The Capital Region of Denmark

Healthcare Innovation Centre

Discussion paper for the mHealth workshop on December 5th 2011.
-Theoretical framework of understanding.

Introduction

This discussion paper is an introduction to the theoretical understanding of the mHealth topic, seen through the lenses of the professional healthcare provider (thus the use *Medical* uptake of mHealth). The paper serves as a common understanding for discussing the following topics at the workshop:

- How can we identify means of measurement of Medical uptake of mHealth solutions?
- How far have we come in mHealth Medical uptake within the EU?
- Which trends; drivers and barriers influence mHealth Medical uptake today and in the future?

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Indicators of Medical uptake

To achieve a state-of play (or overview) of mHealth within the EU, we have found it necessary to identify different means of measurements. We believe that the following to indicators will be usefull for measuring Medical uptake:

- Concept *maturity*
- Geographical and administrative *dissemination*

Maturity

We define maturity as the level to which the concept or project has matured from an idea towards being an integral part of the healthcare service offered. This development will vary from nation to nation within the EU. An example of Danish conditions is given here:

1. Idea
2. Proof of concept
3. Pilot Project
4. Clinical trials seeking clinical evidence of lowered or equal morbidity and mortality
5. HTA, Health Technology Assessment (in Denmark assessing the technology/activity; the perspective of the citizen/patient; the organisation in question and the economic aspects)
6. Incorporation into clinical guidelines
7. Integration into established healthcare service portefolio

We would like to discuss, whether these maturity levels are the same in across the EU and how the development of a mHealth concept is processing.

Dissemination

The dissemination of a concept, an idea or a project can be:

- Local (specific clinic or hospital department)
- Municipal (County-wide)
- Regional (Spanning several hospitals or other units within a region)
- National
- Transnational
- EU-wide
- Multinational

The indicators of maturity and dissemination could provide nuance to a mere listing of mhealth projects. We postulate however, that these two means of measurement are interrelated and not independent. To achieve dissemination we find it obvious that maturity (documentation of clinical evidence and impact concerning HTA) will be increasingly necessary or indeed essential.

Dimensions of mHealth

We have defined a number of dimensions that the Medical uptake of mHealth is related to. The four dimensions are upon the subject of mobility concerning where, how, who and when.

Dimensions:

1. Location. Location in the "Healthcare Space" or treatment subsets (Hospital, GP, home of the citizen, workplace, public space)
2. Means. Human mobility vs. Machine Mobility
3. Role. Mobility of the healthcare professional (Clinician) or Citizen (Patient)
4. Time. Synchronous or asynchronous communication.

We will attempt to define the rather fluffy area of mobile health through these dimensions. These definitions are, however, meant to be subject to debate at the workshop. The dimensions are elaborated below.

