Chapter 31
mHealth in Resource-Constrained Environments

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ABSTRACT
The use of mobile devices in telemedicine contributes to providing more effective and efficient remote healthcare in rural areas improving patients’ life style and medical quality of service in this setting. The idea of creating mobile applications for this scenario led the authors to face important sociotechnical challenges in terms of innovation and design for resource-constrained environments. In this paper the authors present the outcomes of MANTRA (Mobile ANticoagulant TheRApy) Project developed for and evaluated in Venezuela. Through the evaluation of this project under those settings the authors developed an approach to mHealth in the remote management of chronic diseases by supporting the communication between doctors.

1. INTRODUCTION
Rural areas are very often resource-constrained environments where direct access to the Internet, through landlines or mobile phones may be challenging. In such settings, also the quality of health services is often affected by these limitations. In such conditions some chronic diseases are hard to be treated anticoagulant therapy management is one of those because it demands a regular monitoring of patients’ conditions made by doctors or health professionals.

Anticoagulant therapy prevents the formation of thrombus. People at risk of developing thrombosis have to take anticoagulant treatment (warfarin) once a day in a dosage that needs to be adjusted on the basis of the International Normalised Ratio (INR) test results (Cohen et al., 2007). The INR test measures the prothrombin time (PT) – how long it takes for the blood to clot. The dose of warfarin is increased or decreased with the intention of keeping the INR value within an appropriate range. When the treatment starts the INR value is tested every 2-3 days but once its...
level has stabilised it is tested between 7 and 20
days. Since the INR tests are usually performed
in surgeries the patients have to make frequent
visits to meet doctors to take the test and receive
a prescription of warfarin.

In this paper we present MANTRA (Mobile ANticoagulant TheRApy), a project aimed at
studying the feasibility and acceptability of the
introduction of mobile technology in the manage-
ment of anticoagulant therapy involving doctors in
the design phases. The project was implemented as
a proof of concept for a rural setting in Venezuela.
We studied the existing literature and state of the
art and performed a study on the end users profiles
and the context/environment and designed, devel-
oped and evaluated two interactive high-fidelity
prototypes for mobile devices (iPads) aimed at
support the remote communication between doc-
tors who operate in rural areas and doctors who
practice in hospitals. This gave us the chance to
derive a general approach to mHealth in the remote
management of chronic diseases by supporting the
communication among healthcare practitioners.

The paper is organized as follows. First, lit-
erature review and state of the art of telemedicine
in anticoagulant therapy domain is presented and
discussed. In Section 3 the MANTRA project
is presented and its research context and meth-
odology are illustrated. Section 4 presents the
prototypes design and development and Section
5 illustrates the usability evaluations performed
and their results. Finally, conclusion and future
developments are presented.

2. LITERATURE REVIEW
AND STATE OF THE ART

2.1. The Need for ICT Localization
Integrating the Tradition and the New

The design and development of interactive systems
for rural environments needs to consider the variety
of cultures, e.g. different socio-political-economic
contexts, different languages and educational
backgrounds. Thinyane et al. (2007) confirm the
importance of localisation techniques in design
and development and argue that it should be found
“a way to make ICT solutions more sensitive to
the local context, and therefore more effective”
by capitalising on local knowledge and resources.

Therefore, the positive impact of many existing
ICTs has been attributed to their localisation for
specific contexts and cultures. Given the subject
handled by this study, the research focuses also
on supporting the design and development of
localised ICT solutions.

Choi et al. (2005) identified 52 cultural attri-
butes in three different countries in a qualitative
cross-national study of cultural influences on
mobile data service design, which demonstrate
that without any doubt the context and culture
affect the way users interact with technology and
systems. Research also shows that ICT solutions
that simulate as closely as possible traditional
local networks guaranteed a greater success in
developing (Kolko et al., 2007).

All these findings and studies also suggest the
need for a type of ICT localisation that integrates
the traditional knowledge and tools from those
cultures with new tools. However, when ICT
projects are reviewed, or referred to developing
countries, the benefits and implications for the
targeted users tend to be the focus. One the other
hand, others researches also emphasise the fact
that the issues are more related with usability and
efficiency of systems and processes.

An excellent piece of research by De Angeli
et al. (2004) analysed the introduction of ATM
machines in India to evaluate the socio-cultural
impact. They concluded that “(...) as much as
culture can influence technology, the reverse is
also possible” (De Angeli A. et al., 2004). Based
on these results and from a research perspective,
it was necessary to consider the technology for
the targeted rural community, “Wonken”, before
deciding how to design the prototypes.