With Me – The European Platform to Promote Healthy Lifestyle and improve care through a Personal Persuasive Assistant

WITH-ME (332885)

[D1.2] - State-of-the art report on health prevention

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Abstract	This deliverable contains an overview of the state-of-the art on health prevention. It provides an overview about (1) preventive measures and their effects on health, (2) the current available preventive technologies, and (3) the current preventive measures implemented within various European Healthcare systems.
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1 Executive summary

This report tightly relates to T1.1 *State-of-the-art Evaluation on prevention and prevention technology* in which the aim is to analyse the scientific evidences related to the health effects of, mainly, physical activity and sport and secondary of social interaction and psychological wellbeing. A specific attention is given to summarize the direct preventive effects to several chronic diseases, including: cardiovascular disease, stress and mental health, health prevention for obesity and finally hearing loss.

In this deliverable we have analysed today's implementation of preventive medicine by analysing literature reports and also by involving public/local health authorities and health care providers. In addition, the general shift from wellbeing to care is investigated in term of (1) shift in responsibilities (consumer to doctor), (2) shift in stakeholders (lifestyle to care), (3) shift in functionality and requirements and (3) shift in business model (market to reimbursed).

The WITH-ME platform will be tested in three countries where each pilot will focus and illustrate different functionalities and use of the system keeping in mind the envisioned overall scenarios:

- Vision 1: "LifeStyle"
- Vision 2: "LifeCare"
- Vision 3: shift from "LifeStyle" to "LifeCare"
- Vision 4: shift from "LifeCare" to "LifeStyle"

LifeStyle is the state where preventive measures such as sports, physical activity, social interaction and psychological wellbeing are promoted to prevent several chronic diseases including cardiovascular disease, diabetes, hypertension, obesity, depression and osteoporosis. The goal is to entice and support people to change their behaviour.

LifeCare, or primary prevention is the state where (1) healthcare services are provided together with (2) a promotion of healthy complementary behaviours (for the end user) and (3) tools and an environment to promote "team building" (patient + informal and formal carers). In other words the dyad: patient-carers.

Shifts between the two mentioned states are possible: people can shift from the LifeStyle state to the LifeCare state when they are at risk of becoming ill or when a disease is established. Later on, a shift from the LifeCare state to the LifeStyle state comes to pass once a patient enters the recovery phase.

Use Case / Pilot	Lifestyle	LifeCare	Transition Lifestyle to LifeCare	Transition LifeCare to Lifestyle
Overweight / Obesity	✓ Belgium pilot			
Occupational therapy (stress management)				✓ Finnish pilot
Cardiovascual rehabilitation		✓ Spanish pilot		

The state of the art assessment in this report therefore focused on these three health aspects.

2 Introduction

2.1 Purpose, context and scope of this deliverable

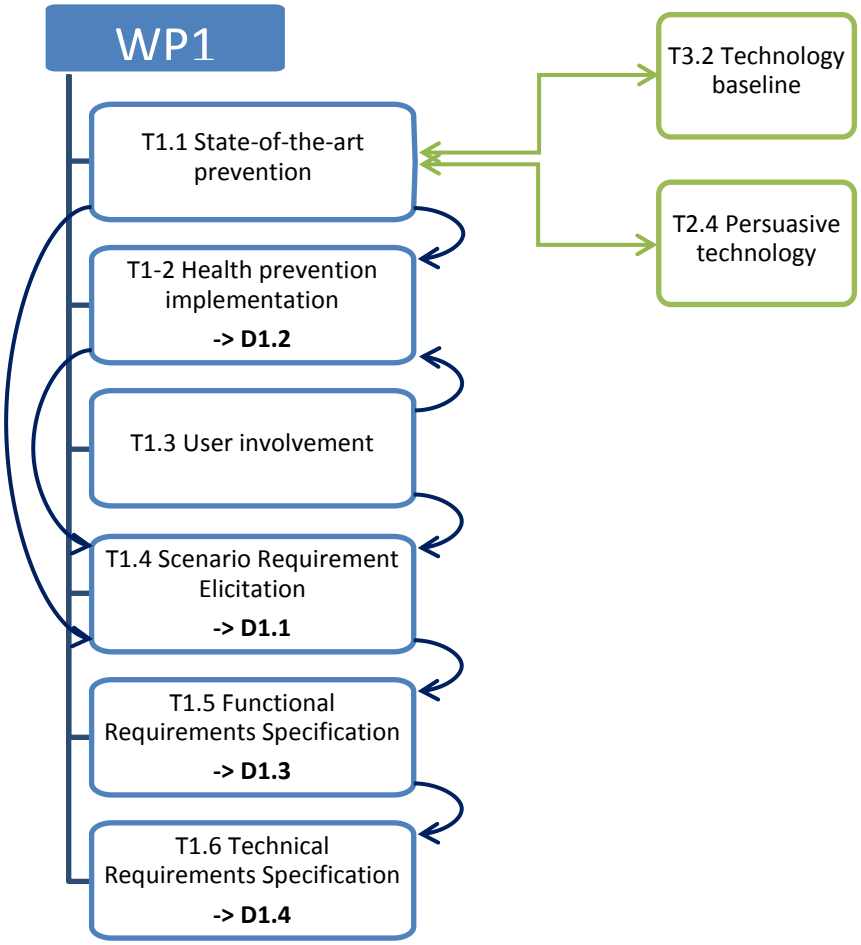
T1.1 *State-of-the-art Evaluation on prevention and prevention technology*, is complementary to task T1.2 *Current health prevention implementation and shift from Lifestyle to Care* and both generate the deliverable D1.2 *State-of-the art report on health prevention* (ADA, M6).

T1.1 *State-of-the-art Evaluation on prevention and prevention technology* in which the aim is to analyse the **scientific evidences** related to the health effects of, mainly, physical activity and sport and secondary of social interaction and psychological wellbeing. A specific attention will be given to summarize the direct preventive effects to several chronic diseases, including: cardiovascular disease, diabetes, hypertension, obesity and depression.

Additionally, we have also investigated current and emerging **technologies** (physiological sensing, localisation, identification, kinematics, and kinetics, affective), **systems** (standardised or proprietary) and **services** providing and promoting healthy lifestyle.

T1.2 analysed today's implementation of preventive medicine by analysing literature reports and also by involving public/local health authorities and health care providers. In addition, the general shift from wellbeing to care will be investigated in term of (1) shift in responsibilities (consumer to doctor), (2) shift in stakeholders (lifestyle to care), (3) shift in functionality and requirements and (3) shift in business model (market to reimbursed).

Diversity across different countries will be analysed.



Ultimately T1.1 and T1.2 were used to bring information to With-Me oaverall questions and objectives:

1. Can With-Me (or persuasive technologies) improve user implication in the care process and in control of healthy lifestyle?
2. Can With-Me (or persuasive technologies) increase users' adherence to treatment/exercise?
3. Does personal persuasive coaching (with the motivational module of WP2) help to manage stress, stick to a diet or rehabilitate better or sooner after a stroke?
4. How does With-Me (1) gather data by a large variety of sensors and controlling treatment by various actuators at home, on the move, at work, in health centres, clinics and hospitals, (2) Analyse the gathered data and (3) manage the data streams and transform it into actionable information for different stakeholders?

3 Scientific evidences of the health benefits of physical activities

Toward the end of 1980 scientific communities started to study and analyse the relationship between physical activity and health benefits or risks. Since then we can notice quadratic trend in the volume of regular and review.

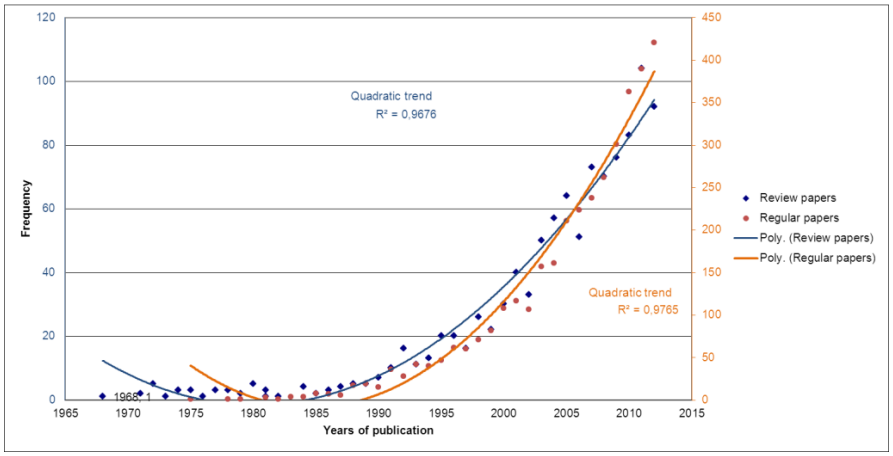


Figure 1. Volume of publications per year related to the health benefits of physical activity. Data collected in July 2013

Today, Physical activity (PA) is recognised as being important for reducing the overall burden of disease. Based on sound epidemiological evidence, guidelines are published, which recommend that every adult should accumulate moderate intensity activity for half an hour on most days of the week (WHO 2010). Additional health benefits would accrue for those undertaking some additional vigorous activities, and for those including more opportunities to be physically active into all aspects of everyday life. It is important continually to update the evidence on which these recommendations are based. In this work we have gathered the latest studies analysing the health impacts of PA and sedentary behaviours.

