

# Application of Telemedicine for the Optimal Control of Asthma Patients

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## Abstract

**Objective:** To assess the impact of a telemedicine project that uses the Medtep platform in patients diagnosed with asthma.

**Method:** An asthma consultation in the Integrated Care Management center of Albacete, in collaboration with the Pneumology department, which treat patients with possible asthma and/or acute asthma.

In March of 2015 a group of 25 patients diagnosed with asthma, previously invited to participate in the study, were selected. Several training meetings were scheduled to assist them in using a web portal to control their asthma. They were also delivered a Peak-Flow and taught how it works.

For 6 months clinical evolution and web portal entrances to follow. The data which was collected: smoking, how long they were diagnosed with asthma, asthma attacks, hospitalizations. Treatments- Evolution, According to patient level.

**Results:** Out of the total 25 patients diagnosed, 17 (67%) were men and 8 (32%) women. The patient's average age is of 34 years old. The total amount of smokers were 5 patients (20%), 3 of the remaining patients had never smoked. The average cigarette consumption of the smokers was of 2 packs a day. 42% had been diagnosed with asthma for less than 1 year; 20% between 1 and 5 years and the rest of patients had been diagnosed for over 5 years. Before entering the study, 50% had to attend emergency visits at least once (a year?), and some patients as much as 4 times in the last year. After entering the study, none of the patients had to attend ER visits. 80% of the total patients entered their health related data on a daily basis, as well as medication registers, which was above 95% in those who assiduously used the system. The total Peak flow of the patients saw an increase of 7% over baseline.

More than 50% of patients increased their treatment before entering the study, and none and even 25% decreased their dose of treatment.

32% of patients have improved their level depending on the base treatment.

**Conclusions:** Improvements in asthma control were achieved in patients who received Medtep Asthma support for 6 months, decreasing assistance in emergency services and, as a result, requiring less treatment.

**Keywords:** Asthma; Platform; Digital health; Medtep platform; Telemedicine; Control

## Introduction

Asthma is a common chronic disease [1,2] characterised by chronic inflammation and/or structural changes of the airways, which leads to recurrent episodes of bronchial obstruction with wheezing, coughing, breathing difficulty, and/or chest tightness [3,4] as a consequence of bronchial hyperreactivity.

According to clinical guidelines, treatment strategies for asthma should be aimed towards minimising symptoms, optimising lung function, and preventing symptom aggravation with few medication side effects. Even though effective therapies are widely available, many patients do not achieve these treatment goals [1-6]. As a consequence, asthma still imposes a significant burden on the individual patient. Most patients' poor asthma control is due to diverse reasons: an incorrect diagnosis; the patient has other diseases with similar symptoms that create confusion, aggravating factors are not controlled; or the patient does not follow the treatment adequately. Asthma treatment compliance is estimated to not exceed 30-50% [7,8]. Therefore, the first thing a patient should ask the doctor if the therapeutic response is not as expected, is if the patient meets the asthma treatment requirement. In a disease like asthma it is very difficult to use direct methods for assessing compliance (drug analytical measurements in biological samples), so we resort to indirect methods. The compliance assessment is done with open and indirect [9,10] questions, or through simple questionnaires such as Chambers, which ask questions related to the

frequency of use of inhaled steroids and/or TAI questionnaire. The high failure level caused by many factors:

1. Characteristics of the drugs used: device type, route of administration, complexity of the therapeutic regimen that shows the patient has not understood the instructions given by health providers, fear of side effects or increased price, presence of comorbidities that result in a complex treatment.
2. It may also be that the patient does take medication but doesn't follow a correct technique. Inhalation route, which is commonly used in asthma treatment, requires a previous training. Healthcare providers must educate the patient on the characteristics of the chosen inhalation device, showing how it is used and perform the technique using a placebo (level of evidence B). It is also advisable to check the skills throughout the following visits [11-15].

