Project:

myAirCoach - Analysis, modelling and sensing of both physiological and environmental factors for the customized and predictive self-management of Asthma"

(myAirCoach, Grant Agreement No. 643607)

MY AIR COACH

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Executive Summary

This deliverable D7.5 (first version) is the outcome of a living report (another one is planned for M36), which documents the planned and accomplished outreach and standardization activities of the myAirCoach project so far. The activities include both those carried out by individual partners and by the project as a whole.

More specifically the document reflects the activities carried out by the myAirCoach beneficiaries on the standardization and concertation actions as part of the WP7 and more specifically related to the task T7.4 "Standardization and concertation actions" (M24 and M36).

The current document is divided in two sections: the first one reports all *concertation activities* carried out during the project lifecycle, which includes the participation in relevant events and exhibitions, liaison with other projects and other concertation efforts, whereas the second part details the *standardization actions* that have been achieved and/or will be performed by the project in the upcoming period especially regarding the development of the clinical decision support system and the myAirCoach analysis, modelling and prediction actions. Inventorying the existing standards impacting the solutions developed in the myAirCoach the lack and/or the inadequacy of current available standards is identified. myAirCoach project works on present if possible relevant standardization groups with strong focus on mHealth regulatory and interoperability forums and key results will be submitted as contributions to the standards processes.

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List of abbreviations and acronyms

(in alphabetic order)

CDS	Clinical Decision Systems
DoW	Description of Work
DSS	Decision Support System
EHR	Electronic Health Record
HL7	Health Level Seven International
ICT	Information and Communication Technologies
PHR	Personal Health Record

1 Introduction

1.1 Purpose and Scope of the Deliverable

This document covers all the activities that have been reported by the partners and describes the concertation and standardization activities achieved during the myAirCoach project.

The main objective of this report is to provide more details about the activities conducted along the first and second year of the myAirCoach project: from January 2015 (month 1) until December 2016 (month 24) and to present the corresponding activities during the last year of the project and on the other hand, to outline and update the concertation activities that conducted during the project duration.

According to WP7 a further objective is to promote the adoption of standards and the awareness of standardization activities in all the research and technological aspects related to the myAirCoach and to encourage the engagement of myAirCoach beneficiaries, by contributing and disseminating to on-going standardization bodies.

1.2 Approach and Relation to Tasks and other Deliverables

This report describes the work carried out in WP7 – "Dissemination and exploitation" and more specifically is mainly related to the task.

1.3 Structure of the Document

The report is structured as follows: Section 2 discusses the liaison and concertation activities elaborated within the project, Section 3 presents the standardization monitoring activities and the outreached outcomes achieved so far by the myAirCoach consortium and in Section 4, we discuss our conclusions and highlight the directions for future activities around the myAirCoach computational modelling and simulation infrastructure outcomes. So, the deliverable concludes with a brief description of the report findings and shapes valuable conclusions resulting from the evaluation of the reported activities undertaken and their effectiveness towards achieving the targets set in the dissemination and standardisation strategy of the project.

2 Concertation Actions

2.1 *Outreach and events*

During the project execution, the myAirCoach researchers have participated in high profile events and EC supported concertation actions, in order to demonstrate there the first project outcomes but also to enhance the collaboration and networking capability between the myAirCoach team and other teams that are working in this area of the asthma disease. The objectives of the project outreach aims to raise awareness of myAirCoach with updated information on the evolution of the project and its findings, to inform about the potential of m-health solutions to tackle chronic disease, to engage with people living with asthma, to get input from end-users and improve the sustainability of myAirCoach solutions beyond the end of the project and to promote myAirCoach findings to encourage m-health use as support tools for disease self-management.

2.1.1 **MyAirCoach at eHealth Forum 2016**

MyAirCoach has been presented at the 2016 eHealth Forum in Athens. The eHealth Forum aims to engage representatives from all fields, provide the grounds to display all points of view, and be the place where ideas develop, mature and are implemented into actions benefiting society and the economy. The participation of more than 500 people in this year's forum together with 20 exhibitors and 26 startupst all coming from 21 countries from around the world has given the posibility to present the share and disseminate the goals and objectives of MyAirCoach.

This year's eHealth Forum 2016 entitled as "Catalyst for reform – Enabler for growth". The event aims to become the meeting point for eHealth stakeholders from Southeast Europe, the Balkans and the Mediterranean region promoting innovation and business collaboration. In parallel, the eHealth Forum Festival showcases how innovation helps us to manage our health and wellbeing The Forum was organised by MINDWORK BUSINESS SOLUTIONS Consulting Services Ltd., under the leadership of Health Level Seven Hellas (HL7) and in cooperation with the European Connected Health Alliance (ECHAlliance), the Greek Network EIP on AHA, the Athens Medical Society, the Hellenic Healthy Cities Network (EDDYPPY), and the valuable support of HL7 International, IHE-Europe (Integrating the Healthcare Enterprise), EHTEL (European Health Telematics Association), the Hellenic Health Informatics Association (HHIA), Open Health Alliance, the Institute of Computer Science (ICS) of the Foundation for Research and Technology – Hellas (FORTH), and the Association of Information Technology Companies of Northern Greece (SEPVE).

The MyAirCoach project has participated in this Forum through an exhibition booth. During the event MyAirCoach partners had the opportunity to demonstrate the project scientific outcomes to several companies, organizations, researchers and experts with knowledge on a wide range of subjects concerning eHealth.

