

Care for Asthma via Mobile Phone (CAMP)

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Abstract. The primary goal of the Care for Asthma via Mobile Phone (CAMP) service is to provide an effective method by which Taiwan's asthma patients can easily monitor their asthma symptoms using a common mobile phone. With the CAMP service, the patient uses his own cellular phone to submit his daily peak expiratory flow rate (PEFR) and answer a simple questionnaire regarding to daily activities. The CAMP service participant then receives an asthma symptom assessment and care suggestion message immediately after inputting his information. This assessment, which is in accordance with the World Health Organization's (WHO) **Global Initiative for Asthma** (GINA) standard, includes weather conditions that might adversely affect the asthma patient (e.g. temperature, pollen count, etc.). This information is, in turn, used to advise the asthma patient how to avoid a severe asthmatic attack.

Keywords. Long-distance care, long-term care, asthma care, chronic disease care, wireless-care system, mobile phone service, e-health, health informatics, tel-health, home care.

Introduction

Taiwan is a small island spreading out geographically along the Tropic of Cancer (N.23.5 latitude). Due to its wide latitudinal range, the temperature often varies by two or three degrees centigrade from North to South.

Taiwan is unique in that more than 50 out of 2,300 people are officially registered with Taiwan's Department of Health as patient's suffering from asthma. Most of Taiwan's asthma patients are classified as "severe" and make trips to the hospital emergency room on a regular basis. According to Taiwan's Department of Health report, more than 1,000 asthma patients die each year in Taiwan. Even though asthma cannot be cured, it does not need to cause death especially in that it can be easily brought under control.

It is very important that asthma patients take the correct dosage of medication. According to physicians, patients who fail to take their medicine correctly often cause their asthma condition to become unstable and sometimes even severe.

In the past, asthma patients had to record their daily peak expiratory flow rate on paper several times throughout the day. Many patients simply become lazy or forgot to record the PEFR. With the CAMP platform, asthma patients no longer need to make or keep a record of their PEFR, rather, they simply input the data directly into their cellular phone. Additionally, the patient receives a health assessment message on their cell phone after inputting their PEFR data.

The asthma care platform has been in service in Taiwan since 2003. Based on input from physicians, the platform has gone through various stages of development including an internet-based phase, a home phone-based phase, and a wireless phase. The platform's data is centrally stored at the National Center for High-Performance Computing and the program results can be viewed on the website. Also, important program notices are sent to patients and physicians from time to time by email or SMS messaging.

1. Methodology

CAMP Objectives are:

- To develop an easy access platform for use by patients and physicians
- To provide asthma attack awareness including changes in the patient's local weather
- To provide long-term asthma care without location or time limitations
- To provide an efficient real-time monitoring service supported by expert medical assistance
- To promote asthma patient care self-management
- To promote more effective diagnosis and treatment of asthma patients
- To provide real-time and historic PEFR relevant statistical flowcharts and support physician's diagnoses
- To illustrate the correlation between asthma symptoms and changes in the weather

2. Primary Platform Service

2.1. Web Service

2.1.1. Patient Participation

Asthma patients can easily access the website to get their personalized information or view their historical and/or real-time data. Additional information such as the latest asthma-related news updates (e.g. a simplified procedure for the measurement of asthma symptoms), medication information, and asthma-related videos can be found on the website as well (Figure 1). Patients are allowed to update their personnel information and view their individual historical flowcharts. Patients are also able to review their asthma care suggestion content messages (Figure 2).

2.1.2. Physician Participation

Using the asthma care website, physicians are able to view their individual patient's raw historical data and the latest asthma-related information/condition. Additionally, the website displays the asthma patient's current condition and weather-related information. This information helps physicians better access their individual patient's conditions and asthma-related needs (Figures 3 and 4).



Figure 1. The CAMP Web Portal

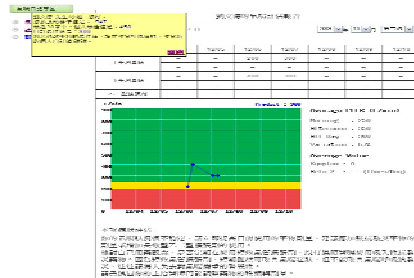


Figure 2. CAMP Historical Data



Figure 3. Monitoring Map



Figure 4. Regional Weather Information

2.2. Mobile Platform Service

2.2.1. Patient Participation

Upon login, patients are required to key in their personal information in order to obtain GINA's standard level of information. According to the patient's input, the CAMP server will calculate the patient's daily PEFR (figures 5 and 6) and send the information to patient's mobile phone automatically. This information is sent to the patient's mobile phone in chart format. It contains all of the patient's asthma care suggestion history and a "condition" color code (e.g. Green = Low Threat, Yellow = Moderate Threat, Red = Severe Threat) (Figure 7) as well.

