Using ICT to Support Individual Guidance in Health Promotion Programs for Increased Physical Activity

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Abstract. Introduction: We report on experiences in implementing a system to
support the individual guidance of training in health promotion programs aiming to
increase participants' regular level of physical activity. Methods: We used an
iterative development approach considering data privacy and security aspects,
followed by a phase of field testing and continuous further development. Results:
Our preliminary results comprise identified clinically relevant parameters, suitable
data collection methods, experienced privacy and security challenges and a glance
on our developed prototype system. Discussion: We consider our results to be of
interest for others doing related research. The most important requirements for a
simple supporting system can be fulfilled with established solutions in the short
run. A more adaptable and flexible system with an increased level of support in
analysing the data, which we aim to achieve, leads to currently open research
challenges.

Keywords. Health Promotion, Physical Activity, Privacy of Patient Data, eHealth

Introduction

The reduction of regular physical activity over the last decades has major negative
effects on public health and working ability ([1], p. 10). The pilot project "Rebirth-
active" [2] has shown that increasing the regular physical activity of people with low
physical activity in their daily routine, can have various positive effects on health and
working ability. Active travelling to work e.g. by bicycle can be a good basis of regular
physical activity. For this reason in a sub-project of a project establishing a pedelec
rental system in Hannover [3] we investigate the usage of pedelecs as part of company
health promotion programs (HPP). To be cost-effective such HPPs need to maximize
the number of people a trainer can look after without compromising the quality of his
support. The research question of this paper is how information and communication
technology (ICT) can support the individual guidance of training in such a HPP,
focusing on clinically relevant parameters, suitable data collection methods and privacy
and security challenges.

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1. Methods

We used an iterative development process which comprised numerous meetings with six health care professionals (HCPs) from the Institute for Sports Medicine of the MHH, and four computer scientists from the PLRI and other project partners. Clinically relevant parameters as well as functional and non-functional requirements were first elaborated from a clinical perspective. Proposals for technical solutions were developed, tested and discussed, leading to new iterations with refined requirements. We applied this iterative approach because a linear development approach like for example the V-Model in software development did not seem to fit into the multi discipline development process which was characterized by mutual learning about each discipline's requirements and capabilities.

In parallel to continuous further development, we started field testing after basic solutions were implemented on a reasonable level. For simplification test users were recruited from another study's control group. Therefore, all test users share some characteristics (e.g. age 45-65, low physical activity on job) and thus belong to a subset of the intended future user group. In spring 2015, about 60 test users were enrolled, a number of 150 test users is intended. Test users are still being recruited continuously.

A distinct inspection regarding aspects of data privacy and security involving the data security officer of the MHH was done to ensure that our solutions meet privacy and security standards to allow field testing. An evaluation regarding health and workability improvement and cost effectiveness is planned but exceeds the scope of this paper.

2. Results

For individually guiding a participant's training, up-to-date information about his physical activity as basis for decision making is needed. The following parameters were identified as suitable: activity carried out, duration of activity, performance, heart rate, energy expenditure, subjective level of exertion. Identified suitable methods for data collection are: manual data entry using a web portal or an Android-App, sensor data collection using the same app and built-in acceleration sensors or external wireless sensors supporting the ANT protocol and the ANT+ profiles "Heart Rate Monitor" and/or "Stride Based Speed & Distance". For our prototype we used the smartphone „Sony Xperia Ray", the chest strap of the „Beurer PM70" heart rate watch and the pedometer „Suunto Foot POD Mini". For data presentation a web portal seemed suitable. The most important view on the data is an overview over a participants past training sessions. The most important mean for communication between trainer and participant is a text-based messaging function enabling the trainer to give the participant feedback on his training in an appropriate form.

A privacy and security concept was elaborated in cooperation with the data security officer of the MHH. Legislation in Lower Saxony requires a written informed consent of each participant. Privacy and security is a legal as well as a user acceptance topic. From legal perspective, simple authentication, an authorisation concept and encrypted transmission of the data seemed adequate for our use case. User acceptance entailed a new issue: Potential future users' representatives stated that collection of GPS data within the HPP would be a dealbreaker. Therefore GPS data is only optional information and can technically be turned off. Since we saw no practical possibility to

equip all participants with means for secure text based communication, participants can't get messages containing personal content from their trainer directly. Therefore our web portal has a messaging function triggering an optional email notification without personal information whenever a message is available.
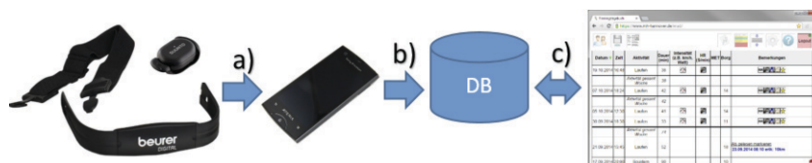

Figure 1. Information flow: a) sensor data is transmitted wireless to the smartphone (ANT/ANT+). b) Data transmission from smartphone to the database is using an encrypted proprietary protocol. c) Communication between client (using the web portal) and database is based on SSL and HTTP.

3. Discussion

The results we present are preliminary. Nevertheless we consider them to be of interest for others doing related research. We presented solutions for supporting trainers in HPPs and first experiences from applying these solutions in a field test. Being aware of the vast amount of health apps and web portals for fitness data, to the authors' knowledge our approach is unique, because we explicitly focus on support of human trainers coaching the participants. Our ongoing field test with a reasonable number of participants already lead to experiences and system improvements. This is valuable for our future research because our planned evaluations obviously require a conveniently provided intervention.

Data privacy and security challenges could be solved with little effort. Notwithstanding the fact that these aspects contain a great potential for conflicting opinions, they did not seem to be critical. Most requirements stated by the HCPs can be fulfilled with available solutions in the short run. But the information of interest for the trainer can be contained in different data types from various sources. Hence, there is a strong need to have a flexible system for analysis of data. Furthermore an increased level of support in analysing the data is desirable. This leads to currently open research challenges. Some of them were described by Kohlmann et al. for heterogeneous and multimodal data in general [4]. One challenge we aim to address is to uncouple the used analysis logic from the devices and data types used in collection and transmission.

References

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