	DRP 2	The patient uses a medicine that is not needed
Effectiveness	DRP 3	The patient does not respond to treatment (non-dosage-dependent)
	DRP 4	The patient uses a dose or frequency inferior to what is needed (Ineffectiveness dosage-dependent)
Safety	DRP 5	The patient uses a dose or frequency superior to what is needed
	DRP 6	The patient uses a medicine which provokes and adverse reaction

The provision of pharmaceutical care with the Dáder methodology is supported on the collection of patient information on a scheduled pharmacy visit. This information can be subjective information (e.g. open questions about general health issues), or objective information (e.g. blood pressure, and other measurements). Then, the pharmacist makes

an evaluation of the patient's health status and possible DRPs found should be reported to the primary care physician responsible for the patient. A plan is then designed in accordance with the patient and a follow-up visit should be scheduled, to evaluate the prosecution of the plan.

1.1.2.2. PHARMACEUTICAL SERVICES

Fuelled by the initial work of Hepler and Strand and the consequent emergence of new roles, the pharmacy profession developed a wide variety of pharmaceutical services. Due to the continuous development of numerous services, the conceptual discussion about what is "pharmaceutical care", "pharmaceutical services" or "pharmacy services" is ongoing. One recent paper advocates that a "professional pharmacy service" is defined as "*an action or set of actions undertaken in or organised by a pharmacy, delivered by a pharmacist or other health practitioner, who applies their specialised health knowledge personally or via an intermediary, with a patient/client, population or other health professional, to optimise the process of care, with the aim to improve health outcomes and the value of healthcare*" (Moullin et al., 2013). To distinguish services provides by pharmacists from other services, this definition is then divided in "pharmacist services" and "Other Healthcare Practitioner Services"; Pharmacist services are then divided in "pharmaceutical services", when it refers to the utilization of pharmacists' knowledge in their field of studies (e.g. those relating to drug therapy like pharmaceutical care) and "Other Healthcare Services" (e.g. health promotion services).

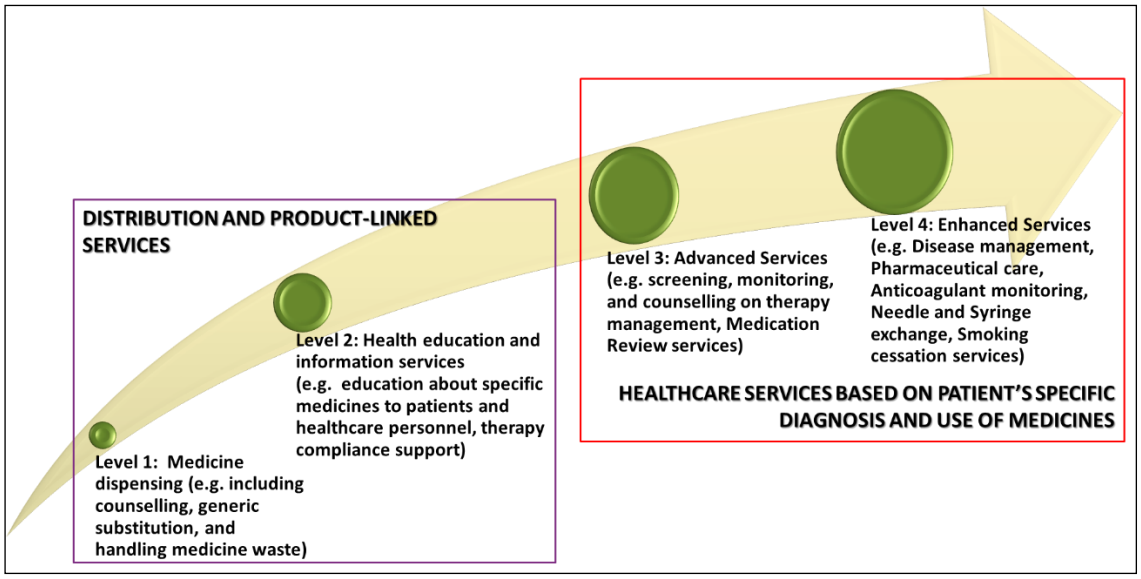
Although there is no universally accepted definition of pharmaceutical services that comprises the entire scope of activities, services, and programs provided by community pharmacies (Moullin et al., 2013), a broad number of professional services performed by pharmacists, that may match community pharmacist's role in primary healthcare in different countries, can be identified. These services can be categorized into 2 main groups (figure 1):

a) Distribution services and Product-linked services

Distribution and product-linked services are fundamental to the pharmacy profession, including dispensing medicines, generic substitution, and handling medicine waste. They may also include education about specific medicines to patient and

healthcare personnel, therapy compliance support and counselling. These services constitute the first tier of pharmacy services, sometimes called "essential" services (Bradley et al., 2007), and are usually regulated through legislation in the respective countries.

Figure 1 - Pharmaceutical Services Maturity Framework



b) Healthcare services based on the patient's specific diagnosis and use of medicines

Services provided by pharmacists based on patient's specific diagnosis relate to monitoring of therapy efficacy and detection of early signs of disease. Medicines-use based services can focus either on the use of medicines as a whole, or on one specific type of medicine. These are the sometimes called "advanced" and "enhanced" pharmaceutical services (Bradley et al., 2007, 2006).

Examples of advanced services are, screening, monitoring, and counselling or therapy management in relation to different diseases. Enhanced services may include home delivery of medicines, anticoagulant monitoring, Disease specific medicines management, Medication Review services, Needle and Syringe exchange, Smoking cessation services, and supervised administration of medicines. A particular set of enhanced services have also been referred to as pharmaceutical care, cognitive services, disease state management, medication therapy management (MTM), and clinical

pharmacy services in order to differentiate them from dispensing services (Nutescu and Klotz, 2007).

This second group of services have been considered extremely valuable for health systems and professionals, not only because of economic savings but also due to a greater efficiency and improvement in health services quality and in patient health-related outcomes (Berenguer et al., 2004; Cranor et al., 2003; Nkansah et al., 2010). However, the evidence regarding the effectiveness of these services is not completely clear (Mossialos et al., 2013). The lack of solid evidence has been identified as one of the barriers for the integration of professional pharmacy services in the health system, and particularly, in primary healthcare (Mossialos et al., 2015).

1.1.3. INTEGRATING PHARMACISTS IN THE PRIMARY HEALTHCARE TEAM

Much discussion around the best way to integrate pharmacists in the primary healthcare team has happened (Mossialos et al., 2013). Studies have identified benefits for patients where pharmacists are integrated into core healthcare teams, allowing greater access and improved public health (Campbell et al., 2014), as well as gains in raising awareness of pharmacists' new role amongst other health professionals (Makowsky et al., 2009).

Until now, pharmacists continue to exert their supply role in the healthcare system without much innovation, in spite of the development of pharmaceutical care programs and other disease management, therapeutic management or public health services (Strand et al., 2016). However, pharmacists can contribute immediate solutions through efforts to enhance medication management, identify and solve drug-related problems and adverse events, and help patients achieve intended outcomes, recognizing that carrying out this responsibility requires communication, collaboration and professionalism (Kennie-Kaulbach et al., 2012).

The integration of community pharmacists in the primary healthcare team depends greatly on both recognition and acceptance of the different health professionals involved in disease management, particularly general practitioners (GPs) and other physicians (Bradley et al., 2012; Edmunds and Calnan, 2001). For decades, this relationship has been overlooked, many times a source of disagreement and resentment between both

professional organizations and other professionals' bodies, becoming a major barrier to a new role for community pharmacists (Bardet et al., 2015; Edmunds and Calnan, 2001; Paulino et al., 2010).

The idea of primary healthcare integration can assume different arrangements: "contracting," "coordination," "cooperation," and "collaboration" (Axelsson and Axelsson, 2006). The difference between these forms of integration depends on the way the formalization of the relationship happens. If the arrangements are depending on "contracting" it means that the integration comprises a formal contract; collaboration on the other hand, is when integration is achieved through voluntary arrangements (Axelsson and Axelsson, 2006). Examples of formal contracts amongst physicians and pharmacists exist from the United States of America (USA) and Canada, to Europe or Australia (Benrimoj and Roberts, 2005; Bradley et al., 2012; Kroger et al., 2000; Noyce, 2007; Schulz, 2006). There are also examples of explicit agreements between GPs and pharmacists concerning their prescription policy (Bernsten et al., 2009; Kooy et al., 2007; van der Kam et al., 2001). Nevertheless, the most common form of practice is still informal collaboration (Bradley et al., 2012).

Different conceptual models have emerged in the last years seeking to define the drivers of the GP-CP collaboration. Among them, Bradley and colleagues (2012), propose a model with 3 levels of collaboration assessed on 7 dimensions: Locality, Service Provision, Trust, "Knowing" each other, Communication, Professional roles, and Professional respect (Table 2).

Several issues arise from this model, mainly regarding the dimensions of trust and professional roles. Physicians need to trust the pharmacist but the contrary is not necessarily true (Bradley et al., 2012). To build trust, physicians need to know the pharmacist, finding it difficult to work with multiple chain pharmacies, which usually have many staff members with high turnover. This implies that in settings of high professional turnover, any form of collaboration is inhibited. Also, a preoccupation to reinforce the traditional roles of GPs and the contempt of pharmacy's commercial aspect leads the authors of this conceptual model to conclude that collaborative arrangements may not be the most appropriate (Bradley et al., 2012). Other studies point for similar key elements in the GP-CP collaboration (Bardet et al., 2015). However, all studies emphasize

the need for communication. Communication is key in the success of establishing a highly productive interprofessional collaboration (Bardet et al., 2015; Roberts et al., 2008; Snyder et al., 2010). Regular GP-CP meetings, may be important in order to solidify the relation between professionals (Kooy et al., 2007; Mossialos et al., 2004).

Table 2 - Dimensions and levels of GP-pharmacist integration (adapted from (Bradley et al., 2012))

	Level 1 - Isolation	Level 2 - Communication	Level 3 - Collaboration
Locality	Geographically separated	Mostly separated	Close geographically
Service provision	Pharmacy provides no additional services beyond dispensing	Pharmacy provides some additional services.	Pharmacy provides enhanced level services
Trust	GP has little trust in the pharmacist, with suspicion about the business element of pharmacy. The need to trust the GP is not considered by the pharmacist	Some trust has been built and is dependent on the pharmacist demonstrating they are trustworthy. GP distrust of pharmacists is associated with the type of pharmacist	A historical relationship – mutual trust has been built
"Knowing" each other	GPs and pharmacist do not feel they "know" each other	GPs may feel that they know some pharmacists locally	Both parties feel they "know" each other. A level of dependency between both professionals may develop
Communication	Limited communication, mostly unidirectional from the pharmacist to the GP	Moderate communication, mostly unidirectional from the pharmacist to the GP. Communication may have been good initially but was not sustained	Regular reciprocal communication is the norm.
Professional roles	Defined, traditional roles. GPs maintain a territorial approach. Pharmacists may be reluctant to expand their role	GP believes that pharmacists can be useful, if properly trained, and their role should be limited to management of minor ailments and helping ease workload.	GP believes pharmacists can offer an enhanced level of service as a result of their expertise. GPs views the pharmacist as a useful resource for them to consult for advice
Professional respect	Limited evidence of professional respect for or confidence in pharmacy from the GP	Some evidence of respect for pharmacy by the GP, but undermined with a distinction between types of pharmacies	Examples of mutual respect for both the individuals and the professionals

In light of these findings, and considering findings from qualitative studies in Portugal (Paulino et al., 2010), the best form for the GP-CP arrangement is still an open research question in the Portuguese context. For individual pharmacies that seek to innovate and provide advanced services, the collaboration form of GP-CP arrangement may the most feasible. Furthermore, it has been demonstrated that pharmacists will have the most important role in the development of GP-pharmacist collaboration (Bardet et al., 2015). Pharmacists as initiators of the collaboration, with frequent communication in the early stages, and physicians' acceptability of pharmacy services, through a previous contact with pharmacy services, are important factors in models of interprofessional collaboration (Doucette et al., 2005; Salgado et al., 2012; Snyder et al., 2010) However, this makes the success of this professional relationship highly dependent on personal attributes and wills (Doucette et al., 2005; Paulino et al., 2010).

1.1.4. COMMUNITY PHARMACY SYSTEM IN PORTUGAL

Community pharmacists in Portugal mostly work in independent pharmacies, since large chains are not allowed and small chains are only nowadays becoming a reality. The opening of community pharmacies is regulated, with main criteria being a minimum distance between pharmacies (350 meters in a straight line) and the number of serviced inhabitants (minimum 3500 inhabitants) (Ministry of Health, 2007). There are some exceptions to these rules, depending on the presence of a healthcare service in the vicinity, or in areas with low population density. Pharmacies have to be opened at least 50 hours a week. The presence of a responsible pharmacist - the technical director - is mandatory and a substitute has to be registered at the National Authority of Medicines and Health Products (INFARMED), in order to assure a pharmacist is present at all times. Non-pharmacist ownership is allowed, with the maximum number of pharmacies per owner capped at four. Pharmacies have a National Health Service (NHS) contract for dispensing prescription medicines, with legislation establishing medicines' profit margins and patients' co-payments (Ministry of Health, 2014). Practicing pharmacists have to be mandatorily registered in INFARMED and licensed by the Portuguese Pharmaceutical Society (Ordem dos Farmacêuticos - OF). By the end of 2014, there were 8682 registered community pharmacists (INFARMED, 2014; Portuguese Pharmaceutical Society, 2012). These are mostly young professionals (67% are less than 45 years old). There is a high

number of females (about 80% of the practitioners), confirming a worldwide trend of feminization in the profession (Hawthorne and Anderson, 2009). The ratio of pharmacists per pharmacy has increased between 2000 and 2014, leading to an average of more than three pharmacists per pharmacy since 2014 (INFARMED, 2014). Simultaneously, the number of pharmacy technicians per pharmacy has dropped, with pharmacists assuming the supply tasks and undifferentiated tasks as part of their work routine. This in turn may have contributed to patients' poor acknowledgment of different workers and competencies at the community pharmacy counter (Cavaco and Bates, 2007).

Over the last twenty years Portuguese community pharmacies have developed consultation services to manage chronic patients and their therapies, in line with international developments on "pharmaceutical services" (Costa et al., 2006) These services have targeted the provision of tailored education on health, drug information, screening and monitoring of blood pressure, body mass index and basic clinical parameters (e.g. blood glucose, blood uric acid, cholesterol, etc.). There was also an effort to develop and implement nationwide pharmaceutical care programs for diabetes and hypertension. These programs were developed by the owners' association National Association of Pharmacies (ANF), and were based in the Dáder methodology (Martínez-Romero et al., 2001). The program for diabetes care was financially supported by the NHS from 2006 to 2009. When the financial support ended, 400 pharmacies were doing patient follow-up, with an average of three patients per pharmacy (INFARMED, 2009). Soon after, most pharmacies terminated the provision of the service. A recent survey found that in a sample of 403 pharmacies (14%), only 333 pharmaceutical care consultations were provided during a 5 days period (Barros et al., 2012).

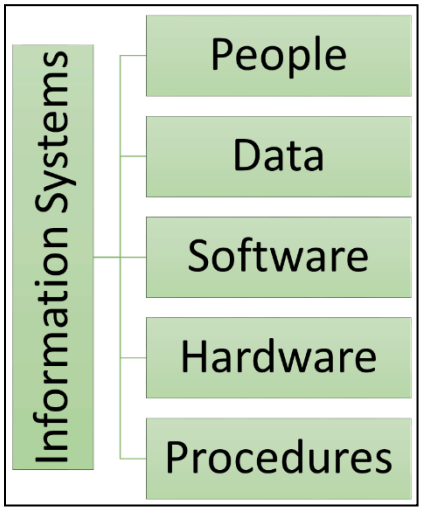
The evidence of longitudinal services provided in Portuguese pharmacies towards medicine use or other disease management services is limited (Martins and Queirós, 2014). Apart from dispensing prescription medicines, none of the new services is supported by NHS reimbursement. These services are entirely supported by medicines' profit margins and patients' direct payments. Nowadays, many Portuguese pharmacies have broadened their service offer to services provided by different professionals such as nutritionists, podologists, or nurses in an attempt to have more revenue to face financial constraints. Unlike pharmaceutical services, the services provided by other healthcare

practitioners inside the pharmacy are regulated and supervised by the Portuguese Health Regulation Authority (Entidade Reguladora da Saúde – ERS) (ERS, 2014).

1.1.5. INFORMATION SYSTEMS AND INFORMATION TECHNOLOGIES IN HEALTHCARE

An Information System (IS) is any organized system for the collection, organization, storage and communication of information. Silver and colleagues (1995), stated that an IS must include software, hardware, data, people, and procedures (figure 2).

Figure 2 –Information systems main components (Source: (Silver et al., 1995))



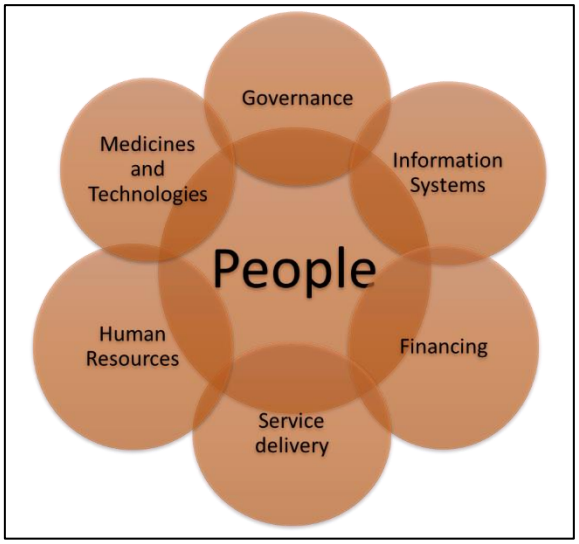
Any specific information system aims to support operations, management and decision-making (Bulgacs, 2013). Information technology is the utilization of computers to support the information system (Zuppo, 2012). Since IS are nowadays supported by a myriad of different machines (e.g. desktops, laptops, mobile phones, tablets, etc.), this research work will refer to the term "information systems and technologies (IST)", reinforcing the difference to IS supported by other Technologies such as paper-based records.

Health information systems (HIS) are now considered a building block of any health system (Alliance for Health and Systems Research Policy, 2009). Figure 3 presents the different health system building blocks, showing how they relate to each other and how they are interdependent. HIS have initially been designed to support health system and services' management. This was done mainly through the shifting from manual to electronic medical records, integrated data systems and architecture for HIS design (Alliance for Health and Systems Research Policy, 2009).

Governments across the globe are promoting IST in their healthcare systems with the intention of transforming service organisation and delivery, especially in terms of resource utilisation, clinical decision making, patient satisfaction and service productivity and quality (Petrakaki et al., 2012). The utilization of IST for the provision of healthcare and health services – eHealth - is a trend in health systems and disease management

focusing on a higher level of interaction with patients, that may have a significant impact on health outcomes (Kreps and Neuhauser, 2010; Kreps, 2014; Kuhn et al., 2007).

Figure 3 - Interconnectedness of Health Systems' building blocks



IST will be essential to effectively build patient-centred health systems. Involving patients in their disease management, in close collaboration with a health professional, has the potential to improve outcomes such as therapy compliance or patient's knowledge about their condition (Barrera et al., 2002). Home telemonitoring of chronic diseases seems to be a promising patient management approach that produces accurate and reliable data, empowers patients, influences their attitudes and behaviours, and potentially improves their medical conditions (Paré et al., 2007; Sacco et al., 2013). Several telemonitoring approaches have already been tested. Examples of telemonitoring interventions exist from remote blood pressure monitoring (Green et al., 2008), congestive heart failure (Polisena et al., 2010), Chronic Obstructive Pulmonary Disease (Cruz et al., 2014), Diabetes management (Armstrong and Powell, 2008; Polisena et al., 2009) or other simpler interventions such as SMS alerts for medication intake (Vervloet et al., 2012).

1.1.5.1. INFORMATION SYSTEMS AND TECHNOLOGIES IN COMMUNITY PHARMACY

The evolution of IST probably will have an important impact on the definition of new roles for the community pharmacist (Fox et al., 2005; Katz and Moyer, 2004; Lam and Rose, 2009; Maddux et al., 2000). The use of properly developed IST based solutions in the medicine dispensing process has the potential to relief pharmacist's workload, leaving more free time to assume other functions while enhancing the patient/professional interaction (Kreps and Neuhauser, 2010). Staff shortages, particularly in pharmacies located in rural or suburban areas, can also be mitigated with the use of IST (Collins et al., 2007). Nevertheless, there is limited evidence of IST usage in the provision of professional pharmacy services (Calabretto and Swatman, 2010). Overall, researchers

have mainly investigated the effects of electronic transfer of prescriptions and decision support systems on the work of community pharmacists (Astrand et al., 2009; Petrakaki et al., 2012), or the implementation of an internet-based medicine cabinet (Calabretto and Swatman, 2010; Calabretto and Warren, 2005). Calabretto and Swatman (2010), who studied the socio-technical implications for information technology related interventions in community pharmacy, including medication management, found that we are still in the "infancy" of using IST in community pharmacies.

The issues arising with IST usage in community pharmacy are common with other settings, with most difficulties in implementation due to managerial or behavioural factors (Kuhn et al., 2007; Motulsky et al., 2011). The underuse of the current systems has been described as partially resulting from a lack of IST skills, but also from IST applications inadequacy for community pharmacists' needs, an insufficient patient-oriented attitude, privacy protection and time constraints (Velez Lapão, 2007; Westerling et al., 2011). Other issues are related to safeguarding patients' rights to privacy and confidentiality as well as establishing methods of communication among pharmacists and other healthcare professionals, in order to ensure continuity of care (Kawamoto et al., 2005).

It is clear that implementing IST that support pharmaceutical care in community pharmacy is impending on more research (Petrakaki et al., 2012; Westerling et al., 2011; Zellmer, 2010). Currently, effective systems to share patient records and information between different healthcare sites and/or healthcare professionals are being developed but their use is still occasional (Goundrey-Smith, 2014). Electronic communication between the General Practitioner (GP) and pharmacists is uncommon. Notwithstanding, in the Netherlands, electronic communication has shown better results than paper based communication, although it does not limit the reports of information discrepancy regarding information obtained from the patient, the physician or the pharmacist (van der Kam et al., 2001). In the majority of countries, IST support for professional pharmaceutical services provision is used only locally, for record keeping, patient management and customer relations (Costa and Nascimento Jr, 2012; Westerling et al., 2011). Nevertheless, IST seem particularly indispensable in facilitating access to information needed in patient care, such as clinical patient data, guidelines, and evidence-based information (Jorgenson et al., 2014).

1.1.6. PHARMACEUTICAL SERVICES REMUNERATION MODELS

The growing importance of pharmaceutical care services within the profession brought to light the discussion about service remuneration (Huttin, 1996). Pharmacists are typically paid for supplying medicines and attention is rarely given to pharmacy services remuneration in the context of the total healthcare budget. Instead, pharmacy services are often seen as a cost to the payer in addition to the cost of the medicines, rather than an investment in healthcare that results in improved quality, safety, better treatment outcomes and cost savings in the long term (Mossialos et al., 2015). This is especially true in an environment of evidence-based policy-making, where health system financers need to be convinced that their budget is being well spent on pharmaceutical services (George and Silcock, 1999; Mossialos et al., 2013).

Payment models for pharmacy services have progressed slowly, despite evidence that such services provide a solid return on investment and improve patient outcomes (Perez et al., 2009; Schumock et al., 2003). However, defining the best remuneration model for pharmaceutical care services is still a matter of debate within the profession and policy makers (Mossialos et al., 2013).

There is an extensive literature describing the various remuneration models throughout the world (Bernsten et al., 2010). Comparing, and describing them, is difficult since every country has its own system (figure 4). Also, it is important to distinguish between remuneration and reimbursement. Remuneration refers to a payment that is due to a provision of a service. In the case of pharmacy services, some of the remuneration is in part due to the selling of medicines that may be reimbursed. Reimbursement usually involves a third-party payer covering part of the remuneration, either before or after the acquisition of the good or service (Nutescu and Klotz, 2007). The reimbursement of medicines prices is the most common form of pharmacy remuneration across Europe (Vogler et al., 2014).

Remuneration models for professional pharmacy services are influenced by the healthcare and health insurance system. For instance, in the USA, the federal government pays for some services (Medicare), while the different states (Medicaid) and private insurances pay for others (Fijalka et al., 2008). The pharmaceutical industry may finance

a small amount of care for those who cannot afford their medicines. In countries such as the United Kingdom (UK), Canada, Australia and New Zealand pharmacists are paid for providing a large number of professional services (Bernsten et al., 2009).

Figure 4 - International comparison of remuneration models for community pharmacies (source: (Bernsten et al., 2009))

Country	Business margin	Fixed or regressive mark-up/margin decided by third party payer or authority	Fixed dispensing fee	Service fee	Capitation
Australia		•	•	•	
Austria		•			
Belgium		•		•	
Brazil	•				
Bulgaria		•			
Canada	•		•	•	
Cyprus		•			
Czech republic		•			
Denmark		•	•	•	
Estonia		•			
Finland		•	•		
France		•	•		
Germany		•	•	•	
Greece		•			
Hungary		•			
Iceland		•			
Iraq	•				
Ireland		•	•	•	
Italy		•			
Japan	•		•		
Jordan	•				
Korea (republic of)	•		•		
Kuwait					
Latvia		•			
Lithuania		•			
Luxembourg		•			
Mexico	x				
Netherlands		•	•		•
New Zealand		•	•		
Norway		•	•		
Peru		•			
Poland		•			
Portugal		•		•	
Saudi Arabia		•			
Slovenia			•		
Slovak Republica		•	•		
Spain		•			
Syria	x				
Sweden		•			
Switzerland		•		•	
Turkey		•			
United Kingdom	•		•	•	
United States	•		•	•	

Within Europe, there are 27 different pharmaceutical pricing and reimbursement systems (Bernsten et al., 2010). Pharmacy remuneration is regulated in all countries, but there are differences in the way pharmacists are paid for professional services beyond dispensing and selling medicines (Vogler et al., 2014). Some countries have a mixed system, while others have a product-oriented system. As an example of different remuneration policies, there are formal incentives for pharmacists to work collaboratively with physicians in Holland, Germany, and Switzerland (Bernsten et al., 2010). In England and Wales, the remuneration for professional services is divided into essential services, advanced services and enhanced services (Noyce, 2007). In the UK, community pharmacies with an NHS contract need to provide the full range of essential services, whereas advanced and enhanced services are optional, and might require additional education and new pharmacy layout (a private consultation space is mandatory). The essential and advanced services are commissioned by the UK's NHS and cover people throughout the country. The enhanced services are commissioned by the local Primary Care Trust, and consequently are not equally distributed over the country (Noyce, 2007).

In Scotland, and in some parts of England and Wales, pharmacists can be paid by the NHS for their professional services when selling Over-the-counter (OTC) medicines as part of The Minor Ailments Scheme (Bernsten et al., 2009). Remuneration for professional services also implies a commitment to assure the quality of such services in a number of countries. In the United Kingdom, community pharmacies need to provide evidence that they meet the conditions of a comprehensive quality assurance framework (Noyce, 2007).

In Portugal, pharmacy remuneration is currently defined by the Decree-Law 19/2014, and is based on a differential mark-up, with an higher mark-up for generics and a fixed mark-up for prescription medicines above €50 (Ministry of Health, 2014). Recently, a small fee per generic medicine package sold was also established, looking to provide pharmacies with incentives to increase the selling of generic medicines and contributing to reduce national pharmaceutical expenditure (Ministry of Health, 2015). Revenues from dispensing prescription medicines usually represent between 85 and 92% of pharmacy revenues (Antão and Grenha, 2012; Doucette et al., 2012; INFARMED, 2012). Unlike dispensing, all other new pharmacy services are not mandatory, with their

provision and price depending on the will of the pharmacy owner. Some pharmacies provide these services free of charge while others choose to charge a fee supported by patients' out-of-pocket payments (Costa et al., 2006; Martins and Queirós, 2014).

1.1.6.1. FINANCIAL INCENTIVES IN COMMUNITY PHARMACY

The need to balance pharmaceutical expenditure budgets will become more challenging given that new and expensive medicines are likely to gain marketing authorisation in the future (Eichler et al., 2016). In this context, it is important to introduce incentives for pharmacists that are oriented to support cost-effective and high-quality medicinal therapy (Bernsten et al., 2009).

In spite of the several issues regarding pharmaceutical services implementation and sustainability, some authors argue that is necessary to introduce a set of incentives aimed at community pharmacists without which, all the potential of pharmaceutical services goes largely untapped (Bernsten et al., 2010; Kroger et al., 2000; Miller and Ortmeier, 1995; Roberts et al., 2008). It is clear that the existence of incentives for pharmaceutical services influences its provision, although it is no guaranty of future sustainability (Gastelurrutia et al., 2009; Roberts et al., 2008). Other aspects such as communication and teamwork, leadership, task delegation, external support or assistance, and reorganization of structure and function are also to be considered (Roberts et al., 2008).

The fundamental purpose of incentives is to provide the right motivation to an agent (e.g. health service provider) to perform well. This includes providing the incentive to develop the capacity to perform well, to acquire the right information, and to then act on it accordingly (Custers et al., 2008). Though there are issues with nomenclature and the definitions, the healthcare area uses different types of financial incentives including : (i) salary (payment for working for a specified time period); (ii) fee-for-service (payment for each service, episode or visit); (iii) capitation (payment for providing care for a patient or for a special population); and (iv) target payments and bonuses (payment for providing a pre-specified level or change in a specific behaviour or quality of care) (Flodgren et al., 2011).

Considering the overall remuneration of pharmacists, Huttin and colleagues (1996), analysed remuneration systems from a sociological perspective. They found that systems

for remuneration could be classified into two major types: product-oriented remuneration using a mark-up or graduated mark-up, and patient-oriented remuneration using a fee for service or capitation method. The traditional pharmacy mark-up or fixed pharmacy margin system of retribution for pharmacists is often seen as providing inadequate incentives to pharmacists; it appeals to their financial interest in selling higher-priced drugs and, in general, to increase sales (Espin and Rovira, 2007). Fee structures may be developed that set the fees based on the type of service provided. Several examples can be found in the literature of fees charged for clinical services in community pharmacies; in the USA, some providers use a capitation fee structure in which the patient might enrol in a service for a predetermined fee in exchange for a bundled package of services provided for a given period of time (Snella et al., 2004).

One of the more challenging objections to provide pharmacists with incentives is that, since pharmaceutical services have been associated with a product - prescription and OTC medicines - some assume the clinical services are paid through the margins on the dispensing of prescriptions (Stubbings et al., 2011). In countries that have remuneration models for both drug dispensing and professional services, it is possible for these models to provide conflicting incentives to pharmacists (Bernsten et al., 2010). This is because remuneration models for professional services in these countries still tend to remunerate the pharmacist primarily for the supply of medicines. In England and Wales, pharmacists are paid for providing professional services, but they are also expected to add a margin to the price of the medicine to their income (Noyce, 2007). For example, in a case of a patient in need of advice to treat his condition with lifestyle changes, such as diet and exercise, instead of a medicine, current remuneration models tend to financially penalize pharmacists for providing this type of professional advice given the traditional link between remuneration and the supply function. The same happens in Portugal and in many other countries across Europe. The only example of a remuneration model that acknowledges and rewards the fact that a pharmacy professional service involves the decision not to dispense a medicine is the “Refusal to fill” or “Refusal to dispense” service found in some Canadian provinces’ pharmacy programs (Houle et al., 2014; Kroger et al., 2000).

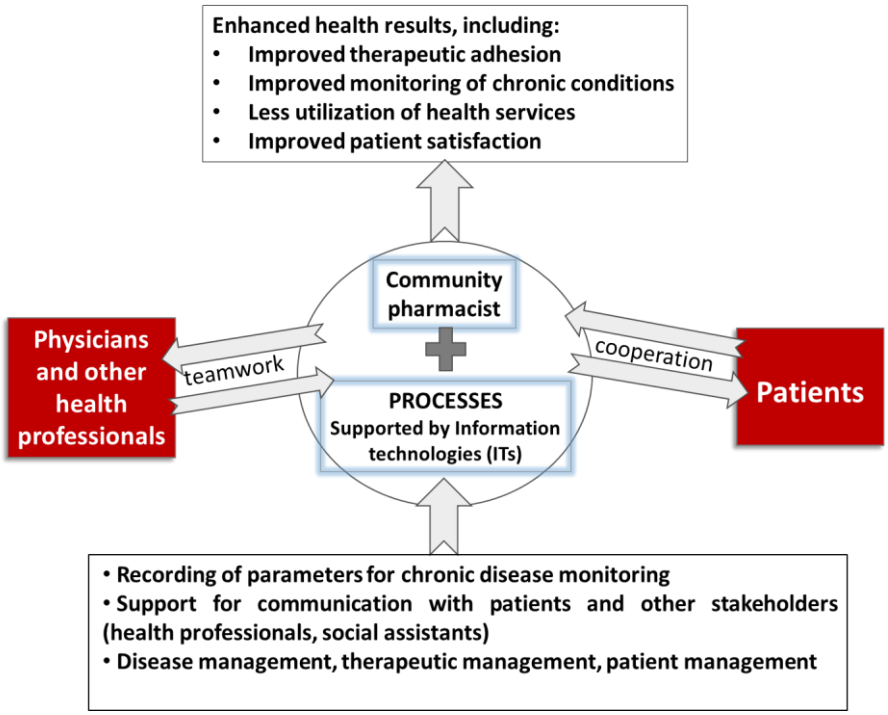
1.2. AIM OF THESIS

Considering current trends, the development of new professional pharmacy services will inevitably require the use of sophisticated IST. However, the success of IST utilization for the provision of health care is impending on more research. The technology's potential to disrupt health professionals' and users' roles represents a threat to the successful implementation (Katz and Moyer, 2004; Mossialos et al., 2013; Motulsky et al., 2011; Petrakaki et al., 2012). Studies show that the use of IST by healthcare professionals may be a burden when the systems are not developed considering the needs of professionals in practice settings (Darbyshire, 2004).

In order to better understand the link between the introduction and use of IST in practice settings, it is important to examine the technical and organizational challenges raised during implementation. Therefore, it is necessary to understand how health professionals and patients perceive IST usefulness for health care provision, and how are they willing to participate in the development of new services. To do so, this project proposes to address several research questions: How will a web-based pharmaceutical service impact pharmacists' work and patient's own disease management? What will be the estimated cost? Are patients willing to participate in the development of patient-oriented pharmaceutical services? What information they will value? What kind of challenges will arise?

To better visualize the different connections that will be enhanced by IST support of online pharmaceutical services, a conceptual model was developed (figure 5). In this model, it is highlighted that community pharmacists supported by IST may play a gatekeeping-like role in disease management.

Figure 5 - Conceptual model for the use of IST in the Community Pharmacy setting (adapted from ePharmacare Project (PTDC/CCI-CIN/122690/2010))



To address the mentioned research questions, the aim of this project is to design, implement and evaluate a disease management web-based interactive service, establishing its utility, acceptability, feasibility, sustainability, and adaptability for a community pharmacy setting, using design science research methodologies (Hevner et al., 2004). In this way, it is intended to explore new models of interaction between patients and health professionals that will allow some insights on the research questions.

As more specific objectives, it is proposed to:

- Identify health system conditions that will be necessary to implement an online pharmaceutical service.
- Identify the major patterns of pharmaceutical services provision in a sample of community pharmacies, thus establishing the current state of pharmaceutical services provision while exploring future services' demand;
- Estimate the cost of current pharmaceutical services, establishing a gold standard for comparison with future services costing;

- Identify potential service's features that may have an impact on health results and patient satisfaction

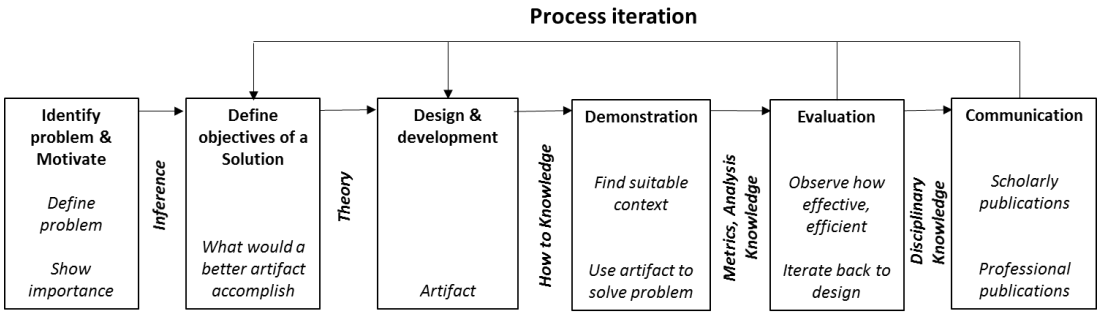
- Identify service's features that most contribute to the perceived usefulness and ease of use of the internet-based patient management service, in the patient perspective;

1.3. METHODOLOGY

The design and implementation of an IST tool in a practice setting poses some challenges. It is frequent that the introduction of new tools is decided by policymakers and experts without involving future users (Fried et al., 2012). However, a user centred approach may be more useful to be certain that the system will satisfy user's needs and that they will be enthusiastic with its use while, simultaneously, the system will be adequate and perceived as useful (Armstrong and Powell, 2008; Demiris et al., 2008). Therefore, the need to use a methodology that allows the design of an innovation with the end user's input is evident.

One of the methodologies IST researchers have at their disposal to study the development of new products is the Design Science Research Methodology (DSRM) (Hevner et al., 2004; Peffers et al., 2007). Hevner and colleagues (2004), have established the rules for DSRM in the form of guidelines. The most important is that the research should produce an artifact to solve a problem. Other guideline state that the development of the artifact should be based on existing knowledge and theories to produce a solution to the defined problem. Moreover, the artifact should be relevant to the resolution of a problem in a particular business model and have its usefulness, quality, and effectiveness rigorously evaluated. As a final guideline, the research should be communicated to the target audiences. These guidelines enlist six activities (figure 6) (Peffers et al., 2007).

Figure 6 – DSRM cycle (adapted from (Peffers et al., 2007)



In Box 3, a detailed description of the activities according to Peffers and colleagues (2007), is presented. As shown in figure 6, the DSRM process can be seen as a design cycle, as is common in information systems research.

Box 3 – Description of the six activities of DSRM, according to Peffers and colleagues (Peffers et al., 2007)

Activity 1 – Problem identification and motivation: Define the specific research problem and justify the value of a solution.

Activity 2 – Define the objectives for a solution: Infer the objectives of a solution from the problem definition and knowledge of what is possible and feasible. Resources required for this include knowledge of the state of problems and current solutions, if any, and their efficacy.

Activity 3 – Design and development: Create the artifact. This activity includes determining the artifact's desired functionality and its architecture and then creating the actual artifact.

Activity 4 – Demonstration: Demonstrate the use of the artifact to solve one or more instances of the problem. This could involve its use in experimentation, simulation, case study, proof, or other appropriate activity.

Activity 5 – Evaluation: Observe and measure how well the artifact supports a solution to the problem. This activity involves comparing the objectives of a solution to actual observed results from use of the artifact in the demonstration. At the end of this activity the researchers can decide whether to iterate back to activity 3 to try to improve the effectiveness of the artifact or to continue on to communication and leave further improvement to subsequent projects.

Activity 6 – Communication: Communicate the problem and its importance, the artifact, its utility and novelty, the rigor of its design, and its effectiveness to researchers and other relevant audiences such as practicing professionals

The approach that this thesis tests is the application of DSRM to the development of a pharmaceutical service supported by a web-based platform – the artifact – for the exchange of information between patients and pharmacists. As such, this project addresses the DSRM process by designing explorative studies with a specific set of tasks

that will allow to accomplish each DSRM activity and the prosecution of this thesis' objectives (table 3).

Table 3 - Design Science Research activities and tasks to perform

DSRM Activity	Objectives	Method/Tasks
1. Diagnose of current situation and identification of problem relevance	Identify health system conditions that will be necessary to implement an online pharmaceutical service	▪ Scenario design for Portuguese pharmacists in 2020.
	Identify the major patterns of pharmaceutical services provision in a sample of community pharmacies, thus establishing the current state of pharmaceutical services provision while exploring future services' demand	▪ Online survey of IT utilization in Portuguese pharmacies. ▪ Observational time-and-motion study to assess Pharmacists' current work patterns and potential demand for pharmaceutical care services.
	Estimate the cost of current pharmaceutical services, establishing a gold standard for comparison with future services costing	▪ Observational time-and-motion study to estimate cost of current pharmaceutical services.
2. Defining the objectives for a solution	(see (Mello, 2013))	▪ Set of qualitative interviews performed within primary health centres and hospitals ▪ Service Experiment Blueprint
3. Design and development	(outsourced to an independent programmer)	▪ Design of artifact (online platform) for pharmaceutical care services provision
4. Demonstration	Identify potential service's features that may have an impact on health results and patient satisfaction	▪ Case-study to test de platform with a purposively selected group of patients
5. Evaluation	Identify service's features that most contribute to the perceived usefulness and ease of use of the internet-based patient management service, in the patient perspective	▪ With an eye-tracking glass, the usability of the current version of the platform as assessed through the use of "task scenarios"
6. Communication	-	▪ Done throughout the duration of the project, through journal, conference communications, journal papers and this thesis.

This thesis will report on the findings of activity 1, 2, 4 and 5. Activity 3 was done separately by an independent programmer and will not be the object of analysis in the current thesis. Activity 6 was done throughout the duration of the project.

1.4. SUMMARY OF STUDY DESIGNS

The detailed explanation of the methods used in each activity are part of the papers that will be presented in the "Results" section of this thesis. Nevertheless, a short summary of the methods follows:

Activity 1 – this activity is constituted by three different studies.

Firstly, a scenario planning exercise was performed aiming at designing three future scenarios for Portuguese community pharmacists, recognizing the changing environment as an opportunity to develop the role that community pharmacists may play in the Portuguese health system. Two objectives were considered: (i) to analyse the possible evolution of community pharmacists' role in the Portuguese health care system by building and studying three different scenarios and (ii) to identify the main driving forces and related uncertainties that may impact on the definition of community pharmacists' future role. The methodological details and results of this study are reported in paper I.

Secondly, to assess the current state of pharmaceutical services provision and use of IST in community pharmacy, an online survey was launched. The online survey was based on a previously developed survey performed in Switzerland (Zehnder et al., 2004), and is presented in appendix 1 of this thesis in its English version. The survey was translated and validated with 2 community pharmacy academic researchers. After this, it was designed in the Google® forms platform and sent via email to 323 pharmacies, part of the owner's organization Association of Portuguese pharmacies (AFP). The results were presented in several conferences and are reported in the beginning of the results section of paper IV.

Following the initial survey, a observational time-and-motion study was performed (Finkler et al., 1993; Rutter et al., 1998). A set of four pharmacies was purposively selected to study pharmacists' work patterns and pharmaceutical care services' potential demand. The aim of this study was to understand pharmacists' workload patterns to assess

how a web-based pharmaceutical service might fit in a pharmacist's workday and its potential value. To execute it, a list of tasks to be observed was developed after reviewing the literature on pharmacy workload studies (Bell et al., 1999; Davies et al., 2014; Fisher et al., 1991; McCann et al., 2010). In appendixes 2 and 3, the observational study protocol and data collecting grid are presented. More details on the methodology and the respective results are presented in paper II.

Beyond accomplishing the aim of understanding pharmacists' workload and work patterns, the observational study provided data that was used to estimate the cost of pharmaceutical services. To do so, a Time-driven Activity-Based Costing (TDABC) model (Kaplan and Anderson, 2004; Kaplan and Porter, 2011) was developed, with the objective of calculating the cost of pharmaceutical services. The details and results of this study are presented in paper III.

Activity 2 – this activity intended to define what objectives the service supported by IST should attain. To understand patients' demand of pharmaceutical services, a set of 50 qualitative semi-structured interviews were performed within two primary healthcare centres and two hospitals. In appendix 4, the interview script is presented. The analysis of the interviews' results allowed to identify patients' perspectives about pharmaceutical services and new services ideas. With this data, it was possible to initiate the Service Experiment Blueprint (SEB). The SEB is a design tool that can be defined as a flowchart with key activities, stakeholders and elements, that when combined describe a service process (Mello, 2013). The SEB methodology itself consists of three stages in order to achieve an integrated service design (Patricio et al., 2008): a) first stage aims at assessing the service experiences for the different service activities; b) second stage features the service design at the multi-interface level supported by the data collected in the previous stage; c) the final stage contains the service design at the concrete interface level and is achieved through the usage of the SEB diagram. The results were presented in several conferences throughout the duration of the project and are presented here in paper IV.

Activity 3 - The design and development of the artifact (pharmaceutical service + online platform) was supported by the SEB developed after the prosecution of activity 2 (Mello, 2013; Patricio et al., 2011). The goal was to produce a web-based platform that include some of activity 2 patients' inputs and could mimic the work processes of Dáder

methodology. The combination of the Dáder model for pharmaceutical care and the SEB enabled the identification of service characteristics and functionalities to include in the initial prototype. The design of the online platform was supported by Agile methodology (Martin, 2002), based on iterative and incremental developments with springs of 7 days using the Trello® platform to plan the springs. At the end of each spring, the prototype was evaluated by pharmacists and patients in order to continuously collect their feedback and therefore improve and develop the artifact based on the input from end users.

Activity 4 - for the demonstration, a group of patients aged 64 to 75 years with chronic diseases were purposively selected. In appendixes 5 and 6 the demonstration protocol and informed consent form are presented. The artifact was tested in two different settings: a) Three community pharmacists (one per community pharmacy) using the platform and face-to-face consultations to interact with patients and; b) A community pharmacist using the platform and scheduled meetings outside the pharmacy setting (Pharmacist C). Patients for both arms of the study were recruited during the first two months of the study. Pharmacist C recruited the patients at a senior university class trained in computer and internet utilization. Initial training with the web-based platform was given to pharmacists and regular training to patients. Details of the methodology and results are presented in paper IV.

Activity 5 - The evaluation occurred in the end of the 8 months demonstration study. The objective was to assess the usability of the web platform and to identify non-existing features to improve the design of the platform in a future DSRM cycle. It included testing both end users of the platform, to assess the usability of the first version of the platform. An eye-tracking glass was used to perform the study. Eye-tracking glasses allow to explore eye activity: where a person looks, for how long, what is ignored, etc. Eye tracking data is collected using either a remote or head-mounted 'eye tracker' connected to a computer (EyeTracking Inc., 2016). To standardize the eye tracking assessment amongst different user typology, a set of task scenarios was defined, differing only in what was asked to be performed by pharmacists and patients. The detailed results of the usability test are presented in appendix 7. Details of the methodology and results of activity 5 are also presented in paper IV.

1.5. REFERENCES

Alliance for Health and Systems Research Policy, 2009. Systems thinking for health systems strengthening, Alliance for Health Policy and Systems Research. WHO, Geneva. doi:10.1155/2010/268925

Anderson, S., 2002. The state of the world's pharmacy: a portrait of the pharmacy profession. J. Interprof. Care 16, 391–404. doi:10.1080/1356182021000008337

Antão, A.A., Grenha, C.M., 2012. Avaliação Económica e Financeira do Setor das Farmácias.

