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Telemedicine in the Malaysian Multimedia Super Corridor: Towards Personalised Lifetime Health Plans

Syed Sibte Raza ABIDI & Zaharin YUSOFF
Health Informatics Research Group, School of Computer Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia.

Abstract. The Malaysian Telemedicine initiative advocates a paradigm shift in healthcare delivery patterns by way of implementing a person-centred and wellness-focused healthcare system. This paper introduces the Malaysian Telemedicine vision, its functionality and associated operational conditions. In particular, we focus on the conceptualisation of one key Telemedicine component i.e. the *Lifetime Health Plan (LHP)* system—a distributed multi-module application for the periodic monitoring and generation of health-care advisories for all Malaysians. In line with the LHP project, we present an innovative healthcare delivery info-structure—*LifePlan*—that aims to provide life-long, pro-active, personalised, wellness-oriented healthcare services to assist individuals to manage and interpret their health needs. Functionally, *LifePlan* based healthcare services are delivered over the WWW, packaged as *Personalised Lifetime Health Plans* that allow individuals to both monitor their health status and to guide them in healthcare planning.

1. Introduction

The Malaysian *Multimedia Super Corridor* (MSC) [1] is a large-scale Information Technology (IT) infrastructure and services project initiated by the Malaysian government. The MSC-based Telemedicine initiative takes a holistic view of healthcare, thereby promoting a person-centred and wellness-focused healthcare system that aims to deliver hitherto remote 'information-centred' healthcare services at the individual, family and community-level. The label "Tele-Health" is perhaps a more appropriate description of the MSC Telemedicine initiative [2] [3].

The MSC Telemedicine initiative, in particular the *Lifetime Health Plan (LHP)* pilot project, provides the best opportunity to promote a paradigm shift vis-à-vis a shift of primary focus towards the health information and maintenance needs of the consumers of healthcare services rather than its providers. The LHP project proposes an 'innovative' healthcare system that emphasises wellness maintenance (as opposed to illness management) and re-asserts the role of the individual in maintaining his or her health, on a continuous 'life-long' basis.

In this paper, we will give a brief overview of the *Lifetime Health Plan (LHP)* [4] pilot project. We will present an innovative healthcare delivery info-structure, called *LifePlan* [5], [6], [7], that aims to meet the charted objectives of the LHP Project.

2. The MSC-Telemedicine Based Lifetime Health Plan Project: An Overview

The MSC Telemedicine model encompass four key pilot projects: (1) *Customised/Personalised Health Information and Education*, (2) *Continuing Medical*

Education, (3) *Teleconsultation* and (4) *Lifetime Health Plan (LHP)*. The remainder of this paper specifically concentrates on fleshing out the LHP component of the MSC-Telemedicine project.

The LHP is probably the most unique and yet complex of all the Telemedicine pilot projects. Key feature of the LHP system is its person-centred implementation, ensuring a lifelong continuity between episodic contacts with healthcare service providers (throughout the nation). A systematic, consistent and temporally relevant summary of an individual's Electronic Medical Record (EMR) will manifest as the *Lifetime Health Record (LHR)*—which is to be used to formulate prospective *Personalised Lifetime Health Plans (PLHP)* that cater for both wellness preservation and illness treatment. In summary, the LHP project will provide the healthcare infrastructure to deliver PLHPs directly via the WWW to individuals or alternatively via primary healthcare providers. The LHP project is designed as a suite of integrated application systems, divided into three basic components on the basis of their intended functionality: (1) *Clinical Support Systems;* (2) *Healthcare Information Management and Support Services (HIMSS);* and (3) The *PLHP system* for the generation and delivery of lifelong healthcare plans—PLHPs—pro-actively customised to meet each individual's specific health needs.

The major role of the PLHP system is to generate individual PLHPs tailored to specific wellness and illness requirements of individuals. Once generated, the PLHPs will be stored in the LHP repository, and will be frequently referenced by their 'owners'. A typical PLHP will integrate all existing medical records (the past), with all recommended healthcare plans assigned by various healthcare providers (the future). The emergent PLHP, is intended to be easily understood by individuals, thereby placing them in a much better position to make well-informed health-related choices. More so, the PLHP will dynamically adjust itself with respect to changes in an individual's state of health.

