

# A Concept to Empower Self-Management of Psychophysiological Wellbeing: Preliminary User Study Experiences

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**Abstract**—In prevention of chronic diseases, health promotion and early interventions based on self-management should be emphasized. Mental health problems and stress cause a significant portion of healthcare costs, and also complicate the management of other chronic conditions. In addition to physical health, psychophysiological and social wellbeing should be equally promoted. Thus, we have previously designed and reported the P4Well or Pervasive Personal and PsychoPhysiological management of WELLness concept for working-age citizens. The concept supports the stress and recovery management on a daily basis through improved health management strategies, and combines psychological methods with personal health technologies. In this paper, we discuss the preliminary user study experiences of ongoing evaluations with two different user groups consisting of: 1) middle-aged men who are using the concept for managing their mental wellbeing or mild depression; and 2) entrepreneurs who are using the concept for coping with stress. Our results provide a preliminary assessment of the role and importance of experts, technologies, and peer-support in the concept.

## I. INTRODUCTION

Health includes physical, psychological and social components, which are highly interrelated. Mental health problems are the most common reason for early retirement in the OECD countries [1] and their economic costs to society are enormous, equaling 3–4% of the gross national product in the EU Member States [2]. Depression is the most common mental health problem, but is under-diagnosed and, especially, under-treated. Only one third of people with depressive disorders receive mental health treatment [3]. Due to the scale of the problem and lack of trained psychotherapists, there is a huge challenge to

provide recommended treatments to all in need. This can only be achieved with methods which utilize scarce therapist resources more efficiently, foster patient empowerment in care and self-treatment, and make efficient self-management tools available in large populations.

In a holistic approach of wellbeing, all inter-related key aspects (physical, mental, and social) should be acknowledged. Factors contributing to decrements in mental health include stress and sleep problems. For example, extended stress may lead to burnout and depression, and is a risk factor for diseases such as hypertension and diabetes [4]. The stressors can rarely be totally avoided, but stress recovery methods can help people cope with stress [5]. An important tool to protect people from health problems and diseases is regular exercise, which can improve people's psychophysiological wellbeing [6].

Computer-aided Cognitive-Behaviour Therapy (CCBT) programs delivered through the Internet have shown their effectiveness for mental wellbeing problems [7]. The National Institute for Health and Clinical Excellence (NICE) of the UK recommends CCBT as a primary intervention method for anxiety disorders, post-traumatic stress disorder, and depression [8]. The reported CCBT methods, however, do not fully exploit the available modern mobile and ambient technologies, and mostly focus solely on mental wellbeing and lack the holistic approach.

We have previously proposed a concept for working-age citizens to empower their self-management of psychophysiological wellbeing through management of stress and recovery from stress [9]. Our P4Well concept integrates several personal health technologies, including web-based tools and software, wearable monitoring devices, mobile phone with special software, and various analysis methods to interpret the gathered and acquired data and to provide feedback. These technologies are used along with modern psychological mini-intervention methods, such as CCBT, to help people manage stress, sleep and mental problems by encouraging and helping them to adopt a healthier lifestyle. The focus of the concept is on early prevention of or intervention on mental and health problems, based especially on assessing stress and recovery, sleeping and exercise habits. The concept fosters self-management but supports expert consultation through the Internet, and aims to lower the barrier for seeking information, help, and possible treatment [10]. The devices, software, and psychophysiological theories and methods are