Armstrong, N., Powell, J., 2008. Preliminary test of an Internet-based diabetes self-management tool. J. Telemed. Telecare 14, 114–116. doi:10.1258/jtt.2008.003002

Astrand, B., Montelius, E., Petersson, G., Ekedahl, A., 2009. Assessment of ePrescription quality: an observational study at three mail-order pharmacies. BMC Med. Inform. Decis. Mak. 9, 8. doi:10.1186/1472-6947-9-8

Axelsson, R., Axelsson, S.B., 2006. Integration and collaboration in public health--a conceptual framework. Int. J. Health Plann. Manage. 21, 75–88. doi:http://dx.doi.org/10.1002/hpm.826

Azevedo, L.F., Costa-Pereira, A., Mendonça, L., Dias, C.C., Castro-Lopes, J.M., 2012. Epidemiology of chronic pain: a population-based nationwide study on its prevalence, characteristics and associated disability in Portugal. J. Pain 13, 773–83. doi:10.1016/j.jpain.2012.05.012

Bardet, J.D., Vo, T.H., Bedouch, P., Allenet, B., 2015. Physicians and community pharmacists collaboration in primary care: A review of specific models. Res. Soc. Adm. Pharm. 11, 602–622. doi:10.1016/j.sapharm.2014.12.003

Barrera, M., Glasgow, R.E., McKay, H.G., Boles, S.M., Feil, E.G., 2002. Do internet-based support interventions change perceptions of social support?: An experimental trial of approaches for supporting diabetes self-management. Am. J. Community Psychol. 30, 637–654. doi:10.1023/A:1016369114780

Barros, P.P., 2012. Health policy reform in tough times: The case of Portugal. Health Policy. 106(1), 17–22. doi:10.1016/j.healthpol.2012.04.008

Barros, P.P., Martins, B., Moura, A., 2012. Evolução do sector das farmácias – revisitar o estudo "A situação concorrencial no sector das farmácias" de 2005. Lisbon.

Bell, H.M., McElnay, J.C., Hughes, C.M., 1999. A self-reported work sampling study in community pharmacy practice. Pharm. world Sci. 21, 210–216.

Benrimoj, S.I., Roberts, A.S., 2005. Providing patient care in community pharmacies in Australia. Ann. Pharmacother. 39, 1911–7. doi:10.1345/aph.1G165

Berenguer, B., La Casa, C., de la Matta, M.J., Martín-Calero, M.J., 2004. Pharmaceutical care: past, present and future. Curr. Pharm. Des. 10, 3931–46. doi:10.2174/1381612043382521

Bernsten, C., Andersson, K., Gariepy, Y., Simoens, S., 2010. A comparative analysis of remuneration models for pharmaceutical professional services. Health Policy. 95(1), 1-9. doi:10.1016/j.healthpol.2009.11.008

Bernsten, C., Gariepy, Y., Lutz, E.M., Reid, P.W., Schneider, P.J., 2009. Developing New Economic Models for Payment for Services by Pharmacists. Int. Pharm. J. 25, 30–45.

Bodenheimer, T., Wagner, E.H., Grumbach, K., 2002. Improving primary care for patients with chronic illness: the chronic care model, Part 2. JAMA 288, 1909–1914. doi:10.1001/jama.288.14.1775

Bradley, F., Ashcroft, D.M., Noyce, P.R., 2012. Integration and differentiation: A conceptual model ofgeneral practitioner and community pharmacist collaboration. Res. Soc. Adm. Pharm. 8, 36–46. doi:10.1016/j.sapharm.2010.12.005

Bradley, F., Elvey, R., Ashcroft, D., Noyce, P., 2007. Commissioning and delivery of services from community pharmacy : a national study. Manchester.

Bradley, F., Elvey, R., Ashcroft, D., Noyce, P., 2006. Commissioning services and the new community pharmacy contract: (3) uptake of enhanced services. Pharm. J. 277, 224–226.

Bulgacs, S., 2013. The first phase of creating a standardised international innovative technological implementation framework/software application. Int. J. Bus. Syst. Res. 7, 250. doi:10.1504/IJBSR.2013.055312

Calabretto, J.P., Swatman, P.M.C., 2010. Sociotechnical implications for information technology related interventions in community medication management - A case study. Electron. J. Heal. Informatics 5, 1–12.

Calabretto, J.P., Warren, J., 2005. Initial assessment of an Internet-based medication record. J. Pharm. Pract. Res. 35, 99–102.

Campbell, J., Dussault, G., Buchan, J., Pozo-Martin, F., Arias, M.G., Leone, C., Siyam, A., Cometto, G., 2014. A Universal Truth: No Health Without a Workforce. Report of Third Global Forum on Human Resources for Health. Geneve. ISBN 978 92 4 150676 2

Carrin, G., Mathauer, I., Xu, K., Evans, D.B., 2008. Universal coverage of health services: Tailoring its implementation. Bull. World Health Organ. 86, 857–863. doi:10.2471/BLT.07.049387

Cavaco, A.M.N., Bates, I.P., 2007. Gauging Portuguese community pharmacy users' perceptions. Prim. Heal. Care Res. Dev. 8, 315–325.

Chisholm-Burns, M.A., Graff Zivin, J.S., Lee, J.K., Spivey, C.A., Slack, M., Herrier, R.N., Hall-Lipsy, E., Abraham, I., Palmer, J., 2010. Economic effects of pharmacists on health outcomes in the United States: A systematic review. Am. J. Heal. Pharm. 67, 1624–1634. doi:10.2146/ajhp100077

Collins, B., Borders, T.F., Tebrink, K., Xu, K.T., 2007. Utilization of prescription medications and ancillary pharmacy services among rural elders in west Texas: distance barriers and implications for telepharmacy. J. Health Hum. Serv. Adm. 30, 75 – 97.

Costa, K.S., Nascimento Jr, J.M. do, 2012. [Horus: technological innovation in pharmaceutical assistance within the Brazilian unified health system]. Rev. Saude Publica 46 Suppl 1, 91 – 99.

Costa, S., Santos, C., Silveira, J., 2006. Community pharmacy services in Portugal. Ann. Pharmacother. 40, 2228–34. doi:10.1345/aph.1H129

Cranor, C.W., Bunting, B.A., Christensen, D.B., 2003. The Asheville Project: Long-term clinical and economic outcomes of a community pharmacy diabetes care program. J. Am. Pharm. Assoc. 43, 173–184.

Cruz, J., Brooks, D., Marques, A., 2014. Home telemonitoring in COPD: A systematic review of methodologies and patients' adherence. Int. J. Med. Inform. doi:10.1016/j.ijmedinf.2014.01.008

Custers, T., Hurley, J., Klazinga, N.S., Brown, A.D., 2008. Selecting effective incentive structures in health care: A decision framework to support health care purchasers in finding the right incentives to drive performance. BMC Health Serv. Res. 8, 66. doi:10.1186/1472-6963-8-66

Darbyshire, P., 2004. "Rage against the machine?": Nurses' and midwives' experiences of using Computerized Patient Information Systems for clinical information. J. Clin. Nurs. 13, 17–25. doi:10.1046/j.1365-2702.2003.00823.x

Davies, J.E., Barber, N., Taylor, D., 2014. What do community pharmacists do?: Results from a work sampling study in London. Int. J. Pharm. Pract. 22, 309–318. doi:10.1111/ijpp.12083

Demiris, G., Afrin, L.B., Speedie, S., Courtney, K.L., Sondhi, M., Vimarlund, V., Lovis, C., Goossen, W., Lynch, C., 2008. Patient-centered Applications: Use of Information Technology to Promote Disease Management and Wellness. A White Paper by the AMIA Knowledge in Motion Working Group. J. Am. Med. Informatics Assoc. 15, 8–13. doi:10.1197/jamia.M2492

Doucette, W.R., McDonough, R.P., Mormann, M.M., Vaschevici, R., Urmie, J.M., Patterson, B.J., 2012. Three-year financial analysis of pharmacy services at an independent community pharmacy. J. Am. Pharm. Assoc. 52, 181. doi:10.1331/JAPhA.2012.11207

Doucette, W.R., Nevins, J., McDonough, R.P., 2005. Factors affecting collaborative care between pharmacists and physicians. Res. Soc. Adm. Pharm. 1, 565–578. doi:10.1016/j.sapharm.2005.09.005

Dussault, G., Ferrinho, P., 2007. A health workforce strategy for Portugal. Cah Sociol Demogr Med 47, 235–240.

Edmunds, J., Calnan, M.W., 2001. The reprofessionalisation of community pharmacy? An exploration of attitudes to extended roles for community pharmacists amongst pharmacists and General Practioners in the United Kingdom. Soc. Sci. Med. 53, 943–955. doi:10.1016/S0277-9536(00)00393-2

Eichler, H., Hurts, H., Broich, K., Rasi, G., 2016. Drug Regulation and Pricing — Can Regulators Influence Affordability? N. Engl. J. Med. 1807–1809. doi:10.1056/NEJMp1601294

ERS, 2014. Advice paper on the provision of healthcare services in pharmacies. Entidade Reguladora da Saúde, Lisboa.

Espin, J., Rovira, J., 2007. Analysis of differences and commonalities in pricing and reimbursement systems in Europe. Granada.

EyeTracking Inc., 2016. What is Eyetracking [WWW Document]. URL http://www.eyetracking.com/About-Us/What-Is-Eye-Tracking

Fijalka, S., Fye, D., Johnson, P.E., 2008. Current issues in pharmaceutical reimbursement, in: American Journal of Health-System Pharmacy. doi:10.2146/ajhp070620

Finkler, S. a, Knickman, J.R., Hendrickson, G., Lipkin, M., Thompson, W.G., 1993. A comparison of work-sampling and time-and-motion techniques for studies in health services research. Health Serv. Res. 28, 577–597.

Fisher, C., Corrigan, O., Henman, M., 1991. A study of community pharmacy practice: 2. Prescription dispensing. J. Soc. Adm. Pharm. 8, 65–68.

Flodgren, G., Eccles, M.P., Shepperd, S., Scott, A., Parmelli, E., Beyer, F.R., 2011. An overview of reviews evaluating the effectiveness of financial incentives in changing healthcare professional behaviours and patient outcomes. Cochrane Database Syst. Rev. CD009255. doi:10.1002/14651858.CD009255

Forrest, C.B., 2003. Primary care in the United States: primary care gatekeeping and referrals: effective filter or failed experiment? Br. Med. J. 326, 692–695. doi:10.1136/bmj.326.7391.692

Fox, N., Ward, K., O'Rourke, A., 2005. The birth of the e-clinic. Continuity or transformation in the UK governance of pharmaceutical consumption?, in: Social Science and Medicine. pp. 1474–1484. doi:10.1016/j.socscimed.2005.03.011

Frenk, J., Sepúlveda, J., Gómez-Dantés, O., McGuinness, M.J., Knaul, F., 1997. The New World order and international health. BMJ 314, 1404–1407.

Fried, L.P., Piot, P., Spencer, H.C., Parker, R., 2012. The changing landscape of global public health. Glob. Public Health 7 Suppl 1, S1–4. doi:10.1080/17441692.2012.698293

Gardete-Correia, L., Boavida, J.M., Raposo, J.F., Mesquita, A.C., Fona, C., Carvalho, R., Massano-Cardoso, S., 2010. First diabetes prevalence study in Portugal: PREVADIAB study. Diabet. Med. 27, 879–881. doi:10.1111/j.1464-5491.2010.03017.x

Gastelurrutia, M.A., Benrimoj, S.I.C., Castrillon, C.C., De Amezua, M.J.C., Fernandez-Llimos, F., Faus, M.J., 2009. Facilitators for practice change in Spanish community pharmacy. Pharm. World Sci. 31, 32–39. doi:10.1007/s11096-008-9261-0

George, B., Silcock, J., 1999. Economic evaluation of pharmacy services--fact or fiction? Pharm. world Sci. 21, 147–51.

Goundrey-Smith, S., 2014. Examining the role of new technology in pharmacy: now and in the future. Pharm. J. doi: 10.1211/PJ.2014.11134174

Green, B.B., Cook, A.J., Ralston, J.D., Fishman, P.A., Catz, S.L., Carlson, J., Carrell, D., Tyll, L., Larson, E.B., Thompson, R.S., 2008. Effectiveness of home blood pressure monitoring, Web communication, and pharmacist care on hypertension control: a randomized controlled trial. JAMA 299, 2857–67. doi:10.1001/jama.299.24.2857

Hawthorne, N., Anderson, C., 2009. The global pharmacy workforce: a systematic review of the literature. Hum. Resour. Health 7, 48. doi:10.1186/1478-4491-7-48

Hepler, C.D., Strand, L.M., 1990. Opportunities and responsibilities in pharmaceutical care. Am. J. Hosp. Pharm.

Hevner, A.R. von, March, S., Park, J., Ram, S., 2004. Design science in information systems research. MIS Q.

Houle, S.K., Grindrod, K.A., Chatterley, T., Tsuyuki, R.T., 2014. Paying pharmacists for patient care: A systematic review of remunerated pharmacy clinical care services. Can Pharm J 147, 209–232. doi:10.1177/1715163514536678

Huttin, C., 1996. A critical review of the remuneration systems for pharmacists. Health Policy. 36(1), 53–68. doi:10.1016/0168-8510(95)00796-2

INFARMED, 2014. Medicine Statistics 2014. Lisboa.

INFARMED, 2012. Medicine Statistics 2011. Lisboa.

INFARMED, 2009. Farmácias com farmacêuticos tecnicamente habilitados a efectuar o seguimento dos doentes nos moldes previstos no Nível II de intervenção do Protocolo de Colaboração da Diabetes Mellitus e Número de doentes por farmácia [WWW Document]. URL http://www.infarmed.pt/portal/page/portal/ (accessed 6.26.11).

Jorgenson, D., Laubscher, T., Lyons, B., Palmer, R., 2014. Integrating pharmacists into primary care teams: Barriers and facilitators, in: International Journal of Pharmacy Practice. pp. 292–299. doi:10.1111/ijpp.12080

Kaplan, R.S., Anderson, S.R., 2004. Time-driven activity-based costing. Harv. Bus. Rev. doi:10.2139/ssrn.485443

Kaplan, R.S., Porter, M.E., 2011. How to solve the cost crisis in health care. Harv. Bus. Rev. 89. doi:10.1037/e632682011-011

Katz, S.J., Moyer, C.A., 2004. The Emerging Role of Online Communication Between Patients and Their Providers. J Gen Intern Med 19, 978–983.

Kawamoto, K., Houlihan, C. a, Balas, E.A., Lobach, D.F., 2005. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. BMJ 330, 765. doi:10.1136/bmj.38398.500764.8F

Kennie-Kaulbach, N., Farrell, B., Ward, N., Johnston, S., Gubbels, A., Eguale, T., Dolovich, L., Jorgenson, D., Waite, N., Winslade, N., 2012. Pharmacist provision of primary health care: a modified Delphi validation of pharmacists' competencies. BMC Fam. Pract. doi:10.1186/1471-2296-13-27

Kooy, M.J., Dessing, W.S., Kroodsma, E.F., Smits, S.R.J.G., Fietje, E.H., Kruijtbosch, M., De Smet, P.A.G.M., 2007. Frequency, nature and determinants of pharmaceutical consultations provided in private by Dutch community pharmacists. Pharm. World Sci. 29, 81–89. doi:10.1007/s11096-006-9067-x

Kreps, G.L., 2014. Achieving the promise of digital health information systems. J. Public health Res. 3.

Kreps, G.L., Neuhauser, L., 2010. New directions in eHealth communication: Opportunities and challenges. Patient Educ. Couns. 78, 329–336. doi:10.1016/j.pec.2010.01.013

Kroger, E., Moisan, J., Grégoire, J.P., 2000. Billing for cognitive services: Understanding Quebec pharmacists' behavior. Ann. Pharmacother. 34, 309–316. doi:10.1345/aph.19133

Kuhn, K.A., Giuse, D.A., Lapão, L., Wurst, S.H.R., 2007. Expanding the scope of health information systems: From hospitals to regional networks, to national infrastructures, and beyond, in: Methods of Information in Medicine. pp. 500–502. doi:10.1160/ME9058

Lam, A.Y., Rose, D., 2009. Telepharmacy services in an urban community health clinic system. J. Am. Pharm. Assoc. (2003). 49, 652–659. doi:10.1331/JAPhA.2009.08128

Leopold, C., Mantel-Teeuwisse, A.K., Vogler, S., Valkova, S., de Joncheere, K., Leufkens, H.G.M., Wagner, A.K., Ross-Degnan, D., Laing, R., 2014. Effect of the economic recession on pharmaceutical policy and medicine sales in eight European countries. Bull. World Health Organ. 92, 630–640. doi:10.2471/BLT.13.129114

Macedo, M.E. de, Lima, M.J., Silva, A.O., Alcântara, P., Ramalhinho, V., Carmona, J., 2007. Prevalência, conhecimento, tratamento e controlo da hipertensão em Portugal. Estudo PAP [2]. Rev. Port. Cardiol. 26, 21–39. doi:10.1007/s10555-012-9411-7

Maddux, M.S., Dong, B.J., Miller, W.A., Nelson, K.M., Raebel, M.A., Raehl, C.L., Smith, W.E., 2000. A Vision of Pharmacy's Future Roles, Responsibilities, and Manpower Needs in the United States 1–53.

Makowsky, M.J., Schindel, T.J., Rosenthal, M., Campbell, K., Tsuyuki, R.T., Madill, H.M., 2009. Collaboration between pharmacists, physicians and nurse practitioners: a qualitative investigation of working relationships in the inpatient medical setting. J. Interprof. Care 23, 169–184. doi:10.1080/13561820802602552

Martin, R.C., 2002. Agile Software Development, Principles, Patterns, and Practices, Book. doi:10.1007/BF03250842

Martínez-Romero, F., Fernandez-Llimós, F., Gastelurrutia, M.A., Parras, M., Faus, M.J., 2001. Programa Dáder de Seguimiento del Tratamiento Farmacológico. Resultados de la fase piloto. Ars Pharm. 42, 53–65.

Martins, L., Queirós, S., 2014. Competition among pharmacies and the typology of services delivered: The Portuguese case. Health Policy. 119(5), 628-39. doi:10.1016/j.healthpol.2015.03.001

McCann, L., Hughes, C.M., Adair, C.G., 2010. A self-reported work-sampling study in community pharmacy practice: A 2009 update. Pharm. World Sci. 32, 536–543.

Mello, D., 2013. Designing Pharmaceutical Services Using the Multilevel Service Design Methodology. Universidade do Porto.

Mil, J.W.F., Boer, W.O., Tromp, T.F.J., 2001. European barriers to the implementation of pharmaceutical care. Int. J. Pharm. Pract. 9, 163–168. doi:10.1111/j.2042-7174.2001.tb01044.x

Miller, M.J., Ortmeier, B.G., 1995. Factors influencing the delivery of pharmacy services. Am Pharm NS35, 39–45.

Ministry of Health, 2015. Order No. 18-A/2015 - Defines the terms and conditions that govern the payment of additional compensation to participating pharmacies in public health programs for the contribution to the reduction of expenditure of the National Health Service (NHS). Lisboa.

Ministry of Health, 2014. Decree-Law no. 19/2014 - Amendments to the legal framework of reimbursements of medicinal products and to the regime of medicinal products price. Lisboa.

Ministry of Health, 2007. Decree-Law no. 307/2007 - Legal status of community pharmacies.

Mossialos, E., Courtin, E., Naci, H., Benrimoj, S., Bouvy, M., Farris, K., Noyce, P., Sketris, I., 2015. From "retailers" to health care providers: Transforming the role of community pharmacists in chronic disease management. Health Policy. 119(5), 628–639. doi:10.1016/j.healthpol.2015.02.007

Mossialos, E., Mrazek, M., Walley, T., 2004. Regulating pharmaceuticals in Europe: striving for efficiency, equity and quality. Open University Press, Maidenhead.

Mossialos, E., Naci, H., Courtin, E., 2013. Expanding the role of community pharmacists: Policymaking in the absence of policy-relevant evidence? Health Policy. 111(2), 135-48. doi:10.1016/j.healthpol.2013.04.003

Motulsky, A., Sicotte, C., Lamothe, L., Winslade, N., Tamblyn, R., 2011. Electronic prescriptions and disruptions to the jurisdiction of community pharmacists. Soc. Sci. Med. 73, 121–128. doi:10.1016/j.socscimed.2011.04.009

Moullin, J.C., Sabater-Hernandez, D., Fernandez-Llimos, F., Benrimoj, S.I., 2013. Defining professional pharmacy services in community pharmacy. Res. Soc. Adm. Pharm. 9, 989–995. doi:10.1016/j.sapharm.2013.02.005

Nkansah, N., Mostovetsky, O., Yu, C., Chheng, T., Beney, J., Bond, C.M., Bero, L., 2010. Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns. Cochrane database Syst. Rev. CD000336. doi:10.1002/14651858.CD000336.pub2

Noyce, P.R., 2007. Providing patient care through community pharmacies in the UK: policy, practice, and research. Ann. Pharmacother. 41, 861–868. doi:10.1345/aph.1K015

Nutescu, E.A., Klotz, R.S., 2007. Basic terminology in obtaining reimbursement for pharmacists' cognitive services. Am. J. Heal. Pharm. doi:10.2146/ajhp060234

Osterberg, L., Blaschke, T., 2005. Adherence to medication. N. Engl. J. Med. 353, 487–97. doi:10.1056/NEJMra050100

Panel de Consenso ad hoc, 1999. Consenso de Granada sobre Problemas relacionados con medicamentos. Pharm Care Esp 1999; 1(2): 107-112

Paré, G., Jaana, M., Sicotte, C., 2007. Systematic Review of Home Telemonitoring for Chronic Diseases: The Evidence Base. J. Am. Med. Informatics Assoc. doi:10.1197/jamia.M2270

Patricio, L., Fisk, R.P., Cunha, J.F. e, 2008. Designing Multi-Interface Service Experiences: The Service Experience Blueprint. J. Serv. Res. 10, 318–334. doi:10.1177/1094670508314264

Patricio, L., Fisk, R.P., Falcao e Cunha, J., Constantine, L., 2011. Multilevel Service Design: From Customer Value Constellation to Service Experience Blueprinting. J. Serv. Res. 14, 180–200. doi:10.1177/1094670511401901

Paulino, E., Guerreiro, M.P., Cantrill, J.A., Martins, A.P., da Costa, F.A., Benrimoj, S.I.C., 2010. Community pharmacists' and physicians' inter-professional work: insights from qualitative studies with multiple stakeholders. Rev Port Clin Geral. 26, 590–606.

Peffers, K., Tuunanen, T., Rothenberger, M. a., Chatterjee, S., 2007. A Design Science Research Methodology for Information Systems Research. J. Manag. Inf. Syst. 24, 45–77. doi:10.2753/MIS0742-1222240302

Perez, A., Doloresco, F., Hoffman, J.M., Meek, P.D., Touchette, D.R., Vermeulen, L.C., Schumock, G.T., 2009. ACCP: economic evaluations of clinical pharmacy services: 2001-2005. Pharmacotherapy 29, 128. doi:10.1592/phco.29.1.128

Petrakaki, D., Barber, N., Waring, J., 2012. The possibilities of technology in shaping healthcare professionals: (Re/De-) Professionalisation of pharmacists in England. Soc. Sci. Med. 75, 429–437. doi:10.1016/j.socscimed.2012.03.033

Polisena, J., Tran, K., Cimon, K., Hutton, B., McGill, S., Palmer, K., 2009. Home telehealth for diabetes management: A systematic review and meta-analysis. Diabetes, Obes. Metab. doi:10.1111/j.1463-1326.2009.01057.x

Polisena, J., Tran, K., Cimon, K., Hutton, B., McGill, S., Palmer, K., Scott, R.E., 2010. Home telemonitoring for congestive heart failure: a systematic review and meta-analysis. J. Telemed. Telecare 16, 68–76. doi:10.1258/jtt.2009.090406

Portuguese Pharmaceutical Society, 2012. The Young Pharmacists - Characterization of Portuguese Pharmacists. [WWW Document].

Riley, R., Manias, E., 2009. Gatekeeping practices of nurses in operating rooms. Soc. Sci. Med. 69, 215–222. doi:10.1016/j.socscimed.2009.04.023

Roberts, A.S., Benrimoj, S. (Charlie), Chen, T.F., Williams, K. a, Aslani, P., 2006. Implementing cognitive services in community pharmacy: a review of facilitators used in practice change. Int. J. Pharm. Pract. 14, 163–170. doi:10.1211/ijpp.14.3.0002

Roberts, A.S., Benrimoj, S.I., Chen, T.F., Williams, K. a, Aslani, P., 2008. Practice change in community pharmacy: quantification of facilitators. Ann. Pharmacother. 42, 861–868. doi:10.1345/aph.1K617

Roberts, A.S., Benrimoj, S.I.C., Chen, T.F., Williams, K.A., Hopp, T.R., Aslani, P., 2005. Understanding practice change in community pharmacy: a qualitative study in Australia. Res. Social Adm. Pharm. 1, 546–64. doi:10.1016/j.sapharm.2005.09.003

Rothman, A.A., Wagner, E.H., 2003. Chronic illness management: what is the role of primary care?. Ann. Intern. Med. 138, 256–61. doi:10.7326/0003-4819-138-3-200302040-00034

Rutter, P., Brown, D., Jones, I., 1998. Pharmacy research: the place of work measurement. Int. J. Pharm. Pract. 6, 46–58. doi:10.1111/j.2042-7174.1998.tb00915.x

Sacco, R., Smith, S., Holmes, D., Shurin, S., Brawley, O., Cazap, E., Glass, R., Komajda, M., Koroshetz, W., Mayer-Davis, E., Mbanya, J., Sledge, G., Varmus, H., 2013. Accelerating progress on non-communicable diseases. Lancet 382, e4–e5.

Salgado, T.M., Moles, R., Benrimoj, S.I., Fernandez-Llimos, F., 2012. Exploring the role of renal pharmacists in outpatient dialysis centres: A qualitative study. Int. J. Clin. Pharm. 34, 569–578. doi:10.1007/s11096-012-9645-z

Sa-Sousa, A., Morais-Almeida, M., Azevedo, L.F., Carvalho, R., Jacinto, T., Todo-Bom, A., Loureiro, C., Bugalho-Almeida, A., Bousquet, J., Fonseca, J.A., 2012. Prevalence of asthma in Portugal - The Portuguese National Asthma Survey. Clin. Transl. Allergy 2, 15. doi:10.1186/2045-7022-2-15

Schulz, M., 2006. A Review of Pharmaceutical Care in Community Pharmacy in Europe. Harvard Heal. Policy Rev. 7, 155–168.

Schumock, G.T., Butler, M.G., Meek, P.D., Vermeulen, L.C., Arondekar, B. V, Bauman, J.L., 2003. Evidence of the economic benefit of clinical pharmacy services: 1996-2000. Pharmacotherapy 23, 113–132. doi:10.1592/phco.23.1.113.31910

Seventh Consultative Committee on Primary Health Care Systems for the 21st Century, 1997. Health care systems for the 21st century. BMJ 314, 1407–1409. doi:10.1136/bmj.314.7091.1409

Silver, M.S., Markus, M.L., Beath, C.M., 1995. The Information Technology Interaction Model: A Foundation for the MBA Core Course. MISQ 19, 361. doi:10.2307/249600

Snella, K. a, Trewyn, R.R., Hansen, L.B., Bradberry, J.C., 2004. Pharmacist compensation for cognitive services: focus on the physician office and community pharmacy. Pharmacotherapy 24, 372–88. doi:10.1592/phco.24.4.372.33179

Snyder, M.E., Zillich, A.J., Primack, B.A., Rice, K.R., Somma McGivney, M.A., Pringle, J.L., Smith, R.B., 2010. Exploring successful community pharmacist-physician collaborative working relationships using mixed methods. Res. Soc. Adm. Pharm. 6, 307–321. doi:10.1016/j.sapharm.2009.11.008

Strand, L.M., Morley, P.C., Cipolle, R.J., Ramsey, R., Lamsam, G.D., 1990. Drug-related problems: their structure and function. DICP 24, 1093–7.

Strand, M.A., Tellers, J., Patterson, A., Ross, A., Palombi, L., 2016. The achievement of public health services in pharmacy practice: A literature review. Res. Soc. Adm. Pharm. 12, 247–56. doi:10.1016/j.sapharm.2015.06.004

Stubbings, J., Nutescu, E., Durley, S.F., Bauman, J.L., 2011. Payment for clinical pharmacy services revisited. Pharmacotherapy 31, 1–8. doi:10.1592/phco.31.1.1

van der Kam, W.J., Meyboom de Jong, B., Tromp, T.F., Moorman, P.W., van der Lei, J., 2001. Effects of electronic communication between the GP and the pharmacist. The quality of medication data on admission and after discharge. Fam. Pract. 18, 605–609. doi:10.1093/fampra/18.6.605

Van Mil, J.W.F., Frokjær, B., Tromp, D.F.J., 2004. Changing a profession, influencing community pharmacy. Pharm. World Sci. doi:10.1023/B:PHAR.0000026821.51632.3b

Velez Lapão, L., 2007. Survey on the status of the hospital information systems in Portugal, in: Methods of Information in Medicine. pp. 493–499. doi:10.1160/ME9055

Vervloet, M., van Dijk, L., Santen-Reestman, J., van Vlijmen, B., van Wingerden, P., Bouvy, M.L., de Bakker, D.H., 2012. SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored. Int. J. Med. Inform. 81, 594–604. doi:10.1016/j.ijmedinf.2012.05.005

Vogler, S., Habimana, K., Arts, D., 2014. Does deregulation in community pharmacy impact accessibility of medicines, quality of pharmacy services and costs? Evidence from nine European countries. Health Policy. 117(3), 311–327. doi:10.1016/j.healthpol.2014.06.001

Westerling, A.M., Haikala, V., Airaksinen, M., 2011. The role of information technology in the development of community pharmacy services: visions and strategic views of international experts. Res. Soc. Adm. Pharm. 430–437. doi:10.1016/j.sapharm.2010.09.004

WHO, 2010. Global Status Report on Non-Communicable Diseases.

WHO, 2008. World Health Report - Primary Health Care: Now More Than Ever. Genève.

Willis, A., Rivers, P., Gray, L.J., Davies, M., Khunti, K., 2014. The effectiveness of screening for diabetes and cardiovascular disease risk factors in a community pharmacy setting. PLoS One 9. doi:10.1371/journal.pone.0091157

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

Zellmer, W.A., 2010. Pharmacy's future: Transformation, diffusion, and imagination. Am. J. Heal. Pharm. doi:10.2146/ajhp090539

Zuppo, C.M., 2012. Defining ICT in a Boundaryless World: The Development of a Working Hierarchy. Int. J. Manag. Inf. Technol. 4, 13–22. doi:10.5121/ijmit.2012.4302

2. RESULTS

2.1. PAPER I

GREGÓRIO, João; CAVACO, Afonso; LAPÃO, Luís Velez. *A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal*. Human resources for Health, 2014, 12.1: 1. DOI: 10.1186/1478-4491-12-58

Gregório et al. Human Resources for Health 2014, 12:58
http://www.human-resources-health.com/content/12/1/58

HUMAN RESOURCES FOR HEALTH

RESEARCH Open Access

A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal

João Gregório[1], Afonso Cavaco[2,3] and Luís Velez Lapão[1*]

Abstract

Background: Health workforce planning is especially important in a setting of political, social, and economic uncertainty. Portuguese community pharmacists are experiencing such conditions as well as increasing patient empowerment, shortage of primary care physicians, and primary health care reforms. This study aims to design three future scenarios for Portuguese community pharmacists, recognizing the changing environment as an opportunity to develop the role that community pharmacists may play in the Portuguese health system.

Methods: The community pharmacist scenario design followed a three-stage approach. The first stage comprised thinking of relevant questions to be addressed and definition of the scenarios horizon. The second stage comprised two face-to-face, scenario-building workshops, for which 10 experts from practice and academic settings were invited. Academic and professional experience was the main selection criteria. The first workshop was meant for context analysis and design of draft scenarios, while the second was aimed at scenario analysis and validation. The final scenarios were built merging workshops' information with data collected from scientific literature followed by team consensus. The final stage involved scenario development carried by the authors alone, developing the narratives behind each scenario.

Results: Analysis allowed the identification of critical factors expected to have particular influence in 2020 for Portuguese community pharmacists, leading to two critical uncertainties: the "Legislative environment" and "Ability to innovate and develop services". Three final scenarios were built, namely "Pharmacy-Mall", "e-Pharmacist", and "Reorganize or Die". These scenarios provide possible trends for market needs, pharmacist workforce numbers, and expected qualifications to be developed by future professionals.

Conclusions: In all scenarios it is clear that the future advance of Portuguese community pharmacists will depend on pharmaceutical services provision beyond medicine dispensing. This innovative professional role will require the acquisition or development of competencies in the fields of management, leadership, marketing, information technologies, teamwork abilities, and behavioural and communication skills. To accomplish a sustainable evolution, legislative changes and adequate financial incentives will be beneficial. The scenario development proves to be valuable as a strategic planning tool, not only for understanding future community pharmacist needs in a complex and uncertain environment, but also for other health care professionals.

Keywords: Community pharmacists, Human resources for health, Pharmaceutical services, Scenario planning, Portugal

* Correspondence: luis.lapao@ihmt.unl.pt
[1]WHO Collaborating Centre for Health Workforce Policy and Planning, International Public Health and Biostatistics Unit, Instituto de Higiene e Medicina Tropical, Rua da Junqueira n°100, 1349-008 Lisbon, Portugal
Full list of author information is available at the end of the article

Gregório et al. Human Resources for Health 2014, 12:58
http://www.human-resources-health.com/content/12/1/58

Background

Community pharmacists' role in global health systems

Human resources are the present focus of attention in health systems strengthening and public health policies [1-3]. This is partly due to the increase of chronic conditions and the emergence of interprofessional models of practice that aim at transforming the daily care for patients with chronic illnesses from acute and reactive to proactive, planned, and population-based [4]. Most successful chronic illness interventions include major roles for non-physicians such as pharmacists and nurses [5-7]. Community pharmacies and pharmacists are in a privileged position within health care systems due to their professional training and easy accessibility (i.e., in most high streets), which could contribute to more reliable monitoring of medication use and patient counselling, as well as health promotion and education [8,9].

For pharmacists, this new role towards a more patient-centred care has become a new paradigm of pharmacy practice, leading to the development of patient information services, pharmaceutical care services, and the development of a clinical role for community pharmacists [10,11]. The work of Hepler and Strand [12], in the early nineties, was a milestone in this change, pointing out to the delivery of longitudinal advanced medication-related services, the rise of professionals' level of responsibility, and the development of cooperative relationships with other health care professionals as essential features to this new role. However, this movement toward patient-centred care in community pharmacy has been taking longer than one would expect back in the nineties, much influenced by inner organizational barriers as well as several external factors such as the economic and legislative context, commercial pressures, government politics and/or policies, technological innovations, new therapies, support from other professionals, health system integration, and the personal attitudes of pharmacists and pharmacy leaders [10,11,13].

Community pharmacists' workforce in Portugal

Portuguese community pharmacists have followed the global trend for an extended practice. Community pharmacists in Portugal serve the public in independent shops, the community pharmacies. The installation of community pharmacies is regulated by the government, establishing the minimum distance between pharmacies and number of inhabitants serviced. The number of pharmacies, now close to 2,900 in total, has increased 9.5% since the turn of the century, with an average of 24 new pharmacies per year [14]. From 2007 onwards, changes in legislation allowed for non-pharmacist ownership, a decrease in the population base from 4,000 to 3,500 inhabitants per pharmacy per county, and a shorter distance between pharmacies from 500 m to 350 m. This political measure had impact in that year, with a rapid increase of pharmacies, but quickly stabilized. Pharmacies have a National Health Service (NHS) contract for dispensing medicines, establishing prescription medicines' profit margins and co-payments. Apart from dispensing, none of the new services is supported by NHS remuneration. To cope with this, pharmacies may offer services such as smoking cessation, minor ailment schemes, and adherence support services, all of which are supported by the patient's direct payments [15]. During the early 21st century, Portuguese pharmacies have implemented pharmaceutical care programs for hypertension and diabetes with the help of professional organizations such as the National Association of Pharmacies (ANF), a pharmacy owner's organization. The program for diabetes was financially supported by the NHS from 2006 to 2009. At the time, a maximum of 400 pharmacies were doing patient follow-up, with an average of three patients per pharmacy [16]. After the cancelation of NHS financial support of these programs, most pharmacies terminated the provision of the service and stopped with patient follow-up. Since then, many pharmacies have broadened their services to other services provided by different professionals such as nutritionists, podologists, or nurses in an attempt to have more revenue to face the present financial constraints.

Community pharmacists represent almost two thirds of the total pharmacist workforce mandatorily registered in the Pharmaceutical Society (OF) [17]. By the end of 2012 there were 7,716 registered community pharmacists [18]. These are mostly young professionals (67% less than 45 years old), 80% of which are women. The total number of community pharmacists has increased 74% between 2000 and 2009, with an annual average of 340 newcomers [19,20]. This sharp rise was a direct consequence of the increase in the number of pharmacy degrees offered in private and public universities. For instance, in 2010 there were more than 1,100 new students enrolled, a 6.5% increase when compared with 2008 admissions [21]. In the same period, the number of pharmacy technicians working in community pharmacy dropped by 25%, mainly due to the oversupply of pharmacists [19,20]. The ratio of pharmacists per pharmacy has increased between 2000 and 2010, with an average above 2 since 2005, leading to 68 pharmacists per 100,000 inhabitants [20,22], which can be considered a homogenous geographical distribution, although with a greater concentration in the Lisbon and Porto metropolitan areas [14,19,20,23]. Due to the decrease of pharmacy technicians, pharmacists then started to have increasingly technical tasks to perform, since the development and implementation of new services was not widespread. With the onset of the economic

crisis of 2008, low salaries and unemployment, especially among recently graduated pharmacists, started to become a reality [24].

The need for strategic planning in community pharmacy

The shortage of primary health care (PHC) physicians, the economic and political uncertainty deriving from the economic crisis that started in 2008, and the primary health care reform currently developing in Portugal, are all contributing to a changed climate and have created an opportunity to rethink the role of community pharmacists within the Portuguese health care system.

Strategic planning is essential to assess the efficiency of human resources and health services, since it is an effective tool to address innovative solutions within health systems [25-27]. Although the organizational environment is recognised as an important factor in health care services functioning and development, external environment continuous modifications challenge decision makers and practitioners. For health professionals, this environment could be described by a constant technological evolution, a growing search for patient-focused care, and empowerment of citizens, particularly in terms of health knowledge [28]. For community pharmacists, the changing environment and the shifting in health care demands is pushing them to a continuous adaptation process and a more advanced role in patient care [29].

Due to these uncertainties, which limit the capacity to predict and plan the needed resources accurately, there is now an opportunity to delve more deeply into Portuguese community pharmacists' future through a thinking exercise supported by the development and analysis of strategic scenarios [30-32]. Undertaking a strategic thinking approach allows for the analysis of different possibilities, without excluding those that seem unlikely. Recent approaches to the issue of pharmacists' future have focused on workforce supply and demand [33-35], while others have proposed scenarios to depict what the profession could be in the future, from the perspective of interviewed experts [36,37]. This last case inspired our work since a flexible approach is used and a creative attitude is promoted towards a future vision on the pharmacist profession.

The aim of this study was to develop future scenarios for the community pharmacist profession in Portugal. To achieve this, two main objectives were considered: (i) to analyse the possible evolution of community pharmacists' role in the Portuguese health care system by building and studying three different scenarios and (ii) to identify the main driving forces and related uncertainties.

Methods

Strategic scenario analysis does not aim to predict the future. Instead, it aims to construct stories for the future that contribute to the better understanding of the external environment in which an organization is operating in order to support strategic decisions, anticipate difficulties, and assess an organization's business positioning [38-41]. Scenario development is a validated and useful methodology, where each scenario can be regarded as a "strategic case" or as a "branch of a decision tree" [42]. Its use extends from academic research to more practical issues as business and public administration [31]. Scenarios are the archetypical products of future studies, as they facilitate both the possibility for a deeper and more creative thinking about the future (reducing the risk of being surprised and unprepared) while, simultaneously, enabling the enhancement of the collective awareness (and preparation) over multiple plausible circumstances [43].

Besides an organizational and business strategy, this methodology has also been used in prospective research of academic medical organizations and professional pharmacy-related groups [36,37,44]. For this work, it was decided to use the community pharmacists' perspective. Although pharmacies and pharmacists are closely linked entities, this distinction is essential since the developmental paths of both bodies do not necessarily overlap.

The method proposed and used by Lapão and Thore was followed [45]. This method condenses the 10-step method of Schoemaker [40] into three stages (Figure 1) that yield a set of three scenarios which represent three different future possibilities. The three scenario development stages are presented in detail below.

First stage – literature review

In this first stage, the authors thought of relevant questions to support and motivate the scenario development process. For instance, "What will be the need for community pharmacists in the future?"; "Is it possible to establish and sustain a new role for community pharmacists within the health care system?", "If so, how can community pharmacists integrate the PHC network?"; "What might happen to the newly graduated pharmacists coming to a labour market that is increasingly saturated?" A scenario horizon was also defined. For this study, we selected the 2020 horizon. Ten years is considered a good enough timescale within policy-making, avoiding difficulties in participants' responsiveness [31].

To perform the literature review, PubMed database and Google Scholar were searched using the following strings: "community pharmacist role", "community pharmacy future", "pharmaceutical services", "pharmacy scenarios", "health services innovation", and "pharmacy information technologies". This search retrieved 167 articles on the global community pharmacists' role, its evolution, barriers and facilitators to professional development, and future market trends such as the challenges of population ageing or the use of information technologies (IT). The information collected was used to prepare a review to inform the

Gregório et al. Human Resources for Health 2014, 12:58
http://www.human-resources-health.com/content/12/1/58

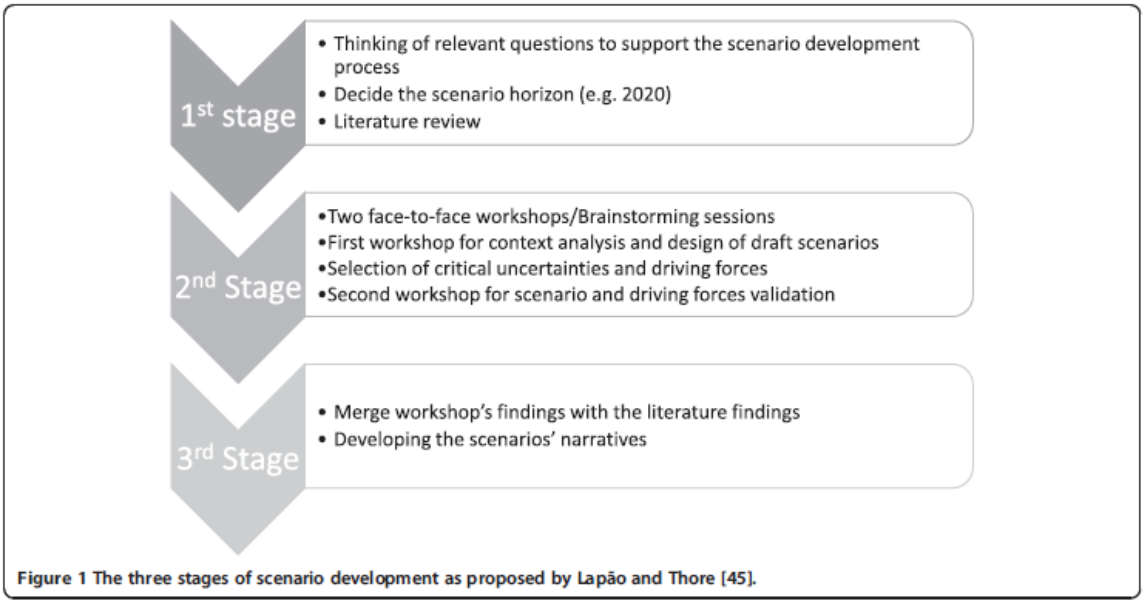


Figure 1 The three stages of scenario development as proposed by Lapão and Thore [45].

next stage of scenario development. Besides the qualitative information, quantitative information related to Portuguese community pharmacists was obtained from the official "Medicine Statistics" reports, available from the regulatory agency (INFARMED) [19,20], as well as complementary information from the OF and the ANF [17,18,22,24].

Second stage – scenario development workshops

The second stage comprised two face-to-face audio-recorded workshops, each with three hours duration. The workshops took place in two different days with the participation of a workgroup that included the first author, a community pharmacy specialist, and a scenario developer. To complete the workgroup, pharmacy and health management experts were invited. A total of 10 experts were invited, 6 of which accepted the invitation (Table 1). These were selected by convenience, using academic experience and professional experience as the main criteria. Academic experience was assessed by relevant publications in the field of community pharmacy. The professional experience was assessed by years of practice and/or ownership of community pharmacy listed on the online CVs. Having community pharmacy experience or health market knowledge in Portugal and being an academic was considered a major asset, although it may be considered a bias toward academia; only one expert was personally known by the researchers. None of the invited experts was an

Table 1 List and characterization of expert informants present at the workshops

Participant	Sex	Workshop presence		Professional and academic experience
		First	Second	
Expert #1	Male	P	P	Doctor of Pharmacy (PhD), Associate Professor in Social Pharmacy, expert in Pharmacist communication, Community pharmacy co-owner
Expert #2	Female	P	P	Doctor of Pharmacy (PhD), Assistant Professor, expert in Pharmaceutical Care
Expert #3	Male	P	P	Master in Health and Development (MSc), Community Pharmacist specialist; study main author
Expert #4	Male	P	P	Doctor of Systems Engineering and Health informatics (PhD), Assistant Professor, expert in scenario design and trained facilitator
Expert #5	Female	P	P	Doctor of Pharmacy (PhD), Expert in Pharmaceutical Care, Community pharmacy technical director
Expert #6	Male	P	P	Manager, Regional Access Manager for a multinational pharmaceuticals company
Expert #7	Female	–	P	Master in Public Health, Community Pharmacist, expert in Pharmaceutical Care, Community pharmacy co-owner
Expert #8	Female	P	P	Pharmacist, Executive Director of a public primary health care centre cluster

P – Present at the workshop.

active representative of a professional organization, thus avoiding possible conflicts of interests. Considering previous pharmacist scenarios analysis reported in the literature [36,37], it was decided that the 8 person group was enough to accomplish our goals.

The workshops were recorded using a digital recorder with participants' verbal consent obtained prior to the workshops. The recordings were transcribed and thematic analysis performed. The first workshop was meant for context analysis and design of draft scenarios, while the second workshop aimed at scenario analysis and validation.

According to Godet [38], the first interaction with experts should start with a short seminar to acquaint all participants with the purposed tools and concepts that will be used in the scenario development process. After this introduction, a presentation was made, highlighting the main findings from the literature review, namely on workforce, economic, technological, political, and demographic trends. Next, the process of collecting information started using the thematic brainstorming technique: the experts were asked to imagine different possibilities for community pharmacists' future role based on whatever their perceptions were on the influence of the literature review findings. This approach allowed a free flow of ideas and discussion, without the boundaries of an interview and conventional reflection. These findings were then summarized into several themes, which is necessary to identify critical uncertainties. Critical uncertainties are environmental factors considered to have an influence in the progression of the theme under analysis [43]. To do so, we asked the participants to vote on the two themes that they thought would be the most influent for the proposed scenario horizon. These themes were then condensed into two major critical uncertainties that will work as the scenarios' "driving forces", to develop an initial draft version of the scenarios discussed in the end of the first workshop [46].

To prepare the second workshop, a story for each of the draft scenarios was written, combining the analysis of the workshop's recording and the selected driving forces. On the second workshop, both the initial draft scenarios and driving forces were checked for consistence and plausibility. This was done by expert consensus. If a scenario or driving force was deemed to be unlikely or if it was incoherent, it would not be considered for further development. Next, the gap between present and future was fulfilled by participants' discussion aiming to reach a narrative of a consistent set of events that would lead to the three scenarios.

Third stage – scenario analysis

This third and last stage of the scenario design process was carried by the authors alone. The workshops' recordings were transcribed and the information collected was combined with information gathered in the literature review to redesign the final set of scenarios, with the corresponding narratives. The narratives are hypothetical stories of the future built by the authors, based on the trends that the invited experts feel that some uncertainties might have on the years to come, their impact on the community pharmacy workforce and on the health system in general.

