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Telemedicine and Education for Asthma Self-Management

PROJETO DE INVESTIGAÇÃO

ÁREA CIENTÍFICA DE PNEUMOLOGIA

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Index

Abbreviations 3

Resumo 4

Abstract 5

EIT Health choice 6

1. Basic data 7

1.1. Selected Pillar for Proposed Activity 7

1.2. Select Segment for Proposed Activity 7

1.3. Co-editors: 7

2. Activity details 8

2.1. Involvement of citizens/patients 8

2.1.1. Ways citizens/patients will be actively involved 8

2.2. Please describe how your recruitment and selection(s) will be achieved: 8

2.3. Please describe the specific need that your educational program will address 8

2.4. Please provide a detailed description of the educational activity 11

2.5. Strategic Fit / Value Proposition 13

2.6. Uniqueness that justifies EIT Health Funding 14

2.7. EIT Health Skills Needs 14

2.8. Learning Outcomes 15

2.9. Clearly Identified Education Market Need 15

2.10. Knowledge Triangle Integration 16

2.11. Collaboration with other Pillar-specific projects or projects from a different Pillar with a similar target. 16

3. Implementation 18

3.1. Digital Activity 18

3.1.1. Partner(s) who have expertise in delivering the planned digital activity 18

3.1.2. Digital Platforms 18

3.1.3. Digital Platform Costs and Criteria 18

3.1.4. EIT Health Digital Learning Platform....18
3.2. Team....19
3.2.1. Capacity and strength of the team to develop, deliver and scale the programme 19
3.3. Programme Design....20
3.4. Language....20
3.5. Venues and Duration....21
3.6. Credits....21
3.7. SWOT Analysis, Risk Analysis and Mitigation....21
3.7.1. Strengths....21
3.7.2. Weaknesses....22
3.7.3. Opportunities....22
3.7.4. Threats....23
3.7.5. Risk analysis and mitigation plan....23
3.8. Marketing Strategy....24
3.8.1. Time for the beginning of marketing strategy's implementation....24
3.8.2. Number of applicants expected to be attracted by the marketing strategy....24
3.9. Recruitment, Selection and Evaluation Process....24
4. Impact....25
4.1. Expected outcomes of the activity: impact (short- and long-term)....25
4.2. Evaluation and Monitoring of Participants....25
4.3. Sustainability....26
4.4. Knowledge Transfer....27
5. Budget....28
6. References....29

Abbreviations

ACeS – *from the portuguese: "*Agrupamento de Centros de Saúde"

ACQ – "Asthma Control Questionnaire"

ACT – "Asthma Control Test"

COPD – "Chronic Obstructive Pulmonary Disease"

CHUC – *from the portuguese:* "Centro Hospitalar e Universitário de Coimbra"

EIT Health – "European Institute of Innovation and Technology for Health"

ICS – "Inhaled Corticosteroid(s)"

IgE – "Immunoglobulin E"

IL-5 – "Interleukin 5"

LABA – "Long Acting Beta-2 Agonist(s)"

LTRA – "Leukotriene Receptor Antagonist"

MINIAQLQ – "Mini Asthma Quality of Life Questionnaire"

PCP – "Patient and Caregiver Pair"

SABA – "Short Acting Beta-2 Agonist(s)"

TEdASM – "Telemedicine and Education for Asthma Self-Management"

WHO – "World Health Organization"

Resumo

A asma é uma doença respiratória crónica com alta prevalência tanto a nível mundial como a nível europeu, caracterizada por episódios de dispneia, tosse, sensação de opressão torácica e sibilos.

A asma, e principalmente a asma não controlada, acarreta perda de qualidade de vida para os doentes e para os seus cuidadores, assim como custos económicos para os sistemas de serviços de saúde, ao ser uma causa de hospitalizações e atendimentos hospitalares não programados.

Desta forma, o controlo clínico desta patologia, nomeadamente prevenindo as suas exacerbações, é um dos principais objetivos da terapêutica, que compreende uma abordagem farmacológica e não-farmacológica.

Nos últimos anos, muito foco tem sido dado ao papel da educação destes doentes. Atualmente, existe evidência de que doentes asmáticos que apresentam um melhor conhecimento sobre a sua doença e, desta forma, lidam melhor com ela, apresentam um melhor controlo clínico e melhor qualidade de vida. Associadamente, estes doentes têm um menor risco de recorrer de forma não programada aos cuidados de saúde, o que leva a uma redução dos custos monetários relacionados com esta patologia.

O TEdASM, projeto criado para submissão a candidatura EIT-Health, é um projeto de base educacional, com uma componente de telemedicina, dirigido a doentes asmáticos e aos seus cuidadores, de modo a que estes consigam lidar melhor com a doença e as suas exacerbações.