2.2.2. Location-Based System

As part of the CAMP program, each patient also agrees to submit his physical location data when submitting his PEFR data. The location information is then compared with local real-time weather data and the patient's overall condition. Physicians can also use this information to determine their patient's asthma condition and compare individual patients to one another (figure 8).



Figure 5. User Data Setup



Figure 6. PEFR Input

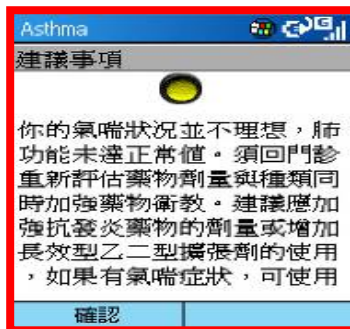


Figure 7. Care Assessment

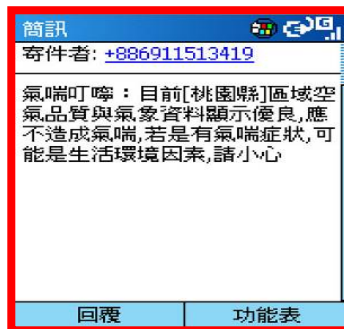


Figure 8. Weather Alert

3. Conceptual Framework

The system consists of two parts that are automatically calculated based on WHO's GINA guidelines. The first part utilizes the patient's age, height and weight to fill in the standard WHO requirement form. The second part uses the physician's expertise to generate data according to GINA guidelines.

The system is made up of more than 18 different disciplines to provide patients appropriate assessment and suggestions. The Asthma Care project is based on more than 15 years of clinical experience and expertise. The care messages the patients receive are based on their daily activities, physical location, current weather conditions, and PEFR (Figure 9).

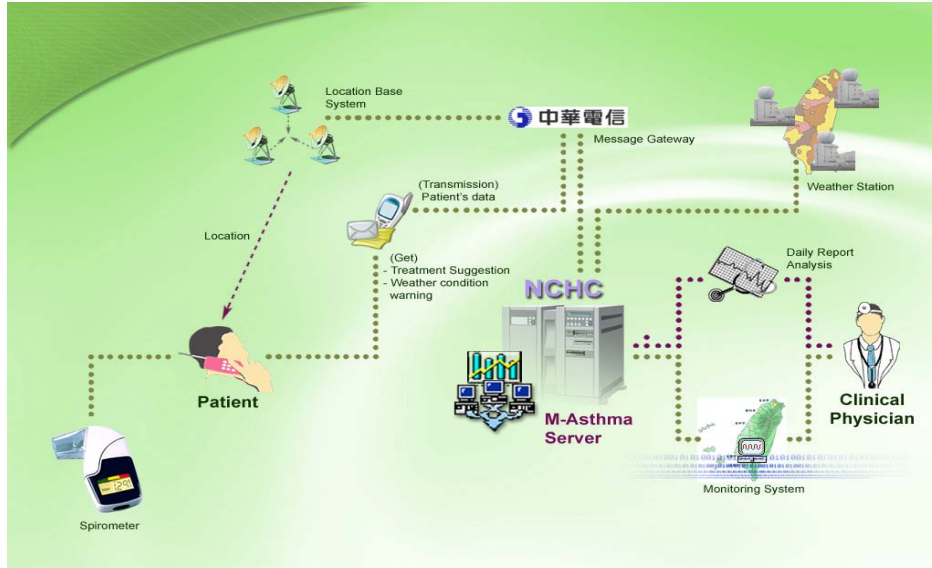


Figure 9. CAMP Flowchart

4. System Description

The CAMP website is designed to give asthma care through both wired and wireless data transmission. The “wired” part of the system is made up of the asthma care educational platform website which includes an asthma medication introductory video and an asthma symptoms survey questionnaire. Anyone interested in learning more about asthma can access the website using an ordinary Internet connection.