This study was performed in strict accordance with the good research practices and code of ethics of *Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa*, Portugal. The protocol was approved by the Ethics Committee of *Instituto de Higiene e Medicina Tropical*, Universidade Nova de Lisboa (Permit Number: 7-2012- PN).

Results

During the scenario workshops, several themes considered to be relevant to community pharmacists' role in the Portuguese health care system were debated. A final voting identified the critical ones. The following descriptions for each of the critical uncertainties were suggested.

Pharmaceutical services

This was considered the main driver for professional development and professionals' satisfaction, being also the driver for service differentiation between pharmacies. The experts further considered that there would be more sophisticated services in the future, which will be essential for customer retention. The concept of a "health care mall", where customers and patients would have access to several health care services provided by different professionals (e.g., nurses, nutritionists, podologists, etc.), was considered highly plausible. When discussing pharmacies' sustainability, the participants' belief was that pharmacies would only offer additional services if or when they were profitable.

Economic environment and financial situation of the pharmacies

The participants agreed with the concept of pharmacies as small enterprises, particularly dependent on NHS cofunding. Presently, pharmacies are facing decreasing profit margins, with new remuneration models that are mostly strangling the smaller pharmacies. The participants' perceptions about this issue were that pharmacist's clinical intervention would be in jeopardy as the financial situation of the pharmacies deteriorates, blocking the eventual development of a new role. To counter the decreasing budget trend, pharmacies would be forced to address and improve their management and search for alternative ways of funding. One identified alternative was the clustering of pharmacies, which is already emerging.

Political will and NHS reorganization

This theme emerged associated with the fundamental idea of a legislative change that would consent new roles to develop. It was recognized that political will is influenced by several aspects, such as the country's economic and financial situation, pressure from social and economic lobbies, health care professional groups, but also by the relationship between the government party and the main professional organizations, ANF and OF. The awareness of a recent phenomenon – pharmacists' unemployment – also emerged as a pressure factor for the politicians and professional organizations. Bearing in mind the most significant pharmaceutical policy and economic change in recent years – the loss of pharmacists' property rights and pharmacies exclusive rights in over-the-counter medicines sales – the participants acknowledged that if the economic situation continues to deteriorate, a change in pharmacy legislation will be inevitable, i.e., there will be pressure to change the minimum distance between providers and adjust the population density limits, allowing for a horizontal and vertical integration of the community pharmacy market. There is also the possibility that the current NHS will suffer liberal reforms, reducing medicine reimbursement and limiting patient purchases.

Patients and clients

The participants considered that the patients' perceptions of health care and consequent behaviour influence the demand of products and services. The current economic setting is forcing many patients to choose lower-priced products and fewer services. This effect will influence prices' policies in order to lower medicine costs even more, through patients' advocacy groups and other associations. It was considered that the relatively low health literacy of Portuguese patients is an impediment for pharmacy extinction. However, the use of the Internet as an information channel for health issues is growing not only in younger age groups, but also in elders too, a group where chronic diseases are prevalent. This fact, alongside with the perceived early adoption of new information technologies by the Portuguese population, makes Internet based health care and pharmacy services very likely and promising in a near future.

Professional organizations role

Most workshop participants were certain that the two main professional organizations (ANF and OF) would still be very strong actors in shaping the community pharmacist role, although the ANF will be more dedicated to protect business interests while the OF will maintain the defence of a professional point of view. This will probably happen, assuming that non-owner pharmacists do not necessarily support ANF's points of view and strategy. The ANF has been advocating the implementation of a new practice model since the late nineties with the OF also supporting this change. However, ANF's economic power and political influence still places it as a main stakeholder in this arena, with participants recognizing that in the future, it would be better for the profession to keep the OF as the main stakeholder to clearly separate the business interests of pharmacies from the professional interests of non-owner pharmacists. Besides this, the role of academia was also deeply discussed. It was recognized that academia will have an important role in defining pharmacist education and thus, their specialization toward a patient centred practice.

Primary health care reform

The present reform is promoting the harmonization of clinical procedures between primary and secondary health care, and this will also influence pharmacies' organization, management, and positioning. The integration of a pharmacist in PHC centres' teams emerged as a possibility. Depending on the functions performed (e.g., disease management versus medicine use management and logistic support) there could be a stronger link with the local community pharmacies to better integrate the patients in the health care network. To make this possible, participants suggested pharmacists should acquire new communication skills to better work with other health professionals, and taking into account factors such as lobbying, trust between professionals, and cultural issues.

Other themes

From the several themes discussed that were not considered critical uncertainties, it is worth to highlight themes such as "absence of a community pharmacist career", implying that the professional development is non-existent and the specialization occurs mainly within the practice setting; technological innovations will surely play a major part in shaping the future pharmacist's role, but could have their potential hindered by most "patients' low IT literacy"; the "inconsistency of services between pharmacies" was identified as one barrier to the dissemination of new forms of practice, contributing to a low speed of diffusion of innovations.

Scenarios' driving-forces

To start the scenario design process it was necessary to condense the critical uncertainties into two driving forces. The first driving force was named "Legislative environment", comprising the critical uncertainties "Political will and NHS reorganization", and "Economic environment". Two extremes for this driving force were considered, namely one with little or no change in the legislative and economic environment, and the other comprising both pharmacy market and health care system liberalization.

Gregório et al. Human Resources for Health 2014, 12:58
http://www.human-resources-health.com/content/12/1/58

The second driving force was named "Ability to develop services", condensing the critical uncertainties "Financial situation of the pharmacies" and "Patients and clients". The extremes for this driving force were low innovation versus high innovation that enables new service development. The first was due to the absence of incentives, lack of demand, and lack of pharmacies' financial capacity, resulting in a low development of new services. The second emerged from greater customer demand, resulting in an increased need for differentiation between pharmacies as a means to expand their client base and profits.

After the driving forces were fully defined and validated by the experts, it was possible to design the following final scenarios (Figure 2).

"Pharmacy-Mall"

In the "Pharmacy-Mall" scenario, new pharmacies' opening and ownership will have been completely liberalized, but with no significant modification in the way pharmacies are paid for their services. Remuneration will come entirely from the profit margins on the sale of medicinal products. There will be no governmental attempts to improve services' development or payment for the existing ones. As the profit margins improve, due to the horizontal and vertical integration of pharmacies into chains, pharmacies' owners will not feel the need to innovate, thus keeping a low development of new pharmaceutical services. The demand for pharmaceutical services will also remain low. There may be pharmacies in the Internet, providing medicines to patients who cannot or do not want to visit the pharmacy to fill their prescriptions.

"e-Pharmacist"

In the "e-Pharmacist" scenario, besides pharmacies' ownership liberalization, there is the possibility of health system liberalization, i.e., greater opportunities for health services' personalization. In this sense, it will be beneficial for the citizens to have a health insurance or a subsystem of care. In this scenario, pharmaceutical care services become the main source of revenue for pharmacies. Pharmacies will be mainly supported by private health systems, thus encouraging the development of additional pharmaceutical services. Community pharmacists, skilled in the provision of services beyond medicine dispensing, will be subject to a strong demand. They will be recognised for the economic and clinical value in the services provided and the impact on patients' quality of life will be definitively proven. Service innovation will lead to a broader utilization of IT: proactive community pharmacists will be showing leadership on the use of information systems for provision of health care, managing virtual spaces, such as electronic cabinets, where all the disease and therapeutic management will be accomplished. "e-Pharmacists" will manage patient's health information and the interaction with PHC physicians and other health professionals using digital and IT resources.

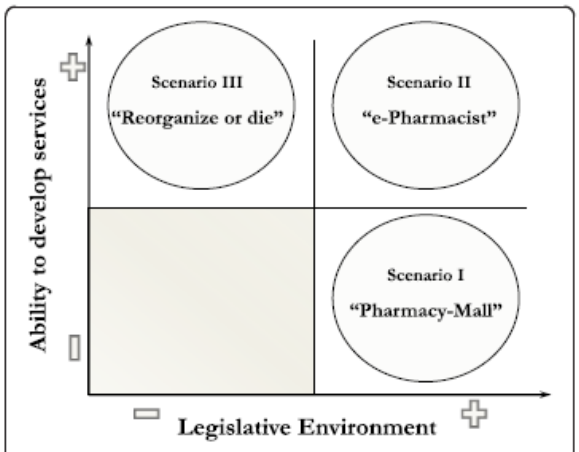


Figure 2 Final community Pharmacists' scenarios.

"Reorganize or Die"

In the "Reorganize or Die" scenario, no significant legislative changes will have occurred, other than cutting profit margins. The current trend for decreasing profit margins will continue, forcing pharmacies to look for other sources of revenue, including reorganizing in groups of pharmacies. This will help survival and will maintain the pharmacies' minimum profit level and costs controlled. The development of services will take place based upon the need to differentiate between pharmacies, implementing strategies to increase their products and services' demand. In this scenario, pharmaceutical services would only exist if supported by individual payers, without any financial support from the health systems. Most pharmacies will have their own Internet site; however, since there will be no legislative change, dispensing prescription medicines will still be performed in the traditional way. The websites will be more dedicated to the sale of over-the-counter products and provision of general health information.

Discussion

From the analysis of our set of scenarios, it seems that the most promising future for community pharmacists in Portugal is the provision of pharmaceutical services that go beyond medicine dispensing.

Comparing this set of scenarios with others found in the literature, namely the scenarios suggested by Norgaard et al. [37] for Danish community pharmacists, we can conclude that much of the trends that led to the development of their scenarios are still very much present today, leading us to believe that the transition in pharmacist role is universal but has been much slower than expected. In that work, five scenarios were developed using a different

Gregório et al. Human Resources for Health 2014, 12:58
http://www.human-resources-health.com/content/12/1/58

methodology. Apart from the "No future scenario", which is a "worst case scenario", that we did not consider developing, there are several common aspects with the remaining scenarios. Their "Uncertain future" scenario is closely related to our "Pharmacy-Mall". However, aspects of their "IT expert" and "Provider of individualised information and future role developer" scenarios are included in the "e-Pharmacist" scenario, with some other aspects being included in the "Reorganize or Die". This may stem from different methods approaching the scenario development, as the perception of pharmacist's role is very similar in both countries. Although different in their context, these scenarios show some intriguing trends in spite of the "Danish" scenarios lack of a clear scenario horizon. The trend towards the use of technological solutions to assist pharmacist's work is present as is the fear of becoming less important in the health system.

The choice of the two driving forces from the themes discussed was a critical step in the definition of our scenarios. They were discussed and validated by the experts at the beginning of the second workshop. For the first driving force, "Legislative environment", the decision was supported by the perception that the most important change in the pharmacy sector in Portugal, and also in Europe, is the liberalization of pharmacies' ownership and installation [23,47,48]. Although some authors found that restrictions to free pharmacy installation are limiting innovation [23], other studies suggested that the current legislation on pharmacy installation ensures equity of access and the quality of medicine dispensing as long as the presence of a pharmacist is mandatory [47-49]. Experts' recognition that these contrasting views stem from the political environment, supported the integration in this driving force of the issues of "political will" and "economic environment". The second driving force "Ability to develop services", intends to reflect the competency, will and vision of a pharmacy owner to develop and implement innovative services. The experts considered that the development and implementation of pharmaceutical services is critical for pharmacy differentiation and sustainability, which in turn impacts on the community pharmacist role. It also acknowledges that pharmacy owners will only have interest in implementing services that will be profitable, with adequate service remuneration as an essential requirement for ensuring service diffusion and adoption, as described in the literature [13,48]. It is expected that pharmacy owners will adopt this new practice, especially in a context of economic constraints. However, the lack of business skills and openness to innovation could represent a barrier to this process of change.

The final three scenarios represent obvious implications and consequences, which are summed up in Table 2.

The "Pharmacy-Mall" scenario is the one that offers community pharmacists fewer chances for professional development, besides representing a likely sharp decrease in workforce numbers (Figure 3). The potential oversupply of pharmacists and rising unemployment will contribute to the increasing number of professionals leaving the country, seeking new job opportunities, professional development, economic stability, and job satisfaction [50]. Others will quit the profession, choosing another career outside community pharmacy [51]. In a scenario where big profit-driven pharmacy chains will emerge, conflicts are expected between business objectives and pharmacists' interventions, namely "free of charge" patient counselling. This can have negative consequences on professional satisfaction and community pharmacists' work conditions [52,53]. For patients, the advantage of this scenario is the reduction of medicine prices, due to greater vertical and horizontal integration and additional competition [47]. For the health system, this scenario could bring important savings in medicine expenditures, as it has been observed in countries with a similar model. Nevertheless, the downside is a reduced accessibility to medicines, especially in remote and rural areas [47,48].

Table 2 Implications and consequences of the different scenarios

	Scenario I "Pharmacy-Mall"	Scenario II "e-Pharmacist"	Scenario III "Reorganize or Die"
Demand for community pharmacists	• Decreases	• Increases	• Decreases
Main functions and responsibilities	• Supervision of dispensing processes	• Caregiver	• Innovator/salesman
Main skills to acquire/improve	• Leadership	• Clinical pharmacy and pharmacotherapy	• Client management
	• Human resources and pharmacy management skills		• Marketing skills
		• Advanced information technologies	• Sales techniques
	• Pharmacovigilance		• Communication skills
	• Information technologies	• Teamwork abilities	
	• Regulatory/reimbursement affairs		
Primary health care integration	• No integration	• Multidisciplinary teams and polyclinics	• In the local health units

Gregório et al. Human Resources for Health 2014, 12:58
http://www.human-resources-health.com/content/12/1/58

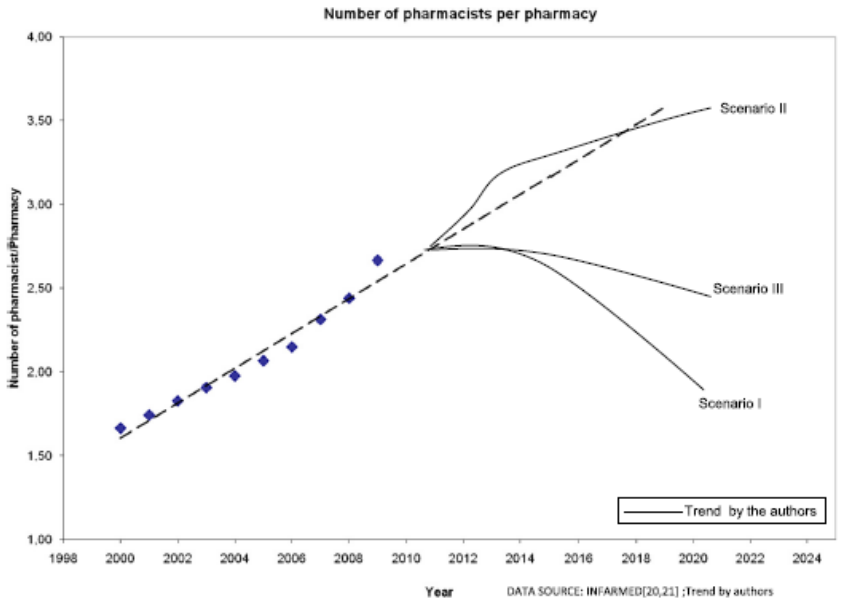


Figure 3 Evolution of the ratio of pharmacists per pharmacy in each scenario.

The "e-Pharmacist" scenario represents a "best case scenario". The numbers of community pharmacists per pharmacy will keep rising, ensuring that a significant part of the trained pharmacists is still absorbed by the community pharmacies market (Figure 3). However, it is crucial for pharmacy professionals to promote a greater collaborative work culture, both inside and outside the pharmacy. This scenario implies a greater collaboration with general practitioners and nurses, and probably some changes in working regulations. With more information to share, the use of IT is an evident solution that will continue to be explored [54,55]. For patients, this may be a valuable scenario since there is the possibility of remote disease and therapy management, associated with better health outcomes, less general practitioner visits and other health care system savings [6,56,57]. It is likely that an improved accessibility will increase patient satisfaction. For the health care system, a real integration of community pharmacists in the PHC network would possibly increase the costs of care. However, the efficiency increment and the reduction of other costs would be relevant to those financing the health system, without affecting the quality of pharmaceutical services provided [58,59].

In the "Reorganize or Die" scenario, customer relations management competencies are the most valuable asset a pharmacist can have. A solid education in marketing and quality of services will be extremely important to increase demand for the products and services each pharmacy is willing to provide. For patients, this scenario is not as valuable as others, since they will be considered as consumers rather than actual patients using a health service. In this sense, not everyone will have access to pharmaceutical care services, depending on the services available at each pharmacy and on the individual means to pay for services. Since funding of pharmaceutical services will be largely dependent on patients, the overall equity of the health care system could be endangered, since most of the people who might need pharmaceutical care may not be able to afford it. As far as the health care system is concerned, besides the lower equity, the absence of community pharmacists' integration in the PHC network will limit the gains in efficiency associated to pharmaceutical care [60].

From scenarios' to reality – roadmap to develop pharmacist's new role

One can argue that to sustain the benefits of the envisioned change, an integrated and longitudinal perspective of services' provision should be considered, requiring event registering, comprehensive data analysis, and interactive dialogue with patients, i.e., enabling a more sophisticated use of information systems. Health care services should be based on health knowledge, people, and technology supporting health care processes. Future pharmaceutical care services should be developed to first deliver valued information to patients and health professionals. This could only work if community pharmacists assume their role as caregivers, supported by adequate information systems, developing caring abilities, and also taking

responsibility for patients' therapeutic results, which is essential to the practice of pharmaceutical care and other professional services [61]. However, this patient-centred practice will also require curricula adaptation towards clinical practice [62-64], without losing sight of all issues related to drug discovery, development, delivery, and use, from applied pharmacology to pharmacoepidemiology.

Information systems will have an important impact on the definition of new roles for community pharmacists [10,65-68]. The proper use of technological solutions could relief pharmacists' workload, sparing time to perform pharmaceutical care functions. These functions will be supported by new technological solutions such as the remote monitoring of patients [56,69,70].

The relation with other health professionals is also essential to the diffusion of this new kind of practice and for the real integration of community pharmacists in primary health care. Firstly, the role of pharmacy technicians has to be clarified. Nowadays, pharmacists are the larger workforce in Portuguese community pharmacy, being required to perform activities that could be performed by technicians with more efficiency. In an exploratory study made recently, Lapão et al. [71] found that pharmacists and technicians are doing the same activities, with pharmacists spending 40% of their time on non-professional tasks. From these findings, it is clear that a better organization of internal functioning of pharmacies is needed, with precise role definition, delegation of tasks, and supervision mechanisms in place if Portuguese community pharmacists want to move beyond medicine dispensing.

A good interprofessional relationship with physicians is an important factor in integrating pharmacists in the PHC network as are interpersonal skills and an adequate communication with all elements of the health care team [72-74]. However, the relationship with physicians is frequently reported as a major barrier to the development of pharmacists' new roles in the community [75,76]. Moreover, nurses have taken roles in primary care provision that could be performed by pharmacists, and this evolution within the health care team is something that community pharmacists should take into account [77,78]. It is important for the community pharmacists to be aware of other health professionals' competencies and skills and vice-versa, probably through educational sharing at the university level, in order to stimulate synergisms which best serve the community health needs.

Future research

This kind of study is particularly important to generate new research questions that will help design the best strategies to enforce an effective change in Portuguese community pharmacists' role. Below are some examples of possible questions that followed the scenario analysis.

Emerging research questions

- What will the impact of the International Monetary Fund/European Central Bank Memorandum of Understanding in the pharmacy business be;
- What impact will the reorganization of the community pharmacy sector in the role of the community pharmacist have;
- What will the future needs of community pharmacists in Portugal be;
- What expectations do the community pharmacists have for their future;
- What services will patients really need from community pharmacists;
- Are today's community pharmacists curricula adapted to future practices;
- What would the impact of a community pharmacist working in PHC, either in a health care centre or in a health care trust, be;
- What new information technologies may be used, how should these be used, and what impact will they have in developing new services.

Further, it will be interesting to define a set of indicators that enables the monitoring of community pharmacists' role evolution. The information gathered in this indicators would help to support better policy making and human resources planning.

Limitations

The scenarios here depicted do not intend to predict or in any way define the future of Portuguese community pharmacists. Rather, they should be seen as a way to frame possible futures, in order to stimulate new forms of practice and prepare the best strategies in an ever-changing society [41]. Bearing this in mind, the choice of two driving forces and the use of a 2×2 matrix may result in a set of arbitrary scenarios. If other driving forces were chosen, different scenarios would be designed. With the methodology described herein we intended to choose the driving forces that seemed to better frame all possible futures, considering them as a starting point instead of a fully developed design.

This methodology is somewhat subjective, which results in a process easily weakened by some "traps" that are usually related either to the way this process is conducted inside an organization (team composition; brainstorming vs. interviews) or to the scenarios' time frame (short-term vs. long-term). One of the most common "traps" that planners face when developing scenarios is to consider the scenarios as a fixed prediction of the future or to bet in only one scenario, instead of looking at alternatives. The scenario analysis is a flexible process meant to be adjusted to future developments. All these difficulties were considered

as a natural part of a scenario planning such as this, but they can also be seen as a weak point of this methodology.

Conclusions

The use of scenario analysis in a strategic thinking process has demonstrated to be of value while planning for future human resources and other policy issues. It creates a good setting for stakeholders to be more involved, and discuss and study common issues. With the present scenarios, it is possible to anticipate future community pharmacists' needs, at market and educational level, thus providing valued information to health regulators and planners.

From these scenarios, it is clear that the foreseen changes in pharmacy practice will potentiate the development of new roles for Portuguese community pharmacists in the future health care system. The new role will require significant legislative changes, adequate financial incentives and other behavioural changes, namely an entrepreneur mindset and innovator's dynamics. Ideally, the new role will balance the traditional dispensing with a clinical orientation, emerging from pharmaceutical care practice and disease managing programs. Defining a model to finance these services will be vital to preserve community pharmacists' contribution and the overall equity of the Portuguese health care system.

Changing all parties' perceptions, from patients to other health professionals, health authorities, and community pharmacists, is critical for embracing a new paradigm in pharmaceutical services provision. In this collaboration, properly designed information systems and technologies will have a very important role, opening the opportunity for community pharmacists to assume true responsibility for patient and disease management.

The practice change will imply new ways of working and interacting with patients, physicians, and other PHC professionals. The envisaged practice change, proposed by the prospective scenarios, would only be effective if all involved professionals are included. The professional organizations have now to show leadership and coordinate strategies to ensure that the new practice might reach all practitioners in a near future for the benefit of the health care system.

Abbreviations

ANF: National Association of Pharmacies; IT: information technologies; NHS: National Health Service; OF: Pharmaceutical Society; PHC: primary health care.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

JG carried out the literature review, conducted the scenario workshop sessions, collected and interpreted data, and drafted the manuscript. AC carried out the final revision for important intellectual content. LVL conceived the study, participated in its design and coordination, and helped to draft the manuscript. All authors read and approved the final manuscript.

Acknowledgements

Part of this research was funded by Fundação para a Ciência e Tecnologia under the number PTDC/CCI-CIN/122690/2010. The authors acknowledge with thanks all the pharmacy experts for their invaluable participation in the scenario workshops, and the key informants who so willingly contributed to this study.

Author details

[1]WHO Collaborating Centre for Health Workforce Policy and Planning, International Public Health and Biostatistics Unit, Instituto de Higiene e Medicina Tropical, Rua da Junqueira n°100, 1349-008 Lisbon, Portugal. [2]Research Institute for Medicines and Pharmaceutical Sciences, Faculdade de Farmácia da Universidade de Lisboa, Av. Professor Gama Pinto, 1649-003 Lisboan, Portugal. [3]Department of Social Pharmacy, School of Pharmacy, The Faculty of Mathematics and Natural Sciences, University of Oslo, Farmasibygningen, Sem Sælands vei 3, 0371 Oslo, Norway.

Received: 31 March 2014 Accepted: 29 September 2014
Published: 13 October 2014

References

1. Campbell J, Dussault G, Buchan J, Pozo-Martin F, Arias MG, Leone C, Siyam A, Cometto G: **A universal truth: no health without a workforce**. In *Forum Report, Third Global Forum on Human Resources for Health, Recife, Brazil*. Geneva: Global Health Workforce Alliance and World Health Organization; 2013.
2. Dussault G: **Gestão dos Recursos Humanos e Qualidade dos Serviços de Saúde.** *Educ Med Salud* 1994, **28**(4):478–489.
3. Dussault G, Ferrinho P: **A health workforce strategy for Portugal.** *Cah Sociol Demogr Med* 2007, **47**(3):235–240.
4. Wagner EH: **Chronic disease management: what will it take to improve care for chronic illness?** *Eff Clin Pract* 1998, **1**(1):2–4.
5. McAlister FA, Lawson FM, Teo KK, Armstrong PW: **A systematic review of randomized trials of disease management programs in heart failure.** *Am J Med* 2001, **110**(5):378–384.
6. 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 (Wash)* 2003, **43**(2):173–184.
7. Willis A, Rivers P, Gray LJ, Davies M, Khunti K: **The effectiveness of screening for diabetes and cardiovascular disease risk factors in a community pharmacy setting.** *PLoS One* 2014, **9**(4):e91157.
8. Chisholm-Burns MA, Graff Zivin JS, Lee JK, Spivey CA, Slack M, Herrier RN, Hall-Lipsy E, Abraham I, Palmer J: **Economic effects of pharmacists on health outcomes in the United States: a systematic review.** *Am J Health Syst Pharm* 2010, **67**(19):1624–1634.
9. Duarte A, Nunes F, Martins L: *Social Responsibility of the Pharmacy Sector in Portugal*. Lisbon: GEST-IN/ISCTE; 2007.
10. Maddux MS, Dong BJ, Miller WA, Nelson KM, Raebel MA, Raehl CL, Smith WE: **A vision of pharmacy's future roles, responsibilities, and manpower needs in the United States: American College of Clinical Pharmacy.** *Pharmacotherapy* 2000, **20**(8):991–1020.
11. Zellmer WA: **Pharmacy's future: transformation, diffusion, and imagination.** *Am J Health Syst Pharm* 2010, **67**(14):1199–1204.
12. Hepler C, Strand L: **Opportunities and responsibilities in pharmaceutical care.** *Am J Hosp Pharm* 1990, **47**(3):533–543.
13. 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.
14. PORDATA: **Health sector statistical data, 2000–2009.** In *Pordata - Base de dados Portugal contemporâneo*; 2011. [http://www.pordata.pt/Portugal/Pessoal+de+saude+medicos++dentistas++odontologistas++enfermeiros+e+farmaceuticos-144]. Accessed 02/02/2011.
15. Costa S, Santos C, Silveira J: **Community pharmacy services in Portugal.** *Ann Pharmacother* 2006, **40**(12):2228–2234.
16. INFARMED: *Farmácias com farmacêuticos tecnicamente habilitados a efectuar o seguimento dos doentes nos moldes previstos no Nível II de intervenção do Protocolo de Colaboração da Diabetes Mellitus e Número de doentes por farmácia*. Lisbon: 2009. [http://www.infarmed.pt/portal/page/portal/INFARMED/DISPOSITIVOS_MEDICOS/PROGRAMA_CONTROLO_DIABETES_MELLITUS/FARMACIAS_ABRANGIDAS_PELO_PROTOCOLO/FARMACIAS_NIVEL_II/2009/Lista2_200910.pdf]. Accessed 26/06/2011.

17. OF: *Statistical Data, November 2009*. Lisbon: Ordem dos Farmacêuticos; 2009. [http://www.ordemfarmaceuticos.pt/scid//ofWebInst_09/default CategoryViewOne.asp?categoryId=1914]. Accessed 15/05/2011.
18. OF: *The Young Pharmacists - Characterization of Portuguese Pharmacists*. Lisbon: Ordem dos Farmacêuticos; 2012. [http://www.ordemfarmaceuticos.pt/xFiles/scContentDeployer_pt/docs/Doc6318.pdf]. Accessed 22/02/2013.
19. INFARMED: *Medicine Statistics 2004*. Lisbon: Instituto Nacional da Farmácia e do Medicamento; 2006.
20. INFARMED: *Medicine Statistics 2009*. Lisbon: Instituto Nacional da Farmácia e do Medicamento; 2010.
21. MCTES: *Access to Higher Education - Index of Courses*. Lisbon: 2011. [http://www.dges.mec.pt/guias/indcurso.asp?curso=9494]. Accessed 29/05/2011.
22. ANF: *Pharmacy in Portugal*. Associação Nacional de Farmácias; 2010. [http://www.anf.pt/index.php?option=com_content&task=blogcategory&id=107&Itemid=107]. Accessed 15/05/2011.
23. Rodrigues A, Marques FB, Ferreira PL, Raposo V: *Estudo do Sector das Farmácias em Portugal*. Coimbra: Centro de Estudos e Investigação em Saúde da Universidade de Coimbra; 2007.
24. OF: *Employability of the Young Pharmacists*. Lisbon: Ordem dos Farmacêuticos; 2012. [http://www.ordemfarmaceuticos.pt/xFiles/scContentDeployer_pt/docs/Doc6443.pdf]. Accessed 22/02/2013.
25. Ginter PM, Duncan WJ, Capper SA: **Strategic planning for public health practice using macroenvironmental analysis.** *Public Health Rep* 1991, **106**(2):134–141.
26. Paz MRD, Gupta N, Quain E, Soucat ALB, WHO: *Manual Para a Monitorização e Avaliação Dos Recursos Humanos de Saúde: Com Aplicação Dedicada aos Países de Rendimento Baixo e Médio*. Geneva: World Health Organization; 2009.
27. WSHA: *Governing Board Orientation Manual - Strategic Planning*. Washington: Washington State Hospital Association; 2011. [http://www.wsha.org/files/62/gov_board_manual_strategic_planning.pdf]. Accessed 07/05/2011.
28. Kuhn KA, Giuse DA, Lapao L, Wurst SH: **Expanding the scope of health information systems - from hospitals to regional networks, to national infrastructures, and beyond.** *Methods Inf Med* 2007, **46**(4):500–502.
29. Azhar S, Hassali MA, Ibrahim MI, Ahmad M, Masood I, Shafie AA: **The role of pharmacists in developing countries: the current scenario in Pakistan.** *Hum Resour Health* 2009, **7**:54.
30. Mintzberg H: **The fall and rise of strategic planning.** *Harv Bus Rev* 1994, 107–114.
31. Postma TJBM, Liebl F: **How to improve scenario analysis as a strategic management tool?** *Technol Forecast Social Change* 2005, **72**(2):161–173.
32. Yoe C: *Scenario-Based Planning and Decision-Making: Guidelines for Use in the U.S. Army Corps of Engineers Planning Studies and Literature Review*. Alexandria, VF: Institute for Water Resources; 2005.
33. Long M, Ridout L, Bagnulo J, Braddock D, Chen T, Gissing P, Lennon B, Sansom L, Shah C: *Pharmacy Workforce Planning Study*. Barton: Pharmacy Guild of Australia; 2010.
34. Patterson DG, Skillman SM, Hart LG: *Washington State's Pharmacist Workforce Through 2020: Influential Factors and Available Data*. Seattle: WWAMI Center for Health Workforce Studies; 2004.
35. Low J: **Pharmacist oversupply-myth or mission?** *J Pharm Prac Res* 2010, **40**(4):262.
36. Leufkens H, Hekster Y, Hudson S: **Scenario analysis of the future of clinical pharmacy.** *Pharm World Sci* 1997, **19**(4):182–185.
37. Norgaard LS, Colberg L, Niemann MR: **The role of the Danish community pharmacist: perceptions and future scenarios.** *Pharm World Sci* 2001, **23**(4):159–164.
38. Godet M: **The art of scenarios and strategic planning: tools and pitfalls.** *Technol Forecast Social Change* 2000, **65**:3–22.
39. Schoemaker PJH: **Multiple scenario development: its conceptual and behavioral foundation.** *Strat Manag J* 1993, **14**(3):193–213.
40. Schoemaker PJH: **Scenario planning: a tool for strategic thinking.** *Sloan Manage Rev* 1995, **36**(2):25–40.
41. Schoemaker PJH: **Twenty common pitfalls in scenario planning.** In *Learning from the Future*. Edited by Fahey L, Randall RM. Chichester: John Wiley & Sons, Ltd; 1998:422–431.
42. Pomerol JC: **Scenario development and practical decision making under uncertainty.** *Decis Supp Syst* 2001, **31**(2):197–204.
43. Bishop P, Hines A, Collins T: **The current state of scenario development: an overview of techniques.** *Foresight* 2007, **9**(1):5.
44. Clark J: **Five futures for academic medicine: the ICRAM scenarios.** *BMJ* 2005, **331**(7508):101–104.
45. Lapão LV, Thore S: **Prioritizing R&D Projects in the Face of Technological and Market Uncertainty: Scenario Planning in the Telecommunication Business.** In *12th International Conference on Forecasting*. Edinburgh: 1998.
46. Heijden K: *Scenarios: The Art of Strategic Conversation*. 2nd edition. Chichester: John Wiley & Sons, Ltd.; 1996.
47. Almarsdottir AB, Morgall JM, Bjornsdottir I: **A question of emphasis: efficiency or equality in the provision of pharmaceuticals.** *Int J Health Plann Manage* 2000, **15**(2):149–161.
48. Lluch M, Kanavos P: **Impact of regulation of community pharmacies on efficiency, access and equity: evidence from the UK and Spain.** *Health Policy* 2010, **95**(2–3):245–254.
49. Lluch M: **Are regulations of community pharmacies in Europe questioning our pro-competitive policies?** *Eurohealth* 2009, **15**(4):3.
50. Dussault G, Franceschini MC: **Not enough there, too many here: understanding geographical imbalances in the distribution of the health workforce.** *Human Resour Health* 2006, **4**:12.
51. Hawthorne N, Anderson C: **The global pharmacy workforce: a systematic review of the literature.** *Hum Resour Health* 2009, **7**:48.
52. Ferguson J, Ashcroft D, Hassell K: **Qualitative insights into job satisfaction and dissatisfaction with management among community and hospital pharmacists.** *Res Social Adm Pharm* 2011, **7**(3):306–316.
53. Resnik DB, Ranelli PL, Resnik SP: **The conflict between ethics and business in community pharmacy: what about patient counseling?** *J Bus Ethics* 2000, **28**(2):179–186.
54. Petropoulou SG, Bekakos MP, Gravvanis GA: **E-prescribing - Telepharmacy.** In *7th Hellenic European Conference on Computers*. Athens: 2005.
55. Sellors C, Sellors J, Levine M, Chan D, Dolovich L, Howard M: **Computer networking to enhance pharmacist-physician communication: a pilot demonstration project in community settings.** *Can Pharmacist J* 2004, **137**(8):26–30.
56. Green BB, Cook AJ, Ralston JD, Fishman PA, Catz SL, Carlson J, Carrell D, Tyll L, Larson EB, Thompson RS: **Effectiveness of home blood pressure monitoring, Web communication, and pharmacist care on hypertension control: a randomized controlled trial.** *JAMA* 2008, **299**(24):2857–2867.
57. Roughead L, Semple S, Vitry A: **The value of pharmacist professional services in the community setting: a systematic review of the literature 1990–2002.** In *Quality Use of Medicines and Pharmacy Research Centre*. Adelaide: University of South Australia, School of Pharmaceutical, Molecular and Biomedical Sciences; 2002.
58. Berenguer B, La Casa C, de la Matta MJ, Martin-Calero MJ: **Pharmaceutical care: past, present and future.** *Curr Pharm Des* 2004, **10**(31):3931–3946.
59. McDonough RP, Harthan AA, McLeese KE, Doucette WR: **Retrospective financial analysis of medication therapy management services from the pharmacy's perspective.** *J Am Pharm Assoc (2003)* 2010, **50**(1):62–66.
60. Westerlund T, Marklund B: **Assessment of the clinical and economic outcomes of pharmacy interventions in drug-related problems.** *J Clin Pharm Ther* 2009, **34**(3):319–327.
61. Wiedenmayer K, Summers RS, Mackie CA, Gous AGS, Everard M: *Developing Pharmacy Practice - A Focus on Patient Care*. Geneva: World Health Organization and International Pharmaceutical Federation; 2006.
62. Benrimoj S: **Educating pharmacists to provide new Pharmacy Services.** In *European Association of Faculties of Pharmacy Annual Congress - New Roles for Pharmacy and Pharmacists in Europe: A Challenge for Education in Pharmacy*. Lisbon: Ordem dos Farmacêuticos; 2011.
63. Fernandez-Llimos F: **Desenvolvimento de conceitos em "Cuidados Farmacêuticos".** In *IV Congresso Ibero-Americano de Ciências Farmacêuticas*. Lisbon: Ordem dos Farmacêuticos; 2011.
64. Jungnickel PW, Kelley KW, Hammer DP, Haines ST, Marlowe KF: **Addressing competencies for the future in the professional curriculum.** *Am J Pharm Educ* 2009, **73**(8):156.
65. Fox N, Ward K, O'Rourke A: **The birth of the e-clinic: continuity or transformation in the UK governance of pharmaceutical consumption?** *Soc Sci Med* 2005, **61**(7):1474–1484.
66. Katz SJ, Moyer CA: **The emerging role of online communication between patients and their providers.** *J Gen Intern Med* 2004, **19**:978–983.
67. Lam AY, Rose D: **Telepharmacy services in an urban community health clinic system.** *J Am Pharm Assoc (2003)* 2009, **49**(5):652–659.

68. Lamb M: *Improving Patient Compliance in Clinical Trials - Smart Packages or Smart Design?* 2010. [https://www.yumpu.com/en/document/view/7773301/improving-patient-compliance-in-clinical-trials-almac]. Accessed 30/05/2011.
69. Vervloet M, Van Dijk L, Santen-Reestman J, Van Vlijmen B, Van Wingerden P, Bouvy ML, De Bakker DH: **SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored.** *Int J Med Inform* 2012, **81**(9):594–604.
70. Collins B, Borders TF, Tebrink K, Xu KT: **Utilization of prescription medications and ancillary pharmacy services among rural elders in west Texas: distance barriers and implications for telepharmacy.** *J Health Hum Serv Adm* 2007, **30**(1):75–97.
71. Lapão LV, Gregório J, Cavaco A, da Silva MM, Lovis C: **Implementing eHealth services for enhanced pharmaceutical care provision: opportunities and challenges.** *Adv Information Syst Technol* 2013, **206**:433–443.
72. Van der Kam WJ, Meyboom de Jong B, Tromp TF, Moorman PW, Van der Lei J: **Effects of electronic communication between the GP and the pharmacist: the quality of medication data on admission and after discharge.** *Fam Pract* 2001, **18**(6):605–609.
73. Bradley F, Elvey R, Ashcroft DM, Hassell K, Kendall J, Sibbald B, Noyce P: **The challenge of integrating community pharmacists into the primary health care team: a case study of local pharmaceutical services (LPS) pilots and interprofessional collaboration.** *J Interprof Care* 2008, **22**(4):387–398.
74. O'Connor M, Pugh J, Jiwa M, Hughes J, Fisher C: **The palliative care interdisciplinary team: where is the community pharmacist?** *J Palliat Med* 2011, **14**(1):7–11.
75. Edmunds J, Calnan MW: **The reprofessionalisation of community pharmacy? An exploration of attitudes to extended roles for community pharmacists amongst pharmacists and General Practioners in the United Kingdom.** *Soc Sci Med* 2001, **53**(7):943–955.
76. Paulino E, Guerreiro MP, Cantrill JA, Martins AP, Costa FA, Benrimoj SIC: **Community pharmacists' and physicians' inter-professional work: insights from qualitative studies with multiple stakeholders.** *Rev Port Clin Geral* 2010, **26**:590–606.
77. Buchan J, Temido M, Fronteira I, Lapao L, Dussault G: **Nurses in advanced roles: a review of acceptability in Portugal.** *Rev Lat Am Enfermagem* 2013, **21**:38–46.
78. Leese B: **New opportunities for nurses and other healthcare professionals? A review of the potential impact of the new GMS contract on the primary care workforce.** *J Health Organ Manag* 2006, **20**(6):525–536.

doi:10.1186/1478-4491-12-58
Cite this article as: Gregório *et al.*: A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal. *Human Resources for Health* 2014 **12**:58.

2.2. PAPER II

GREGÓRIO, João; CAVACO, Afonso Miguel; LAPÃO, Luís Velez. *How to best manage time interaction with patients? Community pharmacist workload and service provision analysis.* Research in Social and Administrative Pharmacy, 2016. (in press)

ARTICLE IN PRESS

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

Research in Social and Administrative Pharmacy ■ (2016) ■–■

RESEARCH IN SOCIAL & ADMINISTRATIVE PHARMACY

Original Research

How to best manage time interaction with patients? Community pharmacist workload and service provision analysis

João Gregório, Pharm.D., M.Sc.[a,b,*], Afonso Miguel Cavaco, Ph.D.[c], Luís Velez Lapão, Ph.D.[a,b]

[a]*Global Health and Tropical Medicine (GHTM), Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira, n° 100, 1349-008 Lisboa, Portugal*

[b]*WHO Collaborating Center for Health Workforce Policy and Planning, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira, n° 100, 1349-008 Lisboa, Portugal*

[c]*Faculty of Pharmacy, University of Lisbon, Research Institute for Medicines (iMed.ULisboa), Av. Prof. Gama Pinto, 1649-003 Lisboa, Portugal*

Abstract

Background: Primary health care disease management models are rooted in multidisciplinary participation; however, implementation of services is lagging behind desires and predictions. Barriers like workload and lack of demand have been described. The aim of this research is to observe the workload and work patterns of Portuguese community pharmacists, and relate it with the demand of pharmaceutical services.

Method: A time-and-motion observational study was performed to describe community pharmacists' workload in a sample of four pharmacies in the metropolitan Lisbon area. A reference list of activities to be observed was developed by reviewing other studies of community pharmacy work. This study took place during a weekday's 8-h shift, focusing on pharmacists' activities. Data to be collected included the type and duration of the activity, who performed it and where. To estimate the demand of pharmaceutical care services, "thematic-patient scenarios" were developed. These scenarios were based on the defined daily dose and package size of the most consumed medicines in Portugal, combined with data obtained from the four pharmacies' information systems on the day the observational study took place.

Results: Between 67.0% and 81.8% of the registered activities were pharmacist-patient interactions. These interactions summed 158.44 min, with a mean duration of 3.98 min per interaction. On average, participant pharmacies' professionals handled 4.2 prescriptions and 0.9 over-the-counter (OTC) consultations per hour. About one third of the day was spent performing administrative and non-differentiated tasks. About 54.92 min were registered as free time, 50% of which were "micro pauses" with 1 min or less. The most dispensed therapeutic subgroup was antihypertensive drugs, while the dispensation of antidiabetics was

Funding: The research reported in this manuscript has been funded by the Portuguese National Science and Technology Foundation (FCT) through the ePharmacare project (Grant number: PTDC/CCI-CIN/122690/2010). Also of importance was the support of the Global Health and Tropical Medicine research center, GHTM – Grant number: UID/Multi/04413/2013.

Conflict of interests: None to declare.

* Corresponding author. Global Health and Tropical Medicine (GHTM), Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira, n° 100, 1349-008 Lisboa, Portugal. Tel.: +351 213 652 600.

E-mail address: jpgregorio@ihmt.unl.pt (J. Gregório).

1551-7411/$ - see front matter
http://dx.doi.org/10.1016/j.sapharm.2016.02.008

characterized by a high number of packages sold per interaction. From the developed scenarios, one can estimate that a chronic patient may visit the pharmacy 4–9 times per year, depending on the condition presented.
Conclusion: Workload results are very similar to findings from studies in other countries, which may be an indication of uniformity of community pharmacy practice across countries. The amount of time a pharmacist has at the counter to interact with a patient during a year renders disease management or therapeutic management non-viable. Also, the perception of "lack of time," many times reported as a barrier for service provision, must be called into question, since substantial available time was found. However, to turn this available time into usable time, redesign of work processes and new role definition are necessary. Both better management and new communication channels should be developed to address this gap and increase patient follow-up services.

Keywords: Pharmaceutical services; Community pharmacy; Pharmacist workload; Pharmacist-patient interaction; Service demand; Portugal

Introduction

The aging population and the prevalence of chronic diseases are challenging health systems to implement reforms toward higher sustainability.[1] These reforms have often focused on primary healthcare (PHC) coverage, supported by multidisciplinary teams.[2] Community pharmacists are adding significant contributions to PHC by fulfilling an increasing range of roles and responsibilities.[3] This largely results from the professional practice promoted by Hepler and Strand, [4] who established the concept of "pharmaceutical care" almost three decades ago. In most health care systems, pharmacists are usually the first health care professional that patients access when seeking health advice, particularly for minor ailments or when making use of their medications. Pharmacists' position is ideal to leverage health care interventions, in particular those related to pharmacotherapy and pharmacovigilance activities.[5]

Pharmacists' interventions have potential benefits for health systems and patients.[6–8] This potential derives from patients visiting community pharmacies more often than any other health care service due to their proximity and accessibility.[9–11] Main drivers for these visits are patients' needs for medication supply and associated information.[12,13] To respond to this demand, a typology of three main services has emerged among community pharmacies[14]: provision of specialized product-related services (e.g. medicine dispensing, medicine compounding); information services (e.g. drug information programs, mailed refill reminders); and pharmacists' care services (e.g. immunizations and health screenings, diabetes management programs, medication therapy management). This movement is thought to be essential to the professions' future, with some authors advocating that the implementation of patient follow-up services and its sustainability has to be dramatically up-taken to make community pharmacists relevant to the health systems.[15–17]

Community pharmacy system in Portugal

Community pharmacists in Portugal work exclusively in independent pharmacies, since large chains are not allowed. The opening of community pharmacies is regulated, with main criteria being a minimum distance between pharmacies (350 m in a straight line) and the number of serviced inhabitants (minimum 3500 inhabitants). There are some exceptions to these rules, depending on the presence of a health care service in the vicinity or in areas with low population density. Pharmacies have to be opened at least 50 h a week. The presence of a responsible pharmacist – the technical director – is mandatory and a substitute has to be registered at the national medicines regulatory agency (INFARMED) to assure a pharmacist is present at all times. Non-pharmacist ownership is allowed, with the maximum number of pharmacies per owner capped at 4. Pharmacies have a National Health Service (NHS) contract for dispensing prescription medicines, with legislation establishing medicines' profit margins and patients' co-payments.[18] Practicing pharmacists have to be mandatorily registered and licensed by the Portuguese Pharmaceutical Society. By the end of 2014, there were 8682 registered community pharmacists.[19,20]

These are mostly young professionals (67% are less than 45 years old). There is a high number of females (80% of the practitioners), confirming a worldwide trend.[21] The ratio of pharmacists per pharmacy has increased between 2000 and 2014, leading to an average of more than 3 pharmacists per pharmacy since 2014.[17,20] Simultaneously, the number of pharmacy technicians and auxiliaries per pharmacy has dropped, with pharmacists assuming the supply tasks and undifferentiated tasks as part of their work routine. This in turn may have contributed to patients' poor acknowledgment of different workers and competencies at the community pharmacy counter.[22]

Over the last twenty years Portuguese community pharmacies have developed consultation services to manage chronic patients and their therapies.[23] These services have targeted the provision of tailored education on health, drug information, screening and monitoring of basic clinical parameters (e.g. blood glucose, acid uric, cholesterol, etc.), blood pressure and body mass index. There was also an effort to develop and implement nationwide pharmaceutical care programs for diabetes and hypertension. These programs were developed by the National Association of Pharmacies (ANF), an owners' association. The program for diabetes care was financially supported by the NHS from 2006 to 2009. When the financial support ended, 400 pharmacies were doing patient follow-up, with an average of three patients per pharmacy.[24] Soon after, most pharmacies terminated the provision of the service. A recent survey found that in a sample of 403 pharmacies (14%), only 333 pharmaceutical care consultations were provided during a 5 days period.[25] Apart from dispensing prescription medicines, none of the present services, e.g. smoking cessation programs, minor ailment counseling, and adherence support services, is supported by NHS remuneration; these services are entirely supported by medicines' profit margins and patients' direct payments.