3.1 Definition

"Physical activities", "exercise", "physical fitness". These terms describe different concepts and are often confused with one another, and the terms are sometimes used interchangeably. We are using the definitions proposed by Caspersen (Caspersen1985):

Physical activity: Any bodily movement produced by skeletal muscles that result in energy expenditure.
Exercise: Planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness.
Physical fitness: A set of attributes that people have or achieve that relates to the ability to perform physical activity.
In this document, *Physical Activity (PA)* will encompass also e*xercise* and *physical fitness.*

3.2 Methodology

As there is an important volume of scientific publications we have conducted this state-of-the art by following as much as possible the systematic review methodology. A systematic review is a scientific tool that can be used to appraise, summarise, and communicate the results and implications of otherwise unmanageable quantities of research. In this way, healthcare providers, for example, can evaluate existing or new technologies and practices efficiently and consider the totality of available evidence. Systematic reviews are of particular value in bringing together a number of separately conducted studies, sometimes with conflicting findings, and synthesising their results.

We selected PubMed (http://www.ncbi.nlm.nih.gov/pubmed) which comprises more than 19 million citations for biomedical literature from MEDLINE, life science journals and online books. MEDLINE is

the US National Library of Medicine's premier bibliographic database covering the fields of medicine, nursing, dentistry, veterinary medicine, the health care system, and the preclinical sciences.

According to our focus, “physical activity health” (MeSH terms and/or each fields) keywords were used and generated 3723 results (blue dots on among which 1065 were classified by PubMed as “review” (orange dots on

Beside Pubmed database, we included Cochrane references.
Papers were sorted by date (newest->oldest). Starting from the most recent paper:

- Abstracts were read (from 2013-2005)
- Papers were deleted from the database if out of the scope:
  - Article about animals
  - Full paper not available in English
- Some references were added by following references inside articles.
- Recent papers (2009-2013) about “sendentary behaviours” were added

3.3 State-of-the-art

3.3.1 Inactivity and sedentary behaviours

The term sedentary behaviour (from the Latin word “sedere”, “to sit”) describes a distinct class of activities that require low levels of energy expenditure in the range of 1.0–1.5METs(multiples of the basal metabolic rate) (Ainsworth 2000) and involve sitting during commuting, in the workplace and the domestic environment, and during leisure.

Available data about inactivity and sedentary behaviours (such as total sitting time; TV viewing time only, TV viewing time and other screen-time behaviours, TV viewing time and other sedentary behaviours) suggests that 31% of the world’s population is not meeting the minimum recommendations for physical activity (Hallal2012) and, in 2009, the global prevalence of inactivity was 17% (WHO2009). Despite promising positive trends in leisure-time (discretionary) physical activity in some countries, incidental, transportation-related, and occupational physical activity prevalences are falling (Kohl2012). The global challenge of physical inactivity is further amplified by the risk it conveys. Lee and colleagues (Lee2012) presented persuasive evidence that 6–10% of all deaths from non-communicable diseases worldwide can be attributed to physical inactivity, and this percentage is even higher for specific diseases (eg, 30% for ischaemic heart disease).
More specifically Rhodes (Rhodes2012) reported that sedentary behaviour was primarily measured as TV viewing or computer use, followed by analysis of a more omnibus assessment of time spent sitting. Sedentary behaviour was correlated with education, age, employment status, gender, BMI, income, smoking status, moderate-to-vigorous physical activity (MVPA), attitudes, and depressive symptoms/quality of life. Their results pointed to the high specificity of various sedentary behaviours (e.g., TV viewing versus sitting and socializing), suggesting that the research domain is complex and cannot be considered the simple absence of MVPA. Several sociodemographic and health factors appeared reliably linked to sedentary behaviour, yet there is an obvious absence of research focused on cognitive, social, and environmental factors that could be of use in anti-sedentary behaviour interventions.

Several studies reported that people who are usually inactive can improve their health and wellbeing by becoming even moderately active on a regular basis. With-Me work-package 2 investigates the cognitive and social determinants that can help changing some sedentary behaviours.

The good news is: even a small modification toward less sedentary behaviour is beneficial. Powell (Powell 2011) recently reported that some activity is better than none, and more is better than some. Even light-intensity activity appears to provide benefit and is preferable to sitting still. Given emerging evidence that light activities have health benefits and with advances in tools for measuring activities of all intensities, it may be time to shift to zero activity as the conceptual starting point for study.

So let’s start moving!

3.3.2 General benefits of physical activities

From the observations about the effects of inactivity, the scientific community has have investigated the health impact of PA.

In 2004, Bauman and collaborators (Bauman2004) published an epidemiological review about the health benefits of physical activity. Combined with other review papers (WHO 2002, USDHHS 1996) we can note that:

- Physical activity need not be strenuous to achieve health benefits.
- Greater health benefits can be achieved by increasing the amount (duration, frequency, or intensity) of physical activity.
- Regular physical activity that is performed on most days of the week reduces the risk of developing or dying from some of the leading causes of illness and death in the United States.
- Regular physical activity:
    - Reduces the risk of dying prematurely.
    - Reduces the risk of dying from heart disease.
    - Reduces the risk of developing diabetes.
    - Reduces the risk of developing high blood pressure.
    - Helps reduce blood pressure in people who already have high blood pressure.
    - Reduces the risk of developing colon cancer.
    - Reduces feelings of depression and anxiety.
    - Helps control weight.
    - Helps build and maintain healthy bones, muscles, and joints.
    - Helps older adults become stronger and better able to move about without falling.
    - Promotes psychological well-being.

Given the numerous health benefits of physical activity, the hazards of being inactive are clear. Physical inactivity is a serious, nationwide problem. In order to address this issue Physical Activity recommendations have evolved over time (USDHHS 1996):

1. Physical activity for better health and well-being has been an important theme throughout much of western history.
2. Public health recommendations have evolved from emphasizing vigorous activity for cardiorespiratory fitness to including the option of moderate levels of activity for numerous health benefits.
3. Recommendations from experts agree that for better health, physical activity should be performed regularly. The most recent recommendations advise people of all ages to include a minimum of 30 minutes of physical activity of moderate intensity (such as brisk walking) on most, if not all, days of the week. It is also acknowledged that for most people, greater health benefits can be obtained by engaging in physical activity of more vigorous intensity or of longer duration.
4. Experts advise previously sedentary people embarking on a physical activity program to start with short durations of moderate-intensity activity and gradually increase the duration or intensity until the goal is reached.
5. Experts advise consulting with a physician before beginning a new physical activity program for people with chronic diseases, such as cardiovascular disease and diabetes mellitus, or for those who are at high risk for these diseases. Experts also advise men over age 40 and women over age 50 to consult a physician before they begin a vigorous activity program.
6. Recent recommendations from experts also suggest that cardiorespiratory endurance activity should be supplemented with strength-developing exercises at least twice per week for adults, in order to improve musculoskeletal health, maintain independence in performing the activities of daily life, and reduce the risk of falling.

3.3.3 Interventions and strategies

Regular physical activity is associated with lower morbidity and mortality rates from cardiovascular disease, diabetes mellitus, cancer, and osteoporosis. Despite these proven health benefits, the majority of the adult population in Western nations does not meet the public health recommendations for physical activity (Jones 1998). Therefore, there is a need for the delivery of effective interventions aimed at positively influencing physical activity behavior.

In order to have a real impact and benefits, generic recommendations (see previous section) or more specific ones have to be implemented and executed by each (group of) individuals. The definition of the intervention and its strategy is crucial for long term adherence. They should address needs of the population/individuals while trying to promote physical activity. Some trends have been identified

1. Consistent influences on physical activity patterns among adults and young people include confidence in one's ability to engage in regular physical activity (e.g., self-efficacy), enjoyment of physical activity, support from others, positive beliefs concerning the benefits of physical activity, and lack of perceived barriers to being physically active(USDHHS 1996).
2. For adults, some interventions have been successful in increasing physical activity in communities, worksites, and health care settings, and at home (USDHHS 1996).
3. Professional advice and guidance with continued support can encourage people to be more physically active in the short to mid-term. However more research is needed to establish which methods of exercise promotion work best in the long-term to encourage specific groups of people to be more physically active (Hillsdon 2005).