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To have a proper asthma management, the patient must occupy the leading place in the daily management of their treatment and the physician shares a portion of their power and control. There must be a change in the doctor-patient relationship to build a forming therapeutic sequence for the asthmatic patient, based primarily on teaching them about the treatment (therapeutic education). This approach is not based on a poorly operating medical culture for patients, as all healthcare professionals become involved in the team in a multidisciplinary structure. The implementation obstacles of integrated educational devices have many cultural implications on behalf of professionals and constraints imposed by the health system. To follow this line of work, there is a proposal to develop an instrument to serve as education of asthmatic patients [16-20].

Telemedicine (TM) is one of the alternatives that we provide the new communication systems applied to medical practice [21-25].

A few years ago seemed like a distant future, but the reality is that today it is a weapon that helps our daily life, in different areas and with multiple uses, a part from treating asthma [26].

Provision of internet technology has been proposed as an appealing method for asthma management [27,28]. In the study by Van der Meer et al. [29] with patients with mild to moderate persistent asthma, it was demonstrated that an internet-based self-management (IBSM) support program during 1 year leads to improved asthma-related quality of life, asthma control, lung function, and the number of symptom-free days as compared to usual care (UC) alone. A post hoc analysis of this study [30] showed that patients with asthma that were not well controlled benefited the most from IBSM support. In addition, this study showed that at 12 months of follow-up, about 60% of the patients were still using the program of their own initiative. Van Gaalen et al. [30] published a randomized controlled trial about Long-Term Outcomes of Internet-Based Self-Management Support in Adults With asthma demonstrating that Improvements in asthma-related quality of life and asthma control were sustained in patients who received IBSM support for 1 year, even up to 1.5 years after terminating support although no differences for inhaled corticosteroid dosage or for lung function, measured as forced expiratory volume in 1 second [31,32].

On one hand, self-treatment plans are an integral part of asthma patient's care and its development manages to reduce morbidity and use of health resources and reduce mortality from this disease. The implementation of action plans by the patients is very poor, which makes them ineffective in clinical practice. It is therefore necessary to incorporate new methods to help asthmatics to follow self-treatment plans, like telemedicine. Telemedicine can be an effective development of self-treatment plans for patients with asthma, because it offers the exchange of information between patients and health personnel at any time, with decision-making in real-time instrument. For these reasons it may be the ideal instrument for correcting the errors, and poor compliance monitoring lung function and self-treatment plans [33-37].

We present here the adaptation of the Medtep digital platform that has developed self-treatment plans for improved monitoring of patients with asthma within a broader behavioral strategy.

## Method

An asthma consultation in the Integrated Care Management center of Albacete in collaboration with the pneumology department and family doctors, who treat patients with possible asthma and/or acute asthma. Patients are adequately studied and prescribed treatment and put in coordination with their family doctor.

In March 2015, a group of 25 patients diagnosed with asthma from this consultation were randomly selected to participate in the study. Several meetings took place to train them in using Medtep asthma, a digital care plan to help control asthma. They were also delivered a Peak-Flow and taught how to use the platform and register their information.

This study shows the before and after of the participating patients.

For 6 months clinical evolution and web portal entrances were measured to monitor follow-up. The data which was collected: smoking, how long they were diagnosed with asthma, asthma attacks, hospitalizations, therapeutic regimens according to patient's asthma level, assessment of asthma control, medication, adverse events, adherence, and measurement of lung function.

In this study we will use Medtep, a digital health platform which facilitates behavioural change by personalizing prevention plans and validated treatment, developed in collaboration with physicians responsible for patient treatment.

In order to translate these criteria to the online environment, the Asthma plan, through the Medtep platform, is formed daily control panel, consisting of a simple questionnaire about daily symptoms and use of bronchodilator relief which the patient should answer. The amount of times the patient has a symptom during the day (determined by the standard protocol for GEMA or customized by your doctor) establishes the level of asthma control.