Community pharmacists' workload

With the onset of new services and practices, there is growing concern that pharmacists' workload is too demanding.[26,27] Workload can be defined as the amount of work an individual has to accomplish during a certain period of time.[28,29] Evidence suggests that higher workloads may have an impact on the quality of service provision, dispensing accuracy and act as a barrier to the practice change envisioned for the profession.[30–32] A recent review of pharmacists' workload in the United Kingdom found that pharmacists spend most of their day dispensing medicines.[29] Other studies report that about half of a workday is spent in professional activities, while approximately 30% is spent in administrative tasks and 20% resting and in house work.[33,34] A study in West Virginia found that pharmacists' increasing workloads hindered pharmacists' availability to spend time with patients.[35] Also of importance is professionals' perception of high workload and work pressure from inadequate breaks or lack of staff.[29,34] Alongside the lack of incentives, "lack of time" is many times reported as a barrier to the development of pharmacists' new role in disease management,[30,36] which highlights the global concern with workload and its evaluation. Therefore, understanding what pharmacists do and how they spend their time is essential to the sustained development of new pharmacy services. Once evaluated, pharmacists' workload should be integrated into the design of new systems or services.

Although the issue of community pharmacists' workload has been addressed in recent studies,[29,37] additional evidence is needed on Portuguese community pharmacists' workload and the associated pattern of pharmacy services provision. New clues to better understand the situation will help policy-makers in the design of better strategies to increment the provision of pharmaceutical care services. Beyond knowing pharmacists' workload and the level of service provision, it is also necessary to look at the other end of the service chain i.e., to estimate the potential demand for new services. This is crucial information to support health care services planning and development.[38] The relationship between services provision, consumption, demand and unsatisfied demand helps to address both service improvement and innovation. Establishing both ends of this continuum will allow predicting factors for success in advanced service provision.[39]

Aim of the study

This study aimed to characterize the workload and activities performed by pharmacists in a set of community pharmacies, including the bundle of services provided and the time spent with patients. The overall objective was to describe Portuguese community pharmacists' workload and work

patterns allowing for the comparison with community pharmacists' workload from other countries. An additional objective was to estimate current chronic medicines needs, to explore the potential demand for new pharmaceutical services.

Methods

To address the main objectives, a multimethod approach was chosen. Firstly, to study pharmacy services provision and characterize pharmacists' workload, an observational time-and-motion study using a thin-slicing approach was designed. Thin-slicing is an approach used in psychology research to describe the ability to find patterns in events based only on narrow windows of experience.[40] Time-and-motion was used to understand how participants spent their time within each window.[41] Thin-slicing underlies an effort to minimize intrusion and avoid changes in professionals' behaviors. In the context of this study, the thin-slice was a day of observation. It was expected that this brief period of observation could be used to assess outcomes, such as workload, at levels higher than expected by chance.[40]

Secondly, a set of "thematic-patient" scenarios focusing in chronic conditions was created. The aim of these scenarios was to foresee the frequency that an average chronic patient visits a pharmacy. This exercise will support the demand forecast for chronic care services that is required to optimize pharmaceutical services provision.

Pharmacists' workload and service provision

The use of time-and-motion studies in a community pharmacy setting has demonstrated its utility in past studies.[41–46] Time-and-motion technique uses an observer to record exactly how much time a subject spends in each task or activity.[42] In this study, the observer was a community pharmacy specialist trained in an initial pilot observation.The observer tended to stay in a discreet place by the counter, adjusting his presence to minimize intrusion, but was allowed to move and keep following the pharmacists if they were performing activities at the back office.

To accomplish the observation study a list of activities was developed. The initial list of activities was created by reviewing other community pharmacy work studies.[34,43,45] As the initial list was based in studies performed in the United Kingdom, the pilot study in two pharmacies assessed the validity and adequacy of the activities to the Portuguese context. Additionally, three other community pharmacists were interviewed to gain insights on more activities that may not be initially included. Afterward, the final list consisting of 15 different activities grouped in 3 broad categories was re-tested in the two pharmacies (Table 1).

Following the pilot study, six high street pharmacies within the metropolitan Lisbon region were contacted. Four were urban pharmacies, while two others were semi-urban pharmacies located in the outskirts of the capital city, where the transition to a rural setting is already observed. The pharmacies were chosen purposively through professional contacts of the research team. This choice was based on the perception that pharmacies' work routine is basically the same across the country. Four pharmacies agreed to participate, three of urban typology and one semi-urban. The study took place during an entire weekday 8 h shift with a 2 h lunch break, as it is customary in Portuguese pharmacies. The choice of the weekday was determined by pharmacies' managers, in order to perform the study with minimal disruption.

An Excel® spreadsheet was created with a structured scheme for coding observations, which comprised the activity performed, the place within the pharmacy where the activity occurred, whom executed it, how much time did it take, and the type of customer (if applicable, e.g. acute/chronic patient, regular/non-regular customer). Since some tasks may occur simultaneously (e.g. dispensing of medicines and provision of pharmaceutical counseling), multitasking recording was allowed. The focus of data collection was on the time spent by every pharmacist on any given activity. The quality of the performed activity was not assessed. Likewise, patient details were not registered. The time spent on counseling while dispensing was not considered, since this counseling is often mixed with non-counseling conversation. Interactions where clear counseling was not provided to the patient were assumed as interactions where just a small conversation took place, not related to the medicines being dispensed (i.e. customer relations).

Patients and customers interacting with pharmacy professionals were initially informed about the study and asked for consent. To assess customer regularity, it was considered that welcoming the patient by its name, before any other exchange, was a signal of customer loyalty. If

Table 1
Definitions, categories, and activities observed

Categories	Activities	Definition
Administrative tasks	Marketing and merchandising activities	Includes all customer relations activities, such as advertising a CRM program and recruiting new costumers
	Inventory and stock control	Includes stock maintenance of prescription medicines, OTC and non-medicinal products, as well as controlling medicines storing (e.g. expiration dates)
	Endorsing prescriptions and clerical health-related work	Includes the verification of prescriptions for formal aspects such as identity elements (patient, health system, physician) and preparing the prescriptions for factoring
	Managerial administration	Includes all clerical work such as dealing with correspondence and meetings with providers representatives, salespersons and vendors, to discuss new drugs or new products purchases
Dispensing tasks	Dispensing of medical devices	Includes the dispensing of bandages, Glucometers, thermometers, sphygmomanometer and medical accessories
	Dispensing of prescription medicines	Includes dispensing of prescribed medicines directly to the customer, performed through the following tasks: Receiving the prescription, interviewing the costumer, validating the prescription (including legal aspects and checking for prescribing errors or interactions between medicines), medicines collection, processing the prescription and collecting payment.
	Provision of medicines to homes	Includes home delivery of medicines and mass dispensing for nursing/residential homes or prisons.
	OTC dispensing	Includes the dispensing of OTC medicines and the sale of health-related products available in the pharmacy that are non-medicinal products e.g., moisturizers, perfumes, nappies, dental brushes, formula milk, etc.
Rest and pauses	Rest, waiting and personal times	Includes breaks between activities, for chatting with professionals and non-professionals, coffee breaks, and resting breaks where no other activity was recorded
Pharmaceutical services	Administration of non-injectable medicines	Includes administering other medicines to patients than parenteral (e.g. eye drops)
	Pharmaceutical counseling on medicines and health issues	Includes the provision of information and counseling about medicines and health issues that may or may not be associated with a dispense
	Provision of screening services	Includes monitoring of blood pressure, glucose, cholesterol, triglycerides, pregnancy and other tests
	Production and control of compounded drugs	Includes the production of compounded drugs for human or veterinary use
	Provision of advanced services	Includes the provision of first aid, pharmaceutical consultations, therapeutic reviews or other pharmaceutical care programs
	Provision of enhanced or other services	Includes the provision of smoking cessation program, directly observed therapy with methadone, nutritionist and other services that may be provided by outsourced professionals (nurses, nutritionists, podologists, external pharmacists)

this was not perceivable, the observer asked the professional afterward whether or not the person was a regular customer. Customer loyalty and patient retention are essential to build trust between patients and their health care providers, which is essential to a longitudinal provision of quality services.[47] Assessing customer regularity will help to establish the potential of longitudinal pharmacy services in the management of chronic patients.

The details of the purchased medicines, OTC products or pharmaceutical service provided, were obtained through the pharmacies' information system (IS). These records were used to inform the demand scenarios to be developed in the second stage of the study.

Pharmaceutical services demand

The aim of this stage of the study was to determine how often an average chronic patient visits the pharmacy to buy his/her medicines. In order to accomplish this, "thematic-patient" scenarios for chronic conditions similar to those most prevalent in Portugal were designed. This approach was necessary since keeping patient records is not a regular procedure across Portuguese pharmacies.

To develop these scenarios, several data sources were analyzed through a documental perspective. Firstly, the mean number of dispensed packages per sale for each therapeutic subgroup was determined using data collected from the pharmacies' IS on the day the observational study took place. Secondly, the Medicines Annual Report, published by INFARMED,[48] was analyzed to obtain the Top 100 of the most consumed medicines and the respective packages sizes. Thirdly, using data from the WHO Collaborating Centre for Drug Statistics Methodology website,[49] a defined daily dose (DDD) was obtained for each of the top 100 medicines. Afterward, INFARMED and WHO data were combined with the mean number of packages for each therapeutic subgroup from the pharmacies' IS, estimating the probable duration of the available medicines packages for a specific course of treatment. The result was a set of "thematic-patient" scenarios, with the expected annual frequency of visits to the pharmacy.

Data analysis and ethical considerations

All data analysis was conducted in MS Excel® and SPSS® (Software Package for Social Sciences; Version 20, IBM, Chicago, IL). Due to the explorative nature of this study, all the analysis was based on descriptive statistics.

This study was performed in strict accordance with the good research practices and code of ethics of *Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa*. The study protocol was approved by the Ethics Committee of the same institute (Permit Number: 7-2012-PN).

Results

Service provision analysis

An overall view of the participating pharmacies is presented in Table 2, comprising baseline information on pharmacies workforce, number of weekly hours of operation, estimated number of prescriptions for an average month and the average prescription volume per professional/hour (maximum weekly working hours is 40 per professional).

The total observation time and number of activities registered are presented in Table 3. In aggregate, a total of 108 h of working time were recorded. During this time, a total of 894 activities were observed, an average of 223 per pharmacy. During the observation day, professionals interacted on average with 40 customers, with 54% of the interactions occurring in the afternoon period (3 p.m. – 7 p.m.). Dispensing professionals (Pharmacists and pharmacy technicians) in pharmacy A had the highest workload in terms of prescriptions per hour, while pharmacy D the highest workload in OTC consultations per hour. These two pharmacies also had the highest number of regular customers.

As expected, the majority of the recorded activities were interactions between professionals and customers (Table 4). In pharmacies A and B, these interactions account for about 80% of the recorded activities, while in pharmacies C and D the pharmacist-patient interaction accounted for approximately 70% of the recorded activities. Between 77.8% and 85.6% of these interactions had some type of medicine dispensed. 54.3% of the interactions with medicines dispensed had 2 or less packages sold. It is worth highlighting

Table 2
Participating pharmacies' characteristics

Pharmacy	Location	Pharmacists + pharmacy technicians	Non-dispensing personnel	Number of weekly hours of operation	Prescriptions per week (estimation)	Estimated prescription volume/total hours worked
A	Urban	4	2	55	300	1.88
B	Urban	3 + 2	1	64	700	3.50
C	Urban	5	3	78	850	4.25
D	Semi-urban	3	2	58	420	3.50

Table 3
Observational study workload per hour

Pharmacy	Weekday	Activities	Total aggregated time (hh:mm:ss)	Regular customers (%)	Prescriptions per professional/hour	OTC consultations per professional/hour
A	Tuesday	220	21:14:21	96.7	5.19	1.06
B	Wednesday	259	31:32:11	59.7	3.91	0.87
C	Wednesday	201	31:18:02	68.0	2.45	0.53
D	Tuesday	212	24:19:49	87.8	5.04	1.13

that all pharmacies provided counseling in more than 60% of the OTC interactions. Chronic medicines dispensing, in the other hand, had less than 50% of interactions with pharmacists' counseling.

The provision of counseling without dispensing any product ranged from 10.5% to 15.7% of the interactions. The provision of screening services without any associated dispensing represented less than 10% of the interactions in all pharmacies. The most common screening service provided was blood pressure monitoring, followed by total cholesterol and capillary glycemia assessment. No provision of pharmaceutical care services was observed in these four pharmacies.

The mean distribution of daily time utilization by pharmacists is seen in Fig. 1. Interactions with patients account for half of pharmacists' registered time (158.44 min). The remaining half of the time was used in administrative tasks (32.7%–103.88 min) or was registered as rest time where no activity was recorded (17.3%–54.92 min).

Time spent in interactions with patients was mainly used for the dispensing of prescription medicines (29.9%–94.72 min), OTC dispensing (13.2%–41.81 min), answering patients' queries and counseling without any products dispensation (4.3%–13.53 min), and finally for screening services (2.6%–8.38 min). The average duration of pharmacist-patient interactions was 3.98 min (min: 10 s; max: 26.25 min; median: 3.10 min). Average durations for the different types of interaction are presented in Table 5.

As for the time used in administrative tasks, it was found that the activity "Endorsing prescriptions and clerical health-related work" accounts for 57.8% of this time, followed by "Inventory and stock control" with 38.8%. These tasks are performed through the day, with no relevant differences between morning and afternoon. As for the rest time, it was calculated by adding unregistered times during the day (not including lunch or coffee breaks): 50% of these brakes had less than 50 s in duration, 39% had between 1 and 5 min and 11% had between 5 and 30 min.

Pharmaceutical services demand scenarios

After analyzing the sales details of each pharmacy for the observation day, it was found that the most demanded therapeutic subgroup was the Antihypertensives (in 14.0% of interactions), followed by Analgesics (12.5%) and Nonsteroidal Anti-inflammatory Drugs (11.1%) (Fig. 2). On the other hand, in spite of only being demanded in 3.1% of interactions, the dispensing of medicines used in diabetes was characterized by a high number of packages sold per interaction (2.1 on average). Adding this to previously collected information regarding national consumption and DDD for the relevant medicines, seven scenarios

Table 4
Patient interactions and activities performed (number and % of total activities)

Pharmacy	Recorded activities involving patient/professional interaction	Interactions with medicine dispensing	Interactions with counseling	Interactions where only counseling was given[a]	Interactions where a OTC was dispensed[a]	Interactions where a screening service was provided[a]
A	180 (81.8%)	140 (77.8%)	93 (51.7%)	26 (15.7%)	25 (13.9%)	17 (9.4%)
B	209 (80.7%)	170 (81.3%)	117 (56.0%)	31 (15.4%)	25 (12.0%)	10 (4.8%)
C	139 (69.2%)	119 (85.6%)	80 (57.6%)	14 (10.5%)	14 (10.1%)	5 (3.6%)
D	142 (67.0%)	121 (85.2%)	77 (54.6%)	15 (11.0%)	15 (10.6%)	3 (2.1%)

[a] Without dispensing of prescription medicines associated.

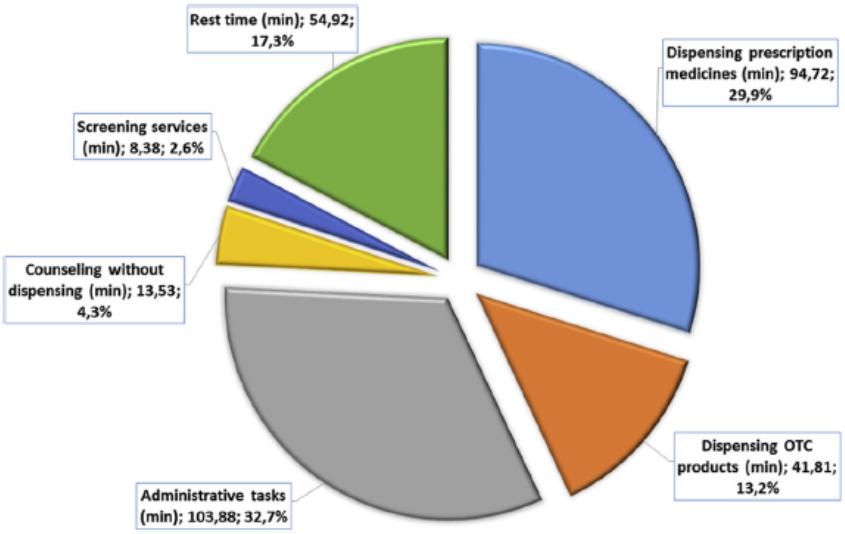


Fig. 1. Average distribution of time per activity performed per pharmacist.

for the most significant chronic conditions were defined (Table 6).

Taking an example from Table 6, the average hypertensive patient (without other complications, associated diseases or other pharmacy services requirements), can be expected to visit a pharmacy to refill his/her prescriptions about every 42 days. This would translate to around 8 or 9 visits per year. Other examples, such as patients with diabetes type II in monotherapy, can have longer intervals between visits i.e. 86 days or 4–5 visits per year.

Discussion

Pharmacists' workload

Study results have characterized community pharmacist's workload, work patterns and estimated demand for chronic medicines, providing a picture of a workday in these pharmacies.

Pharmacist's work pattern in this study was characterized by an 8-h working day, with a 2 h lunch break plus a 30 min break for a small meal, many times outside the pharmacy. During the day, a continuous succession of activities is

Table 5
Average duration of professional activities and services

Activities	Pharmacy				Average times
	A (hh:mm:ss)	B (hh:mm:ss)	C (hh:mm:ss)	D (hh:mm:ss)	
Medicine dispensing	00:04:19 [95% CI: 00:03:28 –00:05:10]	00:05:27 [95% CI: 00:04:34 –00:06:19]	00:05:13 [95% CI: 00:03:47 –00:06:38]	00:04:16 [95% CI: 00:02:56 –00:05:35]	00:04:52 [95% CI: 00:04:20 –00:05:23]
OTC medicine dispensed	00:02:20 [95% CI: 00:01:39 –00:03:00]	00:02:22 [95% CI: 00:01:55 –00:02:48]	00:05:50 [95% CI: 00:02:25 –00:09:14]	00:04:02 [95% CI: 00:02:36 –00:05:29]	00:03:17 [95% CI: 00:02:34 –00:03:59]
Counseling w/out dispensing	00:02:45 [95% CI: 00:01:49 –00:03:41]	00:02:19 [95% CI: 00:01:30 –00:03:08]	00:02:50 [95% CI: 00:01:21 –00:04:18]	00:02:30 [95% CI: 00:01:24 –00:03:36]	00:02:34 [95% CI: 00:02:05 –00:03:03]
Health screening services	00:04:26 [95% CI: 00:02:20 –00:06:36]	00:04:03 [95% CI: 00:02:26 –00:05:40]	00:06:25 [95% CI: 00:00:26 –00:12:23]	–	00:04:09 [95% CI: 00:03:19 –00:04:59]

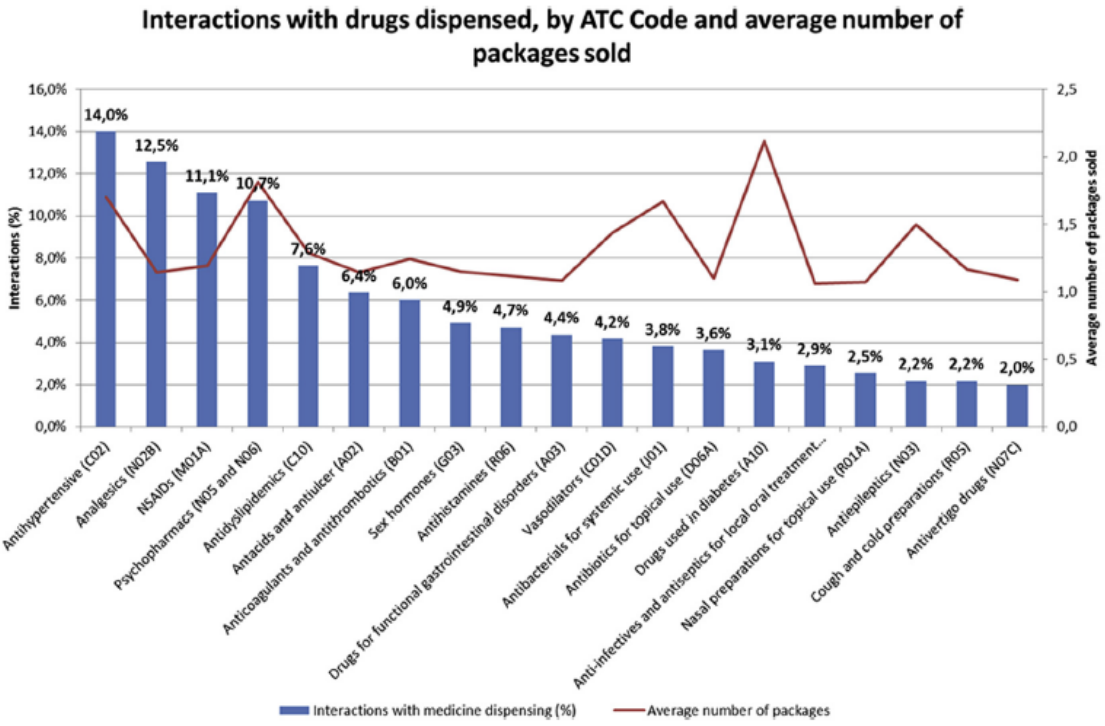


Fig. 2. Average number of dispensed packages by therapeutic subgroup.

interspaced with small breaks (less than a minute) especially when pharmacists were at the counter. Pharmacists used half of their day attending customers and the rest of the day was used for taking care of undifferentiated tasks, essential to the pharmacies activity. In this study, the amount of time dedicated to administrative tasks may be over represented due to the observational study being performed in the beginning of the month, when factoring of prescriptions to the NHS and other payers takes place. Also, the higher workload in terms of prescriptions per hour in pharmacy A and D may be due to the large proportion of regular customers in settings of low to middle incomes. These customers may choose to acquire their medicines early in the month according to the management of a small domestic budget.

Considering the whole set of results on the supply side of the study, from the distribution of time per activity to the mean number of events per hour, it is apparent that community pharmacy practice in Portugal is aligned with findings from different studies made in the UK and elsewhere,[29,30,50] which may be a sign of homogeneity of community pharmacist activity across countries. Interactions with patients, in activities that can be deemed as "professional services," accounts for approximately half of pharmacists' daily time. As expected, the dispensing of prescription medicines still is the most significant service provided, accounting for 29.9% of pharmacists' time. This is in line with recent literature,[45,51] and confirms the high pressure on traditional "product-centered" and supply roles of the pharmacy staff.

Regarding counseling, this study found that about half of overall dispensing activities had some form of counseling. This is also in line with the literature,[44] and is a good sign of drug use information competencies. More advice was given for OTC drugs than prescription medicines, likewise reported in other studies.[45] This may stem from the fact that chronic patients, who usually constitute the higher percentage of customers, are acquainted with their medication, thus not demanding information in every visit. Usually, varying information needs are rooted primarily in background characteristics, such as the level of education or health literacy.[52] However, it is noteworthy to mention that in a setting of expected greater literacy, as the one where pharmacy C is, more advice was registered on all patient

Table 6
"Thematic-patient" scenarios

Scenario #	Description	Therapeutic subgroup and average number of packages dispensed in the observational study		Average interval between visits (min–max)
I	Hypertensive patient without complications	Antihypertensive	1.7	42.5 days (14.5–70.5)
II	Hypertensive patient, cardiovascular polytherapy	Antihypertensive	1.7	42.2 days (13.7–70.7)
		Antidyslipidemic	1.3	
III	Type I diabetic patient, monotherapy	Insulin	2.1	59.6 days (39.7–79.5)
IV	Diabetic patient type II monotherapy	Antidiabetic	2.1	86.1 days (32.0–140.1)
V	Patient with metabolic syndrome	Antidiabetic	2.1	56.8 days (19.8–93.8)
		Antihypertensive	1.7	
		Antidyslipidemic	1.3	
VI	Patient with metabolic syndrome, initial rheumatic pain	Antidiabetic	2.1	51.0 days (17.4–84.5)
		Antihypertensive	1.7	
		Antidyslipidemic	1.3	
		Antirheumatic	1.2	
		Antiulcer	1.1	
VII	Patient with metabolic syndrome, rheumatic pain, anti-coagulated, peripheral neuropathy and insomnia	Antidiabetic	2.1	70.6 days (15.5–125.7)
		Antihypertensive	1.7	
		Antidyslipidemic	1.3	
		Antirheumatic	1.2	
		Antiulcer	1.1	
		Anticoagulant	1.2	
		Anti-insomnia and antianxiety	1.8	
		Peripheral neuropathy	1.5	
		Vasodilator	1.4	

interactions. It seems the internal organization and operation of these pharmacies is reactive to their population characteristics, instead of being proactive, as a function of recognized patients' health needs. This has been suggested by previous studies, where the likelihood of a patient receiving counseling was not related to staffing levels or pharmacist workload, but to public perceptions and practice habits of pharmacists.[44,53,54] Furthermore, it is worth to highlight the time spent in counseling patients without any product delivery, a relevant daily activity. In Portugal, this service is free of charge and represents a "no cost" service that should be better advertised to customers.[46] In a recent study,[55] it was found that a growing number of patients look for pharmacists' consultations before they decide to visit an emergency department. This service demand may be a stepping-stone in the development of a strategy to promote pharmaceutical care services' demand by patients and customers.[56]

Although three pharmacies were licensed to provide pharmaceutical care services, it was not registered any structured medication management, pharmaceutical consultations or other disease management services during the observation period, nor have these pharmacies reported any provision of such services in the previous weeks. The reasons behind this situation are very similar to those already described in the literature, such as the lack of time, lack of financial incentive and the lack of support by a professional organization.[27,30,57] However, the lack of time that has been stated as one main reason for the under provision of these services,[30,58] must be called into question. Other studies also found that pharmacists have free time while reporting otherwise.[29,37] Community pharmacists appear to have a perception gap about the time they are idle. One explanatory hypothesis is the high percentage of time spent doing non-specialized chores and administrative tasks that should be performed by other pharmacy staff. On the other hand, a mean 54.9 min of available time per pharmacist was found distributed along a normal workday. This sum, representing almost 1 h in a routine 8 h

workday, should be interpreted with caution. Even considering that the large majority of the rest time is spent in "micro pauses" between two activities, with less than 5 min, the remaining time is enough to fit at least a daily 15 min standard pharmaceutical care consultation. This finding constitutes evidence of the need for internal functioning reorganization in community pharmacies, with clearer roles for each professional, leading them to a better use of time. Examples from nursing have shown that the introduction of advanced roles has implied a reorganization of services with clear benefits for the professionals and the remaining health care actors.[59] The use of system science methods based on Design and Engineering Methodology for Organizations,[60] can also be used in the pharmacy context to redesign and simplify processes, freeing up more time.

Pharmaceutical services' potential demand

Potential demand for pharmaceutical services is generally accepted to be grounded on the dispensing of prescriptions and OTC medicines.[13,53] From the analysis of the "thematic-patient" scenarios, it was found that a chronic patient might take at least 40 days between two consecutive visits to the pharmacy. In this study, a pharmacist-patient interaction was approximately 4 min long, a finding that resembles other from a recent Portuguese study.[37] Assuming this 4 min duration as the most common, and if no other medication management service or pharmaceutical care opportunities exists, patient follow-up would be almost impossible, even in settings of high customer regularity.

Although the advantages of pharmaceutical care and therapeutic management programs are well established for patients,[8,61] the success of these initiatives has been moderate. Patients often refer out-of-pocket costs and lack of time for pharmacy visits as barriers to participation in pharmaceutical care and therapy management programs.[62,63] To overcome the perceived lack of time on both ends of the service continuum, the development of web-based pharmaceutical services is a possible solution, since it has the potential to reduce unnecessary pharmacy visits.[27,64–66] The development of new channels would also allow an enhancement of the service offering through improved communication, while setting the foundations for new health promotion services to arise.[67] Along with the role of e-prescription, now already a reality in some parts of the country, using the Internet to provide pharmaceutical services can have an impact in pharmacists' workload, pharmacy services' provision, customer satisfaction and ultimately in achieving a competitive advantage for community pharmacy over other health services.[66,68]

In the context of the patient-centered paradigm, PHC reform, and the chronic care model,[68,69] pharmacists should use their position as the medicines supplier to increase provision of patient follow-up services.[50,70] The provision of pharmaceutical care services is a concept that remains relatively unknown.[5] Pharmacies with high customer regularity should use this opportunity to present new services, contributing to increase awareness of their existence aiming to improve their demand. Patients will need better exposure to these concepts and to the new pharmacists' roles in order to correctly perceive and assign value to this type of pharmacist-patient care practice.[62] Pharmacists, on the other hand, need to develop their communication techniques and soft skills.[71] Besides that, management methodologies can provide an additional understanding of the dynamics of an organization to better align the design of new pharmacy services with operations.[46,72,73]

Limitations

This was an exploratory study involving four pharmacies to elicit potential barriers and opportunities to improve pharmaceutical services provision. It can be argued that to improve evidence strength, a larger number of pharmacies needed to be included. In addition, having more days of observation at each site would have resulted in larger data sets for activity assessment. The decision to use a scheduled instead of a randomly assigned weekday, supported by a thin-slicing approach, was made due to the difficulties in having the pharmacies participating otherwise. Since the focus of the study was not only on workload but also on the general activities performed, the authors do not consider that more observation time would necessarily reflect different time distributions.

Time-and-motion observers shadowing workers are much more obvious and are more likely to disrupt the normal routine, leading workers to change their behavior upon being observed. To avoid this difficulty, the observer was instructed to stay in a place where he could observe all the staff, without being too noticeable. Nevertheless, the implication of this possible bias is that the times here presented may represent

maximum times when it refers to service provision, or minimum times when considering free time.

The use of "thematic-patient" scenarios may not be the most precise way to assess pharmacy visits' frequency. It would be better to access patient records, but these are not commonly used and were not used in the studied pharmacies. Additionally, although dispensing prescription medicines in single dose was recently allowed, the vast majority of medicines are still dispensed in the original packages. Thus, using scenarios that combine medicine consumption, medicines packages sizes and sales data was considered a good proxy for foreseeing pharmacy visits.

Conclusion

In this study, it was clear that the dispensing of medicines still is the most time-consuming activity in a Portuguese community pharmacy. The assessment of a single day workload showed that pharmacists spend half of their day interacting with customers and patients, confirming the importance and potential of more specialized communication in the context of primary healthcare and chronic patient follow-up. The similarity with findings from other settings, in spite of different legal and practice environments, points to the development of common policies and practice frameworks that can bring a renewed importance to the profession, especially in the European Union. The study also provided insights on the reasons why new pharmacists' roles have not yet developed. With additional research, there is room for improvement in internal organization and better roles definition within the pharmacy. Also, the limited amount of time with a patient is insufficient to provide a proper follow-up service, which calls for the opportunity to introduce innovative patient management services, supported by new and adequate information systems.

Moreover, the quality of the provided pharmaceutical services during the pharmacist-patient interactions should be assessed. Additional research on these subjects will greatly improve the knowledge on Portuguese community pharmacists work patterns and pharmaceutical services' provision.

Acknowledgment

The authors would like to acknowledge the participant pharmacies for having allowed the observational study to take place.

References

1. Sacco R, Smith S, Holmes D, et al. Accelerating progress on non-communicable diseases. *Lancet* 2013;382(9895):e4–e5. Available at: http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(11)61477-3/abstract.
2. WHO. *World Health Report – Primary Health Care: Now More Than Ever*. Geneve; 2008.
3. Kennie-Kaulbach N, Farrell B, Ward N, et al. Pharmacist provision of primary health care: a modified Delphi validation of pharmacists' competencies. *BMC Fam Pract* 2012;13:27.
4. Hepler C, Strand L. Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm* 1990;47:533–543.
5. Berenguer B, La Casa C, de la Matta MJ, Martín-Calero MJ. Pharmaceutical care: past, present and future. *Curr Pharm Des* 2004;10(31):3931–3946. Available at: http://www.ncbi.nlm.nih.gov/pubmed/15579081.
6. Rupp MT, De Almentero DR, Dion P. Value of community pharmacists' interventions to correct prescribing errors. *Ann Pharmacother* 1992;26:1580–1584.
7. Knapp KK, Katzman H, Hambright JS, Albrant DH. Community pharmacist interventions in a capitated pharmacy benefit contract. *Am J Health Syst Pharm* 1998;55:1141–1145.
8. 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* 2003;43:173–184. Available at: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=1268843512688435.
9. Duarte A, Nunes F, Martins L. *Social Responsibility in the Community Pharmacy Sector in Portugal*. Lisboa; 2007.
10. Marques F, Rodrigues A, Ferreira P, Raposo V. *Estudo do sector das farmácias em Portugal*. Coimbra: Relatório final; 2006.
11. Chisholm-Burns MA, Graff Zivin JS, Lee JK, et al. Economic effects of pharmacists on health outcomes in the United States: a systematic review. *Am J Health Syst Pharm* 2010;67:1624–1634.
12. Hassell K, Rogers A, Noyce P. Community pharmacy as a primary health and self-care resource: a framework for understanding pharmacy utilization. *Health Soc Care Community* 2000;8:40–49.
13. Odukoya OK, Chui MA, Pu J. Factors influencing quality of patient interaction at community pharmacy drive-through and walk-in counselling areas. *Int J Pharm Pract* 2014;22:246–256.
14. 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 (2003)* 2006;46:348–355. Available at: http://www.ncbi.nlm.nih.gov/pubmed/16739756.

15. Van Mil JW, Frokjær B, Tromp DF. Changing a profession, influencing community pharmacy. *Pharm World Sci* 2004;26:129–132.
16. Zellmer WA. Pharmacy's future: transformation, diffusion, and imagination. *Am J Heal Pharm* 2010;67:1199–1204.
17. Gregorio J, Cavaco A, Lapao LV. A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal. *Hum Resour Health* 13 Oct, 2014;12. Available at: http://human-resources-health.biomedcentral.com/articles/10.1186/1478-4491-12-58.
18. Ministry of Health. *Decree-Law no. 19/2014-Amendments to the Legal Framework of Reimbursements of Medicinal Products and to the Regime of Medicinal Products Price*. Lisboa; 2014.
19. Portuguese Pharmaceutical Society. *The Young Pharmacists – Characterization of Portuguese Pharmacists*; 2012.
20. INFARMED. *Medicine Statistics 2014*. Lisboa; 2014. Available at: http://www.infarmed.pt/portal/page/portal/INFARMED/MONITORIZACAO_DO_MERCADO/OBSERVATORIO/ESTATISTICA_DO_MEDICAMENTO/Estat_Medic_2014_final_13112015.pdf.
21. Hawthorne N, Anderson C. The global pharmacy workforce: a systematic review of the literature. *Hum Resour Health* 2009;7:48. Available at: http://www.human-resources-health.com/content/7/1/48.
22. Cavaco AMN, Bates IP. Gauging Portuguese community pharmacy users' perceptions. *Prim Health Care Res Dev* 2007;8(04):315–325.
23. Costa S, Santos C, Silveira J. Community pharmacy services in Portugal. *Ann Pharmacother* 2006;40(12):2228–2234. Available at: http://www.ncbi.nlm.nih.gov/pubmed/17148652. Accessed 05.02.13.
24. INFARMED. *Farmácias com farmacêuticos tecnicamente habilitados a efectuar o seguimento dos doentes nos moldes previstos no Nível II de intervenção do Protocolo de Colaboração da Diabetes Mellitus e Número de doentes por farmácia*; 2009. Available at: http://www.infarmed.pt/portal/page/portal/. Accessed 26.06.11.
25. Barros PP, Martins B, Moura A. *Evolução do sector das farmácias – revisitar o estudo "A situação concorrencial no sector das farmácias" de 2005*. Lisboa; 2012.
26. Hassell K, Seston EM, Schafheutle EI, Wagner A, Eden M. Workload in community pharmacies in the UK and its impact on patient safety and pharmacists' well-being: a review of the evidence. *Health Soc Care Community* 2011;19:561–575.
27. Gregorio J, Pizarro A, Cavaco A, et al. Online pharmaceutical care provision: full-implementation of an eHealth service using design science research. *Stud Health Technol Inf* 2015;210:261–265.
28. Jex SM. *Stress and Job Performance: Theory, Research, and Implications for Managerial Practice. Advanced Topics in Organizational Behavior*. xiv; 1998. p. 129. Available at:, http://www.openisbn.com/isbn/9780761909248/.
29. Lea VM, Corlett SA, Rodgers RM. Workload and its impact on community pharmacists' job satisfaction and stress: a review of the literature. *Int J Pharm Pract* 2012;20(4):259–271. Available at: http://www.ncbi.nlm.nih.gov/pubmed/22775522. Accessed 19.11.15.
30. 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;31:32–39.
31. Latif A, Boardman H. Community pharmacists' attitudes towards medicines use reviews and factors affecting the numbers performed. *Pharm World Sci* 2008;30:536–543.
32. Plake KS, Chesnut RJ, Odorzynski M. Barriers to community pharmacists' provision of diabetes care services in Iowa. *J Pharm Technol* 2007;23:327–338. Available at: http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=emed8&AN=2007594740.
33. Bell HM, McElnay JC, Hughes CM. A self-reported work sampling study in community pharmacy practice. *Pharm World Sci* 1999;21:210–216.
34. McCann L, Hughes CM, Adair CG. A self-reported work-sampling study in community pharmacy practice: a 2009 update. *Pharm World Sci* 2010;32:536–543. Available at: http://ovidsp.ovid.com/athens/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=emed9&AN=2010487218.
35. Alkhateeb FM, Attarabeen O, Latif D, Deliere R. Workload perceptions of Pharmacists: Part of changing a national trend. *Soc Pharm J* 2015;1:e104. Available at: http://socialpharmacyjournal.com/en/articles/104.html.
36. Kooy MJ, Dessing WS, Kroodsma EF, et al. Frequency, nature and determinants of pharmaceutical consultations provided in private by Dutch community pharmacists. *Pharm World Sci* 2007;29:81–89.
37. Cavaco AM, Krookas AA. Community pharmacies automation: any impact on counselling duration and job satisfaction? *Int J Clin Pharmacol* 2014;36:325–335.
38. Suter E, Oelke ND, Adair CE, Armitage GD. Ten key principles for successful health systems integration. *Healthc Q* 2009;13. Spec No:16–23.
39. Ensor T, Cooper S. Overcoming barriers to health service access: influencing the demand side. *Health Policy Plan* 2004;19:69–79.
40. Gladwell M. *Blink – The Power of Thinking Without Thinking*. 1st ed. New York: Little, Brown and Company; 2005.
41. Rutter P, Brown D, Jones I. Pharmacy research: the place of work measurement. *J Pharm Pract* 1998;6(1):46–58. Available at: http://doi.wiley.com/10.1111/j.2042-7174.1998.tb00915.x. Accessed 05.02.13.

42. Finkler SA, Knickman JR, Hendrickson G, Lipkin M, Thompson WG. A comparison of work-sampling and time-and-motion techniques for studies in health services research. *Health Serv Res* 1993;28:577–597.
43. Fisher C, Corrigan O, Henman M. A study of community pharmacy practice: 2. Prescription dispensing. *J Soc Adm Pharm* 1991;8(2):65–68.
44. Angelo LB, Christensen DB, Ferreri SP. Impact of community pharmacy automation on workflow, workload, and patient interaction. *J Am Pharm Assoc* 2005;45:138–144.
45. Davies JE, Barber N, Taylor D. What do community pharmacists do?: results from a work sampling study in London. *Int J Pharm Pract* 2014;22:309–318.
46. Gregório J, Russo G, Lapão LV. Pharmaceutical services cost analysis using time-driven activity-based costing: a contribution to improve community pharmacies' management. *Res Soc Adm Pharm*; 2015, http://dx.doi.org/10.1016/j.sapharm.2015.08.004.
47. Corbin CL, Kelley SW, Schwartz RW. Concepts in service marketing for healthcare professionals. *Am J Surg* 2001;181:1–7.
48. INFARMED. *Medicine Statistics 2009*. Lisbon; 2010.
49. Norwegian Institute of Public Health. *WHO Collaborating Centre for Drug Statistics Methodology*; 2014. Available at: http://www.whocc.no/. Accessed 23.07.14.
50. Mossialos E, Courtin E, Naci H, et al. From "retailers" to health care providers: transforming the role of community pharmacists in chronic disease management. *Health Policy (New York)* 2015;119:628–639. Available at: http://www.scopus.com/inward/record.url?eid=2-s2.0-84933675464&partnerID=40&md5=cc029df245c7319ba2a3b65ff0425667.
51. Bond C, Blenkinsopp A, Inch J, Celino G, Gray N. *The Effect of the New Community Pharmacy Contract on the Community Pharmacy Workforce*. London; 2008. Available at: http://www.pharmacyresearchuk.org/waterway/wp-content/uploads/2012/11/The_effect_of_the_new_community_pharmacy_contract_on_the_community_pharmacy_workforce.pdf.
52. Santana P. Poverty, social exclusion and health in Portugal. *Soc Sci Med* 2002;55:33–45.
53. Cavaco AM, Dias JP, Bates IP. Consumers' perceptions of community pharmacy in Portugal: a qualitative exploratory study. *Pharm World Sci* 2005;27(1):54–60. Available at: http://www.ncbi.nlm.nih.gov/pubmed/15861936.
54. Schommer JC, Wiederholt JB. Pharmacists' perceptions of patients' needs for counseling. *Am J Hosp Pharm* 1994;51:478–485.
55. Barros P, Lourenço A, Moura A, et al. *Políticas Públicas na Saúde 2011 e 2015-Avaliação do Impacto*. Lisboa; 2015.
56. Kaae S, Traulsen JM, Nørgaard LS. Challenges to counseling customers at the pharmacy counter-Why do they exist? *Res Soc Adm Pharm* 2012;8:253–257.
57. Guerreiro M, Cantrill J, Martins P. Acceptability of community pharmaceutical care in Portugal: a qualitative study. *J Health Serv Res Policy* 2010;15:215–222. Available at: http://www.ncbi.nlm.nih.gov/pubmed/20466750.
58. Mil JWF, Boer WO, Tromp TFJ. European barriers to the implementation of pharmaceutical care. *Int J Pharm Pract* 2001;9:163–168. Available at: http://doi.wiley.com/10.1111/j.2042-7174.2001.tb01044.x.
59. Buchan J, Temido M, Fronteira I, Lapão L, Dussault G. Nurses in advanced roles: a review of acceptability in Portugal. Spec No:38–46. *Rev Lat Am Enfermagem* 2013;21. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23459889.
60. Dias DG, Lapão LV, Da Silva MM. Using enterprise ontology for improving emergency management in hospitals. *Stud Health Technol Inform* 2012;180:58–62.
61. Machado M, Bajcar J, Guzzo GC, Einarson TR. Sensitivity of patient outcomes to pharmacist interventions. Part II: systematic review and meta-analysis in hypertension management. *Ann Pharmacother* 2007;41:1770–1781.
62. Garcia GM, Snyder ME, McGrath SH, Smith RB, McGivney MS. Generating demand for pharmacist-provided medication therapy management: identifying patient-preferred marketing strategies. *J Am Pharm Assoc (2003)* 2013;49:611–616. Available at: http://www.ncbi.nlm.nih.gov/pubmed/19748867.
63. Gastelurrutia MA, Gil De San Vicente O, Erauncetamurgil O, Odriozola I, Fernandez-Llimós F. Customers' expectations and satisfaction with a pharmacy not providing advanced cognitive services. *Pharm World Sci* 2006;28:374–376.
64. Kreps GL, Neuhauser L. New directions in eHealth communication: opportunities and challenges. *Patient Educ Couns* 2010;78:329–336.
65. Calabretto JP, Warren J. Initial assessment of an Internet-based medication record. *J Pharm Pract Res* 2005;35:99–102.
66. Calabretto J, Warren J, Darzanos K, Fry B. *Building Common Ground for Communication Between Patients and Community Pharmacists With an Internet Medicine Cabinet*; 2002. p. 1–8.
67. Kreps GL. Achieving the promise of digital health information systems. *J Public Health Res* 2014;3(3). Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4274501/.
68. Bienkowska-Gibbs T, King S, Saunders C, Henham M-L. *New Organisational Models of Primary Care to Meet the Future Needs of the NHS: A Brief Overview of Recent Reports*. Cambridge; 2015.
69. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic

illness: the chronic care model, Part 2. *JAMA* 2002; 288:1909–1914.
70. Whitty JA, Kendall E, Sav A, et al. Preferences for the delivery of community pharmacy services to help manage chronic conditions. *Res Soc Adm Pharm* 2015;11:197–215.
71. Antunes LP, Gomes JJ, Cavaco AM. How pharmacist-patient communication determines pharmacy loyalty? Modeling relevant factors. *Res Soc Adm Pharm* 2015;11:560–570.
72. Veiga P, Lapão LV, Cavaco AM, Guerreiro MP. Quality supply of nonprescription medicines in Portuguese community pharmacy: an exploratory case study. *Res Soc Adm Pharm* 2015;11:880–890.
73. Gomes P, Lapão LV. The SIGLIC system for improving the access to surgery in Portugal. *Electron J Inf Syst Eval* 2011;14:160–166. Available at: http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=buh&AN=65267830&site=ehost-live.

2.3. PAPER III

GREGÓRIO, João; RUSSO, Giuliano; LAPÃO, Luís Velez. *Pharmaceutical services cost analysis using time-driven activity-based costing: A contribution to improve community pharmacies' management*. Research in Social and Administrative Pharmacy, 2016, 12.3: 475-485. DOI:10.1016/j.sapharm.2015.08.004

Available online at www.sciencedirect.com
ScienceDirect
Research in Social and Administrative Pharmacy 12 (2016) 475–485
RESEARCH IN SOCIAL & ADMINISTRATIVE PHARMACY

Original Research

Pharmaceutical services cost analysis using time-driven activity-based costing: A contribution to improve community pharmacies' management

João Gregório, Pharm.D., M.P.H.*, Giuliano Russo, Dr.P.H.[1], Luís Velez Lapão, M.Sc., Ph.D.[1]

Global Health and Tropical Medicine, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira, no 100, 1349-008 Lisboa, Portugal

Abstract

Background: The current financial crisis is pressing health systems to reduce costs while looking to improve service standards. In this context, the necessity to optimize health care systems management has become an imperative. However, little research has been conducted on health care and pharmaceutical services cost management.
Aim: Pharmaceutical services optimization requires a comprehensive understanding of resources usage and its costs. This study explores the development of a time-driven activity-based costing (TDABC) model, with the objective of calculating the cost of pharmaceutical services to help inform policy-making.
Methods: Pharmaceutical services supply patterns were studied in three pharmacies during a weekday through an observational study. Details of each activity's execution were recorded, including time spent per activity performed by pharmacists. Data on pharmacy costs was obtained through pharmacies' accounting records.
Results: The calculated cost of a dispensing service in these pharmacies ranged from €3.16 to €4.29. The cost of a counseling service when no medicine was supplied ranged from €1.24 to €1.46. The cost of health screening services ranged from €2.86 to €4.55.
Conclusion: The presented TDABC model gives us new insights on management and costs of community pharmacies. This study shows the importance of cost analysis for health care services, specifically on pharmaceutical services, in order to better inform pharmacies' management and the elaboration of pharmaceutical policies.

Keywords: Pharmacy management; Time-driven activity-based costing; Pharmaceutical services; Community pharmacy

Introduction

An aging population and an increasing prevalence of chronic diseases in OECD countries, with the associated rising costs of care, have long been considered the main threat to the sustainability of global health systems.[1] The economic crisis affecting some OECD countries became another driver pressing health systems to ration expenditures while

[1] Tel.: +351 213 652 600.
* Corresponding author. Tel.: +351 213 652 600.
E-mail address: jpgregorio@ihmt.unl.pt (J. Gregório).