Figure 1 : The MyAirCoach Booth in eHealth Forum 2016

2.1.2 **World Asthma Day 2016**

The 23rd World Congress of Asthma - WCA-2016 in Madrid, Spain, organized by the Asthma Global Association-INTERASMA, from March 12 through March 15, 2016. This congress was supported by the Spanish societies: SEPAR (Sociedad Española de Neumología y Cirugía Torácica), SEAIC (Sociedad Española de Alergología e Inmunología Clínica), SEICAP (Sociedad Española de Alergia, Inmunología Clínica, Asma y Alergia Pediátrica) and Spanish Pediatric Association (AEP).
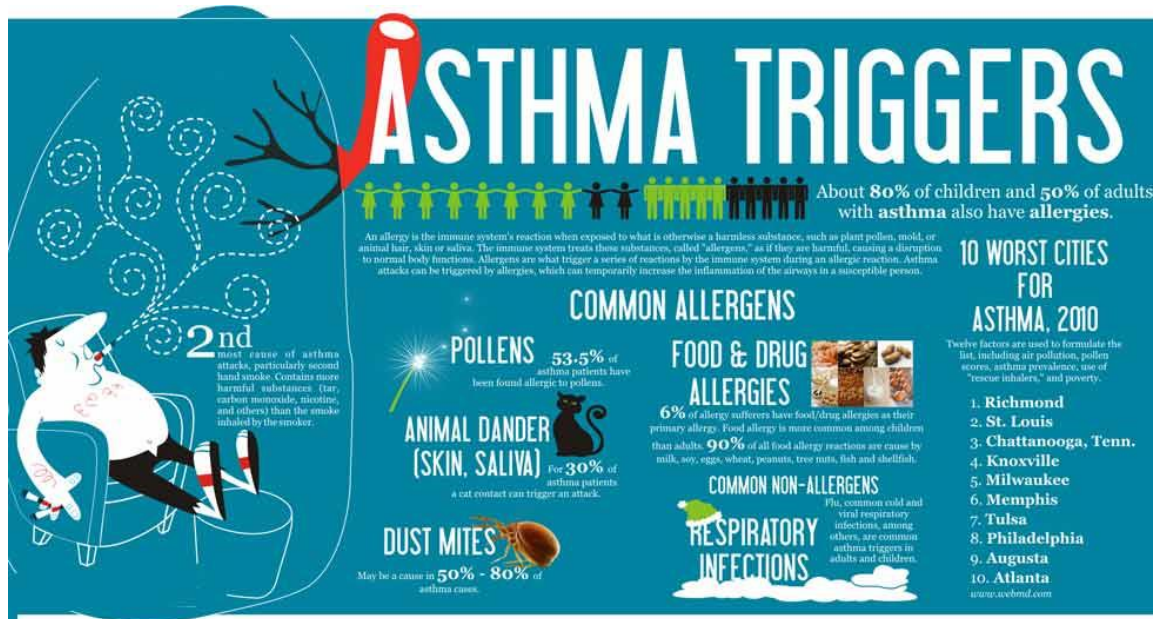
Figure 2 World Asthma Day 2016 "It's Time to Control Asthma" brochure

WCA brought together specialists, physicians, and healthcare professionals from all over the world to share valuable scientific knowledge on asthma, ranging from diagnostic and therapeutic tools and techniques to leading-edge research. WCA has been very popular resulting in highly successful well attended congresses with outstanding state-of-the-art scientific programs.

To demonstrate the objectives of MyAirCoach, ICL presented the project focusing on the high contribution to asthma awareness and holistic care for patients around the world.

2.1.3 **MyAirCoach workshop "Mobile Healthcare for the Self-Management of Chronic Diseases and the Empowerment of Patients"**
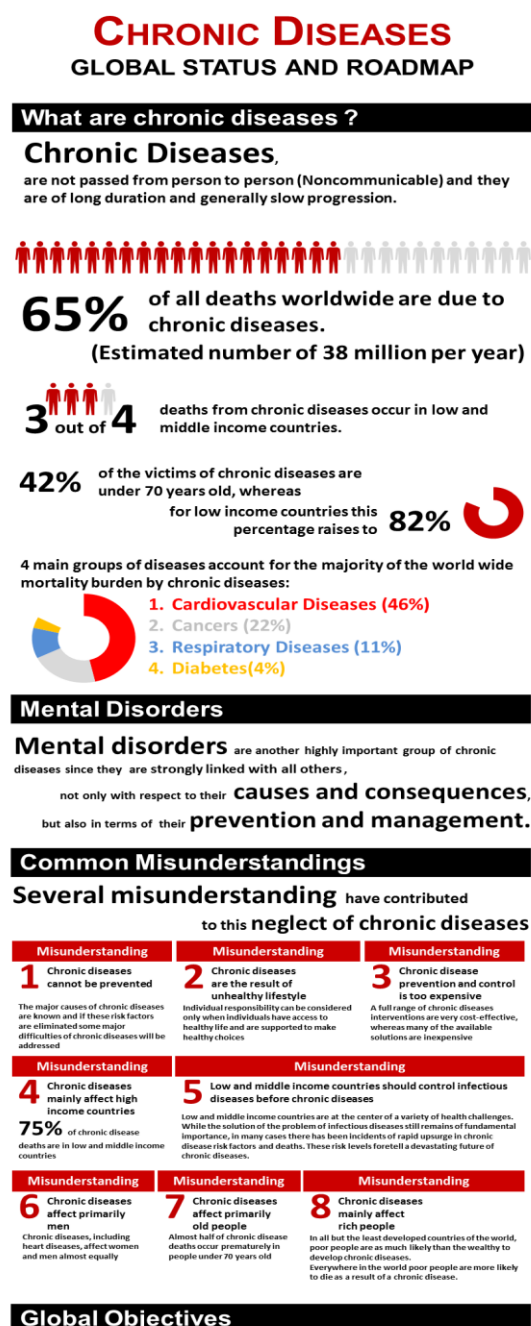
European Chronic Disease Alliance (ECDA) and the Non Communicable Diseases Alliance (NCDA) organized a regional meeting in Brussels to strengthen civil society engagement in the prevention and control of non-communicable diseases (NCDs) in the WHO European region. European Respiratory Society has also supported the meeting as one of the founding members of ECDA underlining huge burden and difficult issues related to the respiratory conditions.