Após um semestre em que os recursos digitais do projeto serão criados, ocorrerão consultas de telemedicina mensais, com os doentes e seus cuidadores, em que estes mesmos recursos serão aplicados. Finalmente, e em conjunto com um parceiro tecnológico, uma plataforma digital seria desenvolvida de modo a que, no futuro, todos estes recursos se possam agregar, podendo, a longo prazo, contribuir para uma distinta abordagem de follow-up para estes doentes.

Palavras Chave: asma, educação de doentes, telemedicina, autogestão de doença, tratamento não-farmacológico

Abstract

Asthma is a highly prevalent chronic respiratory disease both worldwide and in Europe, characterized by episodes of dyspnea, coughing, chest tightness and wheezing.

Asthma, and in particular uncontrolled asthma, entails quality of life loss for sufferers and their caregivers, as well as an economic burden for healthcare services by being a cause of unscheduled hospitalizations and appointments.

Therefore, clinical control of this pathology and prevention of exacerbations are the main objectives of its treatment, which comprises a pharmacological and a non-pharmacological approach.

In recent years, much focus has been given to the role of education of these patients. Currently, there is evidence that asthma sufferers who have better knowledge of their illness and, hence, manage it better, have a better control over their asthma and an improved quality of life. Additionally, these patients have a lower risk of unplanned recourse to healthcare, which in turn leads to a reduction in the associated monetary costs.

TEdASM, a project created to submit an EIT-Health application, is an educational-based project, with a telemedicine component, aimed at asthma patients and their caregivers, so that they can better cope and manage asthma exacerbations.

After a semester in which the project's digital resources will be created, monthly telemedicine consultations will take place with the patients and their caregivers, where these same resources will be applied. Finally, and together with a technological partner, a digital platform will be developed so that, in the future, all these resources can be aggregated and, in the long term, contribute to a distinct follow-up approach of asthma sufferers.

Keywords: asthma, patients' education, telemedicine, self-management, non-pharmacological therapy

EIT Health choice

The authors first came into contact with the European Institute of Innovation and Technology for Health (EIT Health) when they participated in a CALMA (Training and support to calm and raise awareness of dyspnea crisis, in chronic obstructive pulmonary disease) workshop and realized how informing and educating both patients and caregivers can prove beneficial for the control of their chronic respiratory diseases, and how the involvement of caregivers can substantially change the outcomes aimed for a project regarding these pathologies.

EIT Health is an independent body of the European Union created to innovate and tackle problems regarding healthcare for European citizens. This institution has its own methodology for proposals and applications, judging the overlap that the submitted projects share with their own goals and aims. The submission template provided by EIT Health is thorough and extensive, so exceeding the word limit for this work is required.

One of EIT Health's main goals is to address problems concerning chronic diseases and develop solutions that allow for a healthier life and an improvement in healthcare delivery across Europe. At the same time, EIT Health helps the growing of projects that create products and services that, by being marketable and accessible, can reduce health-related costs and strengthen healthcare systems.

Telemedicine and Education for Asthma Self-Management (TEdASM) is a project developed to tackle the challenges evoked by asthma, a highly prevalent chronic respiratory disease. This project aims to be spread across European countries, improving asthma control and quality of life for patients affected by this disease and their caregivers.

Moreover, TEdASM will incorporate a telemedicine component, turning telemedicine into a more familiar tool for healthcare professionals. Additionally, a digital element will be created that can be marketable and disseminated across Europe, that can be complementary for the follow up of asthmatic patients. This element can also serve as basis for future projects, that apply a similar methodology, to improve and transform the follow up of patients affected by other chronic diseases, contributing for an overall healthcare system evolution.

Therefore, TEdASM aims to meet EIT Health's main goals, and a submission to this institution presents as adequate.

1. Basic data

1.1. Selected Pillar for Proposed Activity

Training for Citizens and Patients (Campus).

1.2. Select Segment for Proposed Activity

Training for Citizens and Patients (Campus).

1.3. Co-editors:

Caetano, D. (David).

Ferreira, A.J. (António).

2. Activity details

2.1. Involvement of citizens/patients

The authors are planning to involve citizens/patients in this activity.

2.1.1. Ways citizens/patients will be actively involved

Development and co-creation of programmes/trainings.

Delivery of activities/programmes.

Partnership with patients and patient organizations in the delivery of preventative measures and care.

2.2. Please describe how your recruitment and selection(s) will be achieved:

Initial patient recruitment will be made from hospital Pulmonology consultations at CHUC (Centro Hospitalar e Universitário de Coimbra), in association with ACeS Região Centro (Agrupamento de Centros de Saúde do Centro).

Twenty patients with uncontrolled asthma will be selected, according to the Asthma Control Test (ACT). An ACT score higher than 19 (between 20 and 25), will work as an exclusion criteria, since it reflects controlled asthma [1].

2.3. Please describe the specific need that your educational program will address

Asthma is a prevalent respiratory disease characterized by chronic bronchial inflammation and bronchial hyper-reactivity. It is defined by a variable obstruction to expiratory airflow, and its manifestations comprise episodes of dyspnea, wheezing, coughing and a sensation of thoracic

oppression. This expiratory airflow obstruction is reversible, either spontaneously or with appropriate treatment [1][2].

Asthma is a chronic disease that affects over 300 million people worldwide [1][3]. In Portugal, it affects about 10% of the population [4].

From a clinical standpoint, dyspnea with wheezing, and cough are the main complaint of asthmatic patients, entailing considerable quality of life costs [1][5]. Thus, it is a source of suffering for this population and its caregivers, influencing the way they deal with this respiratory pathology in their daily lives; also being responsible for work absenteeism as well as decreased productivity. [4][5].

The most recent data, from 2016, indicated 2583 hospitalizations in Portugal due to asthma, with 88% of patients considering their disease to be well controlled, and only 57% of asthmatics presenting effectively controlled disease. This reflects a clear discrepancy between the population that considered themselves well controlled and the one that actually was. According to data from 2018, unscheduled care (emergency room visits and unscheduled consultations) costs around 700 euros/year for each asthmatic in Portugal. In adult age, this represents about 2% of global spending on health. [4].

The total cost related to adult asthma in Europe, in 2013, was estimated at 19.3 billion euros. The cost per patient with uncontrolled asthma was estimated to be four times greater than that of a patient with well-controlled disease. [6].

Uncontrolled asthma with exacerbations is one of the main factors responsible for the unscheduled care associated to this disease [7] and, hence, the associated economic costs [1][6]. So, the improvement in asthma management may lead to a reduction of the monetary costs of this disease [6].

Achieving clinical control of asthma for long periods of time is the main objective of the treatment, leading to an avoidance of disease's exacerbations [1][2].

Nowadays, asthma treatment is often individually tailored, based on a pharmacological and a non-pharmacological approach, which encompasses patient education and triggers' avoidance [1][2]. The pharmacological approach can be divided into control agents and crisis or exacerbation reliever agents. The former comprises ICS (inhaled corticosteroids) or ICS-containing agents like ICS-formoterol or ICS-LABA (long acting beta-2 agonists), with or without add-on LTRA (leukotriene receptor antagonists), add-on tiotropium or biologic agents such as anti-IgE or anti-IL5. The latter englobe as-needed SABA (short acting beta-2 agonists) or low dose ICS-formoterol. [1][2][8]**.** Immunotherapy targeting specific allergens may be considered in patient with the diagnosis of allergic asthma [2][9].

Currently, there is evidence supporting the use of patient education programs in the treatment of asthma as a way to improve disease's control: reducing exacerbations and the number of hospitalizations [10][11][12], days of school or work absenteeism [10][11][13], and increasing the quality of life of patients [10][11][14][15], as well as improving adherence to the treatment plan [10][13]. From an economic standpoint, the implementation and incorporation of an educational approach in the treatment plan of an asthmatic patient has proven to be economically profitable [11][16], allowing for the reduction of both direct and indirect costs.

In association with and allied to these educational programs, the use of telemedicine and its resources in several chronic diseases has been studied, and economic benefits have been revealed, as well as in their control and in patients' quality of life [17][18][19]. According to the World Health Organization (WHO), telemedicine can be defined as: “The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities” [20].

The use of telemedicine and its spinoffs (such as telemonitoring programs, digital platforms or applications in mobile devices) has proven useful in asthma control, both in the paediatric population [21][22], and in adulthood [23][24], without diminishing the quality of health care that is provided to patients. The implementation and incorporation of telemedicine and its resources and tools in this chronic respiratory disease, especially regarding severe asthma, proved to be economically profitable, allowing for the reduction of hospitalizations [23][24][25][26] and the costs employed by the patients themselves (e.g. in trips to the health services) [27], increasing the quality of life [23][26][28] and also the access to health care for populations more distant from urban centres or who have difficulties in moving to them [29]. It can also serve as a platform to set up and foster educational programs aimed at these patients [30].

Several telemedicine tools are available for asthma patients [31][32][33][34], reflecting their potential to control this disease. However, many of them are not regulated and present low quality. There is still an important gap that should be addressed in the development of new tools [33][34].

Nevertheless and after a review of the literature, no patient educational program with an associated telemedicine component was identified, currently implemented at the European level; with unique and specific guidelines, which allow for a better asthma control and a reduction of direct and indirect costs associated with this disease.

2.4. Please provide a detailed description of the educational activity

TEdASM will be a telemedicine-based educational program designed for asthmatic patients, in conjunction with their caregivers.

TEdASM will be designed for a full year (2021). It will be divided into two semesters.

1. In the first six months, a multidisciplinary team will be responsible for the creation of all TEdASM resources that later will be used (this can include asynchronous workshops and videos that can be uploaded in the future educational digital platform that will be developed). This multidisciplinary team will include pulmonologists, nurses, social workers and patients or an association for asthmatic patients.
2. In the subsequent six months, the resources created and designed previously will be implemented and applied through telemedicine-based consultations on a monthly basis. In these consultations various objectives and checkpoints will be met. Every consultation would be performed by the same pulmonologist doctor (so the same doctor would always follow up the same patient and caregiver pair - PCP), in coordination with nurses and general doctors.

In the initial consultation:

A) PCPs will be informed about the disease, its natural history and what can be expected regarding manifestations and symptoms. It will be explained to them how to act in a situation of an asthmatic crisis. Also, to identify alarm signals and to act upon them.

B) They will be informed and educated on how certain triggers can exacerbate their disease (e.g. cold, allergens, intense physical activities) and how they should behave in these situations. Obviously, particular and specific situations regarding certain individuals should be identified in the clinical and social history so that a plan of action can be created regarding them.

C) Elaboration of a personalized and individualized plan for each PCP, regarding eating, sleep, physical exercise, allergen or trigger situations eviction. This plan should also incorporate specific strategies for situations for the PCP in question. The plan should be reviewed and adjusted in every single consultation, depending on situations that arise.

D) Identification (in conjunction with the caregiver) of the familiar and community support mechanisms and resources available for each PCP. In the same consultation (or in

the subsequent ones), each PCP should be introduced to the remainder of the telemedicine component of TEdASM that will be explained below.

In every consultation:

E) Assessment of the motivation and determination of each PCP about the self-management of their health care and about their inclusion in all decisions and action plans regarding their disease. In every single consultation, this point should be reviewed, reinforcing that an active role of the patient in the treatment and management of asthma brings benefits, not only in control of the disease, as well as in quality of life.

F) Identification of possible mental, family or work related and physical obstacles that might compromise the plans agreed upon with the patient. Then, if obstacles are identified, a plan to overcome them should be designed, in conjunction with the PCP in question.

G) Active inclusion of caregivers in the decision-making processes. They should also be educated about the disease (as previously mentioned), what to expect from it and how they should act upon an asthmatic crisis.

H) Reinforcement of the concept that caregivers should also worry about their own health and care as well, as their quality of life is an important aspect.

Posteriorly, in the second year of TEdASM, together with a multinational technological partner, an educational digital platform will be developed, where all previous TEdASM resources can be uploaded. It will have individualized access (through a set of unique usernames and passwords and will be encrypted for security purposes).

Through this platform, all future telemedicine-based consultations will take place, further incorporating the telemedicine aspect of the project. These workshops will be performed synchronously (live/online) or asynchronously (offline). The synchronous workshops will have a section destined to experience sharing and discussion of the theme presented, allowing for information sharing between PCPs.

This digital platform will also include virtual workshops elaborated by a multidisciplinary team consisting of pulmonologists, nurses, general doctors and social workers. The workshops will be themed around subjects important for the self-management of asthma: use of inhalers, avoidance of allergens, how to deal with physical activities and how to improve eating and sleeping habits.

A digital discussion forum both for patients and caregivers will also be incorporated in this, where experience sharing can be promoted.

It will include a specific feature that will allow patients to register their crisis, specific duration, identifiable triggers, relief medication used, intensity of symptoms, so that they could have a better perspective of the natural history of their disease. It could also serve as a reliable record for later discussion in online consultations.

The platform will also comprise a functionality that would allow patients or caregivers to record their concerns regarding specific situations to be discussed in future consultations.

For measuring the impact, the MINIAQLQ (Mini Asthma Quality of Life Questionnaire) [35], the ACQ (Asthma Control Questionnaire) [36] and the ACT (Asthma Control Test) [1][37][38] will be applied both at the beginning of the second semester and at the end of the first year in which TEdASM will take place. Posteriorly, they will be also applied one year after the end of these six months, to ensure that the impact lasts.

2.5. Strategic Fit / Value Proposition

TEdASM will focus on the involvement of patients and their caregivers in dealing with asthma and its crisis and in the sharing of information so that they can participate in the decision-making process regarding their disease, in an informed and conscious way.

TEdASM will also be proactive, that is, it will offer resources so that PCPs can better deal with said asthmatic crisis and the natural evolution of the pathology.

Finally, and as already outlined, it will involve not only the asthmatic patient, but also his/her caregiver. In this way, it will not underestimate the impact the disease has on the caregivers' quality of life, since this is a topic that is frequently under addressed.

Currently, as stated before, there is already evidence and guidelines that incorporate an educational approach (or at least incite patients' education) in the treatment of asthma and its management [10][11][39]. This evidence points to positive impacts on several outcomes, already enumerated before.

TEdASM will be built on this premise. It will study the impact of educational programs using telemedicine in the reduction of hospitalizations and emergency services (and therefore cost

reduction), as well as the impact on the quality of life. The improvement in quality of life will be sought not only on the asthmatic patient, but also on his/her caregiver.

2.6. Uniqueness that justifies EIT Health Funding

As previously said, TEdASM will be centred around a telemedicine educational programme.

TEdASM will comprise an original educational digital platform that will be used for communication between health professionals and PCPs. Resources, including workshops and learning videos, will be uploaded to it and a discussion forum for experience sharing between different PCPs will also be added, creating an unique digital platform that can allow TEdASM to reach its objectives and that can serve as basis for future programmes to study the influence of telemedicine in chronic diseases, not only of respiratory origin.

2.7. EIT Health Skills Needs

The EIT Health Skills Needs addressed by TEdASM are:

1. Digital & Data Literacy
2. Management & Leadership Skills
3. Inter-professional & Multidisciplinary Skills
4. Entrepreneurship & Innovation
5. Critical Thinking & Decision Making
6. Interpersonal & Citizen-oriented Skills
7. Communication Skills

An important part of TEdASM will be the elaboration of educational content by a multidisciplinary team, which will address the following skill needs: “Management and Leadership Skills”, “Inter-professional and Multidisciplinary Skills”, “Critical Thinking and Decision Makin”, “Communication Skills”.

The development of the previously mentioned platform that will be used for telemedicine-based consultations and for workshops, and where the anteriorly created resources will be uploaded, together with the addition of a discussion forum for PCPs will address the “Digital and Data Literacy”, “Entrepreneurship and Innovation”, “Critical Thinking and Decision Making”, “Interpersonal and Citizen-oriented skills” and “Communication Skills” skills needs.

2.8. Learning Outcomes

The specific learning outcomes that the target audience can expect to achieve with TEdASM are:

1. Increase patients and caregivers' knowledge about the disease, its natural history, exacerbations and how to prevent these crisis and deal with them, trigger situations and how to avoid them, and the importance of therapy adhesion.
2. Empower and actively involve patients and caregivers in the decision making processes and plans regarding asthma.
3. Promote healthy sleep, eating and overall habits for both patients and caregivers, in order to promote a general healthy lifestyle that can positively impact asthma control.
4. Increase caregivers' tools to support patients in managing their disease and in dealing with asthmatic crisis.
5. Teach caregivers to not let the patients' disease interfere with their quality of life.
6. Increase health professionals' knowledge and appetency in telemedicine and in using digital resources for providing health care.

2.9. Clearly Identified Education Market Need

Adult asthma is a highly prevalent chronic respiratory disease in Europe, entailing 19.3 billion euros of cost in 2013, either direct or indirect [6]. More so, it is a source of suffering for its population, of work and school absenteeism and quality of life costs [1][4][5].

In Europe, uncontrolled asthma has a four times higher cost per patient that controlled asthma, one of the main reasons being the unscheduled health care associated with it [6].

By achieving a better control of asthma and decreasing exacerbations, the need and search of unscheduled health care will reduce, allowing for cost savings related to this pathology [11][16], while also improving patients' quality of life [10][11][14][15].

TEdASM, through a telemedicine educational program, will aim to improve asthma control, by increasing asthma knowledge in both patients and their caregivers. Therefore, the expected improvement in the disease's control might contribute to a reduction in the costs related to this pathology.

2.10. Knowledge Triangle Integration

The integration triangle, composed of *Campus* (Education), *Innovation* (Research) and *Accelerator* (Business) is applied by TEdASM.

Campus: Both patients and caregivers will be educated regarding asthma. The fact that CHUC is a university hospital, credited for teaching together with Universidade de Coimbra, makes direct involvement and participation of patients a possibility.

Innovation: An educational digital platform will be developed, where the telemedicine component will take place and resources will be uploaded, so that the project's goals are further achieved. This platform can be, in the future, replicated on a European scale or several spinoffs of this platform can be created for future projects, either in asthma or in other chronic diseases.

Accelerator: Together with the multinational technology partner, TEdASM's digital platform, essential to the project, could later be rendered a marketable product. EIT Health programmes that allow for the creation of a separate business focused on marketing the product, could be used. Alternatively, a start-up could be created for that purpose.

2.11. Collaboration with other Pillar-specific projects or projects from a different Pillar with a similar target.

CALMA (Training and support to calm and raise awareness of dyspnea crisis) and CRISH (Co-Creating Innovative Solutions for Health) are programmes that TEdASM can collaborate with.

CALMA is a project aimed to provide a service based on training and support to patients with chronic obstructive pulmonary disease (COPD) induced dyspnoea, together with their caregivers and healthcare professionals. CALMA current focus is reducing emergency visits and hospitalizations of COPD patients, and thus on cost savings.

CRISH is an educational programme that brings together patients, caregivers and other important stakeholders, to develop innovative healthcare projects and to design bench-to-bedside research projects. Its objective is to promote the health of populations by identifying some of their unmet needs and providing skills, resources, tools and knowledge to design innovative solutions and research projects that address those needs.