1551-7411/$ - see front matter © 2016 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.sapharm.2015.08.004

preserving quality and access to health care services.[2] These factors are inspiring political decisions to implement health system reforms, de-regulation and pro-competitive policies across health systems worldwide.[3–5]

To deal with these challenges, health system reforms have placed a greater emphasis on primary health care coverage, supported by multidisciplinary teams.[6] Most successful multidisciplinary chronic illness interventions include more significant roles for non-physicians, with studies showing that non-physician health professionals, such as community pharmacists, may be critical components of effective chronic disease care.[7–9] Community pharmacists are significantly contributing to primary health care by fulfilling an increasing range of roles and responsibilities.[10,11] These new roles stem from the origination of the concept of pharmaceutical care[12] over two decades ago. After this initial work, the profession developed numerous new services. These include services such as counseling about medicines and minor ailments, public education to promote public health, medication use review services, disease management services, immunization services, and several activities related to chronic diseases screening such as blood pressure, cholesterol, glycemia and lung capacity monitoring.[13,14]

Community pharmacies in Portugal have followed this general trend, with the provision of pharmaceutical care services supported and advocated by the country's main professional organizations.[14] However, a number of regulatory changes to the community pharmacy market were introduced in 2005, beginning with the extension of sales of over-the-counter (OTC) medicines to general shops beyond pharmacies, to the loss of pharmacists' exclusivity of propriety, and the possibility of a single proprietor to own a maximum number of 4 pharmacies.[15] These regulatory changes also expanded the provision of services to be offered by pharmacies, such as home care support, first aid, medicines administration, immunization (particularly for influenza flu shots), clinical analysis and therapeutic services. This new pro-competition market in which Portuguese community pharmacies presently operate, has brought a new necessity to gain a deeper understanding of costs for these new services, to gauge their potential impact on pharmacies' management.

One issue keeping policy makers from tapping into the potential of community pharmacists' interventions is the clear understanding of their cost-effectiveness.[16] Although some studies point to the cost-effectiveness of pharmaceutical care programs and Pharmacy-based minor ailment schemes,[8,17] it is often mentioned that more research to determine the accurate costs of pharmaceutical services is needed,[17,18] to prevent inappropriate payment incentives, and to accomplish proper pharmacy services research.[19] Notwithstanding, there is a scarcity of costing studies for most types of pharmaceutical services. Some published studies on the profitability of pharmacy services tend to focus on single specific services over a limited period of time.[20,21] In a recent review of pharmacy-based minor ailment schemes' cost-effectiveness,[17] it was found that the majority of the published studies employed a classical top-down approach, sometimes apportioning consultation fees, medicine and administrative costs indiscriminately the cost computations, or had a less than straightforward method of cost calculation. In the case of Portugal, costing studies have focused predominantly on the financial sustainability of the pharmacy business. Recent local studies have drawn the attention on the decreasing average price of prescriptions as a measure of pharmacies' sustainability.[22,23] Therefore, this makes it difficult to draw wide-ranging conclusions on the impact of pharmaceutical services on pharmacy management and other health care resources, as well as on their cost-effectiveness.[24]

To better assess the management implications of pharmaceutical services provision in community pharmacies, there is a need to accurately measure costs through real-world evidence instead of assumptions and self-reported data. Considering that evidence is required to justify pharmacists' activities, the associated costs and assist community pharmacy management,[25] the aim of this work is to explore the development of a time-driven activity-based costing (TDABC) model for pharmaceutical services, with the objective of calculating services' costs, using a bottom-up approach. Accomplishing this objective will help to inform pharmacy managers, pharmacy professional organizations and policy makers about the costs of pharmaceutical services and their cost-effectiveness. Although this approach has been tried in outpatient clinics,[26] this is new to community pharmacy services' costing in Portugal or elsewhere. In the study by Demeere et al,[26] the use of TDABC provided precise values of the costs of different consultations within five different departments, showing the influence of the specificity of the consultation or the usage of activities and

machinery. With this information, managers could design a set of recommendations to improve the business, from centralized clerical assistance, to voice recognition systems. It is therefore expected that the development of such a model for pharmaceutical services costing could provide community pharmacy's managers worldwide with information necessary to redesign activities to achieve a more cost-effective provision of these services.

Methods

Within a health care context, approaches to estimating costs have been broadly categorized mainly into top-down and bottom-up categories. Top-down approaches use relative value units (RVUs), such as hospital days or some other metric to apportion the total costs for a health care system to individual services.[19] Bottom-up approaches such as activity-based costing (ABC), quantify the amount of each resource that is used to produce an individual health care service and apportion costs accordingly to generate aggregate costs for a health care system.[19] In spite of its advantages, it has been difficult for many organizations to implement ABC models for a number of reasons, ranging from the high costs of acquiring the necessary data to construct and update the ABC model, to the use of subjective and time allocation techniques that are costly to validate.[27] To overcome these complications, Kaplan and Anderson developed the time-driven activity-based costing (TDABC) approach, building on ABC concepts. Straightforwardness of implementation is TDABC's main advantage, as it requires estimates of only two parameters: (1) the unit cost of supplying capacity, and (2) the time required to perform transactions and activities.[28] It is important to note that this required estimate is not the total input time for each activity, but only the time spent doing one unit of the activity. The specific advantage of this method is that having measured the time consumed by the different activities necessary to provide a service, managers can them optimize the process improving the activities consuming the most time.[29]

Observational study methodology

This study's approach to the TDABC methodology started with an exploratory observational time-and-motion (T&M) study using the shadowing method.[30] There are two common techniques for collecting work activity information: work-sampling and T&M. Collecting information through work sampling implies that an inference is to be made to calculate the portion of overall work time spent on an activity, based on the percent of observations that relate to that activity. On the other hand, the T&M technique uses an observer to record exactly how much time is being devoted to each task.[30] The usefulness of time and motion studies in a community pharmacy setting has been praised in the literature.[25,31–33]

To accomplish the observational study, it was necessary to develop a list of activities to be observed. An initial list of activity categories was created by reviewing existing community pharmacy studies.[32–34] This list was then validated in one of the participant pharmacies, and subsequently minor adjustments were made. The main inclusion criteria for pharmacy participation were their location in the Lisbon metropolitan area and their willingness to participate in the study. Six pharmacies were contacted, and three pharmacies accepted to be included as participants.

The study took place on one weekday in 2012, during an 8 h shift, with a 2 h lunch break. The data collector – a community pharmacy specialist and trained observer – was free to observe and record all the staff's activities. An Excel® spreadsheet was developed to record a structured scheme for coding observations, which comprised the activity performed, the place within the pharmacy where the activity occurred, whom executed it and how much time did it take.

Ethical approval

This study was carried out following the good research practices and code of ethics of Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa. The study protocol was approved by the IHMT Ethics Committee (Permit Number: 7-2012-PN). Customers interacting with the pharmacy's professionals were informed about the study orally by the staff and gave their consent.

Services' processes

Since time is the apportionment method in a TDABC model, the main outputs of interest for this study were the time spent performing a service and the activities required to carry out each service.

To start the TDABC approach, the services of interest had to be defined. Four types of services were expected:

- Prescription medicine dispensing – any pharmacist/customer interaction with a medicine dispensed following the presentation of a prescription.
- "Over-the-counter" (OTC) medicines dispensing – any pharmacist/customer interaction with an OTC dispensed without any more products.
- Counseling without dispensing – any pharmacist/customer interaction with no dispensing, just pharmacist counseling after a customer's query.
- Health screening services – any pharmacist/customer interaction with the provision of a screening service such as blood pressure, glycemia or cholesterol measurement.

To define each of these services, the sequence of main activities within each provision process was identified. Table 1 details the activities necessary to service provision.

For proper analysis, each activity was considered as a cost centre, to which the direct costs and support resources were assigned. The relation between the activities and the corresponding necessary resources is presented in Table 2.

Cost analysis

After tracking direct costs to specific activities, it is possible to calculate the cost rate per activity by identifying both the expenditures attributable to the resource and the total available capacity for each resource.[28] The total available capacity of the resource was calculated considering 365 days of a year, subtracting weekends (104 days), mandatory holidays (9 days) and vacation days (22), totaling 19.17 days available per month. To calculate the available hours, an 8-h shift workday was considered and then subtracted the time registered as unused in the observation study, to obtain the available capacity of the resource.

The cost data were obtained from the pharmacies' accountant sheets for the month of the observation. To calculate the cost rates for the different activities, direct costs and support resources were calculated as follows[28]:

Table 1
Description of the activities necessary for service provision

Activities necessary for service provision	Description of activity	Services
Receive prescription/patient query	Each request made by the patient – either through a prescription or a self-reported health need – is considered as a service starting point.	Prescription medicine dispensing; OTC dispensing; counseling without dispensing; health screening services
Interview patient/answer patient query	A small interview follows, where the pharmacist asks questions that will guide the process. For the "counseling without dispensing" services, this is the final activity.	Prescription medicine dispensing; OTC dispensing; counseling without dispensing; health screening services
Validate and dispense prescription/OTC medicine	With the information collected in the previous activity, the pharmacist proceeds with the dispensing of the prescription/OTC medicine	Prescription medicine dispensing; OTC dispensing;
Perform service (for screening services)	Performing the technique necessary to provide the required screening service	Health screening services
Process prescription	Printing, in the back of the prescription, all the information necessary for reimbursement by the NHS	Prescription medicine dispensing;
Collect payment	End of transaction and patient interaction receiving a form of payment	Prescription medicine dispensing; OTC dispensing; health screening services
Re-check prescriptions	Re-checking the prescription after the transaction to check for dispensing or administrative errors. Usually made by a different professional or the supervisor	Prescription medicine dispensing;
Manage inventory and records	Checking for stock levels, ordering more medicines if required	Prescription medicine dispensing; OTC dispensing

Table 2
Assignment of costs and support resources for each activity

Activities necessary for service provision	Costs and support resources										
	Salaries (including supervisor)	Work space	Storing space	Amortization and depreciation costs	Taxes	IT and communication	Stationary	Electricity/ water	Laboratory equipment and supplies	Support costs	Other losses
Receive prescription/ patient query	X	X		X				X		X	X
Interview patient/ answer patient query	X	X		X		X		X		X	X
Validate and dispense prescription/OTC	X	X	X	X	X	X	X	X		X	X
Process prescription	X	X		X		X	X	X		X	X
Perform service	X	X		X	X		X	X	X	X	X
Collect payment	X	X		X	X	X		X		X	X
Re-check prescriptions	X	X		X			X	X		X	X
Manage inventory and records	X	X	X	X	X	X	X	X		X	X

- Salaries – includes the salary of the average pharmacist plus 10% of the technical director's salary for supervision purposes;
- Working space – area where the activity takes place. Capital value per square meter obtained from the rent value;
- Storing space – total storage area. Value per square meter obtained from the rent value.
- Amortization and depreciation costs – estimated as a percentage of the annual business volume; it includes the amortization costs of buildings, equipment and depreciation costs of inventory[22];
- Taxes – estimated sales taxes, calculated as a percentage of the annual business volume[22];
- Information system (IS) and communications – include the monthly cost of IS renting and of communications costs, such as telephone, fax and internet;
- Stationary – include costs such as paper, printer ink, and other essential disposable office material;
- Electricity and water costs – include energy and water bills;
- Laboratory equipment and supplies – equipment cost rates based on their practical capacity, and cost of supplies such as gloves, lancets, test stripes, etc;
- Support costs – other support costs include in this case, cost of cleaning services and cost of security services;
- Other losses – estimated on a percentage of the annual business volume, including the cost of damaged medicines' packages that had to be returned to the supplier.[22]

With all the activities' cost rates calculated, it is now possible to find the cost of a specific service, using the following time equation:

$$\begin{aligned} Service\ cost = {} & (t_1 * cost\ rate_1) \\ & + (t_2 * cost\ rate_2) \\ & + (t_3 * cost\ rate_3) \\ & + (t_n * cost\ rate_n) \end{aligned}$$

All data analysis was conducted in Excel® and SPSS® (Software Package for Social Sciences; Version 20, IBM, Chicago, IL).

Results

There were many pharmacist–customer interactions where 'multitasking' and provision of

more than one service was recorded. For the purpose of this work, only those tasks where provision of a single pharmaceutical service was offered were considered, to avoid double counting the time spent with a customer in simultaneous activities.

In one third of these interactions, prescription medicines were dispensed, which was the main pharmaceutical service observed in this case. The average times of service provision varied from pharmacy to pharmacy (Table 3).

For the dispensing service, the average duration considering all pharmacies was 4.41 min (23.9%–29.4% of pharmacist/customer interactions). For most of dispensing services (54.9%), a maximum of 2 medicine packages were dispensed.

The other most provided service was 'counseling without dispensing' (11.0%–15.7% of pharmacist/customer interactions – average time 2.31 min), followed by 'OTC medicines sales' (10.6%–13.9% of interactions – average time 2.55 min) and 'screening services,' which included tests of cholesterol levels, glycemia and blood pressure monitoring (2.1%–9.4% of interactions – average time 4.51 min). Chronic disease management, medicines use review or other medication management services were not observed in these pharmacies.

Identifying the time spent on each activity allowed the calculation of the cost per activity required for each service. Starting with the calculation of unused time per pharmacist, it was found that each pharmacist had a different number of available hours: 129.43 h per pharmacist in pharmacy A, 140.18 h per pharmacist in pharmacy B and 142.04 h per pharmacist for pharmacy C. A simplifying choice was made to consider this available capacity of resources equal for every cost centre, from human resources to space and equipment, since a pharmacy cannot operate without a pharmacist being present. This information allowed the calculation of the cost rate per activity (Table 4).

After this, it is now possible to calculate the total cost of the services using the time equation previously presented, where t1 is the time spent with the first activity and so forth (see Table 1 of Annex 1 for the detailed distribution of time and costs per activity). In Table 5, the calculated costs of each service are presented.

In general, the overall costs of services across the three pharmacies were very similar. For discussion purposes, an average cost for the three pharmacies was calculated, starting with the average cost for a dispensing service at €3.66. Excluding depreciation, amortization and taxes, this value drops to €2.12; OTC dispensing average cost was €2.16, or €1.30 excluding depreciation, amortization and taxes; for the counseling service, the average cost was €1.34 with all the costs included, or €0.87 excluding depreciation and duties; Health screening services' average costs was €3.59, or €1.90 without the extra costs.

Discussion

According to this TDABC analysis, dispensing appeared to be the most expensive service across the three pharmacies. Screening services were also found to represent a relevant cost for the outlets. It is important to highlight that these screening services are usually provided in a separate space of the pharmacy, of varying size, and using different materials, leading to considerable variation in its overall costs. By contrast, counseling without dispensing was found to represent a low-cost service. This cost could be considered as a marketing cost, whereas the pharmacist is both extending the relationship and getting information from the consumer.

When considering the costs for specific dispensing services, it is possible to estimate that for an average medicine dispensing process to be profitable, on average it has to cover costs of €3.66. In Portugal, pharmacy remuneration is nowadays defined by the Decree-Law 19/2014 of

Table 3
Average time spent per service

Services	Pharmacy			Average times (all pharmacies)
	A (hh:mm:ss)	B (hh:mm:ss)	C (hh:mm:ss)	
Medicine dispensing	00:04:19	00:05:27	00:04:16	00:04:41
OTC medicine dispensed	00:02:20	00:02:22	00:04:02	00:02:55
Counseling w/out dispensing	00:02:45	00:02:19	00:02:30	00:02:31
Health screening services	00:04:26	00:04:03	00:06:03	00:04:51

Table 4
Cost rates for the activity, per pharmacy

Activity	Cost rates Pharmacy A (€/hour)	Cost rates Pharmacy B (€/hour)	Cost rates Pharmacy C (€/hour)
Receive prescription/patient query	€28.19	€32.11	€25.97
Interview patient/answer patient query	€31.78	€34.05	€30.29
Validate and dispense prescription/OTC	€48.15	€53.52	€58.38
Process prescription	€32.16	€34.46	€30.99
Perform service	€38.94	€51.03	€46.46
Collect payment	€41.18	€48.36	€39.06
Re-check prescriptions	€28.57	€32.51	€26.67
Manage inventory and records	€48.15	€53.52	€58.38

February 5,[35] that building on the previous system of differential mark-up, introduced a fixed fee per medicine, aiming to achieve an average distribution of 80% fixed fee plus 20% of variable margin. Therefore, considering a 20% profit margin on overall medicine and OTC sales, any sale of €18.30 or less that lasts beyond the average time will be performed at a loss. Considering that the average price of a prescription in Portugal is €25.97,[36] the implication of this finding is that these three pharmacies seemed to be operating within the profit area and were managing to cover their costs for the average dispensing service. However, these are average numbers and thus should be interpreted with caution. Nowadays, 90% of prescription medicines reimbursed by the Portuguese NHS cost under 25 euros,[36] due to the changes in the external reference pricing and changes in the distribution (pharmacies' and wholesalers') margins.[3] One can argue that current policy options have placed great stress on pharmacy management. This result adds to the strong evidence supporting the threat on pharmacies' sustainability,[22,23] since the implementation of the measures of "the Memorandum of Understanding," signed by the Portuguese Government, the European Commission (EC), the European Central Bank (ECB), and the International Monetary Fund (IMF) in 2011.

Evidence suggests that when patients feel that their symptoms are not serious enough to consult a doctor, they visit a pharmacy instead.[17,18] Some evidence from the UK shows that minor ailments (i.e. uncomplicated conditions that may be diagnosed without medical intervention) can be better managed through the use of community pharmacies as they are less costly than the option of visiting an emergency department (ED) or even general practice (GP).[18] In this study, an OTC consultation could cost as much as €2.97. This is much less than what a patient is expected to pay for a emergency visit to the GP or a ED,

Table 5
Costs of services per pharmacy

Services	Pharmacy A	Pharmacy A[a]	Pharmacy B	Pharmacy B[a]	Pharmacy C	Pharmacy C[a]	Average	Average[a]
	Cost	Cost	Cost	Cost	Cost	Cost	Cost	Cost
Dispensing services	€3.16	€1.93	€4.29	€2.03	€3.52	€2.40	€3.66	€2.12
OTC medicine dispensed	€1.61	€1.00	€1.90	€0.89	€2.97	€2.03	€2.16	€1.30
Counseling without dispensing	€1.46	€1.01	€1.31	€0.73	€1.24	€0.86	€1.34	€0.87
Health screening services	€2.86	€1.48	€3.37	€1.45	€4.55	€2.78	€3.59	€1.90

[a] Costs of services excluding depreciation, amortization and taxes.

with those costing as much as €10.30 or €20.60, respectively, in user charges.[37] Currently, the lack of a formal referral protocol between community pharmacies and the remaining NHS services, similar to the minor ailment scheme in place in UK's NHS, hinders harvesting such potential savings for the patients. Policy makers may find in this work an initial starting point to evaluate the cost-effectiveness of such a scheme in the Portuguese health system.

On the costs of pharmacist counseling, it is difficult to compare the results here presented with those from different settings due to the cultural differences. However, estimates exist for the volume and value of the "Counseling service" for prescription medicines or OTC dispensing and for screening tests in Portugal.[38] In one study, the value of counseling was estimated to vary between €1.32 for counseling of prescription medicines, €1.44 for OTC counseling and €1.54 for counseling about screening services.[38] This research shows that the costs of counseling without dispensing are consistent with those from previous studies, which suggests that the cost of a counseling service is likely to range between €1.00 and €1.60 for many pharmacies in Portugal. This is a meaningful finding, since at the moment the costs of counseling services are not covered by any direct or NHS co-payment, although its payment is currently being discussed.[39]

For pharmacy managers, considering that pharmaceutical services without an associated sale are considerably less expensive, due to the absence of inventory costs, developing and sustaining new services focusing on medicine utilization, medicine use review or other pharmaceutical care services, should be promoted, since they can become an important source of revenue. However, even if these services were profitable, it is important to note that the service volume will only be a fraction of a full-time pharmacist's time and salary. Revenues from dispensing prescription medicines usually represent between 85% and 92% of overall pharmacy revenues.[20,36] It seems that the current cost structure and revenue flow contribute to turn dispensing services a vital part of a community pharmacy, as new services are being developed and become an established feature.[20] An argument could be made that focusing on the retail part of the profession should be promoted in times of economic uncertainty, especially if costs can be cut by reducing staffs' salaries; however, given the rapidly evolving roles of the profession, this approach may threaten the very survival of community pharmacists as health professionals.[40]

One common challenge for pharmacists is establishing a price for the service that is both perceived as a good value by the patient and large enough to finance it.[41] Traditionally, pharmacists have provided these new services free of charge.[42] However, some payers have already recognized the value of pharmacist-provided immunizations and reimbursement of these services is commonplace in some countries.[41] With the development of a bottom-up costing model pharmacy managers may be able to define service fees more accurately, thus increasing their cost-effectiveness. This is of importance since the definition of the best remuneration model for pharmaceutical services is still a matter of debate within the profession and policy makers.[16]

The TDABC approach here explored, with its time-based calculations, offered some specific advantages over traditional costing models, chiefly because of its superior transparency in comparison to conventional cost-accounting methods. In this study, validation and dispensing of the prescription, together with managing of inventory and other records, were found to be the highest–cost activities. Since cutting salaries or storage space may not always be an available option, these findings suggest that managers could resort to automation of some part of the processes, applying information technologies to lower the time spent in some activities, leading to the reorganization of processes and the internal functioning of the pharmacy.

The inclusion in a cost management model of financial costs, such as amortization and depreciation as well as other type of overhead costs such as costs due to losses in material or taxes, has traditionally been considered problematic.[43] Health care organizations will always have to maintain inventories of essential items, and in the case of community pharmacies, this inventory is essential to the function they exert in the health system. Thus, this cost will always have to be included in the cost calculation of a medicine dispensing service. In this work, the two approaches were explored, calculating amortization and depreciation based on an estimation of annual business volume and including them in the calculation of capacity cost rates. This may not turn out to be the most accurate approach available, but allowed to explore the differences between inclusion and exclusion of these costs in the cost calculation of a health care service.

Nevertheless, one can argue that TDABC still needs to be completed with other cost analysis to allow more accurate costing of services involving medicine dispensing.

When performing an ABC analysis, the accuracy of cost driver rates from individuals' subjective estimates of their past or future behavior was called into question. The use of observational T&M studies to support TDABC analysis may be a way to overcome such bias. On the other hand, both T&M and work-sampling methods are vulnerable to error as workers may change their behavior when being observed, yielding unusually longer time spent per activity. The implication of this bias is that the costs here calculated should be viewed as maximum costs for these services in these pharmacies. However, a larger number of measurements of time allocated to specific activities may have strengthen the results. Also, the use of only three pharmacies may be considered a fragility of this study. In spite of this, the 3 pharmacies that accepted to participate are similar to a large portion of typical Portuguese pharmacies. A larger sample of pharmacies could provide a better insight of costs and pharmaceutical services provision, namely regarding services not observed like medication use reviews, immunization services or pharmaceutical care services; future research that do so will considerably improve the results here presented. Although this is an exploratory approach, it is expected that the results presented will provide key information for the work of community pharmacy managers, professionals and policy makers.

Conclusion

This work explores the use of time-driven activity-based costing to analyze pharmaceutical services' cost structure providing information to improve management in a set of community pharmacies. From this analysis, most relevant service costs were obtained an analyzed.

The medicine dispensing service was found to be the most expensive in all three participating pharmacies. Another finding of relevance is that the costs of prescription dispensing are barely covered by the margins defined under current legislation. However, the costs of OTC dispensing and the costs of counseling without medicine dispensing shows that the implementation of minor ailment schemes in Portuguese pharmacies may be cost-effective, when compared with the costs in users' charges in GP and ED of the Portuguese NHS.

This work shows that there is a clear opportunity for improving service management by optimizing dispensing, since this represents the most relevant cost. Also, the search for innovative low-cost pharmaceutical care services, which could secure additional revenue streams, should be promoted by corporate as well as independent pharmacy managers.

The remuneration of new pharmaceutical services is an open discussion that will be better informed if a solid body of evidence about the real costs is built. Professional organizations – key drivers for change in Portugal – should promote research on this topic. Developing a bottom-up costing model that allows identifying accurate costs may be an important tool for pharmacy managers for fixing service fees for future services as well as to inform the discussions about remuneration. It is expected that these findings will help inform managers, professionals and policy makers assessing new models of remuneration for pharmaceutical care services in Portugal and abroad. However, further studies covering a larger number of pharmacies and repeated time observations could help improve the rigor of future TDABC costing calculations.

Acknowledgment

This work was supported by ePharmacare project, Foundation for Science and Technology (FCT) grant number PTDC/CCI-CIN/122690/2010.

References

1. Sacco RL, Smith SC, Holmes D, et al. Accelerating progress on non-communicable diseases. *Lancet* 2013;382:e4–5.
2. Leopold C, Mantel-Teeuwisse AK, Vogler S, et al. Effect of the economic recession on pharmaceutical policy and medicine sales in eight European countries. *Bull World Health Organ* 2014;92:630–640D.
3. Barros PP. Health policy reform in tough times: the case of Portugal. *Health Policy* 2012;106:17–22.
4. Vogler S, Habimana K, Arts D. Does deregulation in community pharmacy impact accessibility of medicines, quality of pharmacy services and costs? Evidence from nine European countries. *Health Policy* 2014;117:311–327.
5. Bush J, Langley CA, Wilson KA. The corporatization of community pharmacy: implications for service provision, the public health function, and

pharmacy's claims to professional status in the United Kingdom. *Res Social Adm Pharm* 2009;5:305–318.
6. WHO: World Health Report. *Primary Health Care: Now More Than Ever*. Geneva: World Health Organization; 2008.
7. McAlister FA, Lawson FM, Teo KK, Armstrong PW. A systematic review of randomized trials of disease management programs in heart failure. *Am J Med* 2001;110:378–384.
8. 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 (Wash)* 2003;43:173–184.
9. Willis A, Rivers P, Gray LJ, Davies M, Khunti K. The effectiveness of screening for diabetes and cardiovascular disease risk factors in a community pharmacy setting. *PLoS One* 2014;9:e91157.
10. Whitty JA, Kendall E, Sav A, et al. Preferences for the delivery of community pharmacy services to help manage chronic conditions. *Res Social Adm Pharm* 2015;11:197–215.
11. Kennie-Kaulbach N, Farrell B, Ward N, et al. Pharmacist provision of primary health care: a modified Delphi validation of pharmacists' competencies. *BMC Fam Pract* 2012;13:27.
12. Hepler C, Strand L. Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm* 1990;47:533–543.
13. Anderson S. The state of the world's pharmacy: a portrait of the pharmacy profession. *J Interprof Care* 2002;16:391–404.
14. Costa S, Santos C, Silveira J. Community pharmacy services in Portugal. *Ann Pharmacother* 2006;40:2228–2234.
15. Martins L, Queiros S. Competition among pharmacies and the typology of services delivered: the Portuguese case. *Health Policy* 2015;119:640–647.
16. Mossialos E, Naci H, Courtin E. Expanding the role of community pharmacists: policymaking in the absence of policy-relevant evidence? *Health Policy* 2013;111:135–148.
17. Paudyal V, Watson MC, Sach T, et al. Are pharmacy-based minor ailment schemes a substitute for other service providers? A systematic review. *Br J Gen Pract* 2013;63:e472–481.
18. Watson MC, Ferguson J, Barton GR, et al. A cohort study of influences, health outcomes and costs of patients' health-seeking behaviour for minor ailments from primary and emergency care settings. *BMJ Open* 2015;5:e006261.
19. Chapko MK, Liu C-F, Perkins M, Li Y-F, Fortney JC, Maciejewski ML. Equivalence of two healthcare costing methods: bottom-up and top-down. *Health Econ* 2009;18:1188–1201.
20. Doucette WR, McDonough RP, Mormann MM, Vaschevici R, Urmie JM, Patterson BJ. Three-year financial analysis of pharmacy services at an independent community pharmacy. *J Am Pharm Assoc* 2012;52:181–187.
21. McDonough RP, Harthan AA, McLeese KE, Doucette WR. Retrospective financial analysis of medication therapy management services from the pharmacy's perspective. *J Am Pharm Assoc* 2010;50:62–66.
22. Antão AA, Grenha CM. *Estudo da viabilidade das farmácias.* Aveiro: Universidade de Aveiro; 2012. Edited by Oliveira Reis & Associados L.
23. Barros PP, Martins B, Moura A. *Evolução do sector das farmácias – revisitar o estudo "A situação concorrencial no sector das farmácias" de 2005*. GANEC, Nova School of Business and Economics; 2012.
24. Roughead L, Semple S, Vitry A. *The Value of Pharmacist Professional Services in the Community Setting: A Systematic Review of the Literature 1990–2002*. Quality Use of Medicines and Pharmacy Research Centre. School of Pharmaceutical, Molecular and Biomedical Sciences, University of South Australia; 2002.
25. Rutter PM, Brown D, Jones IF. Pharmacy research: the place of work measurement. *Int J Pharm Pract* 1998;6:46–58.
26. Demeere N, Stouthuysen K, Roodhooft F. Time-driven activity-based costing in an outpatient clinic environment: development, relevance and managerial impact. *Health Policy* 2009;92:296–304.
27. Kaplan RS, Anderson SR. Time-driven activity-based costing. *Harv Bus Rev* 2004;82:131–138. 150.
28. Kaplan RS, Porter ME. How to solve the cost crisis in health care. *Harv Bus Rev* 2011;89:46–52.
29. Harrison A, Van Hoek RI. *Logistics Management and Strategy: Competing Through the Supply Chain*. 4th ed. Pearson Education; 2008.
30. Finkler SA, Knickman JR, Hendrickson G, Lipkin M Jr, Thompson WG. A comparison of work-sampling and time-and-motion techniques for studies in health services research. *Health Serv Res* 1993;28:577–597.
31. Angelo LB, Christensen DB, Ferreri SP. Impact of community pharmacy automation on workflow, workload, and patient interaction. *J Am Pharm Assoc* 2005;45:138–144.
32. Davies JE, Barber N, Taylor D. What do community pharmacists do? results from a work sampling study in London. *Int J Pharm Pract* 2014;22:309–318.
33. Fisher CM, Corrigan OI, Henman MC. A study of community pharmacy practice. 2. Prescription dispensing. *J Soc Adm Pharm* 1991;8:65–68.
34. McCann L, Hughes CM, Adair CG. A self-reported work-sampling study in community pharmacy practice: a 2009 update. *Pharm World Sci* 2010;32:536–543.
35. Decree-Law no. 19/2014. *Amendments to the Legal Framework of Reimbursements of Medicinal Products and to the Regime of Medicinal Products Price.* Lisbon: Ministry of Health; 2014.

36. *INFARMED: Medicine Statistics 2013*. Lisboa: Instituto Nacional da Farmácia e do Medicamento; 2015.
37. *User Charges in the NHS*; 2014, https://www.ers.pt/pages/142 [cited 2015 6/07/2015; Available in Portuguese].
38. Gouveia M, Machado F. Valorização dos Actos Farmacêuticos em Farmácias Comunitárias. In: *9th National Congress of Pharmacies*. Lisboa: ANF; 2008. Edited by CEAUC, CEAS.
39. RCMPharma. *Pharmacies: Divided Parties as for Paid Advice*; 2011, http://www.rcmpharma.com/actualidade/politica-de-saude/farmacias-partidos-divididos-quanto-aconselhamento-pago [cited 28-11-2014; Available in Portuguese].
40. Gregorio J, Cavaco A, Velez Lapao L. A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal. *Hum Resour Health* 2014;12:58.
41. Freeman PR, Jones M, Blumenschein K. It's not just the money: why consumers do not Purchase pharmacist-provided services. *Pharmacol Pharm* 2014;5:570–576.
42. Kuntz RL, Remmert RM. A new trend in pharmacy practice: private consultations. *Int J Pharm Compd* 2001;5:170–173.
43. Mogyorosy Z, Smith P. *The Main Methodological Issues in Costing Health Care Services: A Literature Review*. York: Alcuin College, University of York; 2005. Edited by CHE.

Annex 1

Table 1
Detailed times per activity and related costs in the three pharmacies

Services	Activity	Pharmacy A		Pharmacy B		Pharmacy C	
		Time (hh:mm:ss)	Costs (€)	Time (hh:mm:ss)	Costs (€)	Time (hh:mm:ss)	Costs (€)
Medicine dispensing	Receive prescription/patient query	00:00:13	0.10	00:00:16	0.15	00:00:13	0.09
	Interview patient/answer patient query	00:00:13	0.11	00:00:26	0.25	00:00:13	0.11
	Validate and dispense prescription/ OTC	00:02:22	1.91	00:02:44	2.43	00:02:08	2.08
	Process prescription	00:00:26	0.23	00:00:33	0.31	00:00:26	0.22
	Collect payment	00:00:14	0.16	00:00:16	0.22	00:00:20	0.22
	Re-check prescriptions	00:00:06	0.05	00:00:23	0.21	00:00:13	0.09
	Manage inventory and records	00:00:44	0.59	00:00:49	0.73	00:00:44	0.71
	Total	**0:04:19**	**3.16**	**0:05:27**	**4.29**	**00:04:16**	**3.52**
OTC medicine dispensed	Receive prescription/patient query	00:00:25	0.22	00:00:10	0.09	00:00:36	0.26
	Interview patient/answer patient query	00:00:28	0.25	00:00:26	0.25	00:01:13	0.61
	OTC counseling and dispensing	00:01:03	0.84	00:01:25	1.27	00:01:37	1.57
	Collect payment	00:00:10	0.11	00:00:06	0.09	00:00:12	0.13
	Manage inventory and records	00:00:14	0.19	00:00:14	0.21	00:00:24	0.39
	Total	**0:02:20**	**1.61**	**0:02:22**	**1.90**	**00:04:02**	**2.97**
Counseling w/out dispensing	Receive patient query	00:00:33	0.29	00:00:14	0.12	00:00:15	0.11
	Interview patient/answer patient query	00:02:12	1.17	00:02:05	1.18	00:02:15	1.14
	Total	**0:02:45**	**1.46**	**00:02:19**	**1.31**	**00:02:30**	**1.24**
Health screening services (example for glycemia monitoring)	Receive prescription/patient query	00:00:13	0.12	00:00:12	0.11	00:00:18	0.13
	Perform service	00:03:59	2.59	00:03:39	3.10	00:05:27	4.22
	Collect payment	00:00:13	0.15	00:00:12	0.16	00:00:18	0.20
	Total	**0:04:26**	**2.86**	**00:04:03**	**3.37**	**00:06:03**	**4.55**

2.4. PAPER IV

LAPÃO, Luís Velez; MIRA DA SILVA, Miguel; GREGÓRIO, João; *Implementing an Online Pharmaceutical Service using Design Science Research*. BMC Medical Informatics and Decision Making (Paper submitted on 23/05/2016)

IMPLEMENTING AN ONLINE PHARMACEUTICAL SERVICE USING DESIGN SCIENCE RESEARCH

Luís Velez Lapão*

Global Health and Tropical Medicine (GHTM),

WHO Collaborating Center for Health Workforce Policy and Planning

Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa
Rua da Junqueira, nº 100
1349-008 Lisboa, Portugal
+351 213 652 600

luis.lapao@ihmt.unl.pt

Miguel Mira da Silva

Instituto Superior Técnico, Universidade de Lisboa

Avenida Rovisco Pais, 1 — 1049-001 Lisboa

mms@ist.pt

João Gregório

Global Health and Tropical Medicine (GHTM),

WHO Collaborating Center for Health Workforce Policy and Planning

Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa
Rua da Junqueira, nº 100
1349-008 Lisboa, Portugal
+351 213 652 600

jpgregorio@ihmt.unl.pt

*Corresponding author

Abstract

Background: The rising prevalence of chronic diseases is pressing health systems to introduce reforms. Primary healthcare and multidisciplinary models have been suggested as approaches to deal with this challenge, with new roles for nurses and pharmacists being advocated. More recently, implementing healthcare based on information systems and technologies (e.g. eHealth) has been proposed as a way to improve health services. However, implementing online pharmaceutical services (including their adoption by pharmacists and patients) is still an open research question. In this paper we propose ePharmacare, a new online pharmaceutical service that was implemented using design science research to increase the adoption level from the beginning of the project.

Methods: The Design Science Research Methodology (DSRM) was chosen to implement this online service for chronic diseases management. In the paper DSRM applications is explained, from the definition of the problem to the evaluation of the artifact. During the design and development stage surveys, observations, focus groups, and eye-tracking glasses were used to identify pharmacies' and patients' requirements. During the demonstration and evaluation phases the new service was used in several pharmacies, with real-world pharmacists and patients.

Results: The results show the contribution of DSRM to implement online services for pharmacies. There is a clear opportunity to implement online services for pharmacies, since nowadays pharmacists spend only 50% of their time interacting with patients. On the other hand, patients that regularly visit the same pharmacy recognize the value in patient follow-up using channels such as the Internet. Limitations were identified regarding the busy workloads of pharmacists, but particularly their lack of know-how and experience in dealing with information systems (IST).

Conclusions: This paper summarizes a research project in which an online pharmaceutical service was proposed, designed, developed, demonstrated and evaluated using DSRM. The main barriers for pharmacists' adoption of online services provision the lack of time management and information systems usage skills, as well as a precise role definition within pharmacies. These problems can be addressed with proper training and services reorganization, two proposals to be investigated in future works.

Keywords: Pharmaceutical services, services implementation, online services, patient experience, design science research.

1. Background

Chronic diseases are already the main cause of mortality in Europe, and are becoming a challenge for middle and low income economies due to the demographic and epidemiological

transitions taking place.[1] The increasing prevalence of chronic diseases is inducing health system reforms.[2] A greater emphasis is placed in primary care with interprofessional collaboration emerging as a model of integrated healthcare service provision.[3] The goal of these multidisciplinary models is to transform the daily care of chronic patients, assigning major roles for non-physicians, such as community pharmacists (CP) and nurses.[4–6]

The focus on multidisciplinary models of care and the consequent primary healthcare reforms are encouraging the rethinking of community pharmacists' role.[7] Community Pharmacy orientation towards a patient-centered practice has become the new paradigm of pharmacy practice, supported by the development of a clinical role for community pharmacists and a more active role for patients in their own disease management.[8,9] The new paradigm led to the introduction of "pharmaceutical services" concept.

There are a number of different services performed by pharmacists in different countries that match CP's role in primary healthcare. These services range from the traditional distribution services to more advanced disease management services.[10,11] Moreover, pharmaceutical services have been considered extremely valuable for professionals, patients and healthcare systems, mainly due to a greater efficiency and improvement in individual patient's health related outcomes.[4,9,12]

Costa et al.,[13] have described the status and outlined the trends of community pharmacy services in Portugal. CP in Portugal work exclusively in independent pharmacies, since large chains are not allowed. The opening of community pharmacies is regulated by the national medicines regulatory agency (INFARMED). Pharmacies have a National Health Service (NHS) contract for dispensing prescription medicines, with legislation establishing medicines' profit margins and patients' co-payments [14] Over the last twenty years Portuguese community pharmacies have developed consultation services to manage chronic patients and their therapies, in line with international developments of "pharmaceutical services".[13,15]

Good communication between professionals is essential in multidisciplinary practice, making Information Systems and Technologies (IST) a prerequisite underpinning healthcare services in future health systems.[16] The continuous development of IST led to the onset of eHealth, that can be defined as "the utilization of IST to support health service provision, complying with the needs of citizens, patients, health professionals and other providers".[17] IST in healthcare have been used primarily to improve administrative management. However, implementation of eHealth services has the potential to promote a better access to information by patients and providers, improve the quality, efficacy and safety of healthcare, and encourage healthier lifestyles.[18–20]

Investing in IST and modernizing the architecture of pharmacies is considered as a necessary and critical step towards the diffusion of new forms of practice.[21,22] eHealth services may develop in the next few years to harvest the full potential of CP, enhancing the primary care network and establishing a leverage role for patients.[23]

However, difficulties in eHealth implementation are frequently reported.[24,25] Most of these difficulties are frequently attributed to managerial and behavioral factors.[26] To resolve these difficulties, some authors propose that a user centered approach should be promoted to be certain that eHealth services will satisfy user's needs.[27] The user centered approach also reinforce users' ownership of the system leading to higher adhesion and ongoing use of the system.[28]

The complex characteristics of the problems affecting health systems worldwide demand new ideas and innovations, aiming at more responsive healthcare.[29] The implementation of multidisciplinary services models requires proper planning and management, especially when innovation experience and patient knowledge is lacking. Considering these challenges the ePharmacare project was designed. The main goal of this project was to explore the development of eHealth used to address the challenges of community pharmacists' integration with primary healthcare services. Additionally, the project would also assess the potential of eHealth in the provision of pharmaceutical services by actively enabling the interaction with patients and promoting their education. Furthermore, the project is expected to address the use of eHealth for supporting health services, establishing its acceptability, feasibility, sustainability, and adaptability to future changes.

In order to achieve these objectives, an online pharmaceutical service was conceived, designed, developed, demonstrated and evaluated using the Design Science Research Methodology (DSRM).[30,31] The service (an artifact for DSRM) would support patients' disease and therapeutic monitoring by a CP. Patients were enrolled in an active way, advising them to use the service to interact with pharmacists. Information about patients can be used to understand patients' treatment effects and success rate, but that information is also valuable for assessing the service acceptability and usability.

After this introduction, the paper is divided in three sections. In the next Section, we highlight the research method used for designing, demonstrating and evaluating the service. Section 3 presents the results according to the activities that support DSRM.[30] Section 4 analyzes and discusses the results in more detail. The paper then closes with a conclusion that includes the main lessons learned plus future work.

2. Research Method

The implementation of online services in a healthcare practice presents several challenges.[24] The design of the service must be adequate to both practitioners and users, as well as cost-effective. On the other hand, the utilization of the system has the potential to impact user behavior and perceived usefulness.[19] Therefore, there is a need to use a research method that takes into account the interaction between health professionals and the end user.

The Design Science Research Methodology (DSRM) [30,31] was chosen since DSRM has demonstrated an ability to study the connection between research and professional practices by designing, implementing and evaluating artifacts that address a specific need. In fact, DSRM studies the artificial - any phenomena created by humans - in a rigorous process of proposing artifacts to solve problems, evaluating what has been projected or what is functioning, and communicating the obtained results.[32]

The main output of a DSRM project must be an artifact. In this case, the artifact will be an eHealth pharmaceutical service. Hevner et al.,[31] have established guidelines for a consequent DSRM study. Later, Peffers et al.,[30] proposed converting those guidelines into six activities. For the research presented in this paper, these six activities had a specific set of tasks (table 1).

Table 1 - DSRM activities and respective tasks

DSRM Activity	Tasks
1. Identify problem & motivate	Setup the context using a scenario design for Portuguese pharmacists in 2020. Online survey of IST utilization in Portuguese pharmacies. Observational time-and-motion study to assess pharmacists' current work patterns and potential demand for pharmaceutical care services Cost of current pharmaceutical services
2. Define objectives of a solution	Set of qualitative interviews performed within primary health centers and hospitals
3. Design & development	Design of artifact (online service based on a software platform) for pharmaceutical care provision
4. Demonstration	Field study to test the platform in two settings with a selected group of patients
5. Evaluation	The usability of the platform was assessed through the use of "task scenarios" with eye-tracking glasses and semi-structured interviews of the participants

6. Communication	Practitioners, conference communications, journal papers, and theses.

In the remaining of this section, an explanation of the tasks performed in each activity is provided in more detail.

2.1 Activity 1 - Identify Problem & Motivate

In order to setup the context for this research, a scenario planning exercise was performed to design future scenarios for Portuguese community pharmacists. The exercise recognizes the changing environment as a huge challenge but also an opportunity to develop the role that community pharmacists may play in the Portuguese health system. For this exercise two objectives were considered: (i) to analyze the possible evolution of community pharmacists' role in the Portuguese healthcare system by building and studying three different scenarios, and (ii) to identify the main driving forces and related uncertainties that may impact on the definition of the future community pharmacists' role.

In addition, an online survey was launched to assess the current state of pharmaceutical services provision and the IST usage in community pharmacies, based on a previously developed survey performed in Switzerland.[33] The survey was translated and validated with two academic researchers specialized on Portuguese community pharmacies. The survey was implemented using Google® Forms, and then sent via email to 323 pharmacies that are members of the Association of Portuguese Pharmacies (AFP).

Following this online survey, an observational time-and-motion study was performed to study pharmacists' work patterns and pharmaceutical care services' potential demand.[34,35] The observational study was performed in four pharmacies of the metropolitan Lisbon area, during an eight hours full shift. The objective was to understand the potential value of an online pharmaceutical service, and how that service might fit in a pharmacist's workday.[36] The study characterized the activities performed by CP, including the entire array of provided services, time spent with patients, and an estimation of chronic patients' yearly visits to a pharmacy. Using data from this observational study, a costing study was performed, using Time-driven Activity based costing as methodology.[37]

2.2 Activity 2 - Defining Objectives of a Solution

In this activity the main needs felt by patients when they interact with pharmacies were identified. The identification of those needs, helped to define features of the online service. The objective of this activity was to produce an online service that could mimic the work processes of the Dáder methodology for pharmaceutical care provision,[38] adding functionalities that potential customers felt lacking in their community pharmacy experience.

A set of 50 semi-structured interviews focusing on customer service were performed, with patients at health centers and hospitals in Lisbon and Oporto.[39] These interviews targeted several age groups and sought information regarding the current service concept offered by community pharmacies, as well as what customers would like to have within existing or new services. These interviews also identified the most critical service failures that customers experienced, and collected feedback about potential solutions.

2.3 Activity 3 - Design & Development

The design and development of the online pharmaceutical service was based on the Dáder methodology for pharmaceutical care concepts [38] and Service Experiment Blueprint concepts,[40] that enabled the identification of service characteristics and functionalities required by chronic patients.

The design and development of the software platform (that supports the online service) was based on the Agile methodology,[41,42] using "sprints" of seven days managed by the Trello® online service. After the end of each sprint, a new version of the software platform was published in order to be evaluated immediately by pharmacists and patients. This methodology permits to collect feedback almost continuously from end users, so that new features are prioritized for achieving maximum value.

2.4 Activity 4 - Demonstration

In this activity, the utility (for patients and pharmacists) of the proposed online service was demonstrated. The online service was tested in two different settings during eight months: (i) three CP working within three different community pharmacies using the service and face-to-face consultations to interact with patients (Pharmacists "P"); (ii) a CP using the service and scheduled meetings interacted with patients without the possibility of dispensing medicines (Pharmacist "C"). Pharmacist "C" used the platform outside the community pharmacy to recruit patients among people of a Senior University in a Lisbon municipality.

The target users were purposively selected among patients that presented at least one prescription for chronic medicines and were active users of the internet. A survey was applied to determine patient's internet utilization patterns. Pharmacist's intervention included: patient education about medicines, completion of a drug therapy profile and drug history, assessment of initial drug compliance and patient counseling about lifestyle modifications. Patients were recruited during the first two months of the study according to the following criteria: to have a prescription of a hypertensive, antidiabetic or anti-cholesterol medicine; to have more than 65 years of age; to be an Internet user. Initial training was given both to pharmacists and patients, and follow-up training was provided when needed.

2.5 Activity 5 - Evaluation

The evaluation took place eight months after the start of the demonstration activity, and included tests with pharmacists and patients. The tests were based on a set of scenarios executed by pharmacists and patients (Table 2). Eye-tracking glasses were used to determine which platform features were looked upon when performing each scenarios and how long it took, in order to identify major bottlenecks in users' experience of the platform. All testers were interviewed to provide even more information about the utility of the online service and to identify missing features.