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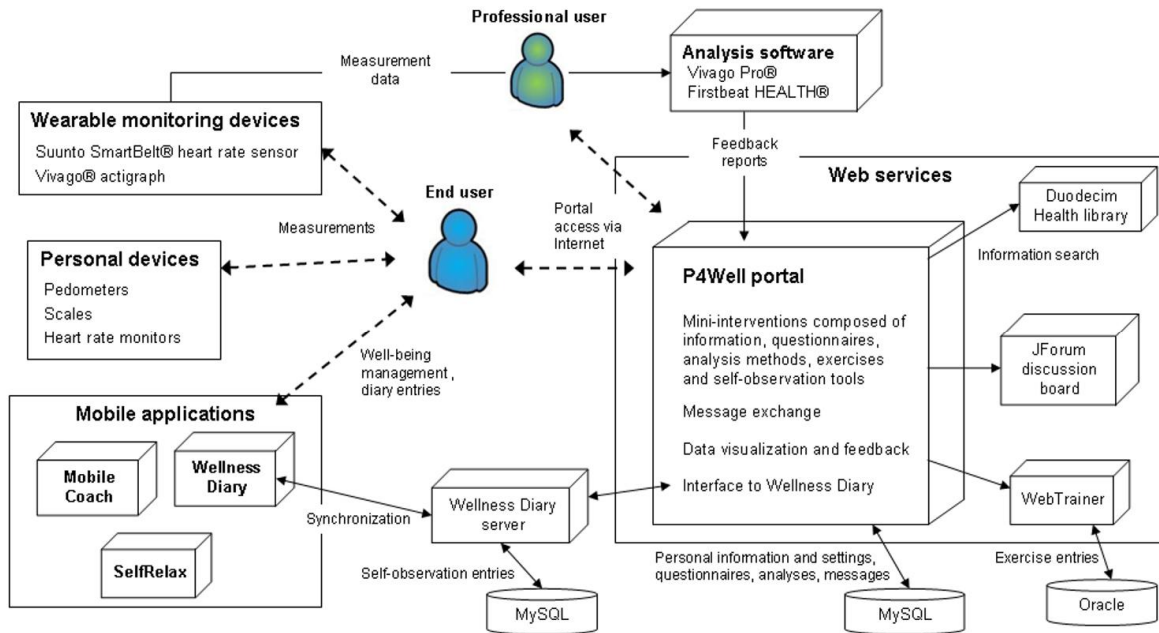


Fig. 1. The P4Well system architecture.

integrated into a web portal providing a novel, coherent, and interactive Personal Health System (PHS) (Fig. 1.).

We have started evaluation studies of the P4Well concept in January 2009. Currently, 34 middle-aged users (12 female and 22 male) are participating in the evaluation. In this paper, we discuss the first user study experiences of our ongoing research. The main goal of the study is to preliminarily assess the feasibility, acceptability, and usefulness of the P4Well concept, based on our experiences and baseline questionnaires. The results will be taken into account when further designing the role of technology, experts, and peer groups in the concept. In addition to the user studies, we describe the P4Well PHS in brief.

## II. P4WELL CONCEPT

### A. Personal Monitoring Devices

The concept involves personal and wearable monitoring devices, such as *Suunto* heart rate monitors (Suunto Ltd., Vantaa, Finland) for measuring exercise intensity and duration and *Vivago Personal Wellness Manager* (Vivago Ltd., Helsinki, Finland) for sleep and activity monitoring. In addition to these monitoring devices, special analysis software (*Firstbeat HEALTH*, Firstbeat Technologies Ltd., Jyväskylä, Finland; and *Vivago Pro*, Vivago Oy, Helsinki, Finland) are used to analyze the monitored data and provide feedback for the user on the balance of stress and recovery in daily life, and on sleep quality and quantity. Devices such as scales and pedometers are also used in self-observations and measurements.

### B. Mobile Applications

Three mobile phone wellness applications are used in the concept: *Nokia Wellness Diary* (Nokia Corp., Espoo, Finland), *Firstbeat Mobile Coach* (Firstbeat Technologies

Ltd., Jyväskylä, Finland), and *Relaxline SelfRelax* (Relaxline, France). The purpose of the applications is to motivate and empower the user to make self-observations of his/her wellness and mental wellbeing on a daily basis with easy-to-access tools [11]. With the mobile applications, the user can also monitor his/her long-term progress in lifestyle changes, to assess achievements, as well as maintaining of personal goals. *Wellness Diary* is a personal diary application [12]. It is used to record and monitor various factors related to physiological and psychological wellbeing, e.g., stress level, sleep quality and quantity, exercise amounts and work time. *Mobile Coach* is used to create a personal exercise plan which is automatically updated based on analysis of performed exercises. *SelfRelax* is a mobile relaxation application which contains multiple relaxation programs with differing lengths and purposes, among which the user can choose based on her needs.