Strategies

For specific interventions that have been tested under different strategies we point to the website of the Missouri Department of Health & Senior Services[1] which present evidence-based interventions where strategies were

- Campaigns and Promotions: This can occur through television advertisements, newspapers, posters, billboards, brochures and a number of other communication channels. When used alone, have been effective in changing knowledge, awareness, and attitudes about physical activity. Some campaigns have also demonstrated the ability to increase individuals' intention to be active or their confidence in becoming physically active.
- Group Education: Group education interventions may include presentations as well as individual or group activities that occur in classrooms community centers, churches, fitness or recreational facilities, worksites and other locations. They can be most effective if they take into consideration both individual characteristics (e.g., knowledge, skills) and group circumstances (e.g., social norms, peer pressure). For example, it may be more helpful to have different group members talk about how physical activity has improved their physical or mental health as opposed to simply describing the relationship between physical activity and health.
- Individual Education: Individual education interventions work to increase physical activity by enhancing individual knowledge and skills as well as altering attitudes and beliefs about physical activity. This may work best when information is matched to the individual. Using tailored messages to take into account specific individual characteristics in creating a physical activity message designed for the individual.
- Environments and Policies: Environmental interventions are designed to change structures and physical surroundings in order to influence individuals' capacity to make healthy choices that can impact their own health or the health of those around them. Policy interventions are laws or regulations that are put in place to achieve a goal, including organizational policies or public policies at the local, state or national levels.
- Multiple Strategies: Any combination of the above strategies

Each of these strategies is most effective when it is combined with other strategies. For example, changing knowledge, attitudes, and beliefs will do little to increase physical activity if there are no places to go to be physically active. Similarly, changing knowledge, attitudes, and beliefs will not be as effective if there is not social support for engaging in physical activity.

Interventions

Interventions were very diverse such as "developing rural walking trails", "encouraging weight loss through a media campaign and support groups", "Lifestyle and structured interventions to increase physical activity and cardio - respiratory fitness", etc.

[1] http://health.mo.gov/data/interventionmica/PhysicalActivity/index_5.html#multi

The effectiveness of tailored messages for individual education interventions have been proved by different studies. For example, in (Marcus 1998) study, the participants given the motivationally-tailored individualized feedback showed greater increases time spent in physical activity and were more likely to achieve recommended physical activity levels. Some other studies, as in (Rhodes 2010), suggest that in addition to tailored messages, if a execution plan is provided to individuals, higher levels of physical activity is reported than those only receiving the physical activity guidelines and recreation guide. So in order to bridge intent to behavior an intermediary construct such as the planning guide (the physical activity planning materials) is critical.

The use of reinforcement methods have also been proven to be successful to reduce overweight and percentage of body fat in fat children who were reinforced for exercising and a reduction in specific sedentary behaviors. In (Epstein 1995) it is said that reducing access to television and other sedentary behaviors may be important in treating childhood obesity and that enforcing a reduction in specific sedentary behaviors provides children the opportunity to choose how to allocate newly available time.

For retired people, risk reduction programs directed at retiree populations (through mail using individualized recommendation letters, newsletters, self-management and health promotion books) can improve health risk status, as in (Fries 1993).

In general, PA interventions studies reported physical fitness-related outcomes such as cardiorespiratory fitness, flexibility and walking speed increase, and loose of body weight and waist circumference in addition to changes in physical activity level itself.

With-Me ecosystem development will take into considerations “campaigns and promotions”, “group education”, “individual education”, “environments and policies” strategies but will mainly focus on **individual or interpersonal strategies** used in behavioral and social science research on physical activity.

These strategies are based on theories and models (reviewed and described in D2.1):

- Classic learning theories
- Health belief model
- Transtheoretical model
- Relapse prevention
- Social cognitive theory
- Theory of planned behavior
- Social support

(USDHHS 1996 page 217-234) reviewed intervention studies (table 6.2 from USDHHS 1996) in which the measured outcome was physical activity, adherence to physical activity, or movement in stage of change.

Technological benefits

Technology is a double-edged sword. Computers, for example, contribute to sedentary leisure-time behaviors. On the other hand, technology has been used to promote physical activity and change exercise behavior (Marshall 2003). For years, pedometers, accelerometers, and heart rate monitors have been used as motivational tools. Newer technologies and approaches being used to promote physical activity include global positioning system (GPS), geographic information systems (GIS), interactive video games, and persuasive technology (is defined as a computer system, device, or application that is intentionally designed to change a personal’s attitude or behavior). Also, experts suggest that Internet-based physical activity interventions should be used by clinicians to promote and change exercise behavior

With the number of people having access to and using mobile devices, which are always connected to Internet, and rapidly increasing, the mobile ecosystem is more and more used as a mode of delivery for physical activity programs. The strength of mobile technology-based physical activity interventions lies in the fact that with this mode of delivery large numbers of individuals can be reached at lower costs than with face-to-face interventions (Marcus 2000). Moreover, participants can access large amounts of information, and they can choose the time when they would like to interact and receive information.

For example, utilizing computer expert systems and self-help manuals to provide individually-tailored, motivationally-matched interventions appears to be an effective, low-cost approach for enhancing physical activity participation in the community (Marcus 1998, Fries 1993).

As conclusion, there is indicative evidence that technology-based physical activity interventions are more effective than a no-technology strategy (Irvine 2013). The added value of specific components of technology-based physical activity interventions such as increased supervisor contact, tailored information, or theoretical fidelity remains to be established. Methodological quality as well as the type of physical activity outcome measure varied, stressing the need for standardization of these measures (Marshall 2003).

Table 6-2. Studies of interventions to increase physical activity among adults

Study	Design	Theoretical approach	Population
Individual approaches			
Weber and Wertheim (1989)	3 month experimental	Self-monitoring	55 women who joined a gym; mean age = 27
King, Haskell, et al. (1995)	2 year experimental	Behavioral management	269 white adults aged 50–65 years
Lombard, Lombard, Winett (1995)	24 week experimental	Stages of change	155 university faculty and staff; mostly women
Cardinal and Sachs (1995)	12 week experimental	Stages of change	113 clerical staff at a university; mean age = 37; 63% black
Belisle (1987)	10 week quasi-experimental with 3-month follow-up	Relapse prevention	350 people enrolled in beginning exercise groups

For each study they also present the intervention and findings.

Intervention	Findings and comments
I-1: Self-monitoring of attendance, fitness exam I-2: Self-monitoring, staff attention, fitness exam C: Fitness exam	I-1 had better attendance than I-2 overall; interest in self-monitoring waned after 4 weeks
I-1: Self-monitoring, telephone contact, vigorous exercise at home I-2: Self-monitoring, telephone contact, moderate exercise at home I-3: Self-monitoring, vigorous exercise in group	Better exercise adherence at 1 year in home-based groups; at year 2 better adherence in vigorous home-based group; 5 times per week schedule may have been difficult to follow
I-1: Weekly calls, general inquiry I-2: Weekly calls, structured inquiry I-3: Call every 3 weeks, general inquiry I-4: Call every 3 weeks, structured inquiry	Frequent call conditions had 63% walking compared with 26% and 22% in the infrequent condition; frequent call and structured inquiry had higher rate of walking than other groups
I-1: Mail-delivered lifestyle packet based on stages of change I-2: Mail-delivered structured exercise packet with exercise prescription C: Mail-delivered fitness feedback packet	No difference in stage of change status among or within groups
I: Exercise class and relapse prevention training C: Exercise class results across experimental groups	Higher attendance in relapse prevention group over 10 weeks and at 3 months; high attrition and inconsistent

I = intervention; C = control or comparison group

4 Technologies, systems providing and promoting healthy lifestyle

In this section we have reviewed technologies emerging in EU research project (section 4.1) and products (section 4.2 and 4.3) providing and promoting healthy lifestyle.

4.1 EU R&D projects

In the past several EU projects have addressed issues on health prevention by e.g. having a healthy lifestyle. The project partners have identified the below related projects and for each project outlined how they are related to the issues addressed in WITH-ME.

Name	Funding Instru-ment	Description	Distinction
Guarantee	ITEA2	A technical solution for personal safety in the home environment is provided. This solution introduces local and network-supported decision making for safety applications on the basis of sensor input and with immediate response and feedback to the people concerned.	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas Guarantee addresses personal safety in the home environment.
MIDAS	ITEA2	Complete and intelligent solutions using different sensor types, actuators and connectivity technologies are developed in order to provide customised support to all people in need of assistance, according to their own specific situation – age, handicap, etc. – in a non-intrusive and respectful way. This will be achieved by means of friendly adaptive interfaces, both indoors and outdoors, designed to overcome the natural scepticism and unease of ageing people with respect to technology.	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas MIDAS supports elderly and handicapped people in need of assistance.
ARCADIA	FP7	This project identifies international, national and cluster programs and aims at aligning the Strategic Research Agendas and roadmaps in the Embedded Systems field. This should improve the coordination of efforts made by the individual projects, and thus optimize resource usage.	With-Me would be one of the projects whose efforts could potentially be coordinated with others through ARCADIA.
COMPLEX	FP7	A new design environment for platform-based design-space exploration is developed. This platform offers developers of mobile embedded systems a highly efficient design methodology and holistic framework for iteratively exploring the design space of embedded hardware/software (HW/SW) systems.	With-Me provides a specific health preservation platform for the end user, whereas COMPLEX delivers a general method for the design of embedded HW/SW systems.
HITCH	FP7	HITCH develops a vision of how interoperability and conformance testing of eHealth systems should be organized in Europe. This ranges from the analysis of eHealth testing tools, over quality management in interoperability testing, to complete certification and quality labelling scenarios.	Where applicable, With-Me will adhere to interoperability standards set forth by HITCH.