The patient, in his Daily control panel can/should also enter the result of peak flow. It has been made available to the participants to study the manual model peakflow, DATOSPIR PEAK-10 SIBEL S.A (<http://www.sibelmed.com>). However, the platform enables automatic introduction of this data through the sensor Propeller Health (<http://propellerhealth.com>). The data is shown in the graph of peak expiratory flow in the patient's control panel.

In addition, when a healthcare professional has established a medication, they will be able to see the different intakes which have been scheduled. Answering 'Yes' or 'No' to successive intakes the level of patient therapeutic compliance is monitored. They also have a 'Preferences' panel, where they can customize treatment.

The healthcare professional can add or edit the treatment designed for the patient. They indicate the medication, dosage, and frequency units. It also has three treatment options to suit every situation: Regular, Action Plan and extended Action Plan. Finally, the plan shows general Asthma recommendations to avoid an attack.

Healthcare professionals have access to all the information patients choose to share with them in real time, organized by individual patient or in an aggregated way.

The frequency of symptoms that trigger a state or change of plan for default- are based on the standard protocol for Spanish guide asthma management (GEMA) based on the number of times a patient has a symptom for a week but the health professional can adapt both the number of times the patient has a symptom as the period to understand.

The clinician can also select when to receive notifications as status changes in asthma control of each patient. In this way, you can determine whether to receive an email for each of the different cases.

The costs are calculated according to the prices of drugs both maintenance and rescue and prices of saved queries (urgent and ordinary).

Finally, thanks to the view option added of patients within the Medtep professionals, healthcare professionals also have access to an overview of all patients who are under treatment asthma and are in a state of partial or inadequate control and/or under an action Plan.

## Results

Twenty-five asthmatic patients aged  $34 \pm 9$ , 5 years, 17 men (68%) and 8 women (32%) have been studied. As for the time of diagnosis of the disease: 42% had a diagnosis of asthma of less than 1 year, 20% between 1 and 5 years and the rest over 5 years (Table 1).

13 patients had to resort to emergency services visit at least once in the last year; four of them went 4 times. Since its inclusion in study, no patient has come to the emergency service.

80% of patients entered the data daily. 95% filling pharmacological data have been collected in those who have regularly used the platform.

Peak flow of patients have an increase of 7% over baseline.

More than 50% of patients had increased their treatment before entering the study. Since their inclusion in the study no one had to increase treatment. Even a 25% decreased the treatment dose (Figure 1).

They have improved their level depending on the base treatment 32% of patients.

None of the smokers leaving the smoking during the study.

We must be stated that there was no active intervention in this regard via platform, a feature in which we are acting on currently (Figure 2).

## Conclusion and Discussion

Telemedicine is the use of new information technologies and

Age of diagnosis	Frequency
-1 year	42%
1-5 years	20%
+5 years	38%

Table 1: Years of disease.

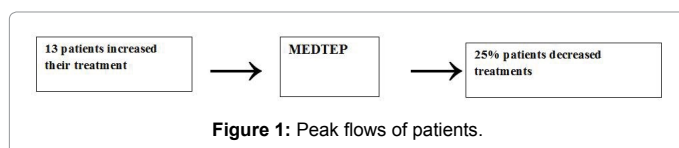


Figure 1: Peak flows of patients.

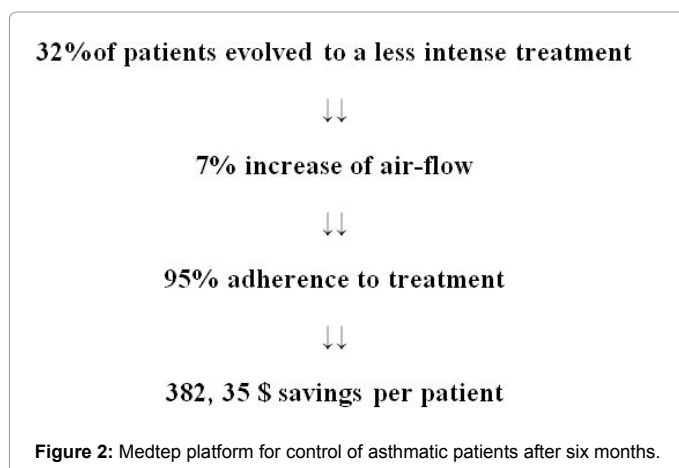


Figure 2: Medtep platform for control of asthmatic patients after six months.