Table 2 - Scenarios developed for testing the online service

Pharmacist scenarios	Patient scenarios
Scenario I -. Enter the ePharmacare platform with your username and password. Look for the date of the next visit to your user XXX. Scenario II - Add a new medicine for the user XXX: Ben-u-ron 500mg, 20 tablets; take one tablet after breakfast and one after dinner. Set the end date of package. Scenario III - Send a message to the user XXX: TEST. Scenario IV - Add the value of postprandial glucose of 182 mg/dL for the user XXX. Scenario V - Find the last blood pressure to the user XXX. Scenario VI - Arrange a visit for the user YYY for the day 07/20/2014, 10:00 am. Scenario VII - Verify the value of total cholesterol to user XXX. Scenario VIII - Verify that the user forum has calculated BMI.	Scenario I -. Enter the ePharmacare platform with your username and password. Seek new messages. Scenario II - Add the value of fasting glucose of 182 mg/dL. Scenario III – Add the blood pressure value 135/85 mm/Hg. Scenario IV – Add the height and weight values. Scenario V - Find the last blood pressure value. Scenario VI – Add a new medicine to the user profile: Ben-u-ron 1000 mg, 18 tablets'; take one tablet after breakfast and one after dinner. Scenario VII – Verify your next appointment with the Pharmacist. Scenario VIII – Send a message "TEST" to the CP. Scenario IX – Find the end date for the package of Ben-u-ron. Scenario X – You have been taking two cups of green tea daily, add this information to your profile.

2.6 Activity 6 – Communication

This activity was performed throughout the duration of the research project and consisted in oral communications, papers published in conference proceedings within the fields of study and three papers already published in peer reviewed journals. A list of the publications is presented as an annex.

Data Analysis

Statistical and other data analyses were performed with MS Excel® and SPSS® (Software Package for Social Sciences; Version 20, IBM, Chicago, IL). The content analysis of the qualitative interviews was performed with Computer Assisted Qualitative Data Analysis Software (CAQDAS) – QSR NVIVO® 10. All data were kept anonymous and confidential.

3. Results

The DSRM was be applied and produced results for each activity. After this section, a discussion section ensues with an overall discussion about the results, the consequences for community pharmacists and a critical appraisal of the DSRM.

3.1 Activity 1: Identify Problem and Motivate

The problem identification is crucial to help focus the DSRM and to guarantee users' involvement. Three complementary approaches were used to define the problem: a scenario exercise, an online survey, and an observational study.

a) Scenario exercise

The scenario analysis highlighted that the development of a new role for community pharmacists is dependent of the economic and legislative environment in which these professionals operate and also of their inner ability to innovate and develop new services. In a scenario where online pharmaceutical services would be a reality across the country, new health regulations have to be in place alongside a more competitive pharmacy market. Besides that, an innovative approach by pharmacy managers and practicing CP will be needed.

b) Online survey

Although the online survey had relatively low response rate (4.76%), it yielded comparable results with similar surveys. In the respondent pharmacies, the average number of computers was 5 (min: 2; max: 10), with a ratio of 2.5 computer per pharmacy. All pharmacies use IST for dispensing medicines and administrative tasks (stock management, reimbursement activities) (Figure 1).

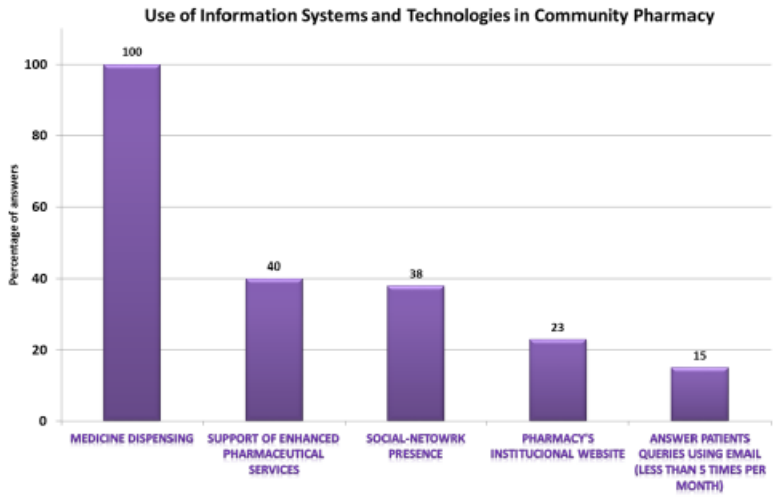


Figure 1 - Characterization of Information Systems and Technologies use in Portuguese Community Pharmacies

Approximately a quarter of respondent pharmacies have an Internet site and 38% have a social network presence. All respondent pharmacies claimed to check their email daily, although only 15% claim to have used the email to answer patients' queries, and less than 5 times a month. The most important barriers to the implementation of online pharmaceutical services in Community Pharmacy referred by all the respondents were the lack of financial incentives for online pharmaceutical services implementation and lack of support and guidance from professional organizations.

c) Observational study

The observational study took place during a week-day's full 8 hours shift. In total, 16 pharmacists were observed. 85% of the observed tasks were performed by pharmacists, corresponding to 65% of the total recorded time. Among the tasks, between 77% and 85% had some sort of medicine dispensed. During the observation day, professionals interacted on average with 40 customers, with 54% of the interactions occurring in the afternoon period (3 p.m. – 7 p.m.). About 54 minutes of free or idle time per pharmacist were found. However, the majority of the free time is spent in micro pauses, with only 11% of the recorded breaks having more than 5 minutes in duration. Regarding the provision of pharmaceutical services, 29.9% of pharmacist time was spent dispensing prescriptions and 13.2% dispensing Over-the-counter (OTC) medicines. 4.3% of pharmacist time was spent counselling patients without dispensing any medicine (Figure 2).

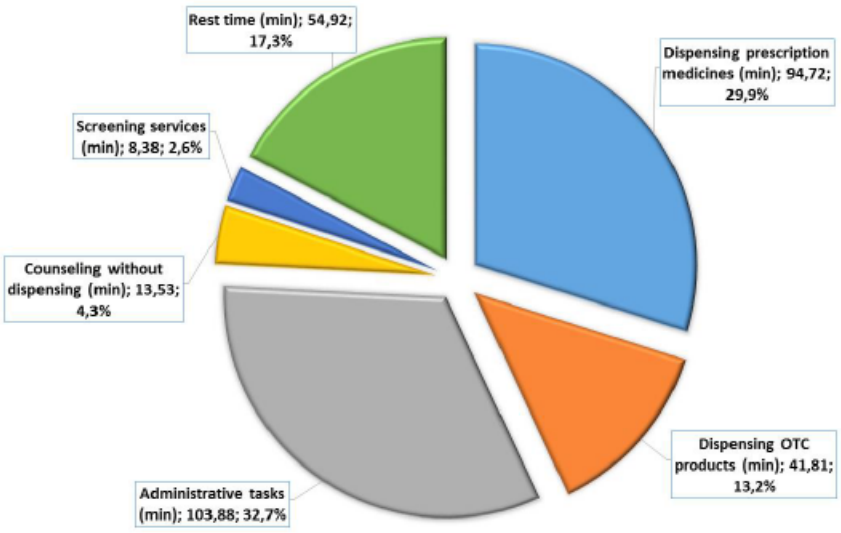


Figure 2 - Percentage of daily time usage by pharmacists

Concerning other activities performed by pharmacists, 32.7% of pharmacists' time was spent in administrative tasks, including ordering and storage of medicines, preparing prescriptions for reimbursement issues, and meetings with vendors and salespersons. In the recorded observations, the only service provided using an IST was the dispensing service. The IST was used to support sales, detecting possible interactions and identifying adverse effects of the dispensed medicines.

d) Costing study

In general, pharmaceutical services costs in the participant pharmacies were similar. The average cost for the dispensing service was €3.66; OTC dispensing average cost was €2.16; for the counselling service, the average cost was €1.34; Health screening services' average costs were €3.59. The costing study also identified the most costly activities in pharmaceutical service provision. In these pharmacies, validation and dispensing of the prescription and the managing of inventory and other records, were found to be the highest-cost activities.

3.2 Activity 2: Define Objectives of a Solution

After the identification of the problem, DSRM proposes the definition of the objectives for a solution. To identify service requirements, a set of 50 qualitative interviews were performed. The qualitative research was undertaken in the hospitals of S. João (Porto) and Egas Moniz (Lisbon), and in the healthcare centers of Campanhã (Porto) and Ajuda (Lisbon). The interviewees were 24 males and 26 females (mean age of 44.4 years) that answered questions about community pharmacy services. 62% of the interviewees reported visiting a pharmacy at least once a month.

46% of the interviewees admitted that they sought healthcare provision with CP for minor issues before going to a general practitioner (GP). When asked about new pharmacy services, the home delivery and internet ordering of medicines were the most referred services, followed by integrating pharmacy services with primary care (e.g. gatekeeping, scheduling of GP consultations, patient follow-up). There was a broad wish for a better integration between community pharmacies and the NHS.

Supported by the results from the first two activities, the main targets for the new service were defined. The online pharmaceutical service should allow the pharmaceutical care of chronic patients without overloading community pharmacists' workload, at a cost comparable to a screening service. This service should address the monitoring of patients' therapy (covering medication reviews, medicine interactions, adhesion and medication management), alongside features that aimed to test service integration with the primary healthcare (e.g. emission of reports to the GP).

3.3 Activity 3: Design and Development

From the insights obtained in the previous activities, the design of a disease management platform to support online pharmaceutical care services for chronic patients was proposed (Figure 3). The platform was called ePharmacare. The core of the platform is the storage of patient's treatment information and the possibility to improve that information by allowing both pharmacists and patients to enter valuable information on the platform. Once pharmacists have their patients registered in the platform, it is possible to provide disease management on several levels: estimation of therapeutic "end dates"; monitoring of therapeutic results; early detection of adverse reactions, addressing minor ailments or other queries reported by patients.

The built platform is able to calculate treatment end dates and warn the pharmacist when that date is approaching, while the patient will receive a notification email. The platform also offers patients the option to request their medicines online (Figure 4). This functionality supports pharmacists and patients on the control of patient's therapeutic compliance and allows the streamlined just-in-time provision of medicines, either in-pharmacy or home delivered.

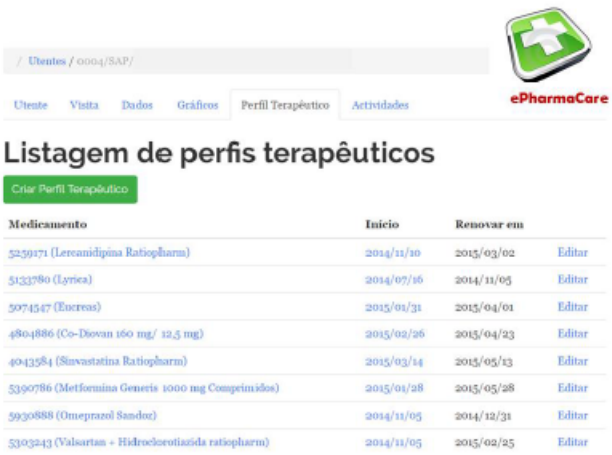


Figure 3 - Screenshot of a therapeutic profile (platform)

Allowing real-time monitoring of patient's parameters such as blood pressure or glycaemia levels is another important aspect of the platform (Figure 6). Currently, pharmacists monitor and register their patient's therapeutic progress on paper (or not at all). ePharmacare allows patients and pharmacists to enter and store these data in a database. Pharmacists can then see, edit, organize, and interpret the data in a more convenient way.

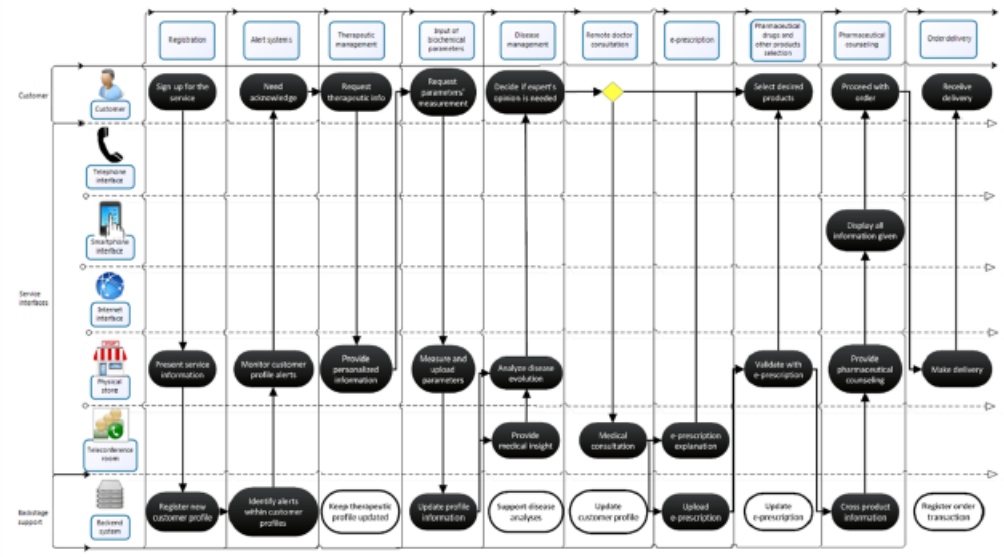


Figure 4 - Service Experience Blueprint for new interfaces of pharmaceutical service provision (reproduced with author's permission)[53]

The most critical advantage within this feature lies in the potential given to patients who are now able to have access to their own therapeutic data outside of the pharmacy and thus greatly improve their own decision making.

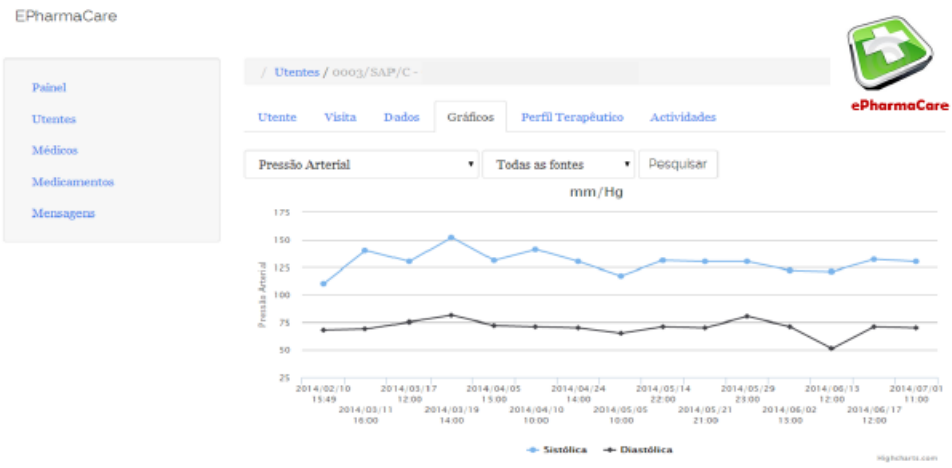


Figure 5 - Screenshot of the blood pressure monitor (pharmacist view)

3.4 Activity 4: Demonstration

A total of 28 patients were enrolled. These patients showed interest in participating, answering the initial survey. 88% of patients use the Internet for more than 2 years. More patients used the Internet to look for information regarding trips and holidays (73.1%) than to search for health related information (57.7%).

Two Pharmacists "P" recruited 3 chronic patients each and another one recruited 6 patients. However, none of these patients used the platform more than once. Asked about the main reasons related with recruitment's difficulty, Pharmacists "P" argued that they were too busy attending patients in the pharmacy. In their opinion, the process of recruiting patients could take about 30 minutes, including: brief explanation of the project (~10 minutes); patient answering the survey (~15 minutes); account creation (~5 minutes); and account verification and validation (~5 minutes). Also, they anticipated non-compliance with this type of intervention by their usual chronic patients, leading them to under-recruit.

Pharmacist "C" recruited 13 patients, but only 5 participated in the study during the full length of the demonstration. Pharmacist "C" patients held monthly meetings, observing, discussing and registering clinical data. These meetings finished with an information session about different health themes, but usually in the context of chronic diseases, such as the proper use of medications, interactions of medicines and health herbal products, etc. The online information exchange between patients and Pharmacist "C" was related to questions of therapeutic changes, self-administration of medicines or self-medication with OTC medicines and

herbal products. The registration, monitoring and storage of biochemical and physiological data in the platform, recorded by both patients and pharmacist "C", was found to contribute to a common interest that may allow an improvement in patient's health outcomes.

All the physiological parameters showed improvements, although the significance of such improvements cannot be determined due to the exploratory nature of the demonstration study and low number of participants.

3.5 Activity 5: Evaluation

The objectives of this activity were to assess the usability of the platform and to identify missing features in the service, aiming to inform the next cycle of DSRM.

It was found that a CP took an average of 7:38 minutes to perform the scenarios. This is an important finding since it fits within the free time found in activity one. For patients, the time to perform a scenario is not significant since they can use the platform whenever is most convenient.

To maintain patient's motivation to use the platform, regular meetings or consultations have to be performed. Only when these meetings were regularly scheduled, patients used the platform to register their parameters or communicate with the pharmacist. Patients found that one of the most valuable assets is the platform's capability to assemble patient's therapeutic profile and to calculate when each drug will be finished or refilled, based on the dose, package size and treatment duration.

The main evaluation conclusions were the following:

- Both pharmacists and patients used the ePharmacare platform without difficulty;
- An additional dashboard is needed on the front page to simplify the access to information. This was felt by both types of users. The font size was found to be too small for most patients, and not suitable for the standard screen resolution of pharmacies' current information system;
- Patient's main request was to have a "text box" to add information about non-conventional therapy, and the possibility to edit information. Also mentioned was the need to have a message system that allowed the files' attachment (e.g. clinical analysis results)
- Patients also asked for "messages" to alert them for therapy ending as well as to screening values out of the ordinary or above the established objectives;
- Some pharmacists found the "send a message" and "schedule a visit" features (which also allows sending a message) confusing;
- In pharmacist's opinion, the main barriers to patient recruitment were: advanced age of patients (65-80 years); lack of time; lack of an adequate space to practice pharmaceutical

care supported by the platform; populations' lack of awareness; and patients refusal to share their data with a pharmacy;

- Patient's demonstrated satisfaction with the platform and would like to continue to use it in their daily routine. They found the platform comfortable and simple to use. However, the lack of communication with a general practitioner was felt by most of the patients.

These suggestions will be implemented in the next research cycle.

4. Discussion

The development of a new online pharmaceutical service could be an important contribution to efficient chronic diseases' management. In this paper, a method to develop and implement a platform for online pharmaceutical services provision was proposed. Although the research work reported in this paper is exploratory in nature, the results presented provide a picture of Portuguese community pharmacy and pharmacists. The different activities of DSRM yielded important results that may have implications for community pharmacy and pharmacists' future that will be discussed in this section.

Research findings

Regarding the results of each activity, some comments can be made. Firstly, the scenario exercise allowed to identify the main drivers to the diffusion of new services: the ability of community pharmacists to innovate and develop new services is dependent not only on the "inner will" of individual pharmacy owners for innovation, but also on the leadership of professional organizations such as the Pharmaceutical Society (OF) and the National Association of Pharmacies (ANF). Also, the economic context and pharmacy setting has to become more competitive, possibly through a liberalization of the pharmacy market or other legislative changes that would encourage innovators.

Although the response rate was low, limiting generalizations, the results from the survey suggest that the potential to develop online services exists. All pharmacies are equipped with an information system and other technological infrastructures that can be further explored. Pharmacy staff must be capacitated to use IST to support the provision of online pharmaceutical services. The conditions that have to be met in order to make online services ubiquitous in the country seem dependent of financial incentives and support from professional organizations, a finding that confirms the results from the scenario analysis.

The dispensing of medicines was found to be the most significant pharmaceutical service provided. No structured medication management service or any other disease management service was observed, in spite of the pharmacies claiming it was provided. This was an expected finding, and the main driver of the current research project. After the development of pharmaceutical care programs in the turn of the century, these programs have started to wither

away, with many pharmacies dropping the provision of these programs. The causes for this have long been discussed within the profession and the reasons range from the lack of payment for these services to the professional inertia regarding the adoption of new forms of practice.[43,44] Also, another barrier. pointed out to this development has been the "lack of time" reported by pharmacists.[45,46] There seems to exist a perception gap about the pharmacists' free time. In reality, enough free time exists to provide at least one consultation per day. More importantly, the potential to find more time is there, if the management of community pharmacies is reorganized, with more clear roles for each of the professionals.

In the demonstration activity, pharmacists P also refer "lack of time" as the reason to under-recruit and not provide the necessary follow-up for the recruited users. Pharmacists overestimated the time needed to recruit patients referring that it would take at least 30 minutes per patient. In reality, after measures done by the researchers, the estimated time for recruitment was 18.32 minutes (about 60% of the pharmacists' estimation) tested in 12 interventions at real time at pharmacy 1, 2 and 3. Moreover, one other reason provided for the low recruit numbers was that pharmacists anticipated non-compliance with this type of intervention by their usual chronic patients, confirming the experience of other research projects in Portugal and elsewhere.[15,47] To overcome this issues, innovative recruitment strategies must be considered and implemented in future research projects.

The results with Pharmacist "C", providing the service in a community setting without a pharmacy infrastructure as support, showed that being available to capture patients' interest and holding regular meetings are important. The use of the personal profile and vital data graphics was an essential key to empower patients on their health self-management, enhancing their health condition perception allowing for better user-acceptance, medication adherence and healthy behaviors. Also of importance, the close monitoring and sharing of information allowed the detection of early signs of adverse reactions or potentially dangerous interactions between medicines and non-prescription products. By the end of the demonstration activity, senior university patients were so engaged that they asked if it was possible to continue to use the platform for data registration because they were already familiar with its functioning. These results show the high importance of continuing the research with new strategies to overcome barriers at community pharmacies.

Implications for research

In this paper, the authors test DSRM as a method to develop new online services, in an iterative process that values end-users inputs. The use of design science to develop technological artifacts to use in healthcare has already demonstrated utility.[48] However, to our knowledge, the use of Peffers et al.,[30] activities to develop a new health service is a novelty. These guidelines have been subject to discussion by experts in the field,[49] and hopefully this research work provides a new example of DSRM application for health service research. The DSRM activities were appropriate to study the contributions of the proposed ePharmacare online service

to improve the interactions between pharmacists and patients. Moreover, the results collected in this DSRM cycle will inform the following research cycle.

Regarding the choice of methodology, the evaluation of the artifact must fulfils the four Österle principles for design-oriented information system research: abstraction, originality, justification and benefits.[50] The ePharmacare platform completely fulfils these four Österle principles by:

- **Abstraction**: ePharmacare may be used by pharmacists or by any other health professional ready to tackle chronic disease management and medicine misuse at both public and private health units. Data requirements are commonly available in any pharmacy or healthcare center, namely patient data, medicines, interactions, etc.

- **Originality**: ePharmacare was designed by a multidisciplinary team including healthcare professionals (e.g. pharmacists and family physicians) and patients, contributing to the creation of a system oriented to their real needs. For the first time the Dáder method was implemented in an online interactive system.

- **Justification**: According to the WHO, chronic diseases are a major worldwide cause of death and healthcare services burden.[1] ePharmacare is an online service to help prevent, manage and control chronic medication that was validated by pharmacists and physicians.

- **Benefits**: the online service benefits healthcare organizations and the society in general by providing an integrated view on patient and facilitating the work of healthcare professionals, namely pharmacists and family physicians. It further contributes to more informed chronic diseases management, once it allows both pharmacists and physicians to check patient data in their specific contexts, speeding up the prescription decision process.

Service modelling

The modelling stage at the end of activity 2 used Service Experience Blueprint (SEB) to ensure a customer driven design able to co-create value with end customers through the service experience would be attained.[40,51] Modelling methodologies can provide an additional understanding of the dynamics of an organization to better align the pharmacy services design with operations.[52] The SEB method enhances the design of customer experiences, especially for technology-enabled services and contributes for a stronger focus on customer-firm relationship. This initial blueprint for the online service allows the development of a new blueprint focusing on the architecture of a community pharmacy based disease management service (Figure 6).

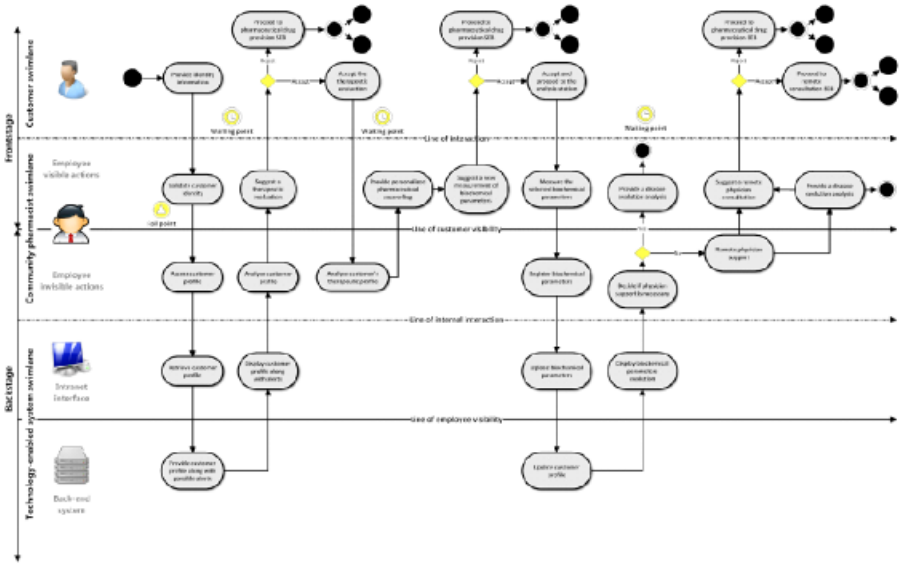


Figure 6 - SEB for the new Disease Management service in community pharmacy (reproduced with author's permission)[53].

The SEB presented in figure 6,[53] highlights the guidelines responsible for the service theater, identifying several actors (on the left) and the flow of possible actions throughout the service. This SEB also defines where the service takes place and how is the customer interacting with the service provider, as well as possible waiting points and fail points.

Implications for pharmacy practice

Whether these professionals have the necessary skills to provide online pharmaceutical care services is an aspect that needs to be further explored. However, training provided on a web-platform with game-based learning, practicing with cases from daily activities, is a future possibility.[54,55] Moreover, the social abilities that these professionals do have may provide the basis to improve the interaction experience with patients in a new online service.[44,56] This can be important considering that customer relationships is one of the key aspects of the new services provided through the Internet.

One can argue that, for these developments to be beneficial, they should be considered in an integrated and longitudinal perspective of services provision, requiring service's events registering, comprehensive analysis of the data and interactive dialogue with patients.[57] This perspective implies a new way of working in Portuguese community pharmacies. Some authors refer that it is necessary to create a new organization at community pharmacies, not only to embrace pharmaceutical care, but also to incorporate it into their business models.[58] Surely community pharmacies and their professionals could play a more active role in chronic disease management within the healthcare system. Embracing the potential of the Internet to support the development of an extended role for community pharmacists is strategic.[59]

Innovation is a process implying the transformation of ideas about a perceived problem into a new product, process or service. Innovation in healthcare has usually a direct impact on the quality of care services and on the life of patients. The challenges posed by the rising prevalence of chronic diseases demand new strategies to innovation in health.[60] The ultimate goal of technology and innovation is to improve quality of life. Yet, all too often, introduction of new tools is decided by policymakers and experts without genuinely involving future users and those experiencing the potential risks.[20] However, good business model designs are likely to be context dependent, and both the design and implementation processes are likely to involve iterative processes.[61]

As it is an objective of a good DSRM study, a new cycle is being prepared to further improve the online service, this time focusing on improving the communication between pharmacists and physicians.

5. Conclusion

The recent evolution of IST (e.g. website and chronic care sensors) is an important opportunity towards the integration of new roles for community pharmacists (within the healthcare system), while allowing a more active role from patients in their disease management. The ePharmacare platform presents a possible turning point in the way business is done within community pharmacies, by reaching out to new channels and shifting the focus from the sale of products to the provision of services.

The use of DSRM helped implementing an online pharmaceutical service through a higher involvement of the stakeholders in a comprehensive way. Moreover, in the problem definition stage of the DSRM cycle presented, several issues relating to community pharmacists and pharmacies activities were identified. The patterns of pharmacist time usage, the costing studies and the patterns of service provision and demand, reflect a need to reorganize pharmacies management and acquire additional skills in order to enable online pharmaceutical services provision.

The ePharmacare platform is able to offer pharmacies a way to better monitor their patients and therefore increase the quality of their therapy. By bringing to life a needed tool, the platform fulfills the detected need for IST in pharmaceutical services provision, offering patients a new way to interact with their data and be part of their own therapy as active members on disease management. There are already benefits to chronic patients using the platform to be more connected with the CP.

The quality and usability of the platform is critical. But the platform is not everything. Developing and implementing online services takes properly trained and motivated professionals. Online pharmaceutical services need to be more integrated in the current daily practices and

some communication and marketing efforts need to be done, to recruit and demonstrate value to the chronic patients. A rethinking of the community pharmacy business model in order to effectively and coherently integrate community pharmacies services into the future health system models, where patients will have an increasing role in disease management, is paramount.

List of abbreviations

AFP - Portuguese Association of Pharmacies

ANF - National Association of Pharmacies

CP - Community Pharmacist

CCM - Chronic Care Model

DSRM - Design Science Research Methodology

GP – General Practitioner

IST- Information Systems and Technologies

NHS - National Health Service

OF – Pharmaceutical Society

OTC – Over-the-counter medicines

SEB - Service Experience Blueprint

WHO - World Health Organization

Ethics approval and consent to participate

This study was performed in strict accordance with the good research practices and code of ethics of Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa. The study protocol was approved by the Ethics Committee of Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa (Permit Number: 7-2012-PN).

Competing interests

None to declare.

Funding

The research reported in this manuscript has been funded by the Portuguese National Science and Technology Foundation (Fundação para a Ciência e Tecnologia, FCT) through the ePharmacare project (PTDC/CCI-CIN/122690/2010). This support and the individual grants to João Gregório are gratefully acknowledged.

Authors' contributions

LVL, JG and MMS have substantially contributed to the design of the study and the writing of this manuscript. All authors read and approved the final manuscript. The funders have not been involved in the study design or reporting.

Authors' information

Luís Velez Lapão received a Ph.D. in Systems Engineering (health care management) from Technical University of Lisbon. He is an active member of the World Health Organization Collaborating Center for Health Workforce Policy and Planning, and leader of the research group on "Population Health, Policies and Services" at the Global Health and Tropical Medicine, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa. He is President of the NGO-AGO-Global Healthcare Cooperation and Development. He is auditor of the European Commission for the Health Care Information Systems since 2005.

João Gregório has a degree in Pharmaceutical Sciences. Registered specialist in Community Pharmacy since September 2009. He holds a Master in Health and Development with a specialization in Program and project management from the Institute of Hygiene and Tropical Medicine (IHMT) of NOVA University Lisbon, and is now working on a PhD project in International Health in the same institution. His research work focus on the use of information technologies to provide and improve health services in the context of primary and specialist health care.

Miguel Mira da Silva received a PhD in Computing Science from the University of Glasgow and more recently a "Sloan Fellowship" from the London Business School. Currently. Miguel is Associate Professor of Information Systems at the University of Lisbon and group leader at the INOV research institute.

Acknowledgements

Also of importance was the support of the Global Health and Tropical Medicine research center, GHTM – UID/Multi/04413/2013.

The authors would also like to acknowledge the participant pharmacies and patients.

Author details

1 *Global Health and Tropical Medicine, WHO Collaborating Centre for Health Workforce Policy and Planning, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira, 100 Lisbon, Portugal.*

2 *Global Health and Tropical Medicine, Instituto de Higiene e Medicina Tropical, Universidade Nova de Lisboa, Rua da Junqueira, 100 Lisbon, Portugal*

3 *Instituto Superior Técnico, Universidade de Lisboa, Avenida Rovisco Pais, 1 — 1049-001 Lisboa Portugal*

References

1. World Health Organization (WHO). Global Status Report on Non-Communicable Diseases. 2010.

2. World Health Organization (WHO). World Health Report - Primary Health Care: Now More Than Ever. Geneve; 2008.

3. Rothman AA, Wagner EH. Chronic illness management: what is the role of primary care?. Ann. Intern. Med. 2003;138:256–61.

4. 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. 2003;43:173–84.

5. Makowsky MJ, Schindel TJ, Rosenthal M, Campbell K, Tsuyuki RT, Madill HM. Collaboration between pharmacists, physicians and nurse practitioners: a qualitative investigation of working relationships in the inpatient medical setting. J. Interprof. Care. 2009;23:169–84.

6. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness: the chronic care model, Part 2. JAMA. 2002;288:1909–14.

7. Kennie-Kaulbach N, Farrell B, Ward N, Johnston S, Gubbels A, Eguale T, et al. Pharmacist

provision of primary health care: a modified Delphi validation of pharmacists' competencies. BMC Fam. Pract. 2012. p. 27.

8. Chisholm-Burns MA, Graff Zivin JS, Lee JK, Spivey CA, Slack M, Herrier RN, et al. Economic effects of pharmacists on health outcomes in the United States: A systematic review. Am. J. Heal. Pharm. 2010;67:1624–34.

9. Berenguer B, La Casa C, de la Matta MJ, Martín-Calero MJ. Pharmaceutical care: past, present and future. Curr. Pharm. Des. 2004;10:3931–46.

10. Bernsten C, Gariepy Y, Lutz EM, Reid PW, Schneider PJ. Developing New Economic Models for Payment for Services by Pharmacists. Int. Pharm. J. 2009;25:30–45.

11. Hawthorne N, Anderson C. The global pharmacy workforce: a systematic review of the literature. Hum. Resour. Health. 2009;7:48.

12. Nkansah N, Mostovetsky O, Yu C, Chheng T, Beney J, Bond CM, et al. Effect of outpatient pharmacists' non-dispensing roles on patient outcomes and prescribing patterns. Cochrane database Syst. Rev. 2010;CD000336.

13. Costa S, Santos C, Silveira J. Community pharmacy services in Portugal. Ann. Pharmacother. 2006;40:2228–34.

14. Ministry of Health. Decree-Law no. 19/2014 - Amendments to the legal framework of reimbursements of medicinal products and to the regime of medicinal products price. Lisboa; 2014.

15. Pereira Guerreiro M, Martins AP, Cantrill JA. Preventable drug-related morbidity in community pharmacy: Development and piloting of a complex intervention. Int. J. Clin. Pharm. 2012;34:699–709.

16. Katz SJ, Moyer CA. The Emerging Role of Online Communication Between Patients and Their Providers. J Gen Intern Med. 2004;19:978–83.

17. Callens S. The EU legal framework on e-health. Heal. Syst. Gov. Eur. Union. 2005.

18. Bates DW, Gawande AA. Improving safety with information technology. N. Engl. J. Med. 2003;348:2526–34.

19. Neuhauser L, Kreps GL. eHealth communication and behavior change: promise and performance. Soc. Semiot. 2010;20:9–27.

20. Piot P. Innovation and technology for global public health. Glob. Public Health. 2012;7:S46–53.

21. Pereira Guerreiro M, Martins AP, Cantrill JA. Preventable drug-related morbidity in community pharmacy: Commentary on the implications for practice and policy of a novel intervention. Int. J. Clin. Pharm. 2012;34:682–5.

22. Gregorio J, Cavaco A, Lapao L V. A scenario-planning approach to human resources for health: the case of community pharmacists in Portugal. Hum. Resour. Health. 2014;12:13.

23. George PP, Molina JA, Cheah J, Chan SC, Lim BP. The evolving role of the community pharmacist in chronic disease management - a literature review. Ann Acad Med Singapore. 2010;39:861–7.

24. Kreps GL, Neuhauser L. New directions in eHealth communication: Opportunities and challenges. Patient Educ. Couns. 2010;78:329–36.

25. Kuhn KA, Giuse DA, Lapão L, Wurst SHR. Expanding the scope of health information systems: From hospitals to regional networks, to national infrastructures, and beyond. Methods Inf. Med. 2007. p. 500–2.

26. Petrakaki D, Barber N, Waring J. The possibilities of technology in shaping healthcare professionals: (Re/De-)Professionalisation of pharmacists in England. Soc. Sci. Med. 2012;75:429–37.

27. Armstrong N, Powell J. Preliminary test of an Internet-based diabetes self-management tool. J. Telemed. Telecare. 2008;14:114–6.

28. Thursky KA, Mahemoff M. User-centered design techniques for a computerised antibiotic decision support system in an intensive care unit. Int. J. Med. Inform. 2007;76:760–8.

29. Christensen CM, Bohmer R, Kenagy J. Will disruptive innovations cure health care? Harv. Bus. Rev. 2000;78:102–12, 199.

30. Peffers K, Tuunanen T, Rothenberger M a., Chatterjee S. A Design Science Research Methodology for Information Systems Research. J. Manag. Inf. Syst. 2007;24:45–77.

31. Hevner AR, March ST, Park J, Ram S. Design Science in Information Systems Research. MIS Q. 2004;28:75–105.

32. Simon H a. The Science of Design: Creating the Artificial. Des. Issues. 1988;4:67.

33. Zehnder S, Bruppacher R, Ruppanner H, 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;2004.

34. Rutter P, Brown D, Jones I. Pharmacy research: the place of work measurement. Int. J. Pharm. Pract. 1998;6:46–58.

35. Finkler S a, Knickman JR, Hendrickson G, Lipkin M, Thompson WG. A comparison of work-sampling and time-and-motion techniques for studies in health services research. Health Serv. Res. 1993;28:577–97.

36. Gregório J, Cavaco AM, Lapão LV. How to Best Manage Time Interaction with Patients? Community Pharmacist Workload and Service Provision Analysis. Res. Soc. Adm. Pharm. 2016;In press.

37. Gregório J, Russo G, Lapão LV. Pharmaceutical services cost analysis using time-driven activity-based costing: A contribution to improve community pharmacies' management. Res. Soc. Adm. Pharm. 2016;12:475–85.

38. Santos H, Iglésias P, Fernández-Llimós F, Faus M, Rodrigues L. Segundo Consenso de Granada sobre problemas relacionados com medicamentos. Acta Med. Port. 2004;17:59–66.

39. Strauss A, Corbin J. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. Basics Qual. Res. Grounded Theory Proced. Tech. 2008.

40. Patricio L, Fisk RP, Cunha JF e. Designing Multi-Interface Service Experiences: The Service Experience Blueprint. J. Serv. Res. 2008;10:318–34.

41. Beck K, Beedle M, Bennekum A Van, Cockburn A, Cunningham W, Fowler M, et al. Manifesto for Agile Software Development [Internet]. Agil. Alliance. 2001. p. 2006. Available from: http://agilemanifesto.org/

42. Martin RC. Agile Software Development, Principles, Patterns, and Practices. Book. 2002.

43. Roberts AS, Benrimoj SIC, Chen TF, Williams KA, Hopp TR, Aslani P. Understanding practice change in community pharmacy: a qualitative study in Australia. Res. Social Adm. Pharm. 2005;1:546–64.

44. Rosenthal MM, Breault RR, Austin Z, Tsuyuki RT. Pharmacists' self-perception of their professional role: insights into community pharmacy culture. J. Am. Pharm. Assoc. (2003). 2011;51:363–7.

45. Gastelurrutia MA, Benrimoj SIC, Castrillon CC, De Amezua MJC, Fernandez-Llimos F, Faus MJ. Facilitators for practice change in Spanish community pharmacy. Pharm. World Sci. 2009;31:32–9.

46. Mil JWF, Boer WO, Tromp TFJ. European barriers to the implementation of pharmaceutical care. Int. J. Pharm. Pract. 2001;9:163–8.

47. Semchuk W, Taylor J, Sulz L, Deschamps M, Tsuyuki RT, Duffy P, et al. Pharmacist Intervention in Risk Reduction Study: High-Risk Cardiac Patients. Can. Pharm. J. / Rev. des Pharm. du Canada. 2007;140:32–7.

48. Ngai EWT, Poon JKL, Suk FFC, Ng CC. Design of an RFID-based healthcare management system using an information system design theory. Inf. Syst. Front. 2009;11:405–17.

49. Venable JR. Design science research post Hevner et al.: Criteria, standards, guidelines, and expectations. Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics). 2010. p. 109–23.

50. Österle H, Becker J, Frank U, Hess T, Karagiannis D, Krcmar H, et al. Memorandum on design-oriented information systems research. Eur. J. Inf. Syst. 2011;20:7–10.

51. Normann R. Reframing business: when the map changes the landscape. Technovation. 2001.

52. Cruz-Correia R, Boldt I, Lapão L, Santos-Pereira C, Rodrigues PP, Ferreira AM, et al. Analysis of the quality of hospital information systems Audit Trails. BMC Med. Inform. Decis. Mak. 2013;13:84.

53. Mello D. Designing Pharmaceutical Services Using the Multilevel Service Design Methodology. Universidade do Porto; 2013.

54. Hookham G, Nesbitt K, Cooper J, Croft H, Rasiah R. Gamification for education: Designing a pharmacy education game. Lect. Notes Comput. Sci. 2015;8955:157–65.

55. Schuller BW, Dunwell I, Weninger F. Serious Gaming for Behavior Change: The State of Play. Pervasive Comput. 2013;48–55.

56. Edmunds J, Calnan MW. The reprofessionalisation of community pharmacy? An exploration of attitudes to extended roles for community pharmacists amongst pharmacists and General Practioners in the United Kingdom. Soc. Sci. Med. 2001;53:943–55.

57. Corbin CL, Kelley SW, Schwartz RW. Concepts in service marketing for healthcare

professionals. Am. J. Surg. 2001. p. 1–7.

58. Nicole P, Rouse MJ. Scope of contemporary pharmacy practice: Roles, responsibilities, and functions of pharmacists and pharmacy technicians Executive summary. Am. J. Heal. Pharm. 2010. p. 1030–1.

59. Westerling AM, Haikala V, Airaksinen M. The role of information technology in the development of community pharmacy services: visions and strategic views of international experts. Res. Soc. Adm. Pharm. 2011;430–7.

60. Gardner CA, Acharya T, Yach D. Technological and social innovation: A unifying new paradigm for global health. Health Aff. 2007. p. 1052–61.

61. Teece DJ. Business Models, Business Strategy and Innovation. Long Range Plann. Elsevier Ltd; 2010;43:172–94.

3. DISCUSSION

Using DSRM to develop a new pharmacist-patient interaction platform, supported by web communication, is a novel approach that provided some insights on the use of IST to improve health outcomes in a community pharmacy setting. Although the research work developed in this thesis is eminently explorative in nature, the results presented in the four papers offer a picture of Portuguese community pharmacy and pharmacists that will allow to explore the possibilities of developing a new role and the associated conditions.

In the following section, some considerations on the presented results will be made, allowing for the discussion of practice and research implications that will close the discussion section of this thesis.

3.1. SUMMING UP THE RESULTS

3.1.1. PAPER I

Besides designing three scenarios for Portuguese community pharmacists' future, this paper identifies health system conditions that will be necessary to implement an online pharmaceutical service. From the analysis reported in paper I, it becomes evident that the development of a new role for community pharmacists is both dependent on the economic and legislative environment in which these professionals operate, and on their ability to innovate and develop new services.

The economic and legislative environment more conducive for implementing new services and support their diffusion is a liberal market, with fewer restrains in pharmacy ownership and installation and more private providers of healthcare. Therefore, one can assume that the pharmacy market needs to become more competitive, providing the environment for pharmacy differentiation.

The ability of community pharmacists to innovate is dependent not only on the "inner will" of individual pharmacy owners but also on the leadership of professional organizations such as the Pharmaceutical Society (OF) and the National Association of Pharmacies (ANF). This finding was somehow confirmed later with all of survey

respondents presented in paper IV declaring that the lack of support from professional organizations is a barrier to the development of online pharmaceutical services.

Another trend highlighted in paper I is the growing number of available pharmacists. The pharmacy market is absorbing these professionals, with the average number of pharmacists per pharmacy also growing since the analysis reported in paper I (Portuguese Pharmaceutical Society, 2013). The trend of substituting pharmacy technicians by pharmacists also continues. These trends along with the definition of remuneration policies for new services, may have an important impact on pharmacy services provision and pharmacists' role definition that will be discussed in the "implications for policy and practice" section.

3.1.2. PAPER II

The study of pharmacists' workload patterns and service provision was the main goal of the work reported in paper II. Understanding what pharmacists do in "a day at the office" and assessing the potential demand for chronic care services was envisioned as a critical step in the design of a new service. The results of this research highlight the need to redefine roles within the pharmacy, as the perception of "lack of time" often reported in the literature, might not be an accurate excuse for not providing pharmaceutical care services. In fact, what needs to be highlighted is that pharmacists spend a significant portion of their daily time executing undifferentiated tasks that could very well be performed by pharmacy technicians or other assistant personnel.

The workload patterns identified in this paper are very similar to workload patterns in other countries. This finding indicates that pharmacists' role is nowadays quite standardized. Although each country has different healthcare systems and arrangements for pharmaceutical service provision, understanding that pharmacists have similar workload patterns across countries is important for professional development policy, since it allows to think in a common strategy for pharmacists' role shift and implementation of new pharmacy services. Nevertheless, a common legal framework in European countries has so far been difficult to achieve (Mossialos et al., 2015, 2004).

3.1.3. PAPER III

To better assess the management implications of pharmaceutical services provision in community pharmacies, there is a need to accurately measure costs. This was the rationale behind the study reported in paper III that aimed to estimate the cost of current pharmaceutical services, establishing a gold standard for comparison with future services' costing.

Finding the cost of dispensing services, OTC consultations, and the cost of a counselling service without the medicine dispensing, were important results that will aid the discussion around the development of new remuneration models for community pharmacy. The counselling service has shown to be a low cost service that can be used to promote and offer other pharmacy services. With the activity costs reported, one can estimate a cost for the online service developed. Considering that the activity "Interview patient/answer patient query" is the support of the new service, it will cost around €32.04 per hour in these pharmacies. Assuming a pharmacist would use 20 minutes per month to provide the service to a patient, the online service in these pharmacies would cost around €10.00 a month per patient just to reach breakeven.

Besides calculating costs, the choice of Time-Driven Activity Based Costing (TDABC) was made since the development of a TDABC model for pharmaceutical services costing could provide community pharmacy's managers with valuable information to redesign activities, aiming to achieve a more cost-effective provision of pharmaceutical services. As highlighted in the discussion of paper III, there is a clear need to optimize the activities that support pharmaceutical services provision.

3.1.4. PAPER IV

The implementation of the online pharmaceutical service through the use of DSRM was successful as a proof of concept. Using DSRM provided a method to address several issues regarding service development, starting with the description of the current practice and the potential demand for novelty services, to the design and implementation of an online platform to support service provision in two different settings.

Pharmacists' answers to the initial survey highlight that Portuguese community pharmacists are accustomed to use IST-based dispensing systems for many years, but there is a very limited use of IST-based communication tools to assist patient care in disease management. Patients' answers about new pharmacy services were an important input. It seems that patients are willing to use specialized pharmacy services. There was little surprise when patients referred that they wanted home delivery of medicines, since this service is seldom provided. Moreover, patients' recognition that pharmacy services must be integrated with NHS's primary care services, was also an important finding. Pharmacists have now to bridge this gap and offer patients real alternatives for their disease management.

The demonstration stage of the DSRM presented in Paper IV was hindered by the low numbers of patients being recruited to participate. The lack of patient recruitment in the three participant pharmacies led the research team to find an alternative in Senior University pupils. This was a visionary move since it allowed to explore the provision of pharmaceutical care by a pharmacist outside the community pharmacy setting. Due to the success of this strategy, there seems to be an option for independent pharmacists in developing disease management services to support chronic patients. This would be a role similar to a "patient advocate", opening the possibility to innovators in the pharmacy profession to transform disease management, as already postulated by other authors (Alston and Waitzman, 2013). Furthermore, if community pharmacists refer "lack of time" to mask their low interest and motivation in providing disease management services, they must be aware that other health professionals, like primary healthcare nurses, may take their place in community-based disease management (Buchan et al., 2013; Leese, 2006).