MyAirCoach project is also working in this direction, trying to further support the positioning of asthma in global and European plans for addressing of chronic diseases. The workshop organized by the MyAirCoach project under the title "Mobile Healthcare for the Self-Management of Chronic Diseases and the Empowerment of Patients" during the MobileHCI 2016 between 6 and 9 of September in Florence, Italy has gathered the interest of researchers from different countries around the world utilizing mobile technologies for the support of patients suffering from chronic diseases.

Figure 3 Infographic for the MyAirCoach workshop "Mobile Healthcare for the Self-Management of Chronic Diseases and the Empowerment of Patients"

2.1.3.1 Workshop Structure

The main goal of the workshop was to create a dynamic and highly interactive atmosphere for the discussion of novel mHealth approaches for the empowerment of chronic patients.

The workshop lasted for one day and will be structured around three main sessions separating the accepted papers into the following research areas:

- **Paper Session 1: Mental disorders in the Modern mHealth environment**
- **Paper Session 2: Mobile applications for the management of chronic conditions**
- **Paper Session 3: User centered design and personalization of mHealth solutions targeting chronic conditions**

The authors of accepted papers summarized their work and answered questions in rounds of 20 minutes, emphasizing the "hands on" presentation of their mHealth solutions.

Each session concluded with a short discussion during which all the workshop participants will be asked to participate by providing their comments, thoughts and suggestions for the specific research area.

In the second part of the workshop a plenary round table took place which allowed the overall discussion of the opportunities and challenges in the design of mobile applications in the modern technological environment and for the proper management of chronic conditions within the healthcare system and from the patients themselves.

2.1.3.2 Workshop Program

09:00 - 09:20	**Introduction and Schedule of the Day** - Global Burden of Chronic Diseases: Opportunities and Challenges in the design of Mobile Human Computer Interfaces K.Votis et al
09:20 - 10:30	**Paper Session 1: Mental disorders in the Modern mHealth environment** - Opportunities for Technology in Self-Management of Mental Health E. Murnane et al - Assistive Mobile Application for Support of Mobility and Communication of People with IDD M. Kultsoce et al - Technologies to Support Psychologists and Patients Interactions A. Lopes **Short Discussion on the relation of chronic diseases with mental condition of patients their families and caregivers**
10:30 - 11:00	Coffee Break
11:00 - 12:30	**Paper Session 2: Mobile applications for the management of chronic conditions** - Fingerprints: Detecting Meaningful Moments for Mobile Health Intervention Y.Wang et al - Mobile apps for IBD Self-Management using Wearable Devices and Sensors C. Pernencar - Standing Hypotension Prediction based on Smartwatch Heart Rate Variability

	Data: A Novel Approach D.Iakovakis et al • Wearable Devices and AI Techniques Integration to Promote Physical Activity D.Baretta et al **Short Discussion on the process of creation of mHealth solutions in the modern IoT environment**
12:30 - 14:00	Lunch Break
14:00 - 15:30	**Paper Session 3: User centered design and personalization of mHealth solutions targeting chronic conditions** • Sociotechnical Design of mHealth Applications for Chronic Diseases R. Barricelli et al • Towards Successful Self-Management and Empowerment for COPD Patients B.Zechmannn et al • End-User Personalization of Context-dependent Applications in AAL scenarios C. Santoro et al • CoachMe: A Platform for Promoting Healthy Lifestyle A. Fadhil et al **Short Discussion on the involvement of patients in the design of modern healthcare solutions and their tailoring to specific users**
15:30 - 16:00	Coffee Break
16:00 - 16:15	**Short Overview of the MyAirCoach project**
16:15 - 17:30	**Round Table on the opportunities and challenges in the design of Mobile Human Computer Interfaces for Chronic Diseases** Clinical Significance, Regulation Framework, Standardization, Usability, Engagement and Adherence, Gamification, Social Networks, Security, Privacy and Ethics

2.1.3.3 Summary of the Workshop results

The MobileHCI 2016 Conference took place in Florence from 6th to 9th September 2016 to discuss about human-computer interaction with mobile devices and services, broadly known as mHealth. myAirCoach EU funded project, in which EFA is involved to develop a connected inhaler that could help patients be on top of their asthma, organised a workshop during the conference entitled Mobile Healthcare for the Self-Management of Chronic Diseases and the Empowerment of Patients.

The first day was dedicated to workshop sessions to create a dynamic and interactive atmosphere for the discussion of novel mHealth approaches for the empowerment of chronic patients. The workshop was divided in three sessions, which was concluded with discussion were participants could comment and give suggestions for the specific research area. Moreover, they could discuss about opportunities and challenges in the design of mobile applications in the modern technological environment and for the proper management of chronic conditions within the healthcare system and from the patients themselves.

Figure 4: The myAirCoach workshop in MobileHCI2016 conference

The first Paper Session, focused on "*Mental disorders in the Modern mHealth environment*", was composed by three speeches. Through them, the authors explained the implication of designing technology-based solutions on people with mental disorders, like bipolar disorder ("MoodRhythm") and Intellectual and Development Disabilities (IDD) ("Travel and Communication Assistant"). Moreover, the last part of this session was dedicated to explain how technological solution could get better the quality of life of patients with these diseases.