Name	Funding Instru-ment	Description	Distinction
DIGITAL. ME	FP7	This project aims at integrating all personal data in a personal sphere by a single, user-controlled point of access: the di.me userware. This tool will run on the user's devices, and rely on scalable peer-to-peer communication in order to avoid external storage of personal data as far as possible and to enhance data portability. External services (e.g. web-communities, enterprise systems) will be integrated via gateways.	With-Me provides a health preservation platform, whereas DIGITAL.ME aims at protecting personal data in today´s information society.
SMART PERSONAL HEALTH	FP7	The full benefit of "personal health systems" (PHS), a key element of growth of eHealth in Europe, can only be realized if they are interoperable. Hence, through workshops and a conference, this project promoted awareness among stakeholders about issues and challenges related to personal health systems interoperability, from technical to organizational and legal aspects.	With-Me provides a specific health preservation platform for the end user, whereas SMART PERSONAL HEALTH raised awareness among stakeholders about interoperability issues between PHS devices.
PASTA	FP7	The PASTA project combines research on electronic packaging and interconnection technology with textile research to realize a more comfortable and more robust integration of electronics in textile. The four addressed application areas are outdoor sports, leisure wear, luminous textile with integrated photovoltaic cells, and motion sensors for evaluating kinematics.	With-Me provides a health preservation platform for the end user. Smart textiles are the future of wearable monitoring and therefore should be interoperable with the With-Me platform.
TRANSFORM	FP7	The underlying concept of TRANSFORM is to develop a 'rapid learning healthcare system' driven by advanced computational infrastructure that can improve both patient safety and the conduct and volume of clinical research in Europe.	With-Me provides a health preservation platform for the end user, whereas TRANSFORM focuses on rapid eLearning in the healthcare system.
CHIRON	ARTEMIS	The CHIRON Project intends to combine state-of-the art technologies and innovative solutions into an integrated framework designed for an effective and person-centric health management along the complete care cycle.	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas CHIRON is focused on monitor the activities of a patient to know how its disease evolves.
EMERGE	STREP	This project follows an integrated approach to develop and implement a model for recurring behaviors and experiences of elderly people, in order to detect deviations from their typical behavior and to reason on acute disorders in their health condition. EMERGE tries to improve emergency assistance through early detection and proactive prevention. Ambient and unobtrusive sensing is used to enhance user acceptance.	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas EMERGE is strongly focused on the elderly. In addition In addition, With-Me will deploy powerful persuasive technologies and techniques.
ROSETTA	AAL	The objective of ROSETTA is, (i), to help Community-dwelling people with progressive chronic disabilities, such as Alzheimer's Disease and Parkinson's Disease, to retain their autonomy, and (ii), to support their (in)formal caregivers. Towards this end, an ICT system for activity guidance and awareness services is developed. The system monitors activities of elderly people, detects unexpected events, and alarms caregivers in case of emergencies.	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas ROSETTA is focused on the elderly, helps in emergency situations, and facilitates care arrangements.
ADAMS	FP7	The main objective of the ADAMS project is to promote the industrial exploitation and	With-Me provides a specific health

Name	Funding Instru-ment	Description	Distinction
		enhancement of the MARTE and other relevant standards for the development of real-time and embedded systems using both, model and component design paradigms	preservation platform for the end user, whereas ADAMS is focused the Embedded Systems field.
AESOP	FP7	IMC-AESOP investigates a Service-oriented Architecture approach for monitoring and control of very large scale Process Control Systems (batch and continuous process applications)	With-Me provides a health preservation platform for the end user, whereas AESOP focuses on standardization of sensors communication.
CHOSEN 2	STREP	The high level objective of the CHOSeN project is to develop application-specifically adaptable communication technologies enabling the real deployment of smart wireless sensor networks in large-scale, performance-critical application fields like the automotive and the aeronautic	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas CHOSEN is focused on communication technologies
SM4ALL 2	STREP	The SM4ALL project will investigate an innovative middleware platform for inter-working of smart embedded services in immersive and person-centric environments, through the use of composability and semantic techniques for dynamic service reconfiguration. By leveraging on P2P technologies, the platform is inherently scalable and able to resist to devices' churn and failures, while preserving the privacy of its human users as well as the security of the whole environment. This is applied to the challenging scenario of private houses and home-care assistance in presence of users with different abilities and needs (e.g., young able bodied, aged and disabled)	With-Me builds a common platform for AAL, rehabilitation, lifestyle and wellness, whereas SM4ALL is focused on home-care assistance without Sensors
VITRO 5	STREP	Wireless Sensor Networks (WSN) built on small-cost devices that sense their surroundings and communicate wirelessly, form the basis of future intelligent environments in various domains like civil infrastructures, agricultural units or even large urban areas.	With-Me provides a specific health preservation platform for the end user, whereas VITRO delivers a new method that deals with a general, technical problem of the Wireless Sensor Network field.

4.2 Sensing technology and extracted parameters

The technologies and systems providing and promoting a healthy lifestyle can be grouped into (1) Ambient/fixed sensors, (2) wearable sensors (monitoring) and (3) interactive technologies (user feed-back). A schematic overview is given in figure 2.

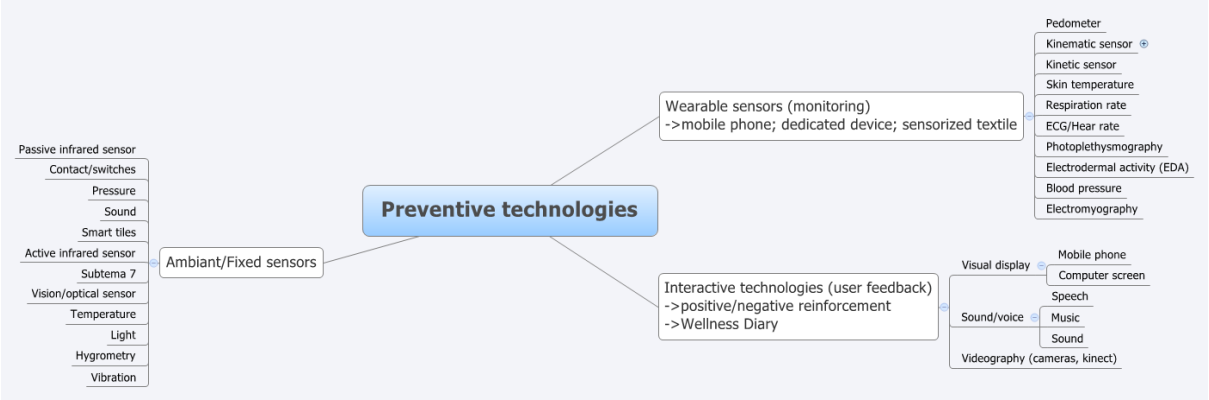


Figure 2: Overview of healthy lifestyle technologies

Those technologies some are used in commercial or consumer products.

4.2.1 Medical products

Vital Signs Medical devices for home use must be considered as Medical Devices, and must conform to applicable norms to this category.
The statement above is based on two documents, which indicate that these are medical products. The first one is a document on ethical and legal aspects of telehealth products, in which indicates that telealarm devices for home care must comply to medical products directive, although they were typically identified as class I. Moreover, according to European Union published guides, it is mentioned that products for disabled people are medical products as long as there is a direct link between product and patient (e.g. a traffic signal for blind persons is not a medical product).
The European directive for medical products is numbered 93/42/CEE (there are various amendments). In Spain, e.g. it is most practical to read the Spanish directive, R.D. 1591/2009. This law (Real Decreto) collects all requirements of the European directive as well as relevant contents for the Spanish market. It may be the same in other countries. The articles more related to the issue that concerns us:

- Article 2. Definition of Medical Product
- Article 11. Classification.
- Article 13. Conditions to get the CE marking
- Article 17: Products for clinical research
- Articles 30 and 31 : Conditions for clinical research

There is another document that summarizes the applicable regulation in each country about applicable regulation of Healthcare products. In Spain it is issued by the “Agencia Española de Medicamentos y Productos Sanitarios (www.aemps.gob.es)[2]”, closely linked to the Health Ministery.
The first step to identify the certification process is to establish the classification of the healthcare product (possible classes are I, IIa, IIb and III).This is so because, based on this classification, there are different paths to get the CE mark.