Dimension 1 Location in Healthcare space

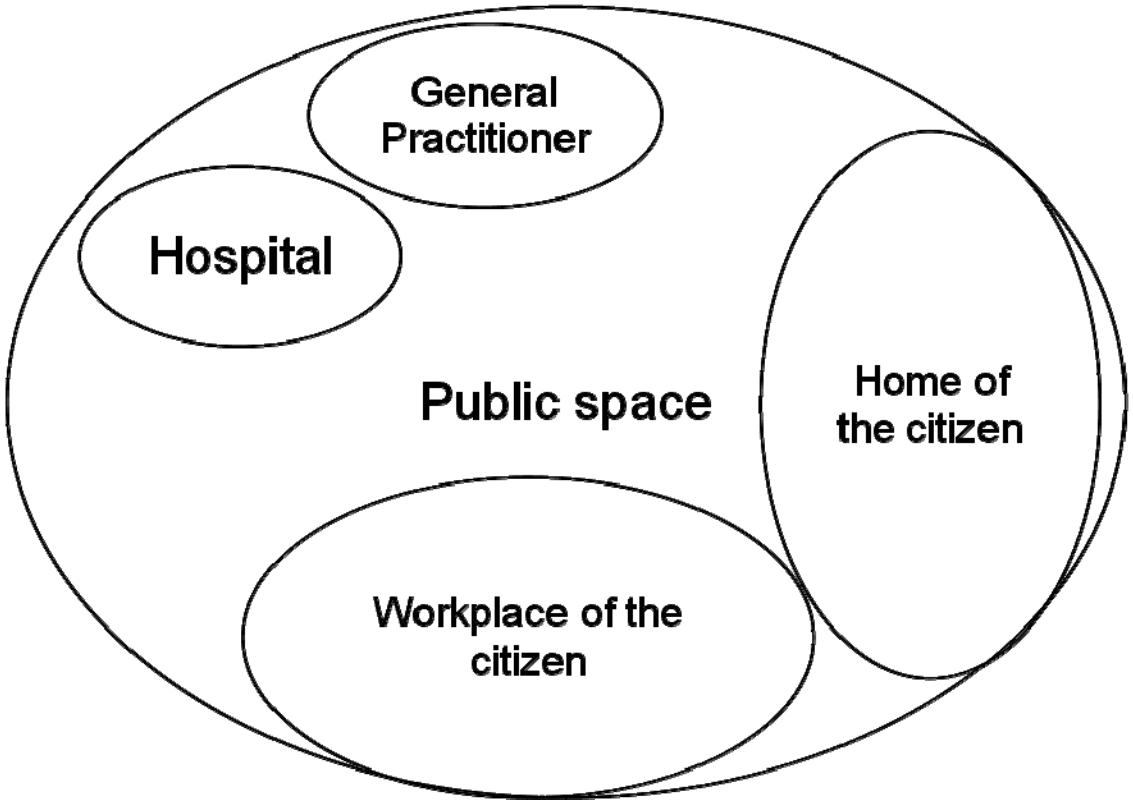

Figure 1. Healthcare space

Figure 1 depicts what we call the *possible* healthcare space. This constitutes anywhere the citizen or patient moves to and from including what lies

between (the public space). With the advent of telemedicine the home of the patient has been included in the healthcare space. This has been the case for treatment of several chronic diseases for some time. Telemedicine has added further possibilities and to some extent ICT support for telemedicine. With mobile health (mHealth) the entire public space is included into the potential healthcare space.

This dimension (Healthcare Space) owes its origin to a merger of two formerly separate dimensions: Location and care setting. Location is originally defined by bloodgas-analysis firm Radiometer. Three forms of mobility are considered in a hospital setting: In-house, travelling and visiting (se figure 2 below):

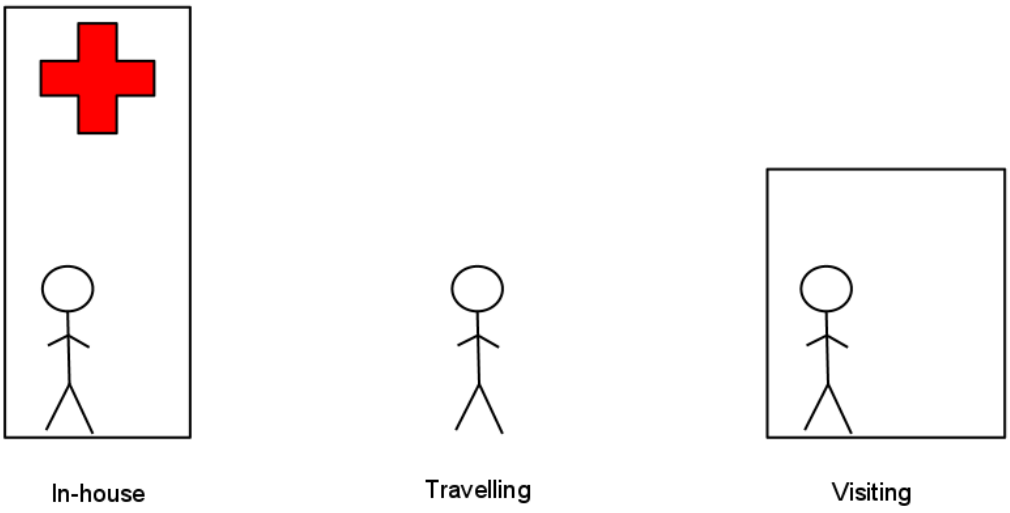

Figure 2. Location

These definitions are with regard to healthcare professionals (clinicians) moving about inside and between hospitals. In-house is the mobility within the hospital (ie. workplace) of the clinician in question. Travelling mobility is moving outside hospitals for professional purposes. Visiting is the support of further workprocesses in another hospital, another healthcare provision location or in the home of a citizen or patient. Since the scope of mHealth is far more extensive than these definitions however, both in terms of workspace (not limited to hospitals) and persona (not limited to clinicians). The aspect of these forms of mobility do however serve the demarcation or definition of mobility, but has been merged with care setting for better clarity. Care setting took into account whether the patient was being treated in a primary care, secondary care setting, at home or in the public space.

Dimension 2 Means of mobility

Mobile work processes can be achieved by two different means. Either supporting ICT equipment can be stationary and the person in question mobile or both the person in question and the supporting equipment is mobile (see Figure 2).

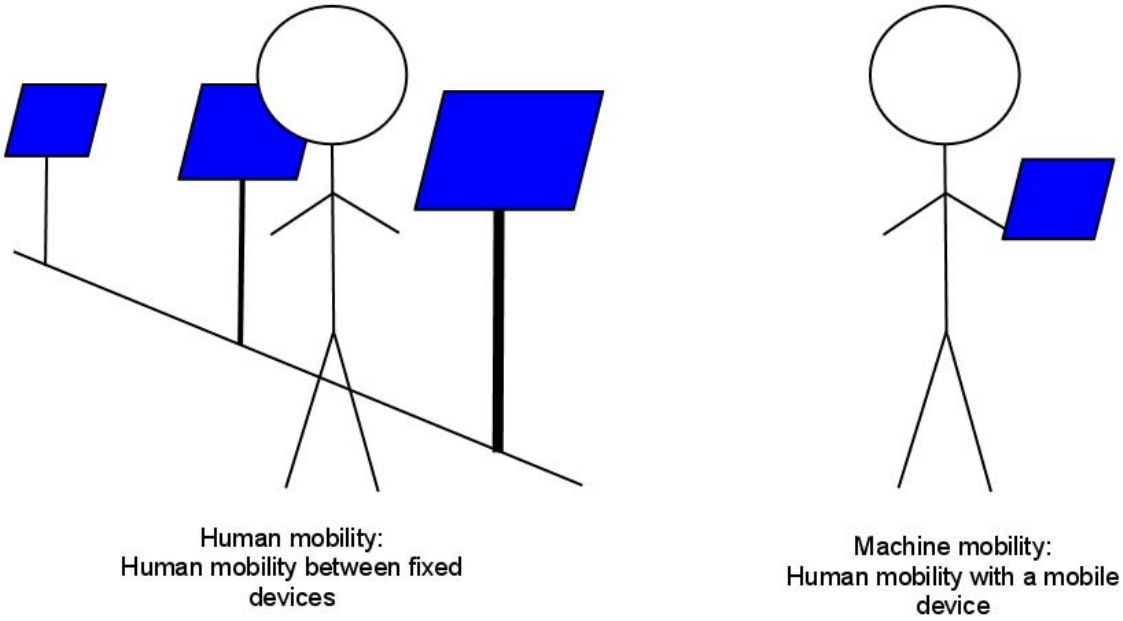

Figure3 Machine vs. human mobility

As an example of the first situation, support of the mobile (or indeed nomadic) work practice of clinicians at a hospital can be achieved by current use of desktop workstations in hospital offices or staff-rooms combined with bedside terminals. To achieve this mobility with stationary equipment exceedingly easy procedures for access to the terminals and ending sessions is of paramount importance.

Dimension 3 Role: Clinician or citizen

The third dimension concerns the subject or person, the mobility of whom, we wish to support or achieve. Is this person a professional healthcare-worker (clinician) or a patient (citizen)?. The boundary is continually moving with the developing possibilities of mHealth. Thus also questioning the authoritative power of the professional healthcare provider.

Dimension 4 Time: Synchronous or asynchronous communication

Whether communication between individuals or systems act to achieve realtime communication (as in a telephone conversation) or asynchronous communication (as in an e-mail).