The implication of technology solutions on different diseases was the theme of the second Paper Session, too. It was dedicated to "*Mobile applications for the management of chronic conditions*".

Every speeches explained a different way in which mobile technologies could analyze the patient's daily behaviors in order to get better the patients' life, like "fingerprints" technique, use of wearable sensors or biochips ("mychron"), detectors to provide biometric data, model-based reasoning systems and personalized human computer interaction in order to promote physical activity.

Finally, the last paper session was focused on user centered design and personalization of mHealth solutions targeting chronic conditions. The specific themes were the investigation of socio technical design of mHealth applications on chronical diseases ("MANTRA Project design"), the analysis of better technology possibilities in order to indicate better solutions for people living with COPD, development of flexible applications able to match the many possible user needs ("AAL Personalisation Rule Editor") and provide high quality user experience and the promotion of health and wellness using a holistic approach in order to maintain the overall wellbeing of the nation ("COACHME").

After the workshop, during the next two days, some partners meetings took place in order to discuss about MyAircoach project and its following developments.

2.1.4 Longdagen

The Longdagen 2016 was organized on April 19 and April 20 in 'De Heerlickheijd van Ermelo". The aim of the Longdagen ("Lung days") scientific conference was to be the national meeting place for scientists, pulmonologists, pediatricians, family physicians, technicians, health care professionals and patients. In addition, separate sessions were organized for the general public in order to present the latest developments in the area of research and care for patients with lung diseases.

The event was organized by NRS - Netherlands Respiratory Society, NVALT - Nederlandse Vereniging van Artsen voor Longziekten en Tuberculose and Longfonds (formerly Astma Fonds). LUMC which is a myAirCoach partner presented the objectives of the project in the Professional session of the event.

Figure 5: LUMC presentation in the Longdagen 2016 Program Overview

2.1.5 eHealth Week

Figure 6 eHealth Week 2016 onsite guide

eHealth Week 2016 was organized by the Dutch Ministry of Health as part of the Dutch Presidency of the Council of the European Union, the European Commission and HIMSS Europe. The educational programme focused on three main themes: Empowering People, Trust & Standards and Social Innovation & Transition.

The programme of the week focused on eHealth policies that are shifting towards eHealth users, and the efforts that are made to increasingly involved in eHealth policy-making. MyAirCoach project has users at the heart of all development processes by adopting a User Centered approach that covers all processes of system implementation. The MyAirCoach Advisory Patient Forum has been implemented in the first months of the project in order to integrate the patients' perspective in both the technical and clinical oriented tasks and help the project to move towards usable, useful tools the comply with the highest standards of privacy and security protection.

The MyAirCoach project was represented in eHealth Week by EFA and MV. EFA, as the dissemination manager of the MyAirCoach project, shared the first year outcomes of the project and distributed material related to the goals of MyAirCoach. LUMC presented the MyAirCoach project and MV also participated in the conference and

pitched the ideas behind the products of the company and their relation to the technical objectives of the envisioned MyAirCoach system.

2.1.6 **MyAirCoach at the ICT Proposers' Day & Innovation Radar Prize**

ICT Proposers' Day 2016 was held in Bratislava, Slovakia on 26 and 27 September. It was a networking event promoting European ICT Research & Innovation and focusing on the Horizon 2020 Work Programme for 2016-17. The event focused on the Horizon 2020 Work Programme 2016-17 in the field of Information & Communication Technologies. It offered a unique and exceptional opportunity to build quality partnerships with academics, researchers, industrial stakeholders, SMEs and government actors from all over Europe.

The programme included:

- Networking sessions organised according to the Pillars and Topics of the Work Programme 2016-17, where potential proposers present their project ideas;

- Information sessions including how to prepare and submit a proposal in H2020;

- Information stands which cover general and horizontal topics of the Work Programme 2016-17;

- A European Commission ICT information desk to supply information on the content and logistics of the event;

- Booths, organised by village, where European Commission officials provide information on the topics of the Work Programme 2016-17 and which serve also as meeting points for proposers interested in the same research and innovation topics;

- Ample space for informal networking and bilateral meetings between participants;

- Workshops organised by Ideal-Ist: Help! I am a proposal coordinator! Proposal coordination in H2020 (26/9 at 15.00); Inside contractual Public Private Partnerships (27/9 at 09.30); and SMEs in H2020 - looking for H2020 support beyond the SME Instrument (27/9 at 11.30);

- Face2Face Brokerage event (run by Ideal-Ist), where you could sign up for short (20 minute) pre-arranged face-to-face meetings.

myAirCoach partner IHP pitched to a panel of experts the myAirCoach smart-inhaler in the context of the Innovation Radar Prize. CERTH was also participated in this event.

Figure 7 Presentation of Dr. Steffen from IHP to the Innovation radar Prize

2.1.7 **World Asthma Day 2015**

myAirCoach participated at the World Asthma Day (May 5, 2015), where the National Asthma Education and Prevention Program (NAEPP) encourages clinicians and others to focus on identifying allergens and irritants that can lead to asthma attacks.

Figure 8 World Asthma Day 2015 logo

Despite the wide availability of asthma therapies, many people with asthma still experience lots of symptoms impacting significantly on their quality of life. In line with this year's World Asthma Day theme "You can control your asthma", myAirCoach, a leading pan-European project where patients are recruited to develop a monitoring device which is integrated with mobile technology to help people with asthma to take the right steps to stay on top of their condition and reduce their risk of an asthma attack. The project presentation aimed to demonstrate the external factors which can impact an individual's ability to manage their asthma and how can be managed through the monitoring system.