[2] http://www.aemps.gob.es/productosSanitarios/prodSanitarios/docs/regulacion-Espana-PS.pdf
http://www.tecnologias-sanitarias.com/in-vitro/MODIFICACION-RD1662_2000_por_RD1591_2009-PS.pdf

4.2.2 Lifestyle/consumer products:

Today, the market of lifestyle and consumer products have increased rapidly. A huge, but not exhaustive list of commercially available lifestyle and consumer products (not medical) is given in the next paragraph. The wearable sensors which are available to the mass market target mainly lifestyle applications. In the list, we see several multinationals, such as Adidas, Nike,… who are entering this market next to small and innovative companies (Amiigo, Fitbit,…) who are pushing innovative products to the market.

When analysing the different sensors, we can conclude that the measured parameters are limited to a few and can be divided in mainly two groups. On one hand, we have the physiological measurements with the main focus on the estimation of the heart rate (even not full electrocardiography) and on the other hand, we see activity measures, or more general, measures that quantify the moment of the body. For the activity, multiple variables can be measures.

- **Physiogical measurements:**
  - **Heart rate** measurements via ECG or HR derived measurents.
  - **Body weight**
- **Activity:**
  - **Accelerometer,** which gives an indication of your total activity during the day. Aslo the kcal consumption can be calculated from these sensor
  - **GPS,** with some derived measures such as speed, distance, position
  - **Power measurements,** this is more sports specific during cycling, but also during running
  - **Cadence**
  - **Stepcounter**
  - **…**

If we look at the functionality, we can identify 4 major groups from these sensors:

- Kinematics
- Physiology
- Sleep
- Nutrition

An overview is given in figure 3. The main functionalities of these consumer products are one (or a combination of) functionalities in these groups. We can distinguish between products that are related to lifestyle, well-being and sports. The functionalities are dependent on the application. Several variables are sportspecific (such as swimming, cycling, running,…).

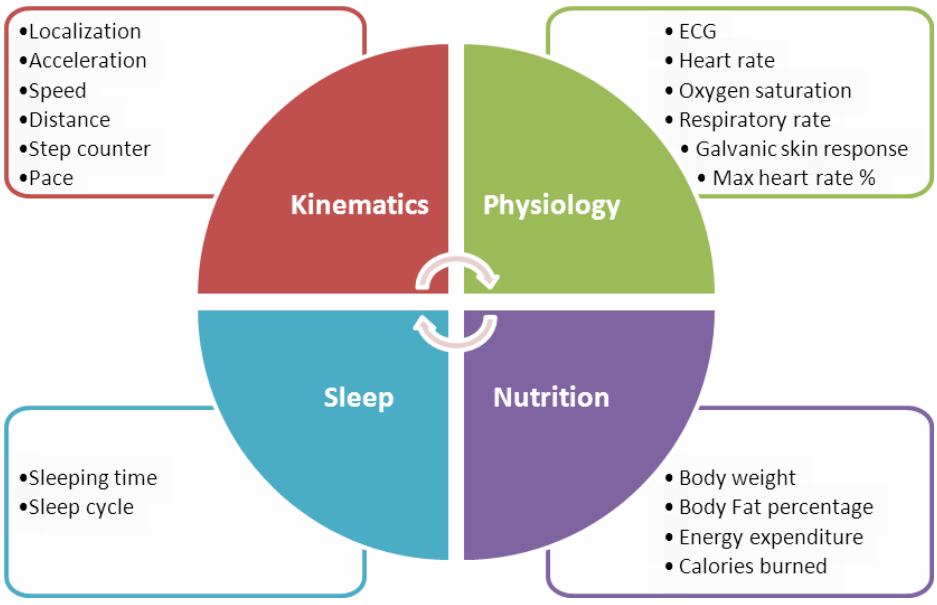


Figure 3: overview of the functionalities in the existing consumer products

The applications vary from smartphone apps that communicates with the sensors to stand alone device, that are supported by the smartphone to other carriers.

At this moment, many sensors are available but they all measure the same parameters. In the ideal world, these sensors should be connected to each other, so there is no need to buy multiple sensors that measure similar variables. However, in reality, there are several barriers that do not allow this at this moment:

- Most sensors have its own standard and data models that do not allow easy communication between the different sensors and the platform that process the data. There should be more standardization in these topics.
- The raw data is not always accessible.
    - Some of the data is processed at sensor level before it is transferred to the platform. To use the same sensor for different applications, the raw data needs to be accessible
    - Several platforms are optimized to work with only one (type of sensor). E.g. watches of polar
    - Several companies don't give access to the raw data to the consumer and/or third party
- Commercial issue: companies are still making a lot of profit on the sale of sensor. The large margins of profit are in the sensors and the hardware. However, in the last years, with the smartphones, there are companies that prove the opposite.

Sensors are components of products (see product list below). With-Me as an ecosystem should and will try to integrate and interact with them. Beside the problem of low level data exchange mentioned above barriers have also been identified when dealing with "higher level" data. Indeed, beyond the ability of two or more computer systems to exchange information, semantic interoperability is the ability to automatically interpret the information exchanged meaningfully and accurately in order to produce useful results as defined by the end users of both systems. To achieve semantic interoperability, both sides must defer to a common information exchange reference model. The content of the information exchange requests are unambiguously defined: what is sent is the same as what is understood.

In the field of health information, to achieve semantic interoperability is even a more important and difficult duty. The complexity of the health domain, its frequent variation and evolution and the differences between the information technologies domain and the health domain need a deep change on the methodologies of information management.

New proposals have arisen during the last decade to solve the problem of semantic interoperability of health information. Among them, the **dual model approach** is the most promising approach that we will investigate.

4.2.3 Product list

A list of lifestyle/consumer products is given in the below table, followed by a number of commercially available product descriptions.

Producer	Products
Adidas	• miCoach SPEED_CELL™ • miCoach heart rate monitor • miCoach PACER Bundle
AliveCor	AliveCor Heart Monitor
APDM	• Emerald • Opal • Sapphire
Azumio	• Sleep time • CARDIO BUDDY • Instant heart-rate
Bionym	Nymi

Bryton	• Cardio 40 • Cardio 60
CamNtech	• Actigraph MotionWatch • Actiwatch Mini • PRO–Diary • Actiheart® • Actiwave Cardio
Casio	CHR200-1
Cosmed	Pony FX MicroQuark Spiropalm, Spiropalm 6MWT Quark Spiro, Quark PFT, Quark i2m, Quark Nobreath Rtube Quark CPET K4b² Fitmate PRO, Fitmate MED
ESPRIT	BioMotion+
Firstbeat	Bodyguard 2
Fitbit	• Aria™ • Flex™ • One™ • Zip™
GaitUp	Physilog4
Garmin	• Forerunner 310XT • Forerunner® 10 • Forerunner® 110 • Forerunner® 210 • Forerunner® 610 • Forerunner® 910XT • FR70
HeartCheck	HeartCheck PEN
Jawbone	Up
Mio Alpha	AlphaHeartRate
Motorola	MOTOACTV
New-Lifestyles	• Pedometer (AT-75, AT-80, AT-82, AT-85) • CW-300 pedometer • piezoelectric pedometer (NL-800, NL-1000, NL-2000, NL-2160, NL-2200) • Pedometer (SW-200, SW-401, SW-651, SW-701)
Nike	• Nike+ FuelBand • Nike+ SportBand • Nike+ SportWatch GPS
Philips	• Actical • DirectLife
Polar	• CS CADENCE SENSOR™ • CS CADENCE SENSOR™ W.I.N.D. • CS speed sensor W.I.N.D. and Twist Lock Bike Mount set • CS SPEED SENSOR™ • CS Speed Sensor™ W.I.N.D. and Universal Bike Mount set

	• GPS sensor (G1, G5) • KÉO POWER • RC3 GPS, RC3 GPS TOUR DE FRANCE • RCX3, RCX5 • RS300X, RS400, RS800CX • S1 foot pod™ • S3+ stride sensor • The CS speed sensor W.I.N.D. and Dual Lock Bike Mount set • FT1, FT2, FT4, FT40, FT60, FT7, FT80 • H1, H2, H6, H7 • Polar WearLink®+ transmitter Nike+ • Polar WearLink®+ transmitter with bluetooth • T31, T31c
Sensixa	• e-AR • e-AR with spO2 • Sensixa heart rate sensor
Shimmer	Shimmer3
Soleus	• GPS 2.0, GPS 3.0 • GPS Draft • GPS Fit • Flash HRM
StepsCount	• Piezo® SC-StepMV™ • Piezo® SC-StepRX™ • Piezo® SC-StepX™
Suunto	• Ambit • M5 • Quest
Timex	• Timex Ironman Easy Trainer • Timex Personal Trainer Heart Rate • Timex Zone Trainer Heart
Valencell	PerformTek®
Vivago	Vivago Ultra
Vivonoetics	Equivital EQ02 LifeMonitor
Zenso	RAMSES monitor
Zephyr	• BioHarness™ 3 • BioPatch™ • HxM BT • HxM™ Smart
Wahoo	BLUE HR

Some of the above commercially available products are briefly described below:

- **http://www.vivago.com/**
  Personal Wellness Manager (Vivago) monitors two of the three important factors of health, physical activity and sleep[8]. The device classifies activity into sleep, passivity, light activity, and health- enhancing activity and calculates the times spent in each activity state. It also estimates daily energy expenditure. Feedback on these parameters is displayed on the watch screen as simple graphs and parameters. The device also stores up to four weeks of continuous activity data, which can be wirelessly transferred to a PC using a USB (Universal

Serial Bus) radio frequency, interface. PC analysis software enables analysis of the data, feedback and follow- up of activity parameters.