Examples of the interdependencies between dimensions and mHealth

Documentation of administration of medicine in a hospital setting
Some hospitals in Denmark have implemented a medication system (sometimes called CPOE for Computerized Physician Order Entry). In this example the system in question only deals with medicine in a hospital setting. The medical doctor can thus enter prescriptions which the clinical staff are to follow during the hospitalization of the patient in question. Daily administration of medicine by hospital staff (frequently a nurse) is documented at the point of delivery (bedside) using a PDA (Personal Digital Assistant) connected to the CPOE through the Wifi network of the hospital. Although this includes a mobile device (the PDA) and therefore fits with the definition of mobile health, we do not consider this mHealth. The reason behind this is that the procedure is only possible in the hospital setting (Dimension 01) and therefore constitutes a very limited mobility. This is therefore a very local extension of the eHealth solution in operation at the hospital.

Diabetic wound at home (the project Telewound)
The project telewound (Telesaar) uses the cameras included in most mobile phones to send either live footage or still images from a specialised nurse visiting the patient at home to the medical doctor situated at the hospital to achieve guidance, second opinions and documentation of the development of the condition. It follows that this fits with the definition of mHealth and therefore is considered a mHealth project.

However should the mobile phone be substituted by equipment (a camera) installed for this purpose in the home of the patient, it could be argued that the project should be considered telemedicine or AAL and not mHealth.

A central point of this attempt of defining dimensions of mHealth is that the citizen or patient is most likely indifferent as to whether a healthcare service is coming through telemedicine, AAL or mHealth (or indeed wifi, 3G or EGDE). Furthermore these services are complimentary and not exclusive. To justify the focus upon mHealth for the purpose of this workshop, we therefore need to find solutions or services that include a central element of mHealth that can not be substituted by telemedicine or AAL. This could be the need for constant monitoring of conditions, whether at home, in public transportation or at work (MONARCA, EPILEPSIAE).

Trends; drivers and inhibitors

We distinguish between *drivers* that are trends which will promote or have positive impact upon mHealth medical uptake. *Inhibitors* will have the opposite effect.

Drivers

One driver is the *global dissemination of mobile phones* and the increased sophistication of technology and consequently use of these devices (smart-

phone and application (app) development). This trend can not reasonably be stopped by any one country or government. However, since this trend or aspects of this trend can be influenced, this could also be considered a driver for mHealth.

Another driver is the changes in the *age-distribution of the populations* of the EU (and wider world in general). The increase in the senior part of the population with respect to the younger is anticipated to provoke a number of problems, in particular with regard to healthcare services. This trend can not be influenced or solved by any single nation or government (or indeed by the EU).

Patient empowerment tends to put the patient in a central, active role as opposed to a passive, recipient of healthcare services. This fits well with several lines of thinking with mHealth and mHealth may to some extend be seen as the ICT support of this tendency.

The demand for more integrated care pathways
Danish Patients are continually experiencing the healthcare system as build up in "silos" ad this may be relevant for other EU patients as well. Many healthcare systems lack integration between deeply specialized theraputic areas, thus prone to delivering a staccato healhtcare service to the citizens when one is looking at the course of the patient over time. Patient organisations are raising awareness about this inappropriate way of delivering healthcare services not just from a service perspective but also because the deep specialization has morbid consequenses for fx the chronically ill with several illnesses. This demand for more integrated care pathways and caremodels naturally increases the demand for ubiquitous healthcare information in different care spaces.

Inhibitors

The patient empowerment trend as described above is not unopposed. For public healthcare service systems this constitutes a change in paradigms and in particular necessitates a reorganisation. This *inertia of public healthcare services* at the individual level as well as organisational constitutes an inhibitor to mHealth uptake.

Another inhibitor is the *privacy and security issues* concerning the handling of healthcare information. These are sensitive matters which can not and may not be distributed or transferred without regard to encryption and keeping records of who accesses the data.

Generally the medical uptake awaits the development in the healthcare consumer market (i.e. healthcare services developed by private providers without legal healthcare authority), where the uptake of smartphones is

moving fast and the speed of the software development (especially the application development) is pushing boundaries for what can be done in the clinical world. At the same time, clinicians (doctors, nurses and other healthcare professionals) are illegitimately or legitimately using their own consumer devices (iphones or android smartphpones etc.) with installed medical apps for clinical purposes (The Springer Publishing 2011 Nursing eBook & Smartphone Survey, September 2011 http://springerpub.com/content/downloads/Springer-Publishing_2011_Nursing_eBook-Smartphone_Survey.pdf).