Due to the low number of users, a specific feature could not be designated as having an important impact in health outcomes. For now, one can state that the closer patient follow-up, provided with the use of several features, may have an impact on health outcomes that needs to be better assessed. User satisfaction with the platform, assessed in the final interview and by the will to continue to use the platform beyond the end of the research, is one more sign of the potential that community pharmacists are leaving unexploited. Moreover, the need to communicate with the GP, either through

ePharmacare platform or email, felt by both pharmacists and patients, highlights the "gatekeeping-like" role that patients refer is a role that fits the pharmacist. According to users' feedback, this connection could greatly improve the perceived usefulness of the platform. Since it was not included in the design of the platform in this initial DSRM cycle, the GP-pharmacist connection will be studied in the next cycle. The use of DSRM provides a strong support to develop the ePharmacare 2.0 platform in a confident way.

With the end of the first cycle of DSRM described in paper IV, several issues regarding the provision of community pharmacists' disease management services supported by IST have been found. Most of them, have been discussed in the last years within the profession. In the following section, these issues are presented and discussed in the light of the findings reported in this thesis.

3.2. IMPLICATIONS FOR PRACTICE AND POLICY

3.2.1. ROLE DEFINITION INSIDE COMMUNITY PHARMACY

With the differentiation that is needed to provide online pharmaceutical services, new categories for working community pharmacists have to be developed. Nowadays in Portugal, only the technical director and the deputy pharmacist are in fact a differentiated function in the pharmacy. They play the role of maximum responsibility in the pharmacy, being legally accountable for medicines dispensing and provision of services by the rest of the staff. However, neither is obligated to have any special education or training in the provision of pharmaceutical care. This causes a skill gap in the pharmacy team that may lead to low motivation to innovate and develop new services. With the training program for pharmacists' provision of pharmaceutical care programs for diabetes and hypertension, pushed by ANF in the turn of the century, some pharmacies are staffed with capacitated professionals. In a competitive market, this will be a precious asset. In a recent paper, Martins & Queirós (2014), found that access to additional pharmacy services may increase as market competition increases. This is usually true in urban markets, where the availability of pharmacies is greater than in in rural areas. However, if the health system is to retain its equity, a policy framework that will allow service diffusion through the country in a way that best assures equity will be needed. Countries where the pharmacy

market is liberalized usually have to provide incentives to rural pharmacies to allow them to remain open (Lluch and Kanavos, 2010).

It seems that the trend of hiring more pharmacists and less pharmacy technicians, highlighted in paper I, has not contributed to improve pharmaceutical services provision. In fact, staffing more pharmacists is not a predictor of practice change (Doucette et al., 2012). Indeed, staffing of less than 3 pharmacy technician has been identified as a negative predictor of practice change and new services implementation (Doucette et al., 2005). At first glance, having more pharmacists per pharmacy may seem a best practice, leading to better pharmaceutical service provision. But if pharmacists are devoting their time to perform undifferentiated tasks, they will have little time or will to provide pharmaceutical care services. As such, the high number of pharmacists per pharmacy reported in paper II, versus the relative absence of technicians must raise some concerns. It is often mentioned that pharmacists are indistinguishable from other pharmacy professionals, which in turn contributes to the low credibility of pharmacy services (Cavaco et al., 2005). However, pharmacist's credibility is essential to the development of the new roles and services (Snyder et al., 2010). Promoting pharmacists' hiring to perform technical tasks may backlash and instead of pharmaceutical care services provision, pharmacists' role will gradually slide back to a dispenser of medicines. Furthermore, the high supply of pharmacists had the effect of lowering pharmacists' salaries (Portuguese Pharmaceutical Society, 2013). In these conditions, professionals' morale may be low (Van Lerberghe et al., 2002). Together with "pull factors" perceived from other countries, such as higher salaries, better career development opportunities and overall family life conditions (Dussault and Franceschini, 2006), it is natural that pharmacists emigration may continue to increase, endangering the goals of universal coverage of pharmaceutical services provision (Campbell et al., 2014).

Patients can perceive pharmacists as a source of credible health information but hey can also have no idea of what pharmacists do and what it is right to expect from them (Costa et al., 2004; Guerreiro et al., 2010). Pharmacy professionals have to recognize that the new roles depend on the development of a specialized body of professionals, that patients can recognize as such and demand for their pharmacies (Kennie-Kaulbach et al., 2012). It is necessary that only professionals with the right credentials and expertise can

be authorized to provide more advanced services, contributing for credibility, accountability and co-responsibility for patients' health outcomes (Noyce, 2006). Differencing such professionals, and assuring that pharmacies that are willing to provide pharmaceutical services focusing on chronic care management have one of these professionals, will be essential to the diffusion of new forms of practice in Portugal. The latest developments on professional policy made by the Portuguese Pharmaceutical Society have included the definition of a competency framework, attributing core competencies and complementary competencies to community pharmacists. The corollary of this strategy points to the implementation of a "Community pharmacy" speciality in a near future. However, the framework is not clear as to what will differentiate pharmacists providing pharmaceutical care services from pharmacists that will assume a "dispenser only" or management role. It will also be relevant to start shifting pharmacist's public image from a drug dispenser to a healthcare service provider, possibly through a more proactive attitude geared to pharmaceutical care (Sabater-Galindo et al., 2015).

The pharmacist-patient relationship can be improved through more intense and frequent communication to achieve an acceptable level of service provision (Bodenheimer et al., 2002; Gidman et al., 2012; Pelicano-Romano et al., 2015). Besides the re-organization and role definition that is necessary within individual pharmacies, community pharmacists need better communication tools to enhance the physician-patient-pharmacist relationship, as has become clear from the demonstration stage of this research. The results from the demonstration stage of ePharmacare service prototype, reported in paper IV, show that using IST will contribute to a better follow-up, through a higher frequency of communication between provider and patient. However, whether this follow-up is effective and valuable for patients and health system, remains an open research question.

3.2.2. Role of Information Systems and Technologies

There has been some discussion about the strategic importance of information systems and technology (IST) in supporting medicine dispensing and the financial management of community pharmacies (Westerling et al., 2011). Undoubtedly, IST will be essential to provide patient care services in future health systems. As e-prescribing,

electronic medical records, and other technological advances are implemented and integrated, patients will have increased access to primary healthcare providers for diagnosis, monitoring, and triage (Mossialos et al., 2013). The potential value of these technologies to improve health system efficiency, will make it an area where pharmacists' expertise and knowledge will be a precious asset (Petrakaki et al., 2012).

Community pharmacies' IST are presently more focused on dispensing than supporting patient care, a finding confirmed in this research and reported in paper IV. This is an worldwide trend, with IST for community pharmacy being mainly used to support standard dispensing of prescriptions, either in paper or by e-prescription (Astrand et al., 2009; Motulsky et al., 2011). Nevertheless, the technological capacity exists to provide patient care. The use of IST may be the key that unlocks pharmacists' full potential (Alston and Waitzman, 2013; Petrakaki et al., 2012).

In this thesis, a methodology to implement online pharmaceutical services was explored. The platform supporting the service was developed using users' inputs, which contributed to the platform's perceived ease of use, following Davis terminology (Davis, 1993). However, due to the low number of patients recruited and pharmacists' resistance to recruit patients, the perceived usefulness of the system could not be conveniently determined. If something can be inferred from this early explorative approach, is that the three pharmacists recruiting patients in the community pharmacy setting had no major problems using the platform, finding it easy to use, but were insufficiently motivated to use the platform and provide the service, thus not recognizing its usefulness. This reluctance to use the platform was expected if these were older pharmacists. But these pharmacists were young, having improved IST skills in relation to their colleagues. This hints at the necessity of designing adequate incentives for service provision even for professionals with the right attitude towards patient care (Feletto et al., 2010). Moreover, in a scenario where IST are prevailing and pharmacists are providing eHealth pharmaceutical services, the reluctance in the use of IST solutions highlights the importance of training and education on the use of IST. Beyond technical competencies regarding the provision of the pharmaceutical service itself, community pharmacists will have to develop capacities for the use of IST, gain marketing skills and improve

communication skills to further increase the integration of pharmaceutical services with primary healthcare services.

As already stated in the introduction section, it was also an aim of this project to establish the online service acceptability, feasibility, sustainability, and adaptability. Service acceptability has been demonstrated by patients' use of the platform during 8 months, actively contacting the pharmacist and showing interest in continuing to use the platform beyond study's end. However, one must account that for patients' good acceptability of the program, the "no cost" nature of the service may have played a significant role, as has been reported in other contexts (Guerreiro et al., 2010). Furthermore, pharmacist acceptability of the service may be considered low, as revealed by the lack of patient recruitment. The feasibility of the online pharmaceutical service has been demonstrated to greatly depend on pharmacists' availability to actively recruit patients for the service. However, the observed low impact on pharmacists' workload hints that this kind of service might be feasible, depending on pharmacists' proactive attitude in identifying the patients who would benefit the most. Furthermore, every patient has its own needs. Needs assessment on an individual level, done by primary care professionals, must be a collaborative action (Asadi-Lari et al., 2003). It is up to the pharmacist to identify patients in the community that will benefit the most from a differentiated service provision and, with the collaboration of the primary healthcare team, develop services that fulfil individual patients' needs.

From a financial perspective, this service is sustainable if it generates more than 10 euros a month per patient in revenue. Integrating this service in the daily work of a pharmacy will depend on finding the right remuneration strategy. More discussion on this issue and on remuneration policies will follow in the next section. Adaptability could be measured in two dimensions. It was found that the online pharmaceutical service can adapt to different contexts, when most patients were recruited outside the community pharmacy setting. In another dimension of adaptability analysis, the several incremental versions utilized during the demonstration stage show that the platform and the service can adapt to different settings and to users' feedback.

What is also lacking is understanding what, how, when, and why a communication should be established between two professionals in practice settings. Supporting

mechanisms – clinical protocols, registration, training, licensing and accreditation processes – need to be brought up to date and used (Alliance for Health and Systems Research Policy, 2009). Also important, is the integration of physicians' (and other primary healthcare professionals) with pharmacists' information systems. Any of these elements would profit from a communication platform such as the one designed during this work, which emphasizes the importance of continuing to develop the design of an online platform to support GP-pharmacist services' integration. The arrangement of the GP-pharmacist integration has implications in the way disease management services provided by pharmacists are paid, which will be discussed in the following section.

3.2.3. Envisioning remuneration models for Portuguese Community Pharmacists

Dispensing of prescription medicines is considered the core role of community pharmacists. Considering that a patient should take as few medicines as possible, the right incentive to pharmacists in this first tier of pharmaceutical services would be one that prevents selling unnecessary and costly medicines. Thus, the best incentive scheme to the dispensing of medicines seems to be fee-per-prescription, detaching the provision of a medicine from a profit margin. This way, pharmacists have nothing to gain in selling the highest priced medicine. Of course, for the pharmaceutical policy of a country this implies finding the correct price to pay for each prescription and who should pay for it. In paper III, an average cost of 3.66€ for the dispensing service was found. Although more data from other pharmacies is needed to calculate a more accurate cost, this finding may help inform policy makers on new incentives schemes for medicine dispensing.

A second tier of pharmaceutical services involves the provision of information about medicines and health issues. In these services, there might be no dispensing involved. Giving information and advice, or dispensing OTC medicines for minor ailments, is an important primary care role seldom recognized by health systems. Some countries, such as the UK and Canada (Bernsten et al., 2010), have incentives for this minor ailments schemes and provision of information but Portugal has not. When someone goes to the pharmacy and is advised to go for a doctor consultation, the pharmacist does not receive any payment. Thus, there is no incentive to refer to the clinician. This may lead to a situation where pharmacists refer less than they should,

preferring to sell OTC medicines that might not alleviate symptoms and make the situation worst. To avoid this, patients' referral to primary care could be paid under a capitation scheme, where pharmacies would receive a fee per approved referrals, while the OTC consultation could be paid by a mix of fee-for-service and business margin over the product. For the capitation scheme, the arrangement of the GP-pharmacist integration (formal contract vs. collaboration) has to be defined, but contracting seems to be the best proposal. In the Portuguese context, this contracting could be included in the commissioning of primary care services signed by Health Centres Group of the geographical area served by a group of pharmacies.

The third level or tier is a mix of services such immunization services, screening services, or needle exchange programs. Traditionally, Portuguese pharmacies have decided to provide these services free of charge or charging a small fee for service. But it is not financially feasible for pharmacists to perform these services at no cost when a considerable amount of time and resources are needed (Snella et al., 2004), as shown by the findings reported in paper III. A fee for service that patient's perceive as small and cost-efficient, seems to be the best incentive model to provide these services, since the health system itself benefits for a high provision of these services. Screening services for chronic patients though, could be placed under a scheme such as a disease management program.

The disease management programs could be viewed as a fourth tier of services. The incentive structure behind such a service could include the multiple fees or incentives provided for the other tiers. For example, a chronic patient such as a diabetic could hypothetically pay for their disease management instead of paying for individual services. In this way, a patient would only pay a fee regarding their situation, regardless of the number of medicines that s/he is taking. This would be optimal for patients who have to take a large number of medicines, which are generally the older and frail patients, for whom the necessity of purchasing a large number of medicines disincentives the purchase of disease management services, even more if they have to pay for it. This bundle of services is something already tried in other industries, with variable degrees of success (Porter, 2010).The discussion around incentives for pharmaceutical services provision may open other discussions and research lines. One thing in common in all of the known

pharmacist incentive schemes is that the incentive does not go to the pharmacist, going to the pharmacy revenue stream instead. But who should be the recipient of the financial incentives? Pharmacists as a solo professional, working independently of a pharmacy or a primary care organization, are not a regular feature of any health system which makes it difficult to think in alternatives to this situation. In this thesis, part of the research was done featuring an independent pharmacist funded with a research scholarship, but in real world conditions some sort of remuneration would have to be in place to make the provided services feasible.

One can argue that incentives for the provision of services that focus on the utilization of medicines (e.g. medicine review services and others), should be paid to individual pharmacists and not to the organization or pharmacy itself. If the pharmacist providing the service and the person receiving payment are the same, it is more likely that a service will be developed and marketed (Bernsten et al., 2009). In this way, pharmacists would be motivated to provide these services, regardless of the setting they are working in, being it an independent or multiple/chain pharmacy. Nevertheless, one can argue that pharmacists' role in the health system is closely tied to the provision of medicines and that this role is only viable if the pharmacist is working in a pharmacy. Therefore, under the current economic and legislative environment, the pharmacy or organization should collect all the payments and then pay the pharmacist accordingly, under the organization's incentives policy.

Another challenge that pharmacists face when obtaining payment from patients is establishing a price for the service that is sufficient to support it and is perceived as a good value by the patient (Freeman et al., 2014). When cognitive services are provided by pharmacists, value may be added to a drug or device. For example, diabetes education may be provided with the purchase of a blood glucose meter (Snella et al., 2004). The current organizational structure and information systems of health care delivery make it challenging to measure (and deliver) value to patients. Thus, most providers fail to do so (Porter, 2010). Measuring pharmaceutical care services value is essential to allow the reform of the reimbursement and remuneration systems, tending to reward value by providing bundled payments covering the full care cycle. Aligning reimbursement with value in this way rewards providers for efficiency in achieving good outcomes while

creating accountability for unsatisfactory care (Porter, 2010). The results presented in paper III will aid the discussion around this issue for Portuguese community pharmacists.

Finally, one has to consider that patients may not desire to pay for these services as well. It should be the payers and insurances that have to provide for these payments, to assure the overall equity of the health systems. In a context of economic constrains, this is surely the biggest barrier, since it will affect pharmaceutical expenditure budgets, which may lead to increased attrition between the industry and community pharmacies.

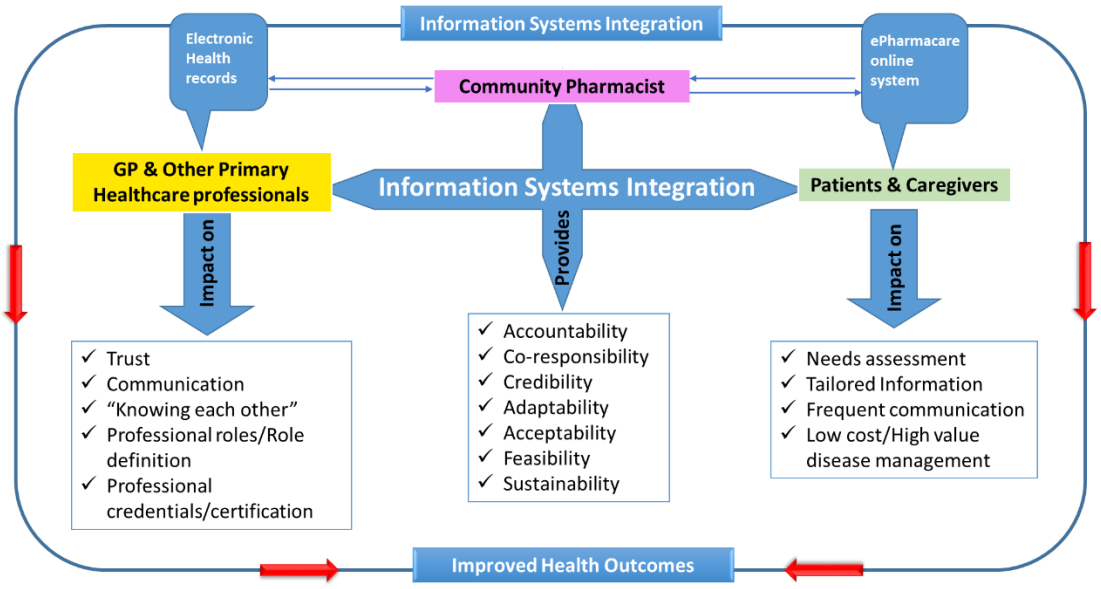
In spite of developing new roles during the last decades, community pharmacists in Portugal continue to have an inefficient incentive package regarding pharmaceutical care services, since it only aims at reducing the pharmaceutical expenditure budget. The economic constraints imposed by the structural adjustment program forced lower margins for pharmacies, installing a regressive mark-up system. These economic constraints bring low motivation to innovate and develop new services (Leopold et al., 2014). In this scenario, pharmacists are expected to provide services with the same or even lower payment. However, if the profession wishes to continue to pursue a different role in the primary care team it has to advocate a new incentives scheme, thoroughly supported by cost-efficiency and utility studies.

3.3. HEALTH INFORMATION SYSTEMS INTEGRATION: A MODEL OF DIMENSIONS TO ASSESS

With the integration of primary healthcare and pharmaceutical services, data sharing portals such as the online platform developed in this thesis will receive data validated by primary healthcare professionals that are useful to pharmacists' provided disease management in the community. In a reciprocal way, the data gathered by patients and caregivers in the same portal, could be validated by community pharmacists before input in the electronic health record managed by primary care professionals. Figure 7 intends to depict a possible scenario for the Health information systems integration that will be needed. An integrated information system that provides the stakeholders of disease management with mechanisms that assure accountability, credibility, acceptability among other dimensions, would have the potential to impact on several factors, already discussed in this thesis. On the professionals' side, the dimensions of

trust, communication, "knowing each other", role definition and professional recognition and certification will surely benefit of such a system. On patients and caregivers' side, an integrated system may improve professionals' needs assessment, while providing tailored information through more frequent communication on a low cost service, yielding a high value disease management.

Figure 7 - Conceptual model for the integration of Health Information Systems in Primary Healthcare



Future research that focus on the impact of information systems on these dimensions will greatly contribute to the advancement of knowledge in the field of health information systems, eHealth, and pharmaceutical services provision.

3.4. LIMITATIONS

The limitations of this thesis were already discussed in the papers presented in the results section. Most were related to the low number of pharmacies, patients and pharmacists answering surveys or participating in the observational study,

One can argue that other methodologies are available to design information systems that would result in a similar or even better online platform. Nevertheless, the use of

DSRM to implement an online pharmaceutical service offered a higher involvement to the stakeholders. This involvement showed the potential to develop a tailored information system. Furthermore, in the problem definition stage of the DSRM cycle presented, several issues relating to community pharmacists and pharmacies activities were identified. However, one must limit these findings to participant pharmacies in spite of the perception that these pharmacies provide a picture of the large majority of the country's pharmacies. Caution is needed when interpreting the findings here reported.

The Dáder methodology to provide patient follow-up was chosen since it was the method used in the pioneer pharmaceutical care programs implemented in Portugal. All participant pharmacists who could provide pharmaceutical care were trained in this methodology. However, one can argue that other methodologies for patient follow-up namely, Medication therapy management (MTM), were available and could offer a valid alternative. The low number of participants in the demonstration stage also hinders the results, namely the estimation of the impact on health outcomes. In the next DSRM cycle, a better recruiting strategy must be defined to increase the number of participants, thus increasing the likelihood of having the sufficient number of participants to accurately assess the impact of online pharmaceutical services on the health outcomes of chronic patients.

3.5. REFERENCES

Alliance for Health and Systems Research Policy, 2009. Systems thinking for health systems strengthening, Alliance for Health Policy and Systems Research. WHO, Geneva. doi:10.1155/2010/268925

Alston, G.L., Waitzman, J., 2013. The I-Tribe Community Pharmacy Practice Model: professional pharmacy unshackled. J. Am. Pharm. Assoc. (2003). 53, 163–71. doi:10.1331/JAPhA.2013.12199

Asadi-Lari, M., Packham, C., Gray, D., 2003. Need for redefining needs. Health Qual. Life Outcomes 1, 34. doi:10.1186/1477-7525-1-34

Astrand, B., Montelius, E., Petersson, G., Ekedahl, A., 2009. Assessment of ePrescription quality: an observational study at three mail-order pharmacies. BMC Med. Inform. Decis. Mak. 9, 8. doi:10.1186/1472-6947-9-8

Bernsten, C., Andersson, K., Gariepy, Y., Simoens, S., 2010. A comparative analysis of remuneration models for pharmaceutical professional services. Health Policy. 95(1), 1-9. doi:10.1016/j.healthpol.2009.11.008

Bernsten, C., Gariepy, Y., Lutz, E.M., Reid, P.W., Schneider, P.J., 2009. Developing New Economic Models for Payment for Services by Pharmacists. Int. Pharm. J. 25, 30–45.

Bodenheimer, T., Wagner, E.H., Grumbach, K., 2002. Improving primary care for patients with chronic illness: the chronic care model, Part 2. JAMA 288, 1909–1914. doi:10.1001/jama.288.14.1775

Buchan, J., Temido, M., Fronteira, I., Lapão, L., Dussault, G., 2013. Nurses in advanced roles: a review of acceptability in Portugal. Rev. Lat. Am. Enfermagem 21 Spec No, 38–46. doi:10.1590/s0104-11692013000700006

Campbell, J., Dussault, G., Buchan, J., Pozo-Martin, F., Arias, M.G., Leone, C., Siyam, A., Cometto, G., 2014. WHO | A Universal Truth: No Health Without a Workforce, A Universal Truth: No Health Without a Workforce. Genève. ISBN 978 92 4 150676 2

Cavaco, A.M., Dias, J.P.S., Bates, I.P., 2005. Consumers' perceptions of community pharmacy in Portugal: a qualitative exploratory study. Pharm. world Sci. 27, 54–60.

Costa, F.P.C., Duggan, C., van Mil, J.W.F., 2004. Assessing the pharmaceutical care needs of asthmatic patients. Pharm. world Sci. 26, 313–318.

Davis, F.D., 1993. User acceptance of information technology: system characteristics, user perceptions and behavioural impacts. Int. J. Man. Mach. Stud. 38, 475–487. doi:10.1006/imms.1993.1022

Doucette, W.R., Nevins, J., McDonough, R.P., 2005. Factors affecting collaborative care between pharmacists and physicians. Res. Soc. Adm. Pharm. 1, 565–578. doi:10.1016/j.sapharm.2005.09.005

Doucette, W.R., Nevins, J.C., Gaither, C., Kreling, D.H., Mott, D.A., Pedersen, C.A., Schommer, J.C., 2012. Organizational factors influencing pharmacy practice change. Res. Soc. Adm. Pharm. 8, 274–84. doi:10.1016/j.sapharm.2011.07.002

Dussault, G., Franceschini, M.C., 2006. Not enough there, too many here: understanding geographical imbalances in the distribution of the health workforce. Hum. Resour. Health 4, 12. doi:10.1186/1478-4491-4-12

Feletto, E., Wilson, L.K., Roberts, A.S., Benrimoj, S.I., 2010. Building capacity to implement cognitive pharmaceutical services: Quantifying the needs of community pharmacies. Res. Soc. Adm. Pharm. 6, 163–173. doi:10.1016/j.sapharm.2009.08.003

Freeman, P.R., Jones, M., Blumenschein, K., 2014. It's Not Just the Money: Why Consumers Do Not Purchase Pharmacist-Provided Services. Pharmacol. Pharm. 5, 570–576.

Gidman, W., Ward, P., McGregor, L., 2012. Understanding public trust in services provided by community pharmacists relative to those provided by general practitioners: a qualitative study. BMJ Open 2, e000939–. doi:10.1136/bmjopen-2012-000939

Guerreiro, M., Cantrill, J., Martins, P., 2010. Acceptability of community pharmaceutical care in Portugal: a qualitative study. J. Health Serv. Res. Policy 15, 215–22. doi:10.1258/jhsrp.2010.009121

Leese, B., 2006. New opportunities for nurses and other healthcare professionals? A review of the potential impact of the new GMS contract on the primary care workforce. J. Heal. Organ. Manag. 20, 525.

Leopold, C., Mantel-Teeuwisse, A.K., Vogler, S., Valkova, S., de Joncheere, K., Leufkens, H.G.M., Wagner, A.K., Ross-Degnan, D., Laing, R., 2014. Effect of the economic recession on pharmaceutical policy and medicine sales in eight European countries. Bull. World Health Organ. 92, 630–640. doi:10.2471/BLT.13.129114

Lluch, M., Kanavos, P., 2010. Impact of regulation of Community Pharmacies on efficiency, access and equity. Evidence from the UK and Spain. Health Policy. 95(2-3), 245–254. doi:10.1016/j.healthpol.2009.11.002

Martins, L., Queirós, S., 2014. Competition among pharmacies and the typology of services delivered: The Portuguese case. Health Policy. 119(5), 640-7. doi:10.1016/j.healthpol.2015.03.001

Mossialos, E., Courtin, E., Naci, H., Benrimoj, S., Bouvy, M., Farris, K., Noyce, P., Sketris, I., 2015. From "retailers" to health care providers: Transforming the role of community pharmacists in chronic disease management. Health Policy. 119(5), 628–639. doi:10.1016/j.healthpol.2015.02.007

Mossialos, E., Mrazek, M., Walley, T., 2004. Regulating pharmaceuticals in Europe: striving for efficiency, equity and quality. Open University Press, Maidenhead.

Mossialos, E., Naci, H., Courtin, E., 2013. Expanding the role of community pharmacists: Policymaking in the absence of policy-relevant evidence? Health Policy. 111(2), 135-48. doi:10.1016/j.healthpol.2013.04.003

Motulsky, A., Sicotte, C., Lamothe, L., Winslade, N., Tamblyn, R., 2011. Electronic prescriptions and disruptions to the jurisdiction of community pharmacists. Soc. Sci. Med. 73, 121–128. doi:10.1016/j.socscimed.2011.04.009

Noyce, P., 2006. Governance and the pharmaceutical workforce in England. Res. Soc. Adm. Pharm. 2, 408–419. doi:10.1016/j.sapharm.2006.07.005

Pelicano-Romano, J., Neves, M.R., Amado, A., Cavaco, A.M., 2015. Do community pharmacists actively engage elderly patients in the dialogue? Results from pharmaceutical care consultations. Heal. Expect. 18, 1721–1734. doi:10.1111/hex.12165

Petrakaki, D., Barber, N., Waring, J., 2012. The possibilities of technology in shaping healthcare professionals: (Re/De-) Professionalisation of pharmacists in England. Soc. Sci. Med. 75, 429–437. doi:10.1016/j.socscimed.2012.03.033

Porter, M.E., 2010. What is Value in Health Care? N. Engl. J. Med. 363, 2477–2481. doi:10.1056/NEJMp1002530

Portuguese Pharmaceutical Society, 2013. Survey of pharmaceutical sciences graduates 2011/2012. Lisboa.

Sabater-Galindo, M., Fernandez-Llimos, F., Sabater-Hernandez, D., Martínez-Martínez, F., Benrimoj, S.I., 2015. Healthcare professional-patient relationships: Systematic review of theoretical models from a community pharmacy perspective. Patient Educ. Couns. 99(3), 339-347. doi:10.1016/j.pec.2015.09.010

Snella, K. a, Trewyn, R.R., Hansen, L.B., Bradberry, J.C., 2004. Pharmacist compensation for cognitive services: focus on the physician office and community pharmacy. Pharmacotherapy 24, 372–88. doi:10.1592/phco.24.4.372.33179

Snyder, M.E., Zillich, A.J., Primack, B.A., Rice, K.R., Somma McGivney, M.A., Pringle, J.L., Smith, R.B., 2010. Exploring successful community pharmacist-physician collaborative working relationships using mixed methods. Res. Soc. Adm. Pharm. 6, 307–321. doi:10.1016/j.sapharm.2009.11.008

Van Lerberghe, W., Conceição, C., Van Damme, W., Ferrinho, P., 2002. When staff is underpaid: Dealing with the individual coping strategies of health personnel. Bull. World Health Organ. 80, 581–584. doi:10.1590/S0042-96862002000700011

Westerling, A.M., Haikala, V., Airaksinen, M., 2011. The role of information technology in the development of community pharmacy services: visions and strategic views of international experts. Res. Soc. Adm. Pharm. 430–437. doi:10.1016/j.sapharm.2010.09.004

4. CONCLUSION

Based on the results of the study, several conclusion can be drawn:

- From the scenario exercise, it is clear that pharmacist's new role will require significant legislative changes, adequate financial incentives and other behavioural changes, namely an entrepreneur mind-set. Here, proper capacity strengthening will be crucial. Also, the recent evolution of IST (e.g. website and chronic care sensors) is an important opportunity towards the integration of new roles for community pharmacists (within the healthcare system), while allowing a more active role from patients in their disease management.

- The assessment of a single day workload showed that pharmacists spend half of their day interacting with customers and patients. However, the short interaction time with a patient is insufficient to provide a proper follow-up service, which calls for the opportunity to introduce innovative patient management services, supported by new and adequate Information Systems. The perceived lack of time, many times declared by pharmacists as a barrier for role development, seems to be an important area to work on. With additional research, there is room for improvement in internal organization and better roles definition within the pharmacy.

- The medicine dispensing service was found to be the most expensive in all the three participating pharmacies. This work shows that there is a clear opportunity for improving service management by optimizing medicine dispensing, through the use of solutions that may reduce pharmacist's workload. The costs of OTC dispensing and the costs of counselling without medicine dispensing shows that the implementation of minor ailment schemes in Portuguese pharmacies may be cost-effective. These low cost services could be used to promote new services focusing on longitudinal patient care.

- The ePharmacare platform is able to offer pharmacies a way to support new pharmaceutical services and to better monitor their patients, improving the quality of their therapeutic monitoring. By bringing to life a needed tool, this platform fulfils the detected need for IST in pharmaceutical services provision, offering patients a new way to interact with their data and be part of their own therapy as active members on disease management. The use of DSRM helped to design and implement an online pharmaceutical service through a higher involvement of the stakeholders in a comprehensive way.

4.1. FUTURE RESEARCH

The ePharmacare platform presents a possible turning point in the way business is done within community pharmacies, by reaching out to new channels and shifting the focus from the sale of products to the provision of services. However, in spite of the quality and usability of the platform being critical issues, the platform is not everything. Developing and implementing eHealth services takes properly trained and motivated professionals. Future professionals will have to acquire aptitudes that will facilitate the implementation of new services namely, communications skills, customer relation, social marketing skills but also theoretical and practical competencies to implement the service in a confident way.

Furthermore, online pharmaceutical services need to be more integrated in the current daily practices. A rethinking of the community pharmacy business model in order to effectively and coherently integrate community pharmacies services into the future health system models, where patients will have an increasing role in disease management, is paramount. More research on the integration of pharmaceutical services and primary care services is needed as is the definition and experimentation of new pharmacy remuneration models. Defining a model to finance these services will be vital to preserve community pharmacists' contribution and the overall equity of the Portuguese health care system.

In the GP-pharmacist collaboration, properly designed information systems and technologies will have a very important role. This project did not address this relation, choosing to address the pharmacist-patient relation first. A new DSRM cycle should

address this relation, focusing on the development of a new version of the platform that covers GPs needs in the integrated disease management process.

Pharmacists' professional organizations have to show leadership and coordinate strategies with other healthcare practitioners' professional organizations, to ensure that the new practice might reach all practitioners in a near future to benefit healthcare system's equity. Research on the best form of the GP-pharmacist arrangement and integration of other healthcare practitioners' contributions, will greatly contribute to inform these strategies.

It is expected that these findings will help inform health system managers, professionals and policy makers assessing new models for pharmaceutical care services integration in Portugal.

5. APPENDIXES

5.1. INITIAL SURVEY ON PHARMACY DESCRIPTION, PHARMACEUTICAL SERVICE PROVISION AND USE OF INFORMATION SYSTEMS AND TECHNOLOGIES.

This project aims to investigate how the community pharmacy services will be in the future as well as the data and information management activities in this context, including the use of information technologies and e-health to implement the new pharmacy services. e-Health is defined in the intersection of informatics, health and services provision, with the objective of enhancing the relation with the citizens and patients through the use of Internet and other technologies.

The main objective of the project is to explore how the pharmaceutical services can improve disease and therapy management, with the goal to improve the quality of the health care provided, while integrating the pharmaceutical services in the health system, using information technologies.

In order to attain our objective your participation is essential. If you wish, we will provide you with a project report with the synthesis of the first results.

Important notice:

Every data collected by this survey will be processed with total confidentiality, with the highest ethical standards, as any serious and responsible research must have.

The survey will take 10 to 15 minutes to finish. Thank you very much for your collaboration.

Project director: Prof. Doutor Luís Velez Lapão (IHMT/UNL).

About you

1. **What role best describe your functions**
    a. Technical director pharmacist
    b. Supervising pharmacist
    c. Pharmacist
    d. Pharmacy manager
    e. Pharmacy technician or assistant
    f. Other Please describe_____

2. **Are you:**
    a. Male
    b. Female

3. **How old are you?**
    _____ (number)

4. **Since when do you work in community pharmacy?**
    a. _____ (year)

5. **How many hours do you work in this community pharmacy in a typical week?**
    _____(number)

6. **What is your academic degree:**
    a. High School
    b. Professional course
    c. Bsc in pharmacy
    d. PharmD
    e. MSc
    f. PhD
7. **If you are a pharmacist, in what institution did you finished your degree?**

8. **Do you have another pharmacy related activity outsider this pharmacy?**
    i. Pharmacy owner's association
    ii. Pharmaceutical Society board of directors
    iii. Union leader
    iv. Providing professional training
    v. Research and Academia
    vi. Participation in association or other professional group
    vii. Participation in discussion groups about Pharmacy

About the pharmacy where you work

9. **District**
    a. Viana do Castelo
    b. Vila Real
    c. Bragança
    d. Braga
    e. Porto
    f. Aveiro
    g. Viseu
    h. Guarda
    i. Coimbra
    j. Santarém
    k. Castelo Branco
    l. Portalegre
    m. Leiria
    n. Lisboa
    o. Évora
    p. Setúbal
    q. Beja
    r. Faro

10. **Type of pharmacy**
    a. Independent pharmacy
    b. Group or Chain ownership with 2 – 5 outlets
    c. Group or Chain ownership with 6 or more outlets
    d. Other Please specify_____

11. **What kind of owner you have in this pharmacy :**
    a. Non-pharmacist owner
    b. Pharmacist owner
    c. Both

12. **Location**
    a. Residential zone
    b. Commercial zone
    c. Industrial zone
    d. Shopping centre
    e. Hospital

13. **Number of inhabitants where the pharmacy is located**
    a. Less than 2000 inhabitants
    b. 2000-5000 inhabitants
    c. More than 5000 inhabitants

14. **How close is your pharmacy to the following healthcare services?**

Health Services	Less than 500 m	500m - 1km	More than 1 km
Acute hospital / Hospital centre of reference	☐	☐	☐
Other Pharmacy	☐	☐	☐
Health centre	☐	☐	☐
Private urgent care centre	☐	☐	☐
Private GP surgery	☐	☐	☐
Nursing centre	☐	☐	☐
Clinical analysis lab	☐	☐	☐
Physiotherapist centre	☐	☐	☐
Dental clinics	☐	☐	☐

15. **Please tell us if the pharmacy ever opens:**
    a. Before 9am (Mon - Fri)

b. Until 7pm (Mon - Fri)
c. Until 9pm (Mon - Fri)
d. After 9pm (Mon - Fri)
e. Saturday until 2pm
f. Saturday after 2pm
g. Sunday until 2pm
h. Sunday after 2 pm

16. Please provide a breakdown of your pharmacy's patient profile. [Does not need to add up to 100%]

Category	Less than 20%	20-40%	40-60%	60-80%	More than 80%
Chronic condition patients					
Families with children under 12					
Acute condition patients					
Patients living in Institutional Care settings (retirement homes, nursing homes, prisons, etc)					

17. Please indicate what percentage of your patients are regular/repeat patients
_____ %

18. How many pharmacists work in this pharmacy?
_____ (number)

19. How many pharmacy technicians work in this pharmacy?
_____ (number)

20. Is there a consultation/counselling area in the pharmacy where you can talk to patients in private
a. Yes
b. No

21. Do you allow any other practitioners to run clinics or services from your pharmacy?

Professional	No	Yes
Nutritionist		
Dietician		
Podiatrist		
Nurse		
Audiologist		
Optometrist		

Psychologist		
Physiotherapist		
Alternative medicines professionals (e.g. acupuncturist)		

Services

22. **How many prescriptions are processed in the pharmacy in a typical month?**
    _____(number)
23. **Do you provide any of the following enhanced services? For each service listed, please tell us whether you provide them now, or whether you would like to provide these services in future [Tick all that apply]**

Services	If not provided currently, would not like to provide in future	If not provided currently, would like to provide in future	Provided currently by other practitioners	Provided currently by a pharmacist or pharmacy technician	Provided currently and exclusively by a pharmacist
Medicines management by patient	☐	☐	☐	☐	☐
Medicine administration	☐	☐	☐	☐	☐
Providing First aid	☐	☐	☐	☐	☐
Vaccine administration	☐	☐	☐	☐	☐
Pharmacist consultation	☐	☐	☐	☐	☐
Home support/ Home delivery	☐	☐	☐	☐	☐
Pharmacovigilance	☐	☐	☐	☐	☐
Pharmaceutical care programs	☐	☐	☐	☐	☐
Disposal of unwanted medicines	☐	☐	☐	☐	☐
Magisterial Medicine production	☐	☐	☐	☐	☐
Non-prescription medicine's monitoring	☐	☐	☐	☐	☐
Supervised methadone service	☐	☐	☐	☐	☐

Needle exchange	☐	☐	☐	☐	☐
Nutrition/weight management	☐	☐	☐	☐	☐
Smoking cessation programs	☐	☐	☐	☐	☐
Use of diagnostic equipment (e.g. E.C.G.)	☐	☐	☐	☐	☐

24. Do you provide any of the following health screening services? [Tick all that apply]

Services	**If not provided currently, would not like to provide in future**	**If not provided currently, would like to provide in future**	**Provided currently by other practitioners**	**Provided currently by a pharmacist or pharmacy technician**	**Provided currently and exclusively by a pharmacist**
Total Cholesterol screening	☐	☐	☐	☐	☐
Blood pressure screening	☐	☐	☐	☐	☐
BMI screening	☐	☐	☐	☐	☐
Lung capacity screening	☐	☐	☐	☐	☐
Diabetes screening	☐	☐	☐	☐	☐
PSA (prostate specific antigen) screening - qualitative	☐	☐	☐	☐	☐
PSA (prostate specific antigen) screening - quantitative	☐	☐	☐	☐	☐
Lipid profile (HDL + LDL + triglycerides screening)	☐	☐	☐	☐	☐

Uric Acid screening	☐	☐	☐	☐	☐
Osteoporosis screening	☐	☐	☐	☐	☐
Pregnancy testing	☐	☐	☐	☐	☐
Audiology screening	☐	☐	☐	☐	☐
INR levels screening	☐	☐	☐	☐	☐
Weight/Height	☐	☐	☐	☐	☐
Serum haemoglobin screening	☐	☐	☐	☐	☐

25. Do you or would you like to provide any service that is not mentioned in the previous lists?

Other Services	**If not provided currently, would not like to provide in future**	**If not provided currently, would like to provide in future**	**Provided currently**
Health information kiosk	☐	☐	☐
Background Music	☐	☐	☐
Aromatized space according to the products for sale	☐	☐	☐
Alternative medicine cabinet	☐	☐	☐
Thematic health workshops	☐	☐	☐
Clothes for specific skin problems	☐	☐	☐
Healthy food area	☐	☐	☐
Health promotion books	☐	☐	☐
Scheduling of Physician appointments and medical exams	☐	☐	☐
Massage cabinet	☐	☐	☐
Personalized alerts (e.g. medicines reminder,	☐	☐	☐

glycaemia screening reminder)			

26. Does this pharmacy provide services to patients in public or private institutions?

	Not provided to any institution	Provided to at least one instituiton
Medicines management by patient	☐	☐
Needle exchange	☐	☐
Nutrition/weight management	☐	☐
Smoking cessation programs	☐	☐
Magisterial Medicine production	☐	☐
Screening services	☐	☐
Health Promotion Campaigns	☐	☐
Pharmaceutical care programs	☐	☐
Pharmacovigilance	☐	☐
Medicine counselling at the institution	☐	☐
Medicine dispensing	☐	☐
Medicine deliver at the institution	☐	☐

27. Do you keep records of the pharmaceutical services provided, by individual patient?

a. No

b. Yes

Technology

28. How many computers exist in the pharmacy?

_____ (number)

29. How many computers are exclusive for clinical pharmacy activities?

_____ (number)

30. Please tell us which computer supplier system you use:

a. Sifarma Clássico
b. Sifarma 2000
c. Winfar XXI
d. Other? _____

31. **Do you use the internet as a current health information resource?**
    a. No
    b. Yes
32. **Do the pharmacy's professional staff have access to relevant healthcare resources on the internet from the pharmacy computer system?**
    a. No
    b. Yes

33. **From the following list, which internet resources do you use the most? [tick all that apply]**
    a. Ordem dos Farmacêuticos
    b. Associação Nacional das Farmácias
    c. Sindicato Nacional dos Farmacêuticos
    d. Prontuário Online (INFARMED)
    e. Medline
    f. Outro. Qual?_____

34. **Does the pharmacy have a dedicated pharmacy email address for professional pharmacy business which pharmacists can access if necessary?**
    a. No
    b. Yes

35. **How frequently do you open your email box during a workday?**
    a. Never
    b. Once in the morning
    c. Once in the afternoon
    d. Once in the morning and once in the afternoon
    e. Every 2 hours
    f. Hourly
    g. Every 15 minutes
    h. It's always open

36. **How frequently do your patients email the pharmacy?**
    a. Never
    b. 1 to 5 times a month
    c. 6 to 10 times a month
    d. 11 to 20 times a month
    e. More than 20 times a month
37. **Do you use the pharmacy's email to answer to patients health questions/issues?**
    c. No
    d. Yes

38. **Does the pharmacy have a social network account?**

e. No
f. Yes

39. Does the pharmacy have a website?

a. No
b. Yes

40. If the pharmacy has a website, which information does it support?

	The website does not support this information	**The website supports this information**
Location/ Contact information	☐	☐
Online sale of Non-prescription products	☐	☐
Therapeutic information about medicines (e.g. indications)	☐	☐
General information about medicines (e.g. prices, availabilty)	☐	☐
Health and health lifestyles information	☐	☐
Exclusive space for patients (personal area)	☐	☐
Blog about health and medicines	☐	☐
Therapeutic guidelines	☐	☐
Pharmacy's Newsletter	☐	☐
Online sale of prescription medicines	☐	☐

41. Which pharmacy activities are supported by a specific feature on your computer system, and do you use this feature to record activity? [Tick all that apply]

Categories	**I don't know**	**My computer system does not supports this feature**	**My computer system supports this but I don't use this feature**	**My computer system supports this and I use this feature**

Counselling and medicine dispensing	☐	☐	☐	☐
Advice on minor illness	☐	☐	☐	☐
Administration of Injectable medicines	☐	☐	☐	☐
Medicine administration	☐	☐	☐	☐
Supporting professional services (e.g. record-keeping, audit)	☐	☐	☐	☐
Communicate with other health professionals	☐	☐	☐	☐
Communicate with patients (via email, text messages)	☐	☐	☐	☐
Pharmaceutical care programs and other disease management programs				
Medicine dispensing for public or private institutions	☐	☐	☐	☐
OTC's and other non-prescription items' dispensing	☐	☐	☐	☐
Home deliveries	☐	☐	☐	☐
Stock management	☐	☐	☐	☐
Research	☐	☐	☐	☐
Non-prescription medicines' monitoring	☐	☐	☐	☐
Pharmacovigilance notifications	☐	☐	☐	☐
Management activities (e.g. factoring)	☐	☐	☐	☐
Screening services	☐	☐	☐	☐
Magisterial Medicine production	☐	☐	☐	☐
Smoking cessation programs	☐	☐	☐	☐
Therapy revisions	☐	☐	☐	☐
Health promotion and education in the pharmacy	☐	☐	☐	☐

Supervised methadone service	☐	☐	☐	☐
Needle exchange	☐	☐	☐	☐

IT systems importance in community pharmacy activities

1. **How important is for you the use of IT systems for community pharmacy management** ***(circle a number where 1 is no importance and 5 is very important)***
   1 2 3 4 5
2. **How important is for you the use of IT systems to the provision of pharmaceutical services in the community pharmacy setting** ***(circle a number where 1 is no importance and 5 is very important)***
   1 2 3 4 5
3. **How satisfied are you with the use of IT systems for community pharmacy management services** ***(circle a number where 1 is not satisfied and 5 is very satisfied)***
   1 2 3 4 5
4. **How satisfied are you with the use of IT systems for the provision of pharmaceutical services** ***(circle a number where 1 is not satisfied and 5 is very satisfied)***
   1 2 3 4 5

5. **The use and implementation of IT systems for the provision of healthcare has several identified barriers. Please tell us if you agree or disagree with the following barriers.**

	I disagree	**I agree**
The baseline IT-knowledge of the staff is very limited.	☐	☐
Implementation requires too much physical and educational effort.	☐	☐
Implementation is overall very cost-intensive.	☐	☐
Vendors are not offering satisfying products.	☐	☐
Available products are not certified, making a choice difficult.	☐	☐
Vendors are not using "open standards", hampering data linkage and information exchange.	☐	☐
Education offered for the use of electronic tools is unsatisfactory	☐	☐

Implementation of eHealth solutions are not encouraged or promoted by regulatory bodies.	☐	☐
There is no financial incentive for the implementation of eHealth solutions.	☐	☐
There is not enough support and guidance from professional organizations.	☐	☐
Available decision support systems are not specific enough (e.g., over-alerting)	☐	☐
Standardization for data exchange is lacking.	☐	☐
The email is not a good a way to share data about my patients health status	☐	☐
I'm hesitant to share patient information with other health professionals.	☐	☐
Patients are reluctant to have their information electronically stored and shared.	☐	☐
Health systems are reluctant to accept eHealth solutions due to cultural issues.	☐	☐
The benefits for my work environment are not evident.	☐	☐
The expense – benefit ratio is not convincing.	☐	☐

This study will proceed with a observational study of the activities taking place in the pharmacy, carried by a project's researcher. If you would like to participate, please leave us your email in the box below, so we can get in touch with you. Thank you very much.