- **www.fitbit.com & http://www.directlife.philips.com/**
  Both products rely on accelerometer for activity type, burned calories, sleep quality estimation. The devices feature memory for local storage and wireless synchronization with remote web server for data collection, analysis and visualization. The devices can be worn on the wrist, on the trunk, on the back etc.

- **Misfit Shine http://www.misfitwearables.com/**
  Misfit Wearables soft-launches a simple, all-metal, activity tracker called Shine through crowdfunding platform Indiegogo.

- **Nike+ Fuel Band http://www.nike.com/us/en_us/c/nikeplus-fuelband**
  The Nike+ Fuel Band leverages just two sensors: the standard 3 axis accelerometer, which monitors activity, and an ambient light sensor that detects light levels in the user's environment and automatically adjusts the brightness of the device's display accordingly.

  http://www.underarmour.com/shop/us/en/armour39
  Armour39™ is the first-of-its-kind performance monitoring system for athletes.
  What do you have to do? Aside from workout, not much. It's literally designed for any athlete and any sport. Whatever your workout, Armour39™ accounts for every movement and tracks your vitals the whole time.

- **Band + app + you = The UP system**
  https://jawbone.com/up
  UP™ is a system that takes a holistic approach to a healthy lifestyle. The wristband tracks your movement and sleep in the background. The app displays your data, lets you add things like meals and mood, and delivers insights that keep you moving forward.

  https://www.fitbug.com/orb

  http://www.withings.com/es/pulse/

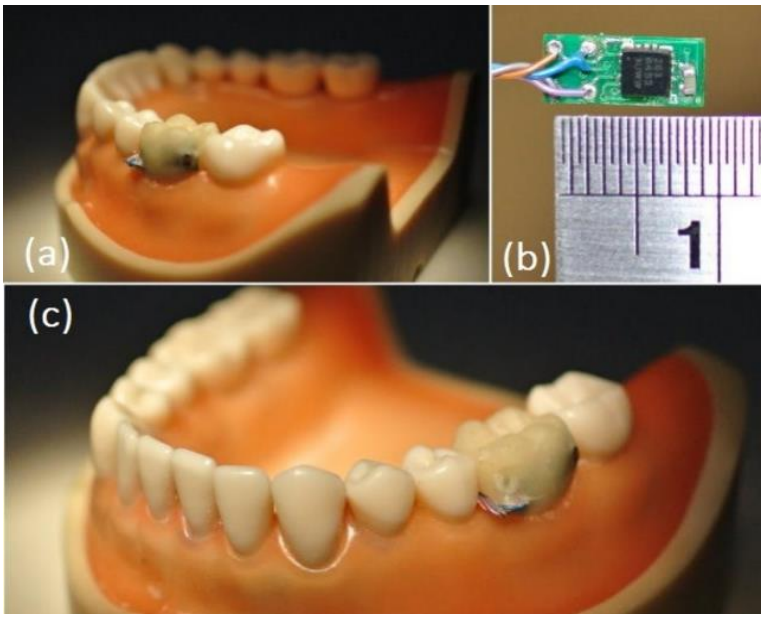
- Bodyguard 2
  Firstbeat Bodyguard 2 is a reliable R-R interval recording device for short and long-term measurements. The device is lightweight and easy to use: Attach the device directly to the skin with two chest electrodes and the Bodyguard 2 starts recording data automatically. Bodyguard 2 has been designed for 24h recordings and can be used during exercise and in other demanding conditions. Data from Bodyguard 2 can be downloaded directly to Firstbeat software.

- Firstbeat SPORTS
  Firstbeat SPORTS is a software tool for professional use in sports testing, coaching, individual athlete and team performance analysis. The method is based on advanced analysis of beat-by-beat heart rate data and especially heart rate variability. Already 200+ professional teams, athletes and training centers are using the system on a daily basis for optimizing the performance.

  The SPORTS product line consists of Team and Individual solutions which both utilize the accomplishment of a decade-long research: The Firstbeat SPORTS Software. While the SPORTS Team holds up to unlimited number of profiles, the lighter Individual is limited to two profiles in order to serve better the individual athletes.
- **Smart refrigerators**
  The touchscreens allow full Web browsing and integrates with Google calendar, allowing the family to keep their schedules in sync. You can use the screen to keep tabs on items you need at the store, so you won't forget that you drank your favourite drink and need more. You can also input items into the screen, letting the fridge know your food inventory. In turn, it can suggest recipes, generate coupons and notify you when something is about to spoil.

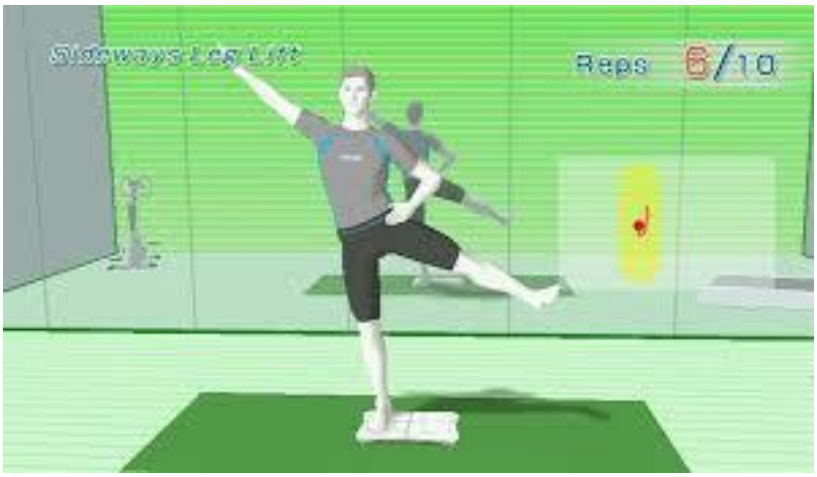
- **Wi-Fi Tooth Sensor**. http://bethanyfamilydental.com/2013/10/07/wi-fi-tooth-sensor-can-track-oral-habits/
  Since each action or activity in your mouth has its own unique movement, researchers were able to connect movements from an embedded sensor to particular activities. By embedding an accelerometer, like those found in most smartphones, inside an artificial denture, researchers were able to achieve 94% accuracy in differentiating between chewing, eating, speaking, coughing, smoking, breathing and drinking. The researchers believe that this data

could be collected and sent directly to a doctor or your own smartphone to help curb bad habits or encourage good ones. As human mouths are nearly always in motion, they can provide excellent streams of data for use in all sorts of health treatment and diagnosis.



- **Wii-Fit.** http://www.nintendo.es/Juegos/Wii/Wii-Fit-283894.html

  The Wii Fit allows you to choose from a variety of cardiovascular exercises that you follow with the game on your television screen. The Wii has a wireless motion detector that picks up on every move including your torso, hands, arms and legs.
  Wii challenges obesity by making video gaming an engaging and physical experience rather than a sedentary one. The Wii has hand-held controllers that you can use to engage muscle groups. The Wii Fit board tracks your body mass index, current weight and endurance levels in an individualized form. The screen guides you on how to make the right moves and how many repetitions you have left with each session. Wii can help you lose weight and has popular fitness endorsers such as "Biggest Loser" trainer Jillian Michaels to help you feel like you are getting a one-on-one personal training session.
  The Wii improves muscle strength and also lets you engage in activities that help with balance and coordination. By engaging in virtual reality games that include snowboarding, boxing, soccer and skiing, you can build up muscles that you may not have used in a long time. Engaging in regular strength training you can combat excess body fat, increase your lean muscle mass and make calorie burning easier.
  In some cases the Wii and Wii Fit may be able to prevent some diseases. Engaging in physical activity up to five days a week for 30 or more minutes a day can prevent life-threatening conditions such as diabetes, heart disease, hypertension, high blood cholesterol, liver disease and certain types of cancers. The Wii and Wii Fit can make your workout experience more exciting by placing you as a character inside the game.



- **Bathroom gadgets**

  www.fitnessinprogress.es/Fitbit-Aria

  www.withings.com/en/wirelessscale

  Smart scales such as the Fitbit Aria Wi-Fi and the Withings Wireless WS-30 can automatically upload your weight via a WiFi connection to your computer, tablet or smartphone to help you keep track of your daily progress.

- **Diet gadgets**. www.hapi.com/products-hapifork.asp

  The HAPIfork is an eating utensil that vibrates and lights up if you eat too quickly. It also transfers your eating-habit information to your computer or smartphone. Its maker claims that eating more slowly “will improve the way you feel after every meal, enhance your digestion and reduce your weight.” The fork is meant to make you more aware of what you’re consuming. A small study last year linked being more mindful about your eating habits to weight loss in women who frequently ate out.

- **Kinect**

  http://www.xbox.com/en-US/kinect

  http://www.microsoft.com/en-us/kinectforwindows/

  The Kinect makes it ideal for creating video games that get people active and moving. In addition, the Kinect's camera can watch you move and record your movements, so it can give feedback on how much you're moving or whether you're doing a particular exercise correctly.
  The same feedback functionality makes the Kinect an ideal tool for at-home and in-clinic physical therapy.
  Some companies are using the Kinect as an advanced video camera for virtual consultations. These ones hopes to reduce the resources hospitals need to commit to following up with chronic disease patients, while still reducing readmissions. The key to that cost saving is a virtual nurse, an avatar that uses Kinect gesture recognition and Nuance voice recognition to communicate with patients just like a human doctor.
  Researchers have demonstrated the potential of the Kinect to both guide a blind person through a building, and to translate from sign language to text and speech in near-real time. One uses the camera's ability to detect 3D objects while the other uses the software's ability to track human hand movements. Both are far from commercialization, but they demonstrate the extraordinary potential of the technology.

- **STMicroelectronics NV**. http://www.st.com/web/en/home.html

  STMicroelectronics NV (STM), Europe's largest semiconductor maker. At CES it is due to unveil a smart-suit prototype with motion sensors which is designed to help people recover from injuries quicker, improve their co-ordination if they are suffering from conditions like Parkinson's Disease or push their body that bit more if they are athletes.

  It works by harnessing sewn-in multisensor nodes that can capture details about how the body is moving. This data is then delivered to computers, tablets and mobile phones for evaluation. Each node combines a microcontroller, nine sensors, including an accelerometer and a gyroscope, and software.

  This technology will improve the recovery of patients in rehabilitation after injuries and athletes' performance as it can track, compare and address issues in their movements and posture. A tennis player will finally be able to compare his forehand with Nadal's.

4.3 Mobile and Internet-based Intervention

Mobile phone use in healthcare continues to expand as technology becomes a ubiquitous component of everyday life. Thirty-one percent of cell phone owners have used their phone to look up health information (Fox 2012). Internet and mobile phone-based interventions are increasingly used by healthcare providers to assist patients in healthy lifestyle behavior interventions. Specifically, PA interventions have begun to adopt mobile phone as a treatment delivery option as part of internet-based or in-person coaching programs. Mobile phones offer benefits such as: ease of administration of the program to a large population, low cost, ability to tailor interventions to individuals, and the ability to send just-in-time messages.

There are patient, intervention, and study factors that were important in the usage and non-usage of a Web-based PA intervention for patients. Although the self-guided components offer several advantages, particularly in relation to costs, reach, and access, older patients and participants with a comorbid condition need a more personal approach (Bossen 2013). For these groups the integration of Web-based interventions in a health care environment seems to be promising.

Solutions

Lifeguide (https://www.lifeguideonline.org)

Lifeguide is an open source software platform that allows researchers to easily and flexibly create and modify internet-delivered interventions and to collaborate across research groups. LifeGuide enables researchers to design interventions that:

- give tailored advice based on the user's answers to questions;
- allow users to plan, chart and check their progress;
- send follow-up messages to users in the form of personalised emails or texts;
- automatically randomise users to different interventions arms;

- store all data on user responses and website usage for output to Excel and CSV

  Join2move (http://www.artroseinbeweging.nl)

  The Join2move intervention is a fully-automated web-based intervention which contains automatic functions (automatic text messaging and automatic e-mails) without human support. The password-secured physical activity program is available 24/7 from the homepage and is provided without charge. The Join2move intervention is a self-paced nine week physical activity program in which patients favourite recreational activity is gradually increased in a time-contingent way. In the first week of the program, users select a central activity such as cycling, walking or gardening, perform a 3-day self- and determine a short term goal for the next eight weeks. Based on test performances and a short term goal, eight tailored weekly modules are automatically generated. Every week, new assignments and evaluation forms about pain and performance are posted on the password-secured website. If a scheduled weekly module is missed, users can choose to repeat the module, adapt the difficulty or continue with the next module. In addition to the weekly physical activity modules, information about osteoarthritis and lifestyle and videos of exercises are supplemented. Automatic e-mails are generated if participants do not visit the website regularly. At the end of the program, participants were encouraged to maintain their regular physical activity into the future.

5 Current health prevention implementation and shift from Lifestyle to Care

The With-Me platform will be tested in three countries where each pilot will focus and illustrate different functionalities and use of the system:

- Finland : Occupational therapy (stress management) – Lifestyle
- Belgium: Overweight/obesity – Lifecare
- Spain: Elderly – Cardiovascual condition – Lifecare

The state of the art, therefore focused on these three health aspects: cardiovascular, obesity (which is also connected to cardiovascular) and stress management.

5.1.1 Health prevention for cardiovascular diseases

1. Regular physical activity or cardiorespiratory fitness decreases the risk of cardiovascular disease mortality in general and of coronary heart disease mortality in particular. Existing data are not conclusive regarding a relationship between physical activity and stroke.
2. The level of decreased risk of coronary heart disease attributable to regular physical activity is similar to that of other lifestyle factors, such as keeping free from cigarette smoking.
3. Regular physical activity prevents or delays the development of high blood pressure, and exercise reduces blood pressure in people with hypertension.

- **Healthy population (lifestyle, primary prevention)**

The relationship between PA and incident and fatal cardiovascular disease (CVD) has been recognised since the systematic review of Powell (Powell1987). The population risk reduction consistently appears greatest for increasing PA or fitness among those who are sedentary [or unfit] and moving them to the recommended PA levels.

Increasing physical activity has been associated with reduced risk of mortality and of cardiovascular disease (CVD). The proportion of people doing no physical activity in a week varies between countries, but can reach nearly 25% in Europe and the Americas. Stensel (Stensel 2009) conducted a systematic review and aimed to answer the following clinical questions: Does counselling people to

increase physical activity lead to increased physical activity in healthy people without existing CVD? What are the health benefits of increasing physical activity in relation to cardiovascular outcomes in healthy people without existing CVD? The evidence suggested that counselling people to increase physical activity may increase people's activity levels over 3–12 months, particularly if accompanied by written materials and telephone follow-up. However, the study is not conclusive whether counselling people to increase physical activity compared with no counselling reduces CVD, or whether counselling people to do higher-intensity exercise compared with counselling them to perform lower-intensity exercise reduces CVD.

- **Non healthy population (secondary, tertiary prevention an care)**

Over the last decades, more and more evidence is accumulated that physical activity (PA) and exercise interventions are essential components in secondary prevention for cardiovascular disease. However, it is less clear whether and which type of PA and exercise intervention (aerobic exercise, dynamic resistive exercise, or both) or characteristic of exercise (frequency, intensity, time or duration, and volume) would yield more benefit in achieving cardiovascular health (Vanhees2012).

Hypertension (HTN), one of the most common medical disorders, is associated with an increased incidence of all-cause and cardiovascular disease (CVD) mortality. Although it is well known that PA will reduces blood pressures (BP) and prevent HTN in both adults with normal BP and those with HTN, definitive conclusions regarding the mechanisms for the BP reductions following endurance exercise cannot be made at this time (Pescatello2004). But based upon (Pescatello2004), the following exercise prescription is recommended for those with high BP:

- Frequency: on most, preferably all, days of the week.
- Intensity: moderate-intensity (40-<60% VO2R - oxygen uptake reserve is the maximun peak of uptake (max VO2) minus the uptake while resting. In fit normal adutls max VO2 is 10 times VO2 in resting).
- Time: more than 30 min of continuous or accumulated physical activity per day.
- Type: primarily endurance physical activity supplemented by resistance exercise.

- **Elderly people**

Elderly people, with CVD or not, will also benefit for continuous and moderate physical activity. Although elderly people loss performance capabilities (Hollmann2007) regarding coordination, flexibility, strength, speed, and endurance, adjusted physical activity will be capable of counteracting age-related changes and performance loss not only in the cardiovascular system but also in the brain (Hollmann2007). For example, a 12-week-long bicycle ergometer-training programme, caused an improvement in the maximum oxygen uptake by 18% and in the aerobic-anaerobic threshold by 22% on untrained men aged 55-70 years as (Hollmann2007) denoted. In General, aerobic dynamic training can improve the endothelial function in old age and thus help prevent cardiovascular diseases.

In addition to prevent cardiovascular diseases, strength training normalizes resting blood pressure in elderly with high normal blood pressure [Martel1999].

Introduction.

Nowadays, cardiovascular diseases (CVD) are increasing and it is one of the principal reasons of death in our society (Lopez et al., 2006). A lot factors are associated with the appearance of CVD such us sedentary habits (Prasad & Das, 2009), high levels of low-density lipoprotein (LDL) (Guardamagna et al., 2012), diabetes mellitus (Laing et al., 2003; McVeigh et al., 2013), hypertension (Guardamagna et al., 2012) or overweight (Chaput et al., 2010). Physical activity could have an important role for preventing CVD (Prasad & das, 2009) and it has beneficial effects at all ages (Andersen et al., 2011; Kessler et al., 2012). In addition, physical activity is able to decrease CVD risk of an indirect way due to the influence that it have on lifestyle, diabetes mellitus and obesity (Shrestha & Ghimire, 2012). As well as physical activity can prevent CVD, well nutrition habits have a high impact too, since early life (Guardamagna et al., 2012; Ye et al., 2012). The reasons of the improvements that health nutrition habits can obtain are in the same direction of physical activity.

There are clear evidences that health nutrition habits prevent overweight, LDL concentrations and diabetes mellitus (Venn & Mann, 2004; Ye et al., 2012). In case that the prevention strategies do not work properly and the cardiovascular disease appears, cardiac rehabilitation is necessary in order to avoid a new episode and recover of it.

Core components of cardiac rehabilitation

Cardiac rehabilitation is a delicate moment in the patient´s life, so you should consider every task that the patients will do. In order to ensure patient´s health, we must control their daily life, especially when they are doing physical activity. First, we must decide which parameters can prevent and control the patient´s health to avoid a new CVD episode. We must assess cardiopulmonary systems, nutrition habits, blood pressure, lipid concentration, diabetes and psychosocial state (Balady et al., 2007). When we talk about cardiopulmonary systems, we must control heart rate and regularity (Balady et al., 2007). Heart rate monitoring is one of the most important parameters when we do physical activity but we will discuss it later. Nutrition habits are relating to total daily caloric intake and dietary content of saturated fat, trans fat, cholesterol, sodium and nutrients. Also, eating habits must be monitored, fruit and vegetables, whole grain, fish consumption and snacks (Balady et al., 2007; Ye et al., 2012). Lipid management is related to cholesterol, high-density lipoprotein (HDL), LDL, and triglycerides measurement. Psychosocial management recount to significant levels of depression, anxiety, anger... (Baldady et al., 2007). All of these items are important to ensure the patient´s health.

What must be measure to prescribe physical activity? How we prescribe physical activity?

When we prescribe physical activity, we must know which is the level of the user and his objective is. In order to ensure the patient quality of life a validate questionnaire is needed, SF36 it is recommended (Balady et al. 2000). On all cardiac pathology, we must do a medical history, a clinical symptomatology assessment and a physical examination that include a 12-lead ECG analysis. It is recommended to include in the protocol an ergometer or treadmill stress test with clinical monitoring, ECG and blood pressure (Rodrigo, 2000). Once we have this information we can prescribe physical activity. When we prescribe physical activity, the two main variables that we must control are the volume and the intensity. In general terms, in order to prescribe physical activity we will use number of steps, oxygen consumption (VO2), distance or duration. The researchers try to know which the activity that gets a better improve is. High intensity interval training appears to promote superior improvements in aerobic fitness and similar improvement in some cardiometabolic risk factors in comparison to continuous moderate exercise (Kessler et al., 2012).

What must we measure when patients are doing the cardiac rehabilitation?

We must assess several parameters when the patients are doing the cardiac rehabilitation. The percent of maximal oxygen consumption (%VO_{2max}) is thoroughly used when physical training is prescribed for cardiovascular disease population (Kessler et al., 2012). While we are training is not easy to measure VO_2, but the percent of heart rate reserve (%HRR) it is a great estimate of %VO_2 reserve (%VO_2R) in patient with heart disease (Brawner et al., 2002). Due to heart rate is relatively easy to measure, we think that is the most important parameter to ensure a properly cardiac rehabilitation. Measure the number of steps that someone has to walk is another possible way of prescribes physical activity (Tudor-Locke et al., 2011). In addition, it is used with people that suffer cardiovascular disease (Jehn et al., 2009). Energy expenditure is also important to measure and the most common variable used for it are the metabolic equivalents (METs) consumption (Marzolini et al., 2012). Perceived exertion is another parameter that it is used to know how the effort is for the patients in cardiac rehabilitation (Maitland & Chalmers, 2009).

How can we measure cardiac rehabilitation parameters?

Nowadays we have many devices to measure the parameters that we have discussed above. If we want to control the distance and the pace we are able to use a GPS. GPS devices has been used in cardiac rehabilitation with patient (Worringham et al., 2011). Another device that control the distance and it is used in cardiac rehabilitation with a great result is pedometers (Kaminsky et al., 2013). Both devices are made to control distance that someone can displace and the pace of it displacement. In order to get information about energy expenditure we will need another type of devices, such as, accelerometers (uniaxial, biaxial and triaxial) and multisensors (Van Remoortel et al., 2012). Triaxial accelerometers and multisensors tend to be more valid than the biaxial and uniaxial accelerometers but a proper validation studies in chronic disease population must be made (Van Remoortel et al., 2012). It should be noted the multisensor Armband (Figure 4), which is able to measure of a direct way the skin temperature, heat dissipation, skin impedance and humidity and acceleration in 2 axis. Armband with these measures calculated daily energy expenditure, duration and classification of

physical activity, METs, energy expenditure during physical activity, number of steps, corporal position and sleep duration and efficiency (Jakicic et al., 2004; Fruin & Rankin, 2004). Armband device has been validated but it overestimates or underestimates some activities (David, 2012).

Figure 4: Armband Sensewear

Other devices that we should use while the patient are doing physical activity are heart rate monitor and electrocardiogram (ECG) (Balady et al., 2007). An example of a device that integrates heart rate monitor and electrocardiogram could be CorlBELT (Figure 5) (Wieland et al., 2007). The last instrument that we can use in order to measure physical activity intensity are the perceived exertion scales like Borg 6-20 scale (Aamot et al., 2013).

Figure 5: CorBELT

Which technologies have been used in cardiac rehabilitation?

Traditionally centre-based cardiac rehabilitation programs are offered to individuals after cardiac events but nowadays home-based cardiac rehabilitation programmes have been introduced in an attempt to widen access and participation. Several researches prove that both options have the same effectiveness (Jolly et al., 2006; Dalal et al., 2010). In order to ensure cardiac rehabilitation will make in a safe way, technology will be important. The use of a pedometer that increases a 10% the number of steps per week achieved a higher physical activity than traditional methods in cardiac rehabilitation subjects (Kaminski, 2013). Motivational SMS could increase physical activity in cardiac rehabilitation patients (Alsaleh et al., 2012). On another research, they create a virtual cardiac rehabilitation program and it achieved the same results than the traditional methods. All the patients gave a positive feedback to the virtual cardiac rehabilitation (Zutz et al., 2007). Cardiologist to interpret angiograms lesions can use Smartphone's and it may serve as a supplementary teleconsultation tool in elective and emergency situations (Bilgi et al., 2013). Worringham et al (2012) used a heart monitor, which measure heart rate and ECG, and a GPS Bluetooth, which measure the patient position (Figure 6). Both devices were connected to a programmed Smartphone. The system provided a feasible and flexible alternative from of supervise cardiac rehabilitation. Participants showed improvements on walking in the 6 minute walk test (6MWT), and reported significantly reduced levels of cardiac depression and significantly improved physical health-related QOL.

Figure 6: Components of remote monitoring system (Worringham et al., 2012)

Another type of design that researchers have developed try to send information with Smartphone to the nearest hospital when a patient were under critical conditions. They used GPS technology and an algorithm to determinate, which the nearest hospital was (Keikhosrokiani et al., 2012). Also, Smartphone have been used to monitor blood pressure, blood glucose, physical activity and body weight. 8-week mobile health technology supported exercise intervention improves metabolic syndrome and heart rate variability (Stuckey et al., 2013).

In conclusion, technology is being used on cardiac rehabilitation with successfully results. We need more research to ensure that the different devices are reliable on this population. Anyway, the great result obtained with new technology like Smartphone, may play an important role in the future nursing home base cardiac rehabilitation, and the adherence of it by the patient is a challenge. Developing new APP and devices may be a solution to get this objective.

5.1.2 Health prevention related to stress and mental health

In 1948 the WHO defined health as “A state of complete physical, mental and social well-being, and not merely the absence of disease”. These three perspectives of health have been seen as a whