Health Policy and Technology (2016) 5, 99–112

Available online at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/hlpt

Use of hierarchical decision modeling to select target markets for a new personal healthcare device

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Available online 15 January 2016

KEYWORDS
Mobile health (mHealth);
Electronic health (eHealth);
Personal health device (PHD);
Internet of things (IoT);
Asthma management;
Hierarchical decision model (HDM)

Abstract
A new product is being developed by a multinational firm for personal asthma management that the patient can wear as an ambulatory device. This device will provide guidance and support for the prevention of exacerbations, the major cause of asthma attacks. However, introducing a device to the medical market is a long multistage and expensive process due to regulatory and reimbursement requirements. The firm desires to target initial niche markets for a subset of this product. This may be a better approach than bearing the high expense for the one time effort of only entering the medical market. Several initial niche markets appear attractive. These include: home care, asthma management, fitness/lifestyle, wellness, and hospital care. The question is, "Which one is more attractive?" By formulating this decision problem as a hierarchical decision model (HDM) with the different niche markets as the alternatives and selecting various levels of criteria we were able to address this question. An expert panel consisting of the firm's executive and operational management, subject matter experts, and external industry analysts was selected to obtain its collective judgments. The results representing the expert panel's judgment indicated that asthma management and home care markets were most attractive and the other three were given less relative importance. Intermediate results were also of interest, such as the relative importance of: market, financial, product, and corporate alignment objectives; regions within the market objectives; and decision elements that contributed to both financial and product objectives.

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http://dx.doi.org/10.1016/j.hlpt.2015.12.001
2211-8837/

Introduction

The growing prevalence of chronic diseases and aging population is placing a heavy burden on national health economics. Personal health or healthcare products that can help alleviate this problem by monitoring and managing the health of patients on an ongoing and continuous basis is seen as key to preventing costly medical interventions. Asthma is a major chronic disease inflicting over 230 million people and is widespread globally [3]. A new product is being developed by a multinational large corporation for personal asthma management that the patient can wear as an ambulatory device which will provide guidance and support for the prevention of exacerbations – the major cause of asthma attacks.

Brief descriptions of personal care and the functional aspects of the new product are provided here. Personal care is the monitoring, management, and notification of certain conditions for healthy living and to prevent the onset of a medical emergency. Monitoring is the continuous collection of personal medical data via specific sensors. The sensor data may be streamed to a device directly onto the wearer's body at small time intervals such milliseconds, seconds, or minutes. The near-real-time data may be aggregated to form a daily record and then downloaded via a wireless network to a local or remote database. The daily records are then combined to form long term monitoring patterns covering weeks and months. The data may include: inhalations, exhalations, pulse rate, blood pressure, body temperature, blood glucose level, and blood oxygen level. The product architecture defines the main functional components of the personal care device. By identifying the functions, we are able to ensure that required features are implemented correctly. It also allows a better understanding of the potential of interchanging the device capabilities from medical to non-medical applications. This interchange of device capabilities is important in case a non-medical market is discovered to be more desirable. The general functional architecture of a personal healthcare device (PHD) is depicted in Figure 1.

With the ubiquitous global adoption of cloud computing, smartphones, wearable devices, and the Internet of Things (IoT) healthcare application and devices are becoming popular. The combination of personal mobile devices and high-capacity wireless networks enable ease of access to innovative healthcare applications for patients, physicians, and hospitals alike [1,27]. An industry is being formed around mobile health termed as “mHealth” and “connected health” [14,18].

The term IoT is now being used closely in conjunction with mHealth to indicate that it is an integral mechanism for data acquisition via sensors. Since the term was first suggested by Ashton in 1999 in an attempt to integrate the concept into supply chain management, IoT technology has experienced rapid growth over the past decades [2]. There are now over 9 billion interconnected devices and it is further expected to reach 24 billion devices by 2020 [8]. Höller et al. explain that IoT is expected to provide advanced connectivity of devices, systems, and services that could go beyond machine to machine communications [13]. IoT technologies have been applied in diverse fields, such as healthcare, environmental monitoring, infrastructure management, industrial applications, energy management, transport systems, and home automation ([11,8] n.d.; [12]). It should be noted that IoT has been widely used in medical and healthcare areas, but these are limited to cloud-connected devices providing data from electrocardiograms, fetal monitors, temperature monitors and blood glucose level sensors [26].

In personal care, the development of medical technologies for health management and chronic diseases has enabled us to cope with our conditions and, in fact, improve our health through self-monitoring and self-management [16]. This approach is not only beneficial for health but also avoids frequent visits to the hospital. Physician and hospital visits for chronic diseases such as asthma are expensive and time consuming. Using wearable or ambulatory monitors for asthma detection can alleviate and possibly prevent the onset of exacerbations. These monitors detect breathing patterns and hence can also be used for applications where

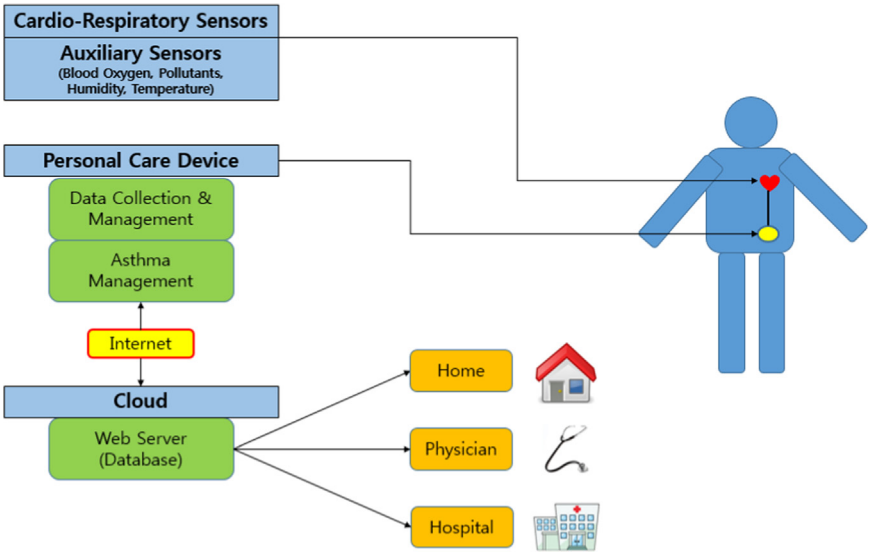

Figure 1 Functional architecture of a personal health device.