3. Functional Description of LifePlan

LifePlan is a sophisticated healthcare deleivery info-structure that aims to provide life-long, pro-active, personalised healthcare services to assist individuals to manage and interpret their health needs based on their health history. Put simply, LifePlan will act as an agent representing and guarding the person's health-related interests and concerns, enabling a continuum of care for the individual. LifePlan will maintain comprehensive, cumulative, correct, coherent and changing *Personalised Lifetime Health Plans (PLHP)* – personalised healthcare plans that 'intelligently' integrate existing illness records (the past health perspective) with wellness plans (the future health perspective) to guide the individual in healthcare planning. The value-added component of LIfePlan is that the PLHP will dynamically adjust itself with respect to changes in an individual's state of health. LifePlan will empower individuals to take responsibility for and an active role in *monitoring* and *maintaining* their own (and their family's) health status. This will be achieved by providing an Internet based health monitoring and recording system through which individuals will be able to monitor their own and their family's health status [8].

In IT terms, LifePlan is an amalgamation of diverse computer technologies—Artificial Intelligence [9] [10], Multimedia [11], Internet and Databases—and is realised by a systematic integration of various task-specific modules. A fusion of technology, role transformation and behavioural change is the distinguishing facet of LifePlan [12].

Figure 1 below describes the overall healthcare delivery system pertaining to LifePlan in more detail and charts our methodology behind the design of LifePlan. Note that the health management team (Mgt. Team) depicted on the left hand side of the Figure 1 reflects two critical changes to the current healthcare models: (1) The individual becomes an integral part of this team and assumes 'ownership' for their wellbeing; and (2) Health

management occurs in the community, with the primary care provider assuming a 'wellness' focus and new responsibility as 'gatekeeper' to the healthcare delivery system.

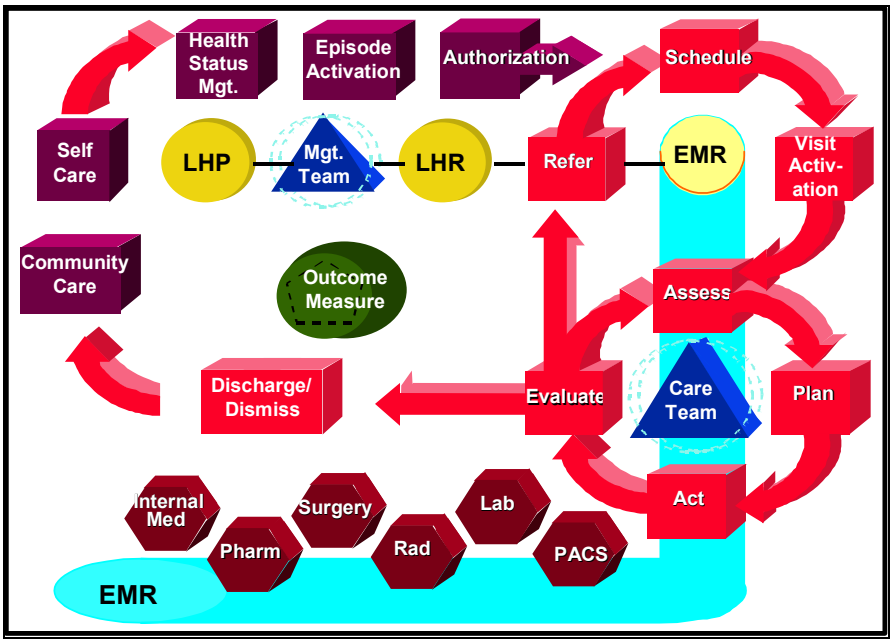

Figure 1: Life Cycle of a Persons Involvement with the Healthcare Management System.

Figure 1 provides an overview of the life cycle of an individual's involvement within the healthcare management system. Each box in the diagram represents a major process or workflow element that can be further described as a number of discrete activities depending on the specific environment (e.g. care setting, level of automation, etc.). Community and "wellness" related processes are depicted in the left half of Figure 1. It is here that an individual spends most of his/her life. Whilst, care delivery processes are depicted in the right half of the Figure 1. We explain below the lifecycle of an individual within the proposed healthcare management system, which in turn also illustrates our methodology behind the design of LifePlan.

- Overall the individual may be considered to be in a steady state under *self-care* with *health status* monitoring as frequently as required. From time to time the person will need to be a consumer of healthcare services and so an episode of care will begin.
- Depending on health system access and usage privileges, some *authorisation* is required before or concurrently with presentation to a care setting.
- At the beginning of an episode of care provision, the person may be *scheduled* or placed on a waiting list. Once the patient is ready to be seen, a formal *visit or encounter* is activated.
- At this point, the core *iterative* clinical process begins with *an assessment*, a phase of data gathering that will allow a decision to be made which usually includes past and most recent history, as well as examination. Once a decision is made, there is a (treatment) *plan* of action.
- Once these *actions* are carried out and recorded, an *evaluation* is made, and the patient may go through the cycle again, be scheduled for another encounter, or be *discharged* from that encounter.

- Here the consumer re-enters the community and depending on the nature of the episode may return to the *self-care/health status monitoring steady* state, or may require a period of *community based care delivery.*

4. Principal Role of *LifePlan*: An Overview

The principal role of LifePlan is to generate individual PLHPs tailored to the 'owner's' specific health status and to deliver it via the Internet either through PCs or Tele-Services. A PLHP comprises a merged set of *Health Expectations* and *Health Tips* (shown in Figure 2). Health expectations are evidence based health events that require planning. They include such items as the routine immunisation schedule, mammograms for females over 45, a new Health Risk Appraisal to be performed, etc. All of these health expectations have the following characteristics:

- Once activated (see below) they are for a uniquely identified person
- Time by which the expectation needs to be satisfied
- The event that is expected
- The action(s)—such as notification of Primary Care Provider (PCP), rescheduling *n* times, etc.—to be performed on the "success" or "failure" of event satisfaction.

Health tips are lifestyle recommendations that do not occur at a particular time but suggest (or even exhort) on-going behavioural changes. Compared to a health expectation, an individual can revert to old habits and "undo" the benefits of the health tip. By contrast, once a health expectation is satisfied, it cannot be undone and the benefits remain. For example, a tetanus booster will reduce or eliminate the risk of tetanus for 5-10 years, but stopping smoking only reduces the risk until the individual starts smoking again.

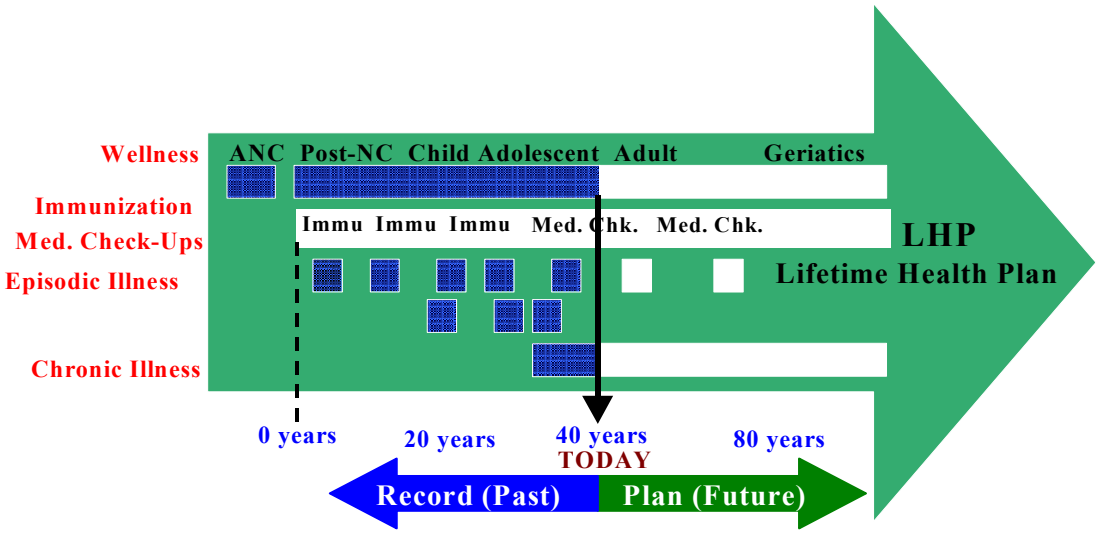

Figure 2: An overview of a typical Personalised Lifetime Health Plan. The boxes will be filled with both wellness and illness related information.

Automation of LifePlan translates into two activities - PLHP Generation and PLHP Delivery. The former involves periodic generation of comprehensive and specific PLHPs. The latter involves global access to the generated PLHP, via a 'live electronic consultation session'—that entails the generation of 'dynamic' Web-based questionnaires—in a timely manner as the individual moves through life. Figure 3 shows the infrastructure for implementing these two activities. Next, we briefly elaborate the modules responsible for PLHP Generation and Delivery.