2.1.8 **MyAirCoach at eHealth Forum 2015**

On the 3-4 December 2015, the myAirCoach project was demonstrated and presented in the eHealth Forum 2015 in Athens Greece. As was described before the eHealth Forum is a new and highly active institution, which promotes multi-level collaborative actions in the country of Greece and between scientific, academic and business organizations having as a centre the promotion of electronic health care.

Hundreds of participants from Europe and U.S. attended the forum constituting it as a successful event. The main objectives of the eHealth Forum are summarised below:

- Support the development and utilization of digital applications in the health sector;

- Inform organisations, health professionals and local government, for the applications and the potential of e-health;

- Raise awareness about the benefits of digital technology to public health and quality of life;

- Promote international interoperability standards and best practices, in order to shape a healthy and competitive medical informatics market;

- Support the institutional constitution of the Greek eHealth ecosystem, involving all stakeholders.

MyAirCoach were presented with a booth in the event in order to investigate the possibility of synergies with interested commercial entities and research institutes. Furthermore, the communication with healthcare professionals and technology providers working in this area of eHealth, provided useful feedback for the development of the MyAirCoach and analytics platform.

2.1.9 myAirCoach at the Responsible Research Innovation-ICT 2015 workshop

On the 8-9th of July, EFA represented myAirCoach consortium at the Responsible Research Innovation-ICT 2015 workshop. The workshop is a European Commission DG Connect initiative together with the RRI-ICT Forum Project.

The event served to identify challenges, share knowledge and experiences and build experiences in the domains of Responsible Research and Innovation (RRI) and Social Sciences and Humanities (SSH), areas that are present in the H2020 programme.

EFA Project Manager Giuseppe De Carlo shared the myAirCoach experience of involving European asthma patients, within an Advisory Patient Forum. More information about the workshop can be found at the website of the workshop Link

2.2 Contacts and synergies with other European projects

The establishment of close synergies among EC and national projects encourages the collaboration but also promotes the re-utilisation of already completed research works, while the involved R&D teams may go beyond other unexplored research and innovation lines. The myAirCoach consortium will foster the horizontal collaboration with other ongoing related projects, which will enable to share experiences with other related projects and networks and find synergies. In this direction, the myAirCoach consortium has already identified some interesting and related projects in the field of Asthma disease and get in contact (see the following sub-sections) with some of them by taking also into consideration the activities that are planned for the near future. Moreover myAirCoach effort will be focused on the organisation of common events with the above initiatives, like for example special interest sessions, workshops etc. This will guarantee the success of efforts undertaken to promote the use of myAirCoach in wider medical business areas, multiplying project´s impact.

2.2.1 AirPROM (Airway Disease Predicting Outcomes through Patient Specific Computational Modelling)

AirPROM stands for 'Airway Disease Predicting Outcomes through Patient Specific Computational Modelling'. This is the technical name for the 5 year European-wide project (2011-2015), which produced computer and physical models of the whole airway system for people with asthma and chronic obstructive pulmonary disease (COPD). The main objectives of the project where:

- To develop accurate models will provide:
- Better diagnosis of different types of asthma and COPD
- Better monitoring of the disease
- Better matching of the right treatment to each patient

- Better tools for more targeted research

- Better understanding of the disease

- Improved quality of life due to personalised medicine

AirPROM is an EU-funded project that brought together 34 partners from universities, research institutes, the biopharmaceutical industry, patient organisations, small companies and existing research projects with expertise in physiology, radiology, image analysis, bioengineering, data harmonization, security and ethics, computational modelling, systems biology, and health communication.

Possible synergy between myAirCoach and AirPROM

The models created from AirPROM are sophisticated tools that run by an expert center, rather than a computer program used on a desktop PC. The modelling process require some human input, such as taking samples and setting up the equipment, but reduces the time it takes to find the best treatment for an individual from a matter of weeks to just a few hours. These models where used as input for myAirCoach 's assessment of airflow and inhaled particles attributes in obstructed pulmonary system.

2.2.2 MANTRA (Mobile for Anticoagulant Therapy)

The MANTRA (Mobile for ANticoagulant TheRApy) project is aimed at introducing mobile devices and innovative interaction design in anticoagulant therapy practice to improve the quality of life of patients and to support doctor-patient communication. This would have the benefit of saving both patient and healthcare workers time and resources and facilitate the monitoring of this therapy. The project is an ongoing usability study and proof of concept and this paper presents the results of a heuristic analysis performed to identify the potentials of this research.

For the urban case, the intention is to provide the patient with an INR self-testing device and a mobile device (an iPod) that transmits the INR result to the patients' doctor/clinic. The doctor is then able to review the result and transmit back to the patients the correct dose of anticoagulant that they need to take and when they need to repeat the INR test. In this setting, the goal is to provide patients with a monitoring device to be used at home to reduce the frequency of visits at the hospitals or clinics. Through the device and an iPod, the patients would be able to send their INR test results to their GPs and to receive back their prescriptions details.

The rural case applies to remote areas in which people do not have direct access to the Internet, from home or from mobile phones. The nearest medical center is typically in the village and serves all the people who leave in that area. The medical center is usually provided with Internet connection and represents the bridge between the rural area patients and the main city hospital staff. The idea is to provide the rural doctor, bio analyst or nurse working at the medical center with a INR testing device and a tablet (iPad or other model), by which they may send the INR test results to a doctor working in the hospital of the main city and will then receive back the prescription details. The goal of this setting is to reduce the time needed for patients living in rural areas to receive their prescription and to provide the rural doctor, bio analyst or nurse a tool to monitor the clinical history of several patients, not only affected by coagulation diseases.

