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Development of online diary and self-management system on e-Healthcare for asthmatic children in Taiwan

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ABSTRACT

Objective: Many regional programs of the countries educate asthmatic children and their families to manage healthcare data. This study aims to establish a Web-based self-management system, eAsthmaCare, to promote the electronic healthcare (e-Healthcare) services for the asthmatic children in Taiwan. The platform can perform real time online functionality based upon a five-tier infrastructure with mutually supportive components to acquire asthma diaries, quality of life assessments and health educations.

Methods: We have designed five multi-disciplinary portions on the interactive interface functioned with the analytical diagrams: (1) online asthma diary, (2) remote asthma assessment, (3) instantaneous asthma alert, (4) diagrammatical clinic support, and (5) asthma health education. The Internet-based asthma diary and assessment program was developed for patients to process self-management healthcare at home. In addition, the online analytical charts can help healthcare professionals to evaluate multi-domain health information of patients immediately.

Results: eAsthmaCare was developed by Java™ Servlet/JSP technology upon Apache Tomcat™ web server and Oracle™ database. Forty-one voluntary asthmatic children (and their parents) were intervened to examine the proposed system. Seven domains of satisfiability assessment by using the system were applied for approving the development. The average scores were scaled in the acceptable range for each domain to ensure feasibility of the proposed system.

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Conclusion: The study revealed the details of system infrastructure and developed functions that can help asthmatic children in self-management for healthcare to enhance communications between patients and hospital professionals.

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1. Introduction

In the past decade, World Health Organization (WHO) and Global Initiative for Asthma (GINA) published a global surveillance revealing that asthma has been the most common chronic disease of children in many developed nations due to their official statistics of health data [1,2]. As the viewpoint of healthcare, it implied that the financial burdens of patients and their families and hospital would be heavier due to rising prevalence of childhood asthma. Many regional programs were continuously making progresses for asthma health care over recent decades in a variety of countries to reduce medical expenses [3–7]. The well-known ISAAC program, “International Study of Asthma and Allergies in Childhood,” comprised three phases for assessments [8] which were followed by past researches to regulate the principles of guidance for preventive care. For example, (1) initiating medications for asthma symptoms by severity, (2) using spirometers for assistance in diagnosis and evaluation, (3) monitoring the asthma morbidity depending upon routine symptom assessments, (4) educating patients by planning self-management asthma care at home, etc. [9]. These procedures enabled asthmatic children and their family to manage healthcare data.

In Taiwan, numerous studies of children with asthma established appropriate assessment questionnaires based on the ISAAC procedure to disseminate prevention knowledge regarding health care in the hospital or at home. The findings exhibited that the increase proportion of nation’s population was 20 times and the age of incidence was getting younger in the last four decades [10–13]. Therefore, patients were gradually encouraged to extend their awareness of managing, preventing, and controlling illness based on the modern guidelines of asthma health care. The guidelines could afford the education of self-management in clinical practice while the data of asthma control at home have been referred to assess the sufficiency of contemporary treatment [14]. Many patients with chronic illness conditions were invented in the self-management programs for educating them with the helpful skills of self healthcare in primary care [15,16]. The programs utilized various resources to serve the patients for approaching medical, role, and emotional managements from problem solving, action planning, to decision making [17]. The self-management program of asthmatic health care assisted patients to take care of themselves effectively including measuring health-related quality of life (QOL) and daily asthma condition; i.e., the program provides various impacts to support clinical decisions on the asthmatic treatments [18,19]. As evaluating the asthmatic conditions of the children in clinic visits, their parents were encouraged to share their watches on the fluctuations of peak expiratory flow (PEF) measured in the previous cure period [20–23]. For the typical self-management,

the asthmatic children were usually asked to write down the daily PEFs twice in the symptom diary at home and show the outcomes in clinic [24,25]. Thus, the computer-based assessment programs could help to improve children’s self-management skills (e.g., assess their asthma symptoms and QOL) and to achieve accurate outcomes (e.g., monitor their functional status and daily PEF) [26,27]. Recently, health services by innovative Internet technique were widely promoted to enhance electronic healthcare (e-Healthcare) for requirements above on self-management of daily traceable illnesses including asthma care [28–33].

The Internet-based applications for asthma e-Healthcare herein would be functioned by online education and assessment for users, feedback from patients and health professionals, interaction interface between children and their parents; networking collaboration of clinical data and healthcare records, and supervision on therapeutic scheme and decision support [34]. The major scope targeted to automatically compute self-reported data and assess the asthma diary for improving asthma control with alert criteria and remote monitoring [21,34]. In addition, via Internet, the minority children could obtain more free resources in education, medication, finance, or their social and physical situation [35–39]. Similar study has been intervened for kids with asthma in southern Taiwan by proposing an asthma reporting Web site to provide off-line data analysis [40]. The past research programs exhibited positive results of self-management for e-Healthcare services of asthma but usually lacked a platform with self-developed and analytical modules.

In this study, we developed a Web-based self-management system, eAsthmaCare, on e-Healthcare services for the children with asthma in Taiwan. The diagram functions of the system inherited from the core modules of self-developed infrastructure in the previous work. Thus, new database schemes and interfaces were created for instant online analyses correlative to the asthma diary, QOL assessment and health education [41,42]. Five multi-disciplinary portions herein were involved in an interactive interface and functioned with five kinds of analytical diagrams relative to management of asthma health care. The questionnaires were adopted from asthma-related QOL (ARQOL) that includes five dimensions: restrictions of social life, physical disturbances from symptoms, limitations of physical activity, daily inconveniences in managing the disease and emotional distress [43]. In this approach, we focused on the methods of design and development that will be detailed in next section followed by results of system performance. In further, the voluntary asthmatic children (and their parents) were intervened by the e-Healthcare project that was enforced in the pediatrics department of Chang-Gung Hospital at Lin Kou (CGH-LK), Taiwan, to evaluate satisfiability and feasibility of eAsthmaCare system. The proposed project has been

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