The “wireless” part of the system consists of the CAMP asthma patient participant being able to upload his data to the CAMP web server and receiving a personalized assessment message immediately thereafter. The assessment message takes into consideration of the patient’s current asthma status as well as his physical location and any changes in his local weather that might adversely affect his asthma condition.

The data is centrally stored at the National Center for High-Performance Computing (NCHC) where it is analyzed and then archived. The system also utilizes more than 40 weather stations across Taiwan to collect weather-related data. This data is updated to the CAMP server every 30~50 seconds. The CAMP system utilizes the local weather information data and the asthma patient’s general condition to produce information that physicians can use to determine the relevance between their patient’s symptoms and changes in the local weather (figure 10).

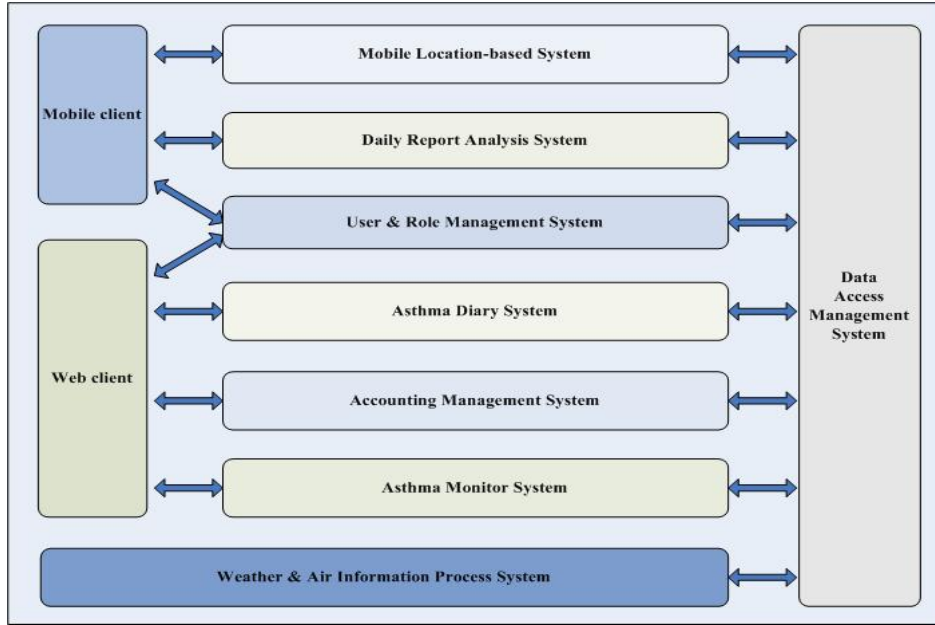


Figure 10. CAMP System Platform

5. Conclusion

The Care for Asthma service has been in use in Taiwan since 2003. Currently, the service provides specialized care to more than 13,000 asthma patients and 400 physicians. Recently, Taiwan's Department Of Health (North Health Bureau) announced that, from 2005 to 2006, the Care for Asthma service program resulted in a 60% reduction in the cost of providing healthcare to Taiwan's asthma sufferers. Figure 11 illustrates the number of Emergency Room visits from 2003 through 2005 for non-CAMP project participants (orange) vs. CAMP project participants (blue).

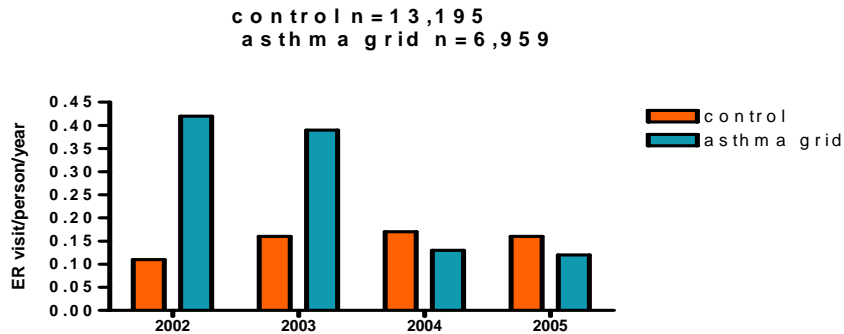


Figure 11. Emergency Room Visits 2003~2005 CAMP participants vs. non-CAMP participants

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