### C. P4Well Portal

P4Well portal is implemented on top of the *Mawell S7* (Mawell Ltd, Oulu, Finland) portal platform. The platform provides ready functionalities such as user account management, authentication, and messaging utility between professional users and normal users.

The tools in the portal integrate psychological theories of behavior change, physiological knowledge, personal health technologies and psychological intervention methods to form a holistic service for mental and physical wellbeing management. The content of the portal is divided into modules focusing on a particular factor of wellbeing, e.g. sleep, exercise or mood. These modules consist of five phases: information, evaluation of personal status, planning of lifestyle changes, putting the plans into action, and follow-up.

The following independent web services are integrated into the portal: *Nokia Wellness Diary Connected* (Nokia Corp., Espoo, Finland), *Firstbeat WebTrainer* (Firstbeat Technologies Ltd., Jyväskylä, Finland) and *Duodecim Health Library* (Duodecim Medical Publications Ltd., Helsinki, Finland). *Wellness Diary Connected* is integrated into the portal in such a way that diary entries can be made and charts examined through portal interface [13]. The entries can be synchronized between the portal and mobile *Wellness Diary*. *WebTrainer* is a web-based application similar to *Mobile Coach*. The user can access *WebTrainer* via portal by using the same credentials. *Duodecim Health Library* is a knowledge base for health-related information.

Professional support and peer support play an important role in the concept. The user can consult experts in psychology and physiology by sending them private messages. Discussion board provides means to communicate and share experiences with other users.

#### D. P4Well Intervention

In addition to technology design, we have designed a specific intervention program, which is based on use of the P4Well technologies. For scalability, the intervention program is based on combination of group meetings with individually tailored action plan, which is supported by the technologies. In the current evaluation, we have used the following intervention process, including three meetings with professionals:

**The first meeting** is an informative and motivating lecture, first psychological intervention session, and introduction to technologies. The lecture is given by professionals to the participants. In the meeting, all P4Well technologies as well as access to the P4Well portal are provided to the users, and they start sleep monitoring with *Vivago*. In addition, a three day heart rate recording accompanied with stress and recovery analysis by *Firstbeat HEALTH* is carried out, and first questionnaires for psychological intervention and user study are filled in. The participants get personal feedback from their *HEALTH* heart rate recordings after the meeting. Also, the participants are encouraged to use the delivered devices and start their self-observations supported by the technologies and mobile wellness applications after the meeting.

During **the second meeting** (after a month) *Vivago* sleep time monitors are collected back for analysis (device's memory capacity lasts for one month), and second questionnaires for psychological intervention and user study are filled in. Analyzed sleep time reports are delivered to the participants through the P4Well portal after the meeting. The participants are encouraged to continue their self-observations with the provided technologies.

**The third meeting** (after three months) is the final meeting with professionals. During this meeting, all the provided technologies are collected from the participants (if the technologies were borrowed), and final questionnaires are filled in. After the meeting, three day heart rate recording accompanied with stress and recovery analysis by

*Firstbeat HEALTH* is repeated. A final assessment of the intervention to the participants is carried out based on the self-observations and the acquired data.

Over the three meetings, the participants have had access to the P4Well portal and the provided technologies (II.A-D). In addition, they can contact a wellness or healthcare professionals (depicted Professional users in Fig. 1) through the P4Well portal for asking help or getting analyzed results of the computerized intervention tools.

### III. USER STUDY METHODS

In this paper, we discuss the first user study experiences of the concept. Our study was carried out with 34 participants between the first and second meetings (II.D). The voluntary participants formed two different groups: 12 participants (males, aged  $48 \pm 4.8$  years) were recruited through a newspaper advertisement (Group 1). The other group consisting of 22 participants (aged  $54 \pm 5.7$ ) were entrepreneurs in the Helsinki metropolitan area, recruited through a campaign by their occupational health provider (Group 2). Group 1 included people who had sleep problems or mild depression. In Group 1, the participants had to report some mild mental health problems to meet a requirement for entry to the study. Group 2, on the other hand, included entrepreneurs who suffered from stress symptoms or lack of time for recovery. The profile of the distinct groups was hence quite different, representing two typical potential user groups for our service concept.