Given the limited time availability, the project expected outcomes are more related to a proof of concept than to an actual evaluation of its concrete application. However, we plan to develop two different interactive prototypes, one for urban and one for rural setting and to test them in the respective contexts with different usability evaluation methods.

Possible synergy between myAirCoach and MANTRA

myAirCoach collaboration with MANTRA lead to the accomplishment of the workshop "Mobile Healthcare for the Self-Management of Chronic Diseases and the Empowerment of Patients" at MobileHCI 2016.". As described earlier the workshop planed prospective future collaborations on the aspects of mHealth that strongly need further investigation:

- Method, techniques, technologies, and design approaches for improving the level of patients' engagement in therapy management in order to contribute to a higher efficacy and effectiveness of the cure and to a higher patients' satisfaction.

- Research or Industry case studies focused on improving patients' quality of life supporting tools for self-monitoring and self-management of their chronic diseases.

- Sociotechnical studies on methods for improving the quality of doctor-patient relationship enabling the construction of direct and fast communication channels focusing on data and avoiding time wasting.

2.2.3 U-BIOPRED (Unbiased BIOmarkers in PREDiction of respiratory disease outcomes)

U-BIOPRED stands for 'Unbiased Biomarkers for the Prediction of Respiratory Disease Outcomes'. This was the technical name for the 5-year European-wide project (2010-2014), which aims:

- to understand more about severe asthma

- to determine how it differs from person to person

- to uncover new information and ideas that could lead to the creation of effective new treatments

Using samples and medical information from hundreds of adults and children with severe asthma and by comparing them to samples from people with mild asthma, no asthma and chronic obstructive pulmonary disease (COPD), the project hopes to identify different sub-types (known as phenotypes) of severe asthma.

It was a research project that brought together scientists from universities, research institutes, the pharmaceutical industry and small companies. Patients with asthma and patient organisations were involved, providing the patient perspective in the development of the project. For example, they advised on how best to recruit people with asthma to take part, how many visits are appropriate for a patient to make to a testing centre and how to communicate the project to the public.

U-BIOPRED was funded by both the European Commission and the European Federation of Pharmaceutical Industries and Associations (EFPIA) called the Innovative Medicines Initiative (IMI). This partnership funds large-scale collaborative research, but it is also one of the first occasions where so many pharmaceutical companies are working together on the same project as partners and not as competitors.

Possible synergy between myAirCoach and U-BIOPRED

myAirCoach has already contacted the U-BIOPRED project in order to collaborate on the data analysis section.

2.2.4 European Asthma Research and Innovation Partnership

The European Asthma Research and Innovation Partnership (EARIP) aims to reduce asthma deaths in Europe by 25% within ten years and by 50% within 20 years. The partnership, made up of 12 European-based organisations, also aims to halve hospital admission rates, speed up the discovery of new treatments and improve self-management. The EARIP project will do this through identifying key gaps in asthma knowledge; it will then address these using a pioneering and integrated approach to research, development and innovation across Europe. Through rapid dissemination of project results, EARIP will ensure that outcomes from knowledge-based asthma research will quickly result in an improved quality of life for people with asthma.

EARIP is a co-ordinated and integrated approach to asthma research, development and innovation across Europe. The project activities range from basic cell science research to assessing and improving European healthcare systems. Supported by the European Commission, EARIP will bring together asthma experts from across Europe to define what's needed to reduce asthma deaths and hospitalisations in all EU member states.

EARIP target a number of asthma research areas to ensure a comprehensive overview of all current research strategies. The most significant of them include

- Research into biological targets, aiming to discover new targets and better define the role of existing biological targets

- Identify new systems, models and tools for phenotypic stratification

- Develop better and more efficient healthcare systems across Europe

- Identify how to establish a European Innovation Partnership (EIP) for the management of asthma

Possible synergy between myAirCoach and EARIP

myAirCoach and EARIP work on the some principals, but they exam the asthma disease from different aspects. The former is focused on the creation of a self-management system based on the up-to date clinical situation while the latter intends to improve the current clinical asthma state towards the reduction of asthma deaths in Europe. A collaboration of those projects will develop a comprehensive 'road map' of asthma priorities in Europe that can be used by clinicians, researchers, industry, and patient groups to lobby for change in the current asthma policy.

2.2.5 **FRESH AIR**

An introductory briefing FRESH AIR is an implementation science project exploring how to improve the prevention, diagnosis and treatment of chronic lung diseases in contexts with limited health care resources. Chronic lung diseases include Chronic Obstructive Pulmonary Disease (COPD) and asthma. Worldwide about 210 million people have COPD and it is now the third leading cause of death worldwide. Asthma affects an estimated 300 million people. Although there is not enough reliable data to calculate how many people are affected in Uganda, small scale prevalence studies have shown Chronic Obstructive Pulmonary Disease (COPD) and asthma affect many people. Chronic lung diseases cause frequent symptoms which prevent people being active and reduce their quality of life. Although these diseases are not curable, with proper treatment their symptoms can usually be controlled and their progression slowed.

Possible synergy between myAirCoach and CHRONIOUS

FRESH AIR primary goal is to improve the prevention, diagnosis and treatment of chronic lung diseases in contexts with limited health care resources. A possible collaboration between the two projects will offer the ability to introduce the myAircoach project results (especially the modelling part to the Fresh Air project.

2.3 Standardisation Activities

The standardisation activities in the myAirCoach project have included until now the mapping, monitoring and communication with relevant standardization actors and important initiatives, through research and engagement with the standards research community, participating in events and reaching out to the various groups of people who engage in standards.