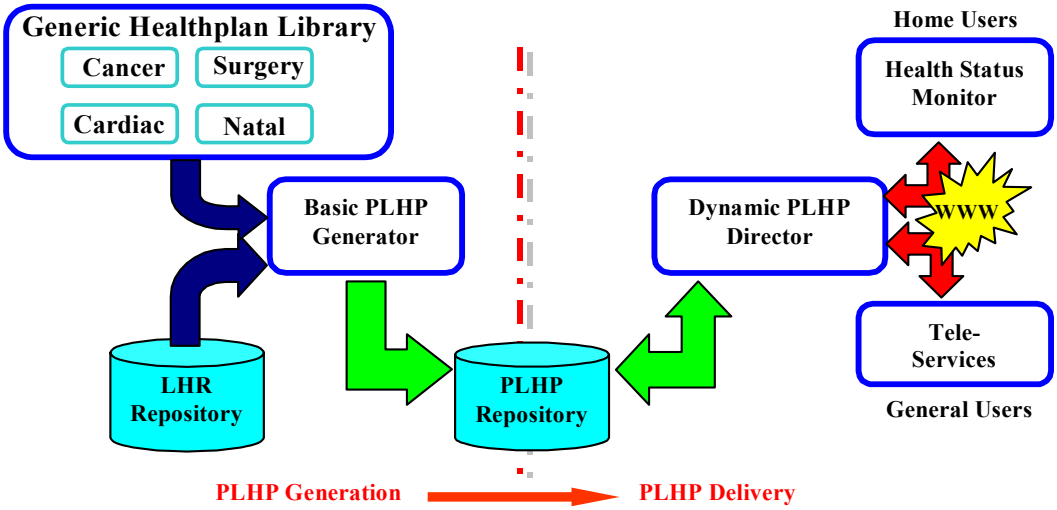

Figure 3: The PLHP infrastructure. Illustrating modules involved in the Generation and Delivery of PLHPs.

4.1. PLHP Generation

The PLHP Generation activity is implemented in terms of two main modules:

Generic Healthcare Plans Repository (GHPR): GHPR is an electronic archive to store a suite of generic healthcare plans. Each generic healthcare plan will be wellness oriented and will incorporate specialised guidelines, procedures, milestones, observations, advice, treatment and test schedules.

Basic PLHP Generator (BPG): The BPG is the core engine responsible for the autonomous and 'intelligent' generation of 'basic' PLHPs—a basic PLHP reflects the various health aspects of the individual that need to be addressed by the individual—that is deemed as being complete, consistent, satisfying multiple constraints and operable. BPG works in concert with the LHR repository, GHPR and/or a healthcare professional. Note that BPG is activated whenever a new PLHP needs to be generated.

4.2. PLHP Delivery

PLHP delivery is achieved by the implementation of the following modules:

Dynamic PLHP Director (DPD): The Dynamic PLHP Director (DPD) is the core 'intelligent' engine responsible for the dynamic and automated customisation of PLHP's based on the individual's most recent health status. DPD will direct all user-PLHP transactions via a web-based virtual 'consultation session', during which it will inquire (using electronic questionnaires) about the current health status of an individual based on his/her existing PLHP. Based on the individual's response, DPD will dynamically customise the PLHP, i.e. it will generate relevant questions either to clarify previous responses or to explore a suspected abnormality in the individual's health profile.

Functionally, DPD is the server side of the PLHP delivery infrastructure; for delivery purposes it interfaces with the PLHP delivery media, i.e. the Health Status Monitor and Tele-Services. Furthermore, DPD also supports the application middleware—a toolset for defining object relationships, configuring user preferences and security profiles for PLHP delivery purposes.

Health Status Monitor (HSM): HSM is a self-contained home-based health maintenance application that can be used by individuals to monitor their personal health status.

Tele-Services: Tele-Services refer to a confluence of PLHP delivery mediums, notably public multi-purpose kiosks, email and telephone. Individuals who do not have PC facilities are intended to use Tele-Services for all interactions with LifePlan.

4. Discussion & Concluding Remarks

Malaysia has proposed an enterprising and challenging 'Tele-Healthcare' vision for national healthcare. The vision is in line with international trends in healthcare and advances in IT technology, more so the systematic amalgamation of an innovative healthcare philosophy with leading edge Information Technology support have realised an all-encompassing, holistic healthcare model for Malaysia [1].

We believe that an investment in healthcare in terms of the incorporation of information technology must be accompanied by the right strategy to provide long-term benefits . The MSC-Telemedicine based LHP project, discussed in this paper, should be seen as a bold and novel initiative that aims to promote a paradigm shift towards a 'person-centred system of healthcare'. Cutting-edge IT technology will be the catalyst for shifting the responsibility of health management from the healthcare provider to 'informed' individuals. For maximum effectiveness, the 'Tele-Healthcare' vision will feature informed, health conscious and empowered individuals that are capable of choosing optimum lifestyle and health management options resulting in a sustained state of self-wellness. For added value, these wellness maintenance services will (a) pro-actively reach out to individuals, (b) be seamless in implementation, (c) continuous in presence, and (d) tailored to the individual's and community's requirements [13] [14].

To meet the objectives set forth by the LHP project, we have presented *LifePlan*—a healthcare delivery infra- and info-structure that successfully enables a continuum of care. The LifePlan infra- and info-structures are currently translated into technical deliverables, with completion of the entire solution being targeted for the year 2001.

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