5.2. OBSERVATIONAL STUDY PROTOCOL

ePharmaCare

Protocolo de Observação

Para melhor descrever as actividades levadas a cabo nas farmácias comunitárias, escolheu-se para esta fase do projecto ePharmacare utilizar um método de observação estruturada. A observação estruturada consiste em observar e em descrever, de forma sistemática, comportamentos e acontecimentos que dizem respeito ao problema de investigação (Fortin et al., 2009). O objectivo será sempre constatar factos e relatá-los fielmente. Para se conseguir este objectivo, é necessário construir um plano de observação:

O que observar:
- Nesta fase do estudo vamos observar e contabilizar a duração de cada uma das actividades levadas a cabo nas instalações da farmácia que estejam relacionadas com o acto farmacêutico, quer pelos farmacêuticos quer pelos técnicos de farmácia.

Quando anotar as observações:
- As observações são anotadas no início de cada actividade, com hora inicial e hora final a delimitarem o evento.

Como serão anotadas as observações:
- As observações serão anotadas numa grelha de observação em Excel. Cada uma das actividades está codificada (ver anexo 1), desde a sua descrição, até à forma como é feita, onde é feita, por quem é feita e para quem é feita (ver anexo 2). Pretende-se registar todas as actividades que aconteçam com a equipa da farmácia durante um dia inteiro de trabalho.

Onde se farão as observações:
- As observações serão feitas no meio natural, isto é, no espaço da farmácia comunitária. Terá de ser um local onde seja possível observar toda a equipa da farmácia, ou que permita livre circulação entre o *back* e o *front office*.

Quem faz as observações:
- É necessário que o observador tenha conhecimento com precisão dos comportamentos que vai observar. Nesta fase do estudo, o observador será o investigador especialista em farmácia comunitária, dado que é o que melhor conseguirá distinguir entre as diversas actividades, além do conhecimento que tem dos seus pares permitir uma mais fina distinção entre as actividades.

Anexo 1

cod.	O quê
0	Nada
1	Actividades de Marketing e Merchandising
2	Administração de Injectáveis
3	Administração de medicamentos não injectáveis
4	Administração de primeiros socorros
5	Auditorias
6	Comunicação com DT ou gestor (telef, email, fax)
7	Comunicação com outros profissionais de saúde (telef, email, fax)
8	Comunicação não presencial com os utentes (telef, email, fax)
9	Consulta farmacêutica
10	Dispensa de Dispositivos médicos (compressas, pensos, fitas e máquinas de glicemia, DIU, termometros, esfigmomanómetros,etc)
11	Dispensa de medicamentos com receita
12	Dispensa de medicamentos para lares, prisões, casas de repouso ou outras instituições
13	Dispensa de MNSRM
14	Dispensa de MSRM em venda suspensa
15	Dispensa de MSRM sem receita
16	Dispensa de Parafarmácia (dietetica, cosmetica, puericultura, higiene oral, ortopedia, oculista, autocuidados)
17	Encomenda de medicamentos
18	Entregas ao domicílio
19	Formação da equipa
20	Formação profissional (CDP)
21	Informação não terapêutica ao doente: Direcções
22	Informação não terapêutica ao doente: Horário da farmácia
23	Informação não terapêutica ao doente: outras
24	Informação terapêutica ao doente: Aconselhamento sobre medicamentos e questões de saúde
25	Informação terapêutica ao doente: Disponibilidade de medicamentos
26	Investigação
27	Monitorização da terapêutica MNSRM
28	Notificação ao serviço de Farmacovigilância

2

cod.	O quê
29	Pagamentos de serviços (ex:Consulta nutrição)
30	Pausas
31	Prestação de serviços rastreio fora da farmácia
32	Prestação de serviços rastreio na farmácia
33	Produção e controlo de medicamentos manipulados
34	Programa de Cessação Tabágica
35	Programas de Gestão de Doença (ex. PCF)
36	Recolha de medicamentos usados
37	Regularização de venda suspensa de MSRM
38	Revisão terapêutica
39	Serviço de farmácia veterinária
40	Serviços de promoção e educação para a saúde fora da farmácia
41	Serviços de promoção e educação para a saúde na farmácia
42	Tarefas de gestão: Arrumar medicamentos
43	Tarefas de gestão: Conferir receituário
44	Tarefas de gestão: Controlo prazos validade
45	Tarefas de gestão: Entrada de encomendas
46	Tarefas de gestão: Facturação e fecho de lotes
47	Tarefas de gestão: Resolver receituário devolvido
48	Tarefas de gestão: Reuniões com delegados e vendedores
49	Tarefas de gestão: Ver correio
50	Toma observada de Metadona
51	Troca de Seringas

cod.	Como
0	Nada
1	Arrumou por ordem alfabetica/forma farmaceutica
2	Colocou os medicamentos usados em contentor segregado
3	Conferiu pontos chave do receituário: carimbos, assinatura, data, erros de dispensa, etc)
4	Contactou um numero de emergência (112, policia, bombeiros)
5	Diálogo com o utente - Aconselhamento
6	Diálogo com o utente - Small talk
7	Entrega de panfletos
8	Observação da actividade
9	Organização da zona de Parafarmácia
10	Para café, snack ou conversa, dentro da farmácia
11	Para café, snack ou conversa, fora da farmácia
12	Recolha da validade por lista de medicamentos
13	Recolha de seringa usada e entrega de um Kit
14	Recolha de seringa usada e venda de seringa nova
15	Usando a técnica de administração
16	Usou material de penso
17	Utilizou carta
18	Utilizou fax
19	Utilizou formulário
20	Utilizou material de laboratório
21	Utilizou material de limpeza
22	Utilizou meio de diagnóstico propriedade do utente
23	Utilizou meios audiovisuais
24	Utilizou meios de diagnóstico e terapêutica
25	Utilizou telefone
26	Utilizou terminal com Sistema de Informação da Farmacia - Gestão de Stocks
27	Utilizou terminal com Sistema de Informação da Farmacia - Vendas
28	Utilizou terminal informático (email)
29	Utilizou terminal informático (internet)
30	Utilizou veiculo da farmácia
31	Utilizou veículo próprio

cod.	Quem	cod.	Onde
1	Ajudante técnico I	**1**	Balcão atendimento
2	Ajudante técnico II	**2**	Balcão personalizado
3	Farmacêutico I	**3**	Escritório do DT
4	Farmacêutico adjunto	**4**	Exterior da farmácia
5	Farmacêutico II	**5**	Gabinete privado
6	Director técnico (DT)	**6**	Laboratório
7	Farmacêutico III	**7**	Quarto
8	Farmacêutico IV	**8**	Zona de Armazém
9		**9**	Zona de Espera
10	Gestor da farmácia	**10**	Zona de expositores
11	DT + Gestor	**11**	Zona de conferência
12	Estagiário		
13	Nutricionista		
14	Enfermeira		
15	Podologista		
16	Dietista		
17	Outro		

Anexo 2:

Cod. Farm	Inicial time	Final time	Duration (H:min)	Who	What	How	What2	How2	What3	How3	Where	Utente regular (S/N)	Doente crónico (S/N)
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										
1			0:00										

Referências Bibliográficas:

FORTIN, M.-F., CÔTÉ, J. & FILION, F. 2009. *Fundamentos e Etapas do Processo de Investigação*, Lusodidacta.

6

5.3. OBSERVATIONAL STUDY DATA COLLECTION GRID

Cod. Farm	Inicial time	Final time	Duration (H:min)	Who	What	How	What2	How2	What3	How3	Where	Utente regular (S/N)	Medica/ crónico (S/N)		codigo	Anos experiência	Anos de casa
3			0:00											Ajudante técnico I			
3			0:00											Ajudante técnico II			
3			0:00											Farmacêutico I			
3			0:00											Farmacêutico adjunto			
3			0:00											Farmacêutico II			
3			0:00											Director técnico (DT)			
3			0:00											Farmacêutico III			
3			0:00											Farmacêutico IV			
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														
3			0:00														

5.4. ACTIVITY 2 INTERVIEW SCRIPT

Section 1: Demographic information:

□ Age □Gender □Occupation

Section 2: Mapping the activities involved in a service experience:

 How often do you visit a community pharmacy?

 Can you express what motives cause a pharmacy visit?

 Please describe step by step your trip to the pharmacy (i.e. how do you know that you need to visit a pharmacy).

 How do you interact with your pharmacy (i.e. channels used).

 Is there any issue that you identified on the process of visiting a pharmacy?

Section 3: Documenting the current service offering:

 What is the role of the community pharmacy in your life?

 What services do you take part of within a community pharmacy?

- What is the degree of satisfaction associated with such services?
- Do you propose any improvements for such services?

 What new services would you like to be implemented within community pharmacies?

- Would these services have a positive impact in your service experience?

Section 4: Understanding the service experience:

 What are the most crucial factors that influence the selection of a pharmacy?

 Do you have a regular pharmacy?

- What distance is this pharmacy located from your home/workplace?
- Do you suggest improvements for this pharmacy?

 What reasons have caused you to be unsatisfied with the service provided in a pharmacy?

- What could be done to avoid such situations?

 How do you see community pharmacies in 20 years?

5.5. WEB-PLATFORM PROTOTYPE DEMONSTRATION PROTOCOL

ePharmaCare

Protocolo de teste de protótipo

Introdução

A utilização e gestão da informação em saúde, com o desenvolvimento das tecnologias e-Health, é uma realidade dos sistemas de saúde da qual ainda muito se desconhece.(Kreps and Neuhauser, 2010) A comunicação entre profissionais de saúde e utentes utilizando a Internet é uma nova tendência que poderá ter um impacto significativo na forma como é feita a gestão da doença.

A monitorização à distância de doenças crónicas parece ser uma abordagem promissora na gestão dos doentes ao envolvê-los na gestão da sua condição. Uma abordagem centrada no utente aquando do desenvolvimento de uma ferramenta ou intervenção na internet será importante para assegurar que esta irá ao encontro das necessidades dos doentes e que estes serão mais entusiastas no seu uso. (Armstrong and Powell, 2008)

O envolvimento do doente no processo de gestão da doença já demonstrou melhoria de resultados clínicos e de adesão à terapêutica, tendo produzido doentes mais informados, que demonstram alteração de comportamentos e atitudes.(Barrera et al., 2002) Igualmente, os cuidadores têm a possibilidade de prestar informação crucial e dar feedback sobre a gestão da doença ao doente.(Gillespie, 2000)

Mas este potencial é restringido pelo conhecimento limitado da sua efectividade, alta prevalência de erros de utilização e altas taxas de desistência.(Yu et al., 2012)

Este estudo, enquadrado na investigação em desenvolvimento no âmbito do projecto ePharmacare, propõe estudar a utilização de uma plataforma web para gestão de doença, averiguando o valor clínico, económico e social dos serviços de gestão de terapêutica e doença efectuada pelo farmacêutico comunitário (FC), quando potenciados com tecnologias e-Health em colaboração estreita com os utentes/doentes.

Objectivos

- Objectivo geral:
  - ✓ Testar a utilização do protótipo da plataforma ePharmacare
- Objectivos específicos:

1

- ✓ Avaliar o valor clínico do serviço (outcomes clínicos)
- ✓ Avaliar a satisfação do utente com o serviço (outcome humanístico)
- ✓ Avaliar o valor económico do serviço (outcomes económicos)

Métodos, população e recursos

Este será um estudo de caso, prospectivo e longitudinal.(Bowling, 2009)

A população em estudo serão doentes hipertensos, diabéticos e dislipidémicos que sejam utilizadores frequentes da internet. Haverá duas intervenções em estudo, uma em que o farmacêutico está numa farmácia, e uma segunda intervenção em que o farmacêutico não está na farmácia.

Na intervenção com base na farmácia comunitária, a amostragem será feita por conveniência, escolhendo os casos entre os doentes que são utilizadores frequentes da internet que apresentem uma receita médica com um fármaco dos grupos usualmente utilizados para o tratamento das patologias indicadas. Para efectuar esta selecção, será aplicado um pequeno questionário, onde o farmacêutico deverá averiguar se o doente é utilizador frequente da internet, nomeadamente, qual a frequência e se utiliza o email, se utiliza home-banking ou outro serviço semelhante, se recorre à internet para informação sobre saúde. Se responder afirmativamente às questões é elegível a participar. Igualmente, mesmo que a resposta não seja afirmativa, mas o utente manifeste intenção de utilizar a internet para participar, também poderá ser elegível.

Na intervenção onde o farmacêutico não está na farmácia, a amostragem de doentes será feita na população das universidades seniores que estejam abertas à participação, entre os doentes que são utilizadores frequentes da internet, que declararem ter pelo menos uma das condições mencionadas.

Após aceitar participar, será solicitado ao utente a assinatura do consentimento informado.

A recolha de dados para o estudo será efectuada através de questionário aplicado presencialmente a cada doente, assim como através da plataforma ePharmacare. Para os doentes seleccionados na farmácia o protocolo a seguir será o protocolo dos programas de cuidados farmacêuticos, que têm por base o método DADER. Assim, o protocolo segue os seguintes passos:

1. Marcação de visita a efectuar na farmácia, de acordo com a disponibilidade dos intervenientes
2. Na visita, o farmacêutico deve recolher os seguintes dados:
    a. Dados subjectivos – em geral efectuado com perguntas abertas. (Ex: como é que o doente se tem sentido; teve algum episódio de agravamento de sintomas desde a ultima visita; recorreu a algum serviço urgência e porquê, etc.)
    b. Dados objectivos – recolhidos com recurso a medições (ver tabela de variáveis para recolher). Devem ser recolhidos o máximo de medições, disponíveis no serviço da farmácia. Deve ser solicitado os últimos boletins de análise para recolha dos parâmetros não disponíveis na farmácia.

c. Avaliação – deve ser efectuada uma avaliação da situação do doente, recorrendo à informação recolhida. Deve ser dada especial atenção à existência de PRMs (tabela 1). Pode ainda (se for caso disso) ser avaliada a técnica de auto-medição da tensão arterial (para doentes que têm esfigmomanómetro em casa).
d. Plano – deve ser estabelecido um plano, juntamente com o doente, onde conste:
    i. Quais os objectivos a atingir até à próxima visita (dentro dos parâmetros bioquímicos)
    ii. Se foi registado PRM e se foi comunicado ou médico de família
    iii. Se foi entregue material educativo
    iv. Data da próxima visita

A frequência das visitas deve ficar ao critério do farmacêutico, sempre de acordo com o doente, mas não deve exceder os 2 meses entre visitas. Recomenda-se marcar visitas para o mesmo dia em que o doente terá de ir à farmácia adquirir medicamentos.

Para os doentes com seguimento à distância, o farmacêutico deverá seguir idêntico protocolo, no que concerne à abordagem conceptual. Isto é, deve haver uma preocupação em comunicar com doente através da plataforma, incentivando a registar os eventos e os parâmetros necessários a uma correcta avaliação. Haverá uma visita inicial para inscrição de interessados, que devem obedecer aos critérios já descritos, a ocorrer nas instalações das universidades seniores ou associações participantes. Nessa visita, será efectuada uma recolha de dados para avaliação inicial. No final da avaliação, será efectuada uma segunda visita para nova recolha de dados para a avaliação final. Os restantes dados deverão constar dos registos efectuados pelos doentes, e constituem também uma medida de avaliação, nomeadamente, da utilização da plataforma.

Tabela 1 - Lista de PRMs e pressupostos (ANF, 2003)

Classificação de PRM	Descrição
PRM 1	Não tomar medicamento que necessita
PRM 2	Tomar um medicamento que não necessita
PRM 3	Tomar um medicamento que não é efectivo por razões não quantitativas
PRM 4	Tomar um medicamento que não é efectivo por razões quantitativas
PRM 5	Tomar um medicamento que não é seguro por razões não quantitativas
PRM 6	Tomar um medicamento que não é seguro por razões quantitativas

Pressupostos

a) Um problema de saúde só pode estar associado a um PRM;

b) Um medicamento pode causar um ou vários PRMs;

c) Os problemas de adesão à terapêutica não são PRMs mas sim causa de um PRM:

- ✓ Quando o doente não toma totalmente o medicamento que necessita (PRM 1)
- ✓ Quando o doente toma parcialmente o medicamento (PRM 4)
- ✓ Quando o doente toma o medicamento em excesso (PRM 6)

d) As interacções também não são PRMs mas sim causa de PRMs:

- ✓ Porque inibem a acção de outro medicamento (PRM 4)
- ✓ Porque potenciam os acontecimentos adversos (PRM 5)
- ✓ Porque potenciam a acção de um outro medicamento (PRM 6)

Serão diversas as variáveis a recolher nos questionários de avaliação, divididas em 8 grupos principais. Na tabela 2, apresentamos a operacionalização prevista para cada uma das variáveis.

Tabela 2 - Operacionalização de variáveis para o estudo do protótipo

Variável	Questão	Tipo	Relação de dependência
Variáveis Socio-demográficas			
Idade	Aberta – Qual a sua idade (poderá ser recodificada posteriormente)	Quantitativa, contínua	Independente
Sexo	Fechada – Sexo? Masculino/Feminino	Qualitativa, dicotómica	Independente
Estado Civil	Fechada – 5 alternativas de resposta (Solteiro; Casado; Divorciado; Viúvo; União de facto)	Qualitativa, politómica	Independente
Residência	2 Questões: Aberta – Freguesia e Concelho Fechada – Meio Urbano; Meio Suburbano; Meio Rural	Qualitativa, politómica	Independente
Habilitações literárias	Questão fechada – Qual o nível educacional completo: Nenhum; 1° ciclo do básico (até 4ª classe); 2° ciclo básico; 3° Ciclo (até ao 9°ano – antigo 5° do liceu); Ensino Secundário (até ao 12°); Ensino Superior;	Qualitativa, politómica	Independente
Parâmetros Clínicos			
Pressão arterial	Aberta – recolha de valores para pressão sistólica e diastólica em mmHg	Quantitativa, contínua	Dependente
Glicémia	Aberta - recolha de valores para glicemia em jejum, pós-prandial e ocasional em mg/dl	Quantitativa, contínua	Dependente
Colesterol	Aberta - recolha de valores para colesterol total, e HDL, LDL (se disponível) em mg/dl	Quantitativa, contínua	Dependente
Triglicéridos	Aberta - recolha de valores para triglicerídeos (se disponível) em mg/dl	Quantitativa, contínua	Dependente

Variável	Questão	Tipo	Relação de dependência
Peso	Aberta – recolha de valores em Kg	Quantitativa, contínua	Dependente
Altura	Aberta – recolha de valores em m	Quantitativa, contínua	Dependente
IMC	Aberta – calculado a partir da fórmula peso/(altura)^2	Quantitativa, contínua	Dependente
Circunferência abdominal	Aberta – recolha de valores em cm	Quantitativa, contínua	Dependente
Hábitos tabágicos	Fechada – É fumador? Sim; Não	Qualitativa, dicotómica	Dependente
Risco cardiovascular a 10 anos	Aberta – calculada a partir dos parâmetros bioquímicos em http://www.framinghamheartstudy.org/risk/gencardio.html	Quantitativa, contínua	Dependente
Parâmetros "farmacêuticos"			
N° de medicamentos	Aberta – Número de medicamentos que está a tomar actualmente	Qualitativa dicotómica	Dependente
Medicamentos utilizados	Aberta – Quais os grupos de medicamentos utilizados	Qualitativa, politómica	Independente
Adesão à terapêutica (medida por farmacêutico)	Aberta – número de unidades (comprimidos, capsulas, etc) excedentárias num determinado período de tempo	Quantitativa, contínua	Dependente
Adesão à terapêutica (auto-medida)	Aberta – pontuação atribuída por resposta ao questionário de Morisky (adaptado ao português - http://media.mycme.com/documents/30/11-136_case_3_table_2_rev_7413.pdf)	Quantitativa, contínua, ordinal	Dependente
N° de PRMs detectados	Aberta – número de PRMs detectados pelo farmacêutico (o conceito de PRM é o que consta no consenso de Granada – método DADER)	Quantitativa, contínua	Dependente
N° de PRMs resolvidos	Aberta - número de PRMs resolvidos na sequência da intervenção do farmacêutico	Quantitativa, contínua	Dependente
Utilização de serviços de saúde			
Local de assistência médica	Fechada – Qual o local onde efectua o acompanhamento médico? Só centro saúde; Só hospital; Só privado; Centro de Saúde e hospital; Centro de saúde e privado; Privado e Hospital; Centro de saúde, hospital e privado; nenhuam	Qualitativa, politómica	Independente
Tipo de médico	Fechada – Que tipo de médico o acompanha? Clínico geral; Especialista; Clínico geral e especialista; Sem médico	Qualitativa, politómica	Independente
N° de consultas GP nos últimos 6 meses	Aberta – número de consultas de medicina familiar a que o doente compareceu nos últimos 6 meses	Quantitativa, contínua	Dependente
N° de consultas enfermagem nos últimos 6 meses	Aberta – número de consultas de enfermagem a que o doente compareceu nos últimos 6 meses	Quantitativa, contínua	Dependente
N° de consultas com	Aberta – número de consultas de especialista (cardiologista, endocrinologista) a que o doente compareceu nos últimos 6	Quantitativa, contínua	Dependente

Variável	Questão	Tipo	Relação de dependência
especialista	meses		
N° de dias de internamento	Aberta – número de dias que o doente esteve internado por motivos relacionados com as patologias seleccionadas	Quantitativa, contínua	Dependente
Consultas de urgência	Aberta – número de visitas às urgências por agravamento súbdito da sua condição crónica	Quantitativa, contínua	Dependente
Dias de baixa	Aberta – número de dias de baixa	Quantitativa, contínua	Dependente
Utilização de serviços Farmacêuticos			
Farmácia habitual	2 Questões: Fechada – Tem uma farmácia habitual? Sim/Não Aberta – Localidade (freguesia/concelho)	Qualitativa, dicotómica	Independente
N° de visitas à farmácia nos últimos 6 meses	Aberta – número de visitas à farmácia	Quantitativa, contínua	Dependente
Serviços farmacêuticos utilizados	Fechada – A partir da lista de serviços do questionário já efectuado às farmácias	Qualitativa, politomica	Independente
Parâmetros económicos			
Utilização da plataforma			
Número de logs			
Tempo ligado			
Tipo de registos efectuados	Fechada – quais os registos que mais vezes foram efectuados pelo utente	Qualitativa, politómica	Dependente
Satisfação do doente			
Questionário de satisfação	A elaborar		
"Willingness to pay"	Aberta – atribuir um valor numérico em euros ao serviço	Quantitativa, contínua	Independente

Recursos previstos

Ao longo deste estudo, serão utilizados diferentes recursos, consoante a fase da intervenção. Assim, na fase de formação inicial serão necessários:

- ✓ Uma sala; material didáctico; Senhas de almoço; Combustível para deslocação às farmácias participantes; veículo para deslocação; Computador portátil

Para a fase de intervenção e avaliação:

- ✓ Balança; fita métrica; aparelho para medições bioquímicas e fitas reagentes; esfigmomanómetro (aneróide, digital de mesa); computador;

Cronograma

Project reference : PTDC/CCI-CIN/122690/2010

Task: Study the prototype of the "Patient management service model" in two distinct pharmacy settings

Task Denomination	Participant responsible for task	2013							2014					
		6	7	8	9	10	11	12	1	2	3	4	5	6
Elaboração protocolo	JG; AC; MMS; LL													
Formação Inicial	JG; AC; LL													
Intervenção	JG;													
Avaliação Final	JG; AC; MMS; LL													

Referências

ARMSTRONG, N. & POWELL, J. 2008. Preliminary test of an Internet-based diabetes self-management tool. *J Telemed Telecare,* 14, 114-6.

BARRERA, M., JR., GLASGOW, R. E., MCKAY, H. G., BOLES, S. M. & FEIL, E. G. 2002. Do Internet-based support interventions change perceptions of social support?: An experimental trial of approaches for supporting diabetes self-management. *Am J Community Psychol,* 30, 637-54.

BOWLING, A. 2009. *Research methods in Health - investigating health and health services,* Maidenhead, McGraw-Hill Education.

GILLESPIE, G. 2000. Deploying an I.T. cure for chronic diseases. *Health Data Manag,* 8, 68-70, 72, 74.

KREPS, G. L. & NEUHAUSER, L. 2010. New directions in eHealth communication: opportunities and challenges. *Patient Educ Couns,* 78, 329-36.

YU, C. H., BAHNIWAL, R., LAUPACIS, A., LEUNG, E., ORR, M. S. & STRAUS, S. E. 2012. Systematic review and evaluation of web-accessible tools for management of diabetes and related cardiovascular risk factors by patients and healthcare providers. *J Am Med Inform Assoc,* 19, 514-22.

5.6. INFORMED CONSENT FORM

Declaração de consentimento informado

Designação do Estudo: ePharmacare – projecto FCT (PTDC/CCI-CIN/122690/2010)

Eu, abaixo-assinado:

- Fui informado de que o Estudo de Investigação acima mencionado se destina a investigar serviços de farmácia comunitária e actividades de gestão de dados e informação, através da utilização de tecnologias de informação;

- Aceito participar de livre vontade no estudo acima mencionado. Concordo que sejam efectuados os exames e a colheita de amostras de sangue para realizar as análises que fazem parte deste estudo.

- Foi-me garantido que todos os dados relativos à identificação dos Participantes neste estudo são confidenciais e que será mantido o anonimato.

- Sei que posso recusar-me a participar ou interromper a qualquer momento a participação no estudo, sem nenhum tipo de penalização por este facto.

- Também autorizo a divulgação dos resultados obtidos no meio científico, garantindo o anonimato.

- Compreendi a informação que me foi dada, tive oportunidade de fazer perguntas e as minhas dúvidas foram esclarecidas.

5.7. USABILITY TEST RESULTS

ePharmaCare

Report on ePharmaCare platform usability test

Following the working plan defined for the ePharmaCare project, the evaluation and usability test of the platform was performed between the 14th and 16th of July, 2014.

This evaluation included the testing of both end users of the platform, Community Pharmacists and patients.

We divided the evaluation in 4 tests. The first test was meant to test the platform in a current use scenario. Using eye-tracking glasses, the user, with the glasses on, was indicated to seek any information relating to a patient already inserted in the system. Then a 'patient', who came to the Pharmacy for a screening test of blood pressure and cholesterol, was recruited by presenting the project; the patient is recruited when he accepts to participate.

For the rest of the evaluation, scenarios (or tasks) were designed, differing only in what was asked to be performed by Pharmacists and patients (table 1).

Table 1. - Scenarios developed for the testing of ePharmaCare platform.

Pharmacists scenarios	Patients scenarios
Scenario I -. Enter the ePharmaCare platform with your username and password. Look for the date of the next visit to your user XXX.	**Scenario I** -. Enter the ePharmaCare platform with your username and password. Look for new messages.
Scenario II - Add a new medicine for the user XXX: Ben-u-ron 500mg, 20 tablets; take one tablet after breakfast and one after dinner. Set the end date of package.	**Scenario II** - Add the value of fasting glucose of 182 mg/dL.
Scenario III - Send a message to the user XXX: TEST.	**Scenario III** – Add the blood pressure value 135/85 mm/Hg.
Scenario IV - Add the value of postprandial glucose of 182 mg / dL for the user XXX.	**Scenario IV** – Add the height and weight values.
Scenario V - Find the last blood pressure to the user XXX.	**Scenario V** - Find the last blood pressure value.
Scenario VI - Arrange a visit for the user YYY for the day 07/20/2014, 10:00 am.	**Scenario VI** – Add a new medicine to the user profile: Ben-u-ron 1000mg, 18 tablets'; take one tablet after breakfast and one after dinner.
Scenario VII - Verify the value of total cholesterol to user XXX.	**Scenario VII** – Verify your next appointment with the Pharmacist.
Scenario VIII - Verify that the user forum has calculated BMI.	**Scenario VIII** – Send a message "TEST" to the Pharmacist.
	Scenario IX – Find the end date for the package of Ben-u-ron.
	Scenario X – You have been taking two cups of green tea daily, add this information to your profile.

1

To help in assessing the usability of the web platform, we used eye-tracking glasses. The user wear the glasses while performing the tasks for each scenario. The glasses recorded a video which was then analysed.

In the next section, a detailed description of each user's experience with the platform while completing the scenarios is made.

RESULTS

TEST 1

Date: 14th July 2014 at 2:30pm

Location: Pharmacy Lisboa

Observed Subject: Pharmacist

Results:

Observation of a Pharmacist, seeking information for a certain patient/user.

Searching for information - it was required to seek information about the last blood pressure measurement of a patient already entered in the platform, the Pharmacist performed the following steps:

- Searching for information - Total video duration: 2 minutes and 26 seconds - entered the user record using the correct path (user, then the name with the link). After that, the Pharmacist searched the screen and tried several options to find the desired value. Opened the "Visit" tab, then clicked "show" in the latest record. But the record did not have what was intended, having lost one minute to find the value of blood pressure in the registration screen. This information was more easily found if acceded to the "Graphics" tab, and selected "Blood Pressure". This difficulty may indicate a need for more training, but also the need to present a summary of the latest figures recorded in the record of each user's home page.
- New user registration – total video duration: 6 minutes and 4 seconds - before accessing the computer to do the recording, the Pharmacist performed the blood pressure and cholesterol screening, which lasted a total of 8 minutes. Then moved to the computer where she had open the platform. Presented the service and clarified patient's doubts (50 seconds). Initiated the registration with the completion of the questionnaire. The execution of the questionnaire is too long, and the fact that the user needs to accept participation by e-mail did not allow the Pharmacist to register values obtained at screening.

TEST 2

Date: 16th July 2014 at 11:00 am

Location: Pharmacy Lisboa, Pharmacy Central (Amadora)

Observed Subject: 4 Pharmacists, 1 in Pharmacy Central (Amadora), 3 in Pharmacy Lisboa.

Results:

Observation of Pharmacists using the platform to perform a set of scenarios.

Pharmacy Central (Amadora) – total video duration: 7 minutes and 34 seconds

- ✓ Scenario I - login done in 10 seconds; found the date of the next visit in 10 seconds, following the proper path.
- ✓ Scenario II - enters the "therapeutic Profile" tab, and then click "Create Profile", 15 seconds. To find the right medicine, searched with "ben u". Then there was difficulty in selecting the right drug, since all the information is not visible on the screen (the resolution used for SIFARMA is not suitable for ePharmaCare). This operation took 40 seconds. After selection, correctly defines the number of doses and selects the correct schedule without hesitation, obtaining the duration of the package. It took 20 seconds.
- ✓ Scenario III - went immediately to the "Message" tab, chose the user and wrote the message "Test". It took 20 seconds.
- ✓ Scenario IV - There was a slight hesitation between the tabs "Template" and "data". Chose the tab "data" that does not allow adding data to fulfil the scenario. It took 20 seconds to realize that this was not the way. She went back to "visit" tab, has to scroll down the screen seeking the record of "postprandial blood glucose" and added the desired data.
- ✓ Scenario V - sought the value of blood pressure in the "Graphics" tab immediately. When asked if there was another place where she could find such data, went immediately to the "Data" tab.
- ✓ Scenario VI - scheduled a visit with success in 20 seconds. Had to make a slight scroll to press the "Create Template" button
- ✓ Scenario VII – went immediately to the "Graphics" tab. When faced with the possibility of looking elsewhere, had doubts but chose the "Data" tab.
- ✓ Scenario VIII - was also successful, but needed a high number of clicks to access information that is not in the graph form.

Pharmacy Lisboa – Pharmacist 1 (M.V.) – total video duration: 10 minutes and 35 seconds

- ✓ Scenario I - login done in 10 seconds; did not find the date of the next visit for patient XXX, assuming the last visit recorded as being the next. Total duration, 50 seconds.
- ✓ Scenario II - loses 10 seconds looking for the right menu, until she enters the "Medications" tab. Search by medicine name, until she realized that she was in the wrong tab. It took 40 seconds to realize. After being helped, enters the “user profile” tab and 15 seconds after clicked "therapeutic profile". Searched where she could add the medicine, needing help to click on “create profile” tab; was difficult to select the right medicine, since all the information is not visible on the screen (the resolution used for SIFARMA causes the zoom screen is not suitable for ePharmaCare); Had difficulty in defining the rest of the scenario, by indecision about the terms "dose" and "dosage"; Took 2 and a half minutes to complete the definition of the therapeutic profile.
- ✓ Scenario III - Staying in the user record (right action), went to the "Activities" tab. But after 10 seconds realizes the error, and goes to the “message”. It took 10 seconds to write and send message

- ✓ Scenario IV - Choose the user and immediately goes to the "Data" tab and click "biochemical data." Checks the last value, and considers the scenario closed. Had to be informed of what was intended. She executes the intended path, creating the appointment for the indicated day, and going over to the "biochemical data" tab to add the data.
- ✓ Scenario V - after selecting the user correctly, has slight hesitation when considering going to the "therapeutic profile" tab immediately. Go to the "Data" tab and then hesitates between the date of the last visit and choice of viewing visits' "physiological data." But after a hint, about "where to find" the value of blood pressure, quickly choose the tab "Charts" as intended.
- ✓ Scenario VI - has scheduled a visit with success in 20 seconds.
- ✓ Scenario VII - Searching for the value in the "biochemical data" tab of the previous user, but it is an empty record for the visit did not take place. Then goes to the "user" tab, choose the user and scrolls searching for information. Choose the "Data" tab, and look for information in the "biochemical data" tab, but the last visit has no information, which leads to hesitation. Goes to "therapeutic profile" tab, but realizes that is not here. With help, she could proceed to the "Graphics" tab to find the requested information. Selects and seems to expect that the information appears soon, until she realizes she had to click on "search". It took 1 ½ minutes to complete this scenario.
- ✓ Scenario VIII - Go immediately to the user record looking for information on the homepage. As this information is not there, she enters into "data" tab but exits immediately and go to the "chart" tab (dead-end - no chart for BMI). Back to "data" realizes that the only way to see the information is to see a visit which has a value of BMI calculated. She concludes there aren't any for this patient.

Pharmacy Lisboa – Pharmacist 2 (S.O.) – total video duration: 11 minutes and 16 seconds.

- ✓ Scenario I - login done in 5 seconds; found the date for the next appointments. Not only for today, but also for the next 7 days. Took 40 seconds to complete the scenario.
- ✓ Scenario II – chooses the user immediately. Go to the correct menu "therapeutic profile" and click on "create profile"; Search by name "ben" but the system does not respond, leading her to search for "paracetamol". This action leads to have to search for ben-u-ron on the screen, with much scroll until she realizes that it is better to go by the brand name (doubted that the system assumed the hyphen). Writes "Ben-u-ron" and seems to expect it in screen. Had difficult to select the medicine, since all the information is not visible on the screen (the screen resolution used for SIFARMA is not suitable for ePharmaCare); After the selection, had no difficulty in defining the rest of the scenario. Took 2 and a half minutes to complete the definition of the therapeutic profile.
- ✓ Scenario III - Staying in the user record (right action), and goes to the tab "messages". It took 10 seconds to send a message.
- ✓ Scenario IV - Choose the user and immediately goes to the "Data" tab and clicks "biochemical data." She hesitates, since she is not finding what she needs in this tab. Looks at "therapeutic profile tab" but avoids it and tries again in the "data" tab. She then is advised to create a new visit to proceed. Enters the last visit, and then clicks the correct tab. Took 2 minutes to complete the scenario
- ✓ Scenario V - after selecting the user correctly, has slight hesitation when considering going to the "data" tab or "graphics" tab immediately. She explains the places where she could consult the information, but is certain about the choosing the tab "Charts" as intended.

- ✓ Scenario VI - has scheduled the visit with success in 20 seconds.
- ✓ Scenario VII – She searches for the value immediately in the "graphics" tab. The user hasn't any information, but the scenario is successfully completed within 30 seconds.
- ✓ Scenario VIII – Staying in the "graphics" tab, she concludes that it is not possible to consult this value. Here she confirms the patient has values for height and weight, but then she is not sure the system can calculate the BMI and considers calculating it manually. After being taught to see the date for a weight measurement in the graphics tab, she can look for the value in "Physiological data" edit menu. Complains about the difficulty to access this information.

Pharmacy Lisboa – Pharmacist 3 (A.Q.) – total video duration: 11 minutes and 55 seconds.:

- ✓ Scenario I - login done in 20 seconds; found the date for the next appointments. Took 40 seconds to complete the scenario.
- ✓ Scenario II – chooses the user immediately. Passes through the menu "Data" and then goes to the "therapeutic profile" tab. Clicks on "create profile"; Search by active substance "paracetamol". As it has much information, she decides to search "ben-u-ron" in the name box. Had difficulty to select the medicine, since all the information is not visible on the screen (the resolution used for SIFARMA causes the zoom screen is not suitable for ePharmaCare); After the selection, start defining the time of medicine intake by the time of the day, having only decided the number of tablets afterwards, with difficulty since the eye tracker shows hesitance in choosing the right number in "dose". There are doubts regarding the terminology. Took almost 3 minutes to complete the scenario.
- ✓ Scenario III – Has doubts where to send message, considers the "visits" tab. Then chooses the right tab "messages", writes and sends message. Took 50 seconds to finish the scenario.
- ✓ Scenario IV - Choose the user and immediately goes to the "visit" tab and schedules a new visit. Enters the information. Took 40 seconds to complete the scenario
- ✓ Scenario V - after selecting the user correctly, she looks for the info in the "data" tab, but selects "biochemical data". She is oblivious to this fact during 30 seconds, until she selects "graphics" tab and successfully closes this scenario. Has difficulty in seeing the data (the font is to small).
- ✓ Scenario VI - has scheduled the visit with success in 1 minute, making sure to write a message to the patient warning to this visit.
- ✓ Scenario VII – She searches for the value immediately in the "graphics" tab. The user hasn't any information, but the scenario is successfully completed within 30 seconds.
- ✓ Scenario VIII – Staying in the "graphics" tab, she concludes that it is not possible to consult this value. Changes for patient's main page, where the information is also not available. Then goes to the "data" tab, in biochemical data, unsuccessful. Tries "therapeutic profile" for a few seconds before looking in "graphics" again. Goes to the "visits" tab and enters "physiological data", since she knows that the patient has a BMI calculated. She knows how to get the info but finds it difficult to access it quickly.

TEST 3

5

Date: 15th July 2014 at 9:00 am

Location: IHMT, UNL

Observed Subject: 2 expert ePharmaCare Pharmacists.

The scenarios were the same as the previous tests.

Pharmacist A.P. – total video duration: 4 minutes and 14 seconds

- ✓ Scenario I - login done under 10 seconds; found the date for the next appointments. Didn't go to the "Calendar View" where she could see the appointments. Took less than 30 seconds to complete the scenario. Also, she used the platform to register the next visit, not to the Pharmacy, but for a health service.
- ✓ Scenario II – chooses the user immediately and then goes to the "therapeutic profile" tab. Clicks on "create profile"; Search by brand name "ben-u-ron" in the name box. Found it quickly and had no problems finishing the scenario. Took 50 seconds to complete the scenario.
- ✓ Scenario III – Goes to "message" tab immediately, writes the subject, the message, and then selects de patient. Took 15 seconds to finish the scenario.
- ✓ Scenario IV - Choose the user and immediately goes to the "visit" tab and schedules a new visit, for the day and hour the test took place. Finds the "biochemical data" tab, and enters the required information. Took 50 seconds to complete the scenario
- ✓ Scenario V – enters the "Graphics" took 10 seconds to decide which patient to choose; she selects "graphics" tab and successfully closes this scenario. Took 30 seconds to finish the scenario
- ✓ Scenario VI - has scheduled the visit with success in 15 seconds; didn't' write any message to the patient.
- ✓ Scenario VII – After selecting a test patient, she searches for the value immediately in the "graphics" tab. The scenario is successfully completed within 10 seconds.
- ✓ Scenario VIII – With the patient selected, goes to the "visits" tab and enters "physiological data", since she knows that the user has a BMI calculated.

Pharmacist J.G. – total video duration: 7 minutes and 16 seconds

- ✓ Scenario I - login took 1 minute, due to the failure in recognize that the Caps Lock was on. Found the date for the next appointments by clicking on the calendar view. Took under 30 seconds to find the appointment.
- ✓ Scenario II – chooses the user immediately and then goes to the "therapeutic profile" tab. Clicks on "create profile"; Search by brand name "ben-u-ron" in the name box. Found it quickly by looking firstly to the package size. To define the end date of the package, first mistakenly choose the number of packages. After recognizing the error, has no problems closing the scenario. Took 1 minute to finish the scenario.
- ✓ Scenario III – Chooses a patient first and then goes to "message" tab and then selects the patient. Writes the subject and the message. Took 30 seconds to finish the scenario.

- ✓ Scenario IV - Chooses the patient and immediately goes to the "biochemical data" tab. Insists on clicking this tab with no apparent response from the system. Goes back to try another patient. Looks around until finally find that has to schedule a new visit. Took 1 minute to get to this conclusion. After this, goes immediately to the "biochemical data" tab, and enters the required information. Took 1 minute and half to complete the scenario.
- ✓ Scenario V – chooses a patient and enters the "Graphics" tab immediately and successfully closes this scenario. Took 20 seconds to finish the scenario
- ✓ Scenario VI - has scheduled the visit with success in 20 seconds writing a small message to the patient (telling to come to the visit in fasting).
- ✓ Scenario VII – After selecting a patient, searches for the value immediately in the "graphics" tab. The patient didn't have any value inserted, goes to the "Data" tab to verify. The scenario is successfully completed within 40 seconds.
- ✓ Scenario VIII – With the patient selected, tries to find the information on the "resume" screen, but it isn't there. Goes to the "data" tab and after to the "graphics" tab. Finds that there isn't any graph for BMI. Goes back to the "visits" tab. In the list of visits, has to enter several visits in the "physiological data" tab , until he finds the required BMI. Took 1 minute to close the scenario.

TEST 4

Date: 16th July 2014 at 11:00 am

Location: IHMT, UNL

Observed Subject: 3 patients, from the Seniors University of Alcântara.

The scenarios were performed under the assistance of one expert Pharmacist that offered help by pointing at the right tabs and menus. This hinders the analysis of independent usage. The time it took to finish a scenario is not significant.

Results:

Patient 1 (M.D.)

- ✓ Scenario I – patient complains about the difference in image definition. Font size may be too small. Takes 1 minute to do the login. Didn't see the new message tab.
- ✓ Scenario II, III, IV and V were done immediately after the login, with a lot of assistance from the Pharmacist.
- ✓ Scenario VI – has only the possibility to search for a medicine through the bar code number. Had some difficulties in deciding the correct check box for the time of the day
- ✓ Scenario VII – has a scheduled visit for September that does not appear on the planning screen.
- ✓ Scenario IX – was not performed.
- ✓ Scenario X – Choose to send a message to the Pharmacist, since there isn't another option on the current version of the platform.

Patient 2 (N.P.)

- ✓ Scenario I – Takes less than a 1 minute to do the login. Goes to the message tab to see the new messages.
- ✓ Scenario II – instead of the glucose value, with assistance from the Pharmacist, inputs information about her cholesterol. Had doubts about the correct box to input the values and selecting the date.
- ✓ Scenario III and IV – not performed.
- ✓ Scenario V – immediately knows that must go to the "graphics" tab, although confessing that she does not use the platform as much as it was intended (the husband does it for her). Asked where else can she see the pretended information, has doubts about the definition of "physiological data" and "biochemical data", regarding cholesterol. She decides to return to the graphics to finish the scenario.
- ✓ Scenario VI – takes a little while to decide for the "therapeutic profile" tab. With assistance, she enters the medicine. Has problems finding where she can input the information, since the check boxes are not on screen (due to the zoom used). With assistance, goes to the "panel" tab, and finishes the scenario.
- ✓ Scenario VII – hesitates between the "therapeutic profile" and "message" tabs. Has a scheduled visit for September that does not appear on the planning screen.
- ✓ Scenario VIII – performed successfully.
- ✓ Scenario IX – was not performed.
- ✓ Scenario X – Starts by choosing "physiological data" tab. Finds the list confusing. With assistance, choose to send a message to the Pharmacist, but has troubles choosing "message" tab.

Patient 3 (N.P.)

- ✓ Scenario I – complains about the difficulty in seeing the screen. Also, insisted in inputting the ePharmaCare URL in the login box. Checks for new messages without difficulty.
- ✓ Scenario II and III – not performed.
- ✓ Scenario IV– With assistance, shows more difficulty looking for the keys of the keyboard than to finish the scenario. Finds that the value for height was not correct, and fixes it.
- ✓ Scenario V – not performed
- ✓ Scenario VI – decides to go to the "therapeutic profile" tab. With assistance, enters the medicine bar code. Has no problems finding where he can input the information regarding the daily intakes. After checking the needed boxes, presses enter and leaves this tab. Did not complete the scenario.
- ✓ Scenario VII – goes to the "Panel" tab immediately and completes the scenario.
- ✓ Scenario VIII – performed successfully, with a much more elaborated message.
- ✓ Scenario IX – was not performed, due to being misled by the assistant Pharmacist.
- ✓ Scenario X - immediately choose to send a message to the Pharmacist. Writes the message and sends, with no problems.

DISCUSSION

With the results described in the previous section, we can have a clearer picture of features to be improved.

As the tests were performed by two different types of user, in this section the main findings are separated by user type. As general findings, the need for more training, for both pharmacists and patients, is evident as is the need to adapt PC screen resolution to the pharmacies' settings.

PHARMACISTS

Recruiting patients

The execution of the initial questionnaire is too long, and the fact that the user needs to accept participation by e-mail did not allow the Pharmacist to register values obtained at screening.

Visualizing information

There is a need to add a dashboard with a set of parameters for each patient. This relates to the difficulty in finding information. This difficulty may also indicate a need for more training, but also the need to present a summary of the latest figures recorded in the record of each user's home page.

Also, adding visual aids to point for the next visits may be a good improvement. Possibly, a tab with "next visits" reports. By default, the view of Pharmacist's initial screen should be the calendar view.

When viewing graphics, upon selecting the intend parameter, the visualization could be immediate, without the need to press "Search".

The font size for the graphics' data boxes is too small.

When clicking the names of patients should be re-directed to their initial page, with a new dashboard.

Adding information

The use of "biochemical data" and "physiological data" terminologies in separate tabs may hamper the access to this information. Probably would be best to use just one tab where all the information can be inputted.

Also, there is a need to add a shortcut to add data without scheduling a visit. The tendency of the Pharmacist is to go directly to a tab (e.g. physiological data), but is then confronted with the impossibility of adding data via this path. Some frustration arises.

When adding a medicine to a therapeutic profile, correctly identifying the right text box may help. Defining the duration of a package could be simplified. Maybe when selecting the schedule, by ticking the correspondent box, the system could assume the dose the patient is taking.

When selecting a medicine for a therapeutic profile, the size of the package could be the second or third row near to the name, since it is used to distinguish between several possibilities within the same medicine name.

Communication

When scheduling a visit, a "template" text could be a good help.

There is confusion between sending a message and scheduling a visit (which can also send a message). Also, there is confusion between visits to the Pharmacy and visits to other health services. Perhaps we could add this functionality, allowing the Pharmacist to register or even schedule patients' visits to other health services.

For Pharmacists not so acquainted with the platform, to send a message for a certain patient involves choosing the patient first. But this is avoidable as the message system allows selecting the patient in the header of the message box. More training is needed.

PATIENTS

Visualizing information

Font size is too small. A shortcut to increase font size may be needed

The small text boxes with the description of the initials for time of the day on the therapeutic profile, did not appear when the patient passed the mouse on the letters.

Adding information

It is necessary to add a new box in the "therapeutic profile" menu that allows for the search by medicine name.

It is necessary to add a box in the therapeutic profile to add information related to non-conventional therapy as the use of herb-products or homeopathic products, etc.

Alert systems for inputting the correct information in the correct boxes (e.g. systolic and diastolic blood pressure, height intervals, weight intervals, etc.) to avoid incorrect recording of values that may lead to incorrect assessments

Communication

Maybe a drop down list exemplifying the user name (e.g. intial@gmail.com, etc.) could appear on the log in screen when passing the mouse over the boxes, to facilitate the log in process.

Alert system, with colours, may be useful to signal new messages in the inbox, on the initial screen