telecommunications to health care. In fact Telemedicine is a term encompassing all methods used to examine, investigate, monitor and treat, with the patient and doctor, physically located in different places, transferring the expertise. Unnecessary travelling of patients and escorts is eliminated. Image acquisition, storage, display, processing, and transfer, form the basis of telemedicine. In the last few years tele health, a more inclusive term, has grown exponentially [27-31].

An increasingly large number of applications in various medical specialties and in different fields of health are finding these technologies useful [31-36].

Self-treatment plans are an integral part of patient care with asthma. Its development manages to reduce morbidity and use of health resources and reduce mortality from this disease. However, the implementation of action plans by the patients is very poor, which makes them ineffective in clinical practice. It is therefore necessary to incorporate new methods to help asthmatics to follow the plans of self-treatment.

Telemedicine can be an effective development of self-treatment plans for patients with asthma, because it offers the exchange of information between patients and health personnel at any time, with decision-making in real-time instrument. For these reasons it may be the ideal instrument for correcting the errors, and poor compliance monitoring lung function and self-treatment plans [37-40].

Telemedicine can become the key tool for action plans in writing, which are essential for asthma control and even prevent deaths from this disease.

So far there are few experiences in our country of telemedicine application in pathologies. The preliminary results of a study on control of heart failure shows that telemedicine has reduced mortality by 34% and hospitalizations by 63%. Readmissions for other reasons are also reduced by 41% and the cost per patient is reduced by 68%. There is emphasis on the high level of satisfaction shown by patients who are part of the project, as they feel better controlled and safer. This data confirms the feasibility of a telemedicine project in chronic elderly patients, despite their limited experience in the use of electronic devices [39-42].

During this period (6 months), the average number of non-serious decompensation requiring hospital treatment was significantly lower in the group of telemedicine. Also hospital readmission for any cause and the average number of days in the hospital was significantly reduced. In addition, the study we have shown that the efficiency of telemedicine was independent of education level, the severity of HF, the presence of depressive symptoms or the fragility of the patient [40-42].

According to the study, patients with heart failure (HF) electronically controlled have better outcomes in terms of relapse and re-hospitalization than patients with conventional monitoring. Telemedicine for respiratory chronic diseases in our country has been applied to patients with lung transplants [37], for enhances in spirometry quality in primary care, to control asthma in a pilot project from osadizetka, diagnosis and treatment for sleep apnea syndrome [38]. The use of telemedicine in transplant patient offers multiple benefits, such as early detection of graft rejection or infections, facilitating early treatment and reducing the number of scheduled visits and hospitalizations.

We have no evidence of studies with difficult to control asthmatic patients as the next therapeutic step is to introduce monitoring through an e-health system [29-33].

Short term outcomes in our study show a decrease of patients attending emergency room for asthma exacerbations, as well as improved adherence and treatment compliance which is leading to favourable clinical consequences through improving respiratory function.

Because of this studies limitation namely six months follow restricted in a situational illness like asthma, we should consider these clinical data as preliminary results; but clinical data presented are certainly a prediction of the final data that will result after work and we the honour of publishing within a couple of years.

The aim is to promote health education through patients' self-monitoring in the early detection and treatment of acute episodes that could lead to future events related to acute asthma. This will avoid readmissions and improve their quality of life. The short experience of telemedicine in optimized asthma control and its cost-effectiveness requires boost studies in the long term to support its use [34-37].

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