Thus, the myAirCoach consortium had collaboration with simulation and modelling related organisations as well as a presence at key standards-related events

2.3.1 **MyAirCoach and OpenEHR**

OpenEHR is an open standard specification in health informatics that describes the management and storage, retrieval and exchange of health data in electronic health records (EHRs). In openEHR, all health data for a person is stored in a "one lifetime", vendor-independent, person-centred EHR. The openEHR approach is multi-level, single source modelling within a service-oriented software architecture, in which models built by domain experts are in their own layer. It is delineated by a set of specifications published by the openEHR Foundation.

The openEHR architecture (Figure 9 Block **Diagram of openEHR specification components** consists of an information model (RM), which includes the invariant semantics of EHR, Demographic details, as well as supporting data types, identifiers and useful design patterns, an archetype model, which includes the archetype definition and query language and a service model that defines access to key back-end services including the EHR Service and APIs used for application access. OpenEHR is based on an archetype methodology for specification of content. OpenEHR archetypes are being used widely as prototypes to various e-health projects to specify national e-health

information standards. Systems conforming to openEHR are using standardized information models, content models and terminologies provided by these archetypes.

MyAirCoach portal, in order to conform to the e-health information standards, uses openEHR archetypes to store patient assessments data as well as environmental data file follows the structure and "rules" of a given archetype and is the basic format for importing data to the portal and also exporting data from it. Finally, MyAirCoach portal uses openEHR archetypes in order to form the patient's medical profile based on Environmental data, Fitbit and the Smart Inhaler devices.

The essential outcome of the openEHR approach is systems and tools for computing with health information at a semantic level, thus enabling true analytic functions like decision support, and research querying.
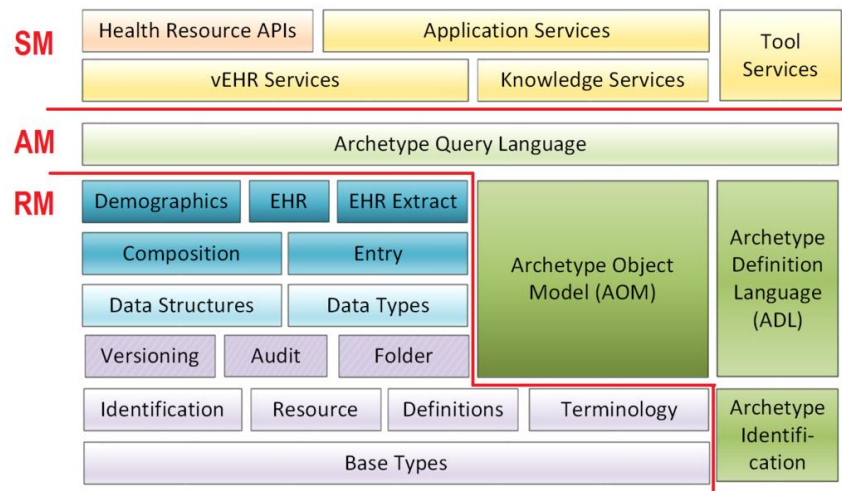

Figure 9 Block Diagram of openEHR specification components

Partner MV has had discussions with other openEHR for the development of the archetypes. Once approved by the clinical partners within the MyAirCoach project MV will release those archetypes to the openEHR community. MV will also update the project page[1] at the openEHR website with information about the MyAirCoach project.

2.3.2 Arden Syntax for clinical algorithms

MyAirCoach utilizes Arden syntax for representing and sharing medical knowledge in an executable format which can be used by clinical CDS systems. Arden Syntax can be seen as a hybrid between classical production rules and procedural representation of clinical algorithms. The code is organized in self-contained files called Medical Logic Modules (MLMs)[1]. The execution of an MLM can be triggered by specific data-based or time-based events or by a direct call[2].

The content of an MLM is divided into four categories, maintenance, library, resources and knowledge, which are divided into slots. Maintenance, resources and library include maintenance of the knowledge base, change control, localized strings and explanatory information while knowledge category includes implementable clinical information.

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[1] http://www.openehr.org/who_is_using_openehr/funded_research_projects

If a project needs to adopt the Arden Syntax, two main parameters need to be customized. The former, called the compiler problem, and includes the building of an Arden compiler. The latter, refers to the curly braces problem, and includes the compatibility of the data and message types of a clinical information system into Arden Syntax data types and vice versa. The designers of the Arden Syntax deliberately left this mapping process to the particular project due to the lack of standardized interfaces and patient records.

The rules written in Arden Syntax have to be translated into executable instruction of the underlying computer system. This can be achieved in two ways. The first includes the translation of Arden-written rules into machine code directly while the other includes the translation of Arden Syntax rules to stored procedures of the underlying system or into an intermediate high-level language which is then compiled to produce the executable MLM. Another not so well known approach is by using ArdenML and extensible stylesheet language transformation instead of a classical compiler. The translation pipeline is represented in Figure 10
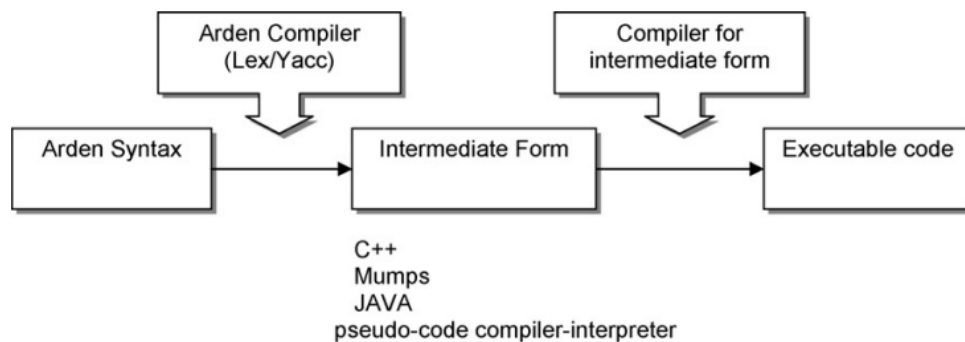

Figure 10 Translate the Arden Syntax rules into an intermediate high-level language which is then compiled to produce the executable MLM

For each particular architecture and information system, a different Arden Syntax compiler must be written as well as a program for the runtime execution of the MLMs.