TEdASM has a strong educational approach to a chronic respiratory disease that is marked by exacerbations. Together with CALMA, it can path the way to a telemedicine-based follow up of respiratory patients and recognize advantages that an educational digital platform can bring, especially in times where face-to-face medicine is challenged.

In collaboration with CRISH, TEdASM can more clearly identify needs unmet for asthmatic patients and incorporate methods to address in the future, as the programme advances.

3. Implementation

3.1. Digital Activity

The type of online educational programme that the activity will develop and implement include:

1. Blended Learning programme

   Once the COVID-19 pandemic ends, some of these workshops can be transposed into a face-to-face regime, in a mixed arrangement.

2. Digital platform
3. Online Workshop
4. Webinar

3.1.1. Partner(s) who have expertise in delivering the planned digital activity

A multinational technological partner with competence in this field.

3.1.2. Digital Platforms

Platform developed by the technological partner.

3.1.3. Digital Platform Costs and Criteria

Not applicable since it will be developed by the technological partner.

3.1.4. EIT Health Digital Learning Platform

The authors agree that Campus will be allowed to collect the digital educational content and make it available to the entire EIT Health Network through the Digital Learning Platform.

3.2. Team

Types of partners participating in the activity:

1. Academic Partners
    a. Education

2. Non-Academic Partners
    a. Business
    b. Hospitals/University Hospitals
    c. Others

        An asthmatic patients' association can be incorporated in the first six months of TEdASM, to help in the creation of the resources on which the rest of the programme will be based.

3.2.1. Capacity and strength of the team to develop, deliver and scale the programme

Professor António Jorge Ferreira, member of CHUC's Pulmonology Department and Professor at Faculdade de Medicina da Universidade de Coimbra and his team, together with David Caetano (student at Faculdade de Medicina da Universidade de Coimbra), will lead the activities held in Coimbra, Portugal. Posteriorly, sixth grade medicine students would be recruited and trained to participate in the clinical team associated with TEdASM.

Professor António Jorge Ferreira presents a vast knowledge and experience in research associated with the active involvement of patients in managing chronic respiratory diseases. He will also add fundamental experience in the development of an innovative program based on patient education, having been involved in previous EIT Health activities. He is currently one of the main researchers of the CALMA Project – EIT Health.

Associated with this clinical team, there will be a multinational technological company, whose goal will be to design a digital educational platform, encrypted and secure, in which TEdASM resources will be uploaded and included to be available to PCPs. At the same time, it will develop a strategy to introduce and adapt TEdASM to target markets, in order to achieve its objectives.

3.3. Programme Design

As already detailed, on its first year TEdASM will be divided in two six months periods. In the first half of the year, a multidisciplinary team, together with the input of asthmatic patients or an association of asthmatic patients, will design and create resources (workshops, videos) that address crucial topics related to asthma: natural history, exacerbations and how to deal with them, therapeutics, prevention of crisis, trigger eviction, adhesion to the treatment and recognition of alarm signals. In the following six months, at the monthly telemedicine-based consultations, these resources will be applied on an individualized approach to each PCP, empowering them to participate in the decision processes [addressing the Learning outcomes 1) and 2)]. Simultaneously, at these consultations and incorporated on the resources designed, healthy habits regarding their daily lives will be promoted to each PCP, associating a healthy lifestyle to a positive impact on asthma control [thus addressing the Learning Outcome 3)].

Specific resources and attention will be dedicated to the caregiver and the influence he/she has on the patients' disease. They will be informed on how they can support patients in managing the disease, on recognizing alarm signals themselves that should prompt immediate medical observation, and what they should do in an eventual exacerbation. This will be accompanied by a reinforcement of the importance of their own quality of life and how they should behave to not let it be impacted by their patient's asthma [addressing the Learning Outcome 4) and 5)].

While TEdASM will focus on all these objectives, health professionals will also be taught and more familiarized with telemedicine and the importance it can have on modern medicine [addressing the Learning Outcome 6)].

An educational digital platform will be designed, in partnership with a multinational technological company, as mentioned. This platform will serve to aggregate all the resources created for TEdASM, as medium for telemedicine-based consultations for follow up of patients and to value patients' experiences exchanges. This will contribute and promote the achievement of all the Learning Outcomes depicted.

3.4. Language

The language that will be used in the development of this project will be the local one: Portuguese. Due to previous successful experiences with University Hospital Clínic from

Barcelona, translation to Spanish will be quickly achieved if a partnership with this hospital is achieved for future iterations/submissions of TEdASM.

All digital materials will later be translated into English. Also, English subtitles will be added in the videos provided on the platform, in order to expand the target population.

3.5. Venues and Duration

TEdASM will be developed and organized in Coimbra, Portugal. On posterior submissions of TEdASM, Barcelona can be integrated.