The participants of both groups were asked to compare the following topics: 1) automatic wellness data collection versus own notes and subjective experience; 2) automatic analysis versus expert feedback; and 3) personal solutions versus social support, e.g., peer groups. The questionnaires were filled in by the participants at the first meetings (baseline questionnaires) (See II.D). The participants filled in background questionnaires on demographic information and their habits as information technology and wellness technology users. In addition, we asked how they followed up their wellness, what were their main goals considering positive lifestyle changes, and how they saw the importance and role of experts, peer groups, devices and internet services in supporting their personal wellbeing.

### IV. PRELIMINARY USER STUDY EXPERIENCES

At the baseline, all the volunteers had been using the Internet on a daily basis. Five participants reported that they had been using the Internet daily with their mobile phone. However, health and wellness related portals were used seldom or never. If used, the portals were used for checking health related information e.g., on diseases or medicines. A blood pressure monitor (19/34), heart rate meter (11/34) and step counter (10/34) were the most popular wellness devices in use.

The participants had mainly taken notes of exercise (14/34) and weight (13/34), before they participated in our evaluation (Table I). Notes were made mostly daily (10/34) or weekly (11/34). Majority (19/34) of the participants

replied that controlling the stress was one of the most challenging personal wellness factors that they would like to pay attention to. Sleep and mental wellbeing were seen almost as important as the stress management. None of the participants, however, reported making self-observations related to their stress level, and only two participants had followed up their sleep or emotional feelings. Exercise activity and weight management were seen also as important wellness factors (Table I).

Participants' attitudes towards mobile phone applications or wellness devices were more positive than towards Internet wellness portals. Most (30/34) participants agreed (16/34) or slightly agreed (14/34) that wellness *devices* can motivate them for a healthy lifestyle, but only 9/34 respondents agreed and 20/34 slightly agreed that Internet services can motivate for positive wellness level changes. Moreover, communication with professionals and their personal feedback were seen as the key issue for this kind of service concept: 23 users agreed (9 slightly agreed, two neutral) that an experts' role is important for personal wellness management. Peer-group support, on the other hand, was not perceived as an influencing approach in the wellness service domain (8 neutral and 3 slightly disagreed).

Generally, according to the participants' feedback, the content of the intervention meetings and the P4Well portal were found useful, and the provided technologies were received enthusiastically. Furthermore, although the participants reported that they have been using the personal devices and mobile health applications actively, the web-portal and its peer-support services had only been visited occasionally, according to the portal's log information.

## V. DISCUSSION AND CONCLUSION

The usefulness of CCBT methods has been reported in the literature [7]. In the P4Well concept, we have utilized the CCBT and physiological methods with modern mobile phone applications and different measurement devices. The P4Well approach provides an opportunity for self-observation everywhere, regardless of time and location [9].

Currently, the first evaluations of the P4Well service concept with working-age participants are ongoing (about 2/3 of the intervention time completed). According to our experiences, the P4Well service concept was perceived favorably by the voluntary participants. The held intervention sessions were also successful.

Our preliminary user study results suggest that we have chosen the focus of the concept, i.e. wellbeing and load recovery, appropriately. The participants saw stress, sleep, and mental wellbeing as important wellness factors (similar to our focus for self-observation), but they had not self-monitored these factors before. This was probably due to the non-common availability of such tools, before our introduction to P4Well concept. The results of this study support our vision that people wish to get mobile technology-based mental wellbeing self-observation tools with a low-barrier to expert consultations.

TABLE I

WELLNESS FACTORS (NUMBER OF USERS N=34).		
Wellness factor	CONSIDERED AS AN IMPORTANT GOAL	Has taken notes of the factor
Exercise activity	18	14
Weight management	14	13
Stress	19	0
Mental well-being	17	2
Sleep	18	2

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