2.3.3 **myAirCoach adopts HL7 standards**

To achieve a high level of knowledge abstraction and ease the sharing of knowledge the Arden Syntax for Medical Logic Modules (MLMs) has been chosen to represent health-related knowledge. Arden Syntax has been standardized by Health Level 7 (HL7)[3] and incorporates a number of concepts, making it easy to express rules in the medical domain in a manner close to natural language. The promise is that experts from the domain are able to understand the expressed logic and validate the coded knowledge[4].

HL7 is a set of flexible standards, guidelines, and methodologies for exchanging and developing electronic health records (EHRs). These standards define how information is packaged and communicated from one party to another, setting the language, structure and data types required for seamless integration between systems. HL7 standards support clinical practice and the management, delivery, and evaluation of health services, and are recognized as the most commonly used in the world.

HL7 standards are grouped into reference categories:

- Primary Standards - Primary standards are considered the most popular standards integral for system integrations, inter-operability and compliance.

- Foundational Standards - Foundational standards define the fundamental tools and building blocks used to build the standards, and the technology infrastructure that implementers of HL7 standards must manage.

- Clinical and Administrative Domains - Messaging and document standards for clinical specialties and groups are found in this section.

- EHR Profiles - These standards provide functional models and profiles that enable the constructs for management of electronic health records.

- Implementation Guides - This section is for implementation guides and/or support documents created to be used in conjunction with an existing standard.

- Rules and References - Technical specifications, programming structures and guidelines for software and standards development.

- Education & Awareness.

myAirCoach utilizes HL7 standards to define and provide formats for messaging and data exchange, decision support, rules syntax and common health data definitions in clinical documents, EHR and PHR claims attachments, quality reporting, product labels for prescription medications and clinical genomics.

2.3.4 Dash7 Alliance Protocol

DASH7 Alliance Protocol is an open source Wireless Sensor and Actuator Network protocol that is based on the ISO/IEC 18000-7 ISO/IEC 18000, an international standard that describes a series of diverse RFID technologies. Each utilizing a unique frequency range. ISO/IEC 18000-7 describes the parameters for active air interface communications at 433 MHz (2008 - 2009) DASH7 Alliance Protocol 2.

DASH7 is similarly suited to a wide range of applications in development or being deployed. In myAirCoach DASH7 will be utilized for location-Based Services. More explicitly, developing new location-based services using a range of DASH7-enabled devices including smartcards, wearables and other conventional products that can take advantage of the unique small footprint, low power, long range, and low cost of DASH7 relative to less practical and high-power wireless technologies. Using DASH7, users can "check in" to venues in ways not practical with current check-in technologies like GPS, which are power-intensive. Through the location management the user will be informed for all the location based useful data that will optimize the asthma management and asthma attack prevention.

2.3.5 Body Area Network

A Body Area Network is formally defined by IEEE 802.15 as, *"a communication standard optimized for low power devices and operation on, in or around the human body (but not limited to humans) to serve a variety of applications including medical, consumer electronics / personal entertainment and other"* [IEEE 802.15].

In more common terms, a Body Area Network is a system of devices in close proximity to a person's body that cooperate for the benefit of the user. As IEEE mentioned, the most obvious application of a BAN is in the medical sector, however there are also more recreational uses to BANs.

Fitbit, one of the devices that are implemented for asthma patients' activity tracking is utilizing the wireless body area network of the wearable space. WBAN the short-range, low-power, international wireless communication standard that guides the device that operate around patient hand. It's called a network because it actually can be a series of sensors tracking different things. This set of standards was created in an effort for these devices and their generated data to come with an assurance of confidentiality, authentication, integrity, and data freshness.

2.3.6 **ISO/IEEE 11073**

ISO/IEEE 11703 defines a common framework for making an abstract model of personal health data available in transport-independent transfer syntax required to establish logical connections between systems and to provide presentation capabilities and services needed to perform communication tasks. The protocol is optimized to personal health usage requirements and leverages commonly used methods and tools wherever possible.

ISO/IEEE 11703 addresses a need for an openly defined, independent standard for converting the information profile into an interoperable transmission format so the information can be exchanged to and from personal telehealth devices and computer engines (e.g., cell phones, personal computers, personal health appliances and set top boxes).

The ISO/IEEE 11073 Medical / Health Device Communication Standards are a family of ISO, IEEE, and CEN joint standards addressing the interoperability of medical devices. The ISO/IEEE 11073 standard family defines parts of a system, with which it is possible, to exchange and evaluate vital signs data between different medical devices, as well as remote control these devices.

myAirCoach will investigate the feasibility of applying the ISO/IEEE 11073 standards, for monitoring the wearable home health monitoring.

3 Conclusion

In this document, an agile strategic standardization and concentration framework tailored for the myAirCoach project has been presented and updated from the first version of the M24 document. This deliverable highlights the increasing focus of the concertation and standardisation efforts into the myAirCoach project. The implementation work in myAirCoach has developed to such a stage that it will continue beyond the end of the project.

The project standardization strategy has been followed and updated by the whole consortium of academics, researchers, users, developers and providers achieving the optimum engagement and participation of all myAirCoach partners with the corresponding activities from the beginning of the project.

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