In the first six months a multidisciplinary team, mentioned before, will create TEdASM resources that will be applied in the following semester. Twenty PCPs will be part of TEdASM, throughout these latter six months It is expected that all these pairs participate in the total number of telemedicine-based consultations. All the pairs will have access to the digital platform and its resources.

On subsequent iterations of TEdASM, if the COVID-19 pandemic ends, some of these workshops can be transposed into a face-to-face regime, transforming TEdASM into a mixed arrangement.

3.6. Credits

Not applicable.

3.7. SWOT Analysis, Risk Analysis and Mitigation

3.7.1. Strengths

Patient education is a central piece of the treatment of chronic respiratory illnesses, like asthma. TEdASM will not only tackle this, but also improve education of caregivers that can be of a pivotal importance for the support of asthmatic patients. At the same time, it will increase healthcare professionals' knowledge in telemedicine. So, TEdASM will cover three fundamental pillars of asthma treatment: patients, healthcare professionals and caregivers.

TEdASM will not focus solely on diminishing hospitalization rates and asthma related costs. It will also aim to improve the quality of life of patients and caregivers whilst they manage the disease and aim to introduce and educate healthcare professionals in the importance of telemedicine on modern healthcare.
Especially in a time where the COVID-19 pandemic altered substantially the way we behave on a face-to-face manner, an educational-based digital programme associated with an online platform can path the way to an increase of the relevancy that is paid to telemedicine.
The digital platform will congregate all resources that will be readily available for any PCP at any time, a telemedicine-based consultation service for future follow up and a discussion forum for experience sharing, tackling all the learning outcomes at once.
TEdASM will be developed by a team led by Professor Antonio Jorge Ferreira, a pulmonologist experienced in EIT Health programmes dealing with patient education regarding chronic respiratory diseases.
Finally, the association of a multinational technological partner, can be of vital impact for ramping up the platform and for marketing it in the future. Not only for asthma and respiratory diseases, but also to other chronic illnesses.

3.7.2. Weaknesses

The associated digital platform can be challenging to manage by the elderly population or by people not accustomed to engaging in electronic platforms and devices.

In the first year of TEdASM, no direct and face-to-face contact will be possible between patients and healthcare professionals, so no physical exam or objective evaluation of asthma control can be executed.

3.7.3. Opportunities

In our current context of the COVID-19 pandemic, telemedicine will certainly assume and important role in ensuring access to health care for the population (as it has already begun to do). TEdASM, with its telemedicine component, could then promote the transition of certain aspects of follow-up of asthmatic patients, which until now was done in a face-to-face manner, to a digital form. This could save resources for both patients and health care services, as it would also contribute to alleviate waiting lists that are arising as the result of the current pandemic.

On the other hand, an educational program that aims to reduce the number of unscheduled attendances for the asthmatic population may also prove useful in the context of the COVID-19 pandemic, by reducing this population's direct contacts with emergency services, thus relieving much of the burden of them, in a time that they are especially overloaded.

3.7.4. Threats

Asthma, as a chronic respiratory pathology, is often manifested by crisis triggered by specific stimuli.

At this moment, COVID-19 is proving to be a major threat to any research that involves patients, especially in health, and more so in the respiratory area.

Not only a viral infection such as the one caused by SARS-COV2 can serve as trigger for a worsening of the underlying asthma disease, as asthma itself puts the patient at an higher risk of complications by these infections.

All these factors may lead to some of the participants being infected, especially since TEdASM will take place throughout 12 months. An infection could lead to a worsening in an asthmatic patient, which could lead to confusion in the data obtained and thus in the intended conclusions.

3.7.5. Risk analysis and mitigation plan

TEdASM will not involve face-to-face interaction, so patients and caregivers will not be in direct contact with healthcare services, so a potential infection source would be evicted.

In every consultation/workshop, hygiene, disinfection, mask wearing, and social distancing advices will be reinforced, and a special set of resources can be dedicated to this theme.

Because COVID-19 infection can be a potential trigger to asthma exacerbations and can affect the control of the disease, patients will be educated about the virus, recognition of potential infection signs, how they should behave to prevent it and how they should act in case they get infected.

3.8. Marketing Strategy

In conjunction with the technological partner, social media accounts will be created that will promote and publicize TEdASM. The project will also be spread through asthma patients' associations and hospital communication networks.

A communication programme will be developed throughout TEdASM's first year, so that it can culminate in propagation of not only the project, but also of the educational digital platform and the advantages it brings to the digital follow-up of asthma and possibly other chronic diseases.

3.8.1. Time for the beginning of marketing strategy's implementation

Since the first day, a communication plan will be developed, as indicated before. The propagation and spread of TEdASM will be put into practice in the second semester of the project.

3.8.2. Number of applicants expected to be attracted by the marketing strategy

Around 100 public and/or private European hospitals.

3.9. Recruitment, Selection and Evaluation Process

Twenty patients with uncontrolled asthma (an ACT score 19 or lower) [1] will be selected and recruited from Pulmonology consultations at CHUC in association with ACeS Centro.

4. Impact

4.1. Expected outcomes of the activity: impact (short- and long-term)

As previously mentioned, asthma is a highly prevalent chronic disease, and its crises (due to uncontrolled disease) are responsible for numerous unscheduled hospital admissions and attendances and, consequently, high direct and indirect costs. Better control of asthma, reducing and preventing exacerbations, could thus lead to a reduction in these attendances and so in the associated costs.

An active involvement of patients and their caregivers in the management of their disease would also result in an improvement of their quality of life and in a greater adherence to therapy.

The impact will be measured as explained in the 2.4. section, by evaluating: the MINIAQLQ [35], the ACQ [36] and ACT [1][37][38], at the beginning of the second semester, at the end of the first year and one year posteriorly.

Besides, the involvement of health professionals in the monitoring and follow-up of asthmatic patients through telemedicine will prove to be a learning moment for them. This fact will be useful not only for TEdASM and asthma, but for many other pathologies since (even more accelerated by the context of the COVID-19 pandemic) telemedicine will be a very important tool in the future of health care.

It is expected that TEdASM will lead to a 15% reduction of unscheduled healthcare visits and to a 130.000 (one hundred and thirty thousand) euros of costs savings.

4.2. Evaluation and Monitoring of Participants

TEdASM involves patients, their respective caregivers and, also at a certain level, health professionals.

Patients will be given tools for a better self-management of their disease, its crisis and its prevention; for acquiring information and skills that allow them to be actively involved in the decision-making process regarding their care plan, while fostering a spirit of experience sharing.

Together will patients, caregivers will also be involved in TEdASM. Their role is to assist their respective patient in an asthmatic crisis, helping them in their prevention and in making decisions as to the best way to manage the disease. They can also act as a bridge or link between the patient and the health professionals.

Up to a certain level, TEdASM will also lay focus on health professionals, by promoting patient-centred care, considering their own perspectives, opinions and beliefs. Their learning in the use of telemedicine and digital media for health care delivery will also be a target point of the project.

The Kirkpatrick Model [40] will be used to evaluate all these outcomes, in its 4 levels:

1. Reaction – It will be observed and analysed the satisfaction of patients, caregivers and health professionals regarding TEdASM and its educational aspects: contents, accessibility, knowledge acquired and the appliance of it in their daily lives. This will be done through monthly appointments, with questions addressed to this topic, in a qualitative manner.

2. Learning – The difference in asthma knowledge before and after TEdASM will be analysed and an increase will be sought: by applying the MINIAQLQ [35], the ACQ [36] and ACT [1][37][38], at the beginning of the second semester, at the end of the first year and, also, one year posteriorly.

3. Behaviour – The difference in behaviour, caused by skills learned regarding self-management of their disease, will be analysed through the regular follow up of these patients. Evidence of application of the knowledge acquired in the management of their daily lives with the disease, through monthly appointments, will be looked for: adherence to the pharmacological treatment, eviction of allergens and other triggers and their identification, recognition of alarm signals with crisis prevention measures, performance in physical activities and improvement of lifestyle habits.

4. Results – The results of the outcomes indicated previously will be statistically analysed.

4.3. Sustainability

The partnership with the multinational technological company will allow TEdASM to achieve its sustainability, by developing the educational digital platform that will later achieve self-sustainability by being sponsored and invested on by industries and services connected to healthcare and with direct interest in asthma management: municipalities, hospitals, pharmacies, ministries, regional health administrations and governmental agencies.

4.4. Knowledge Transfer

TEdASM aims to improve patients' self-management of their asthmatic disease, resulting in a positive impact in patients' and caregivers' outcomes and reducing healthcare costs and hospitalizations. So TEdASM's team counts that the developed business model gets scaled-up in the future by hospitals and research associations (whether public or private) to integrate it into a useful resource for asthmatic patients.

Patients' subjective feedback regarding both approval and the usability of TEdASM's tools and resources for asthma, will be monitored in regular reunions between all partners, so that data can be extracted to make needed adjustments to the future submissions of the project.

These data will be processed to obtain a scalable and sustainable plan. The multinational technological partner will be of vital importance regarding this process, by studying and setting this plan to implement TEdASM in Barcelona, Spain, in the following submission of the project, and later scaling it up to a wider set of European countries, as the project reaches its self-sustainability.

5. Budget

TEdASM's budget will be as follows:

1. Project and academic coordination: 5 000 €
2. Platform development, moderation and hosting: 10 000 €
3. Training and data collection: 5 000 €
4. Co-creation and development of platform contents: 10 000 €
5. Communication & Dissemination (communication materials, trip for a scientific meeting for results promotion, one open access publication): 10 000 €
6. Evaluation: 3 000 €
7. Sustainability and business development 3000 €
8. Marketing and communication 5000 €

Therefore, the total budget is estimated at 51 000 € (fifty-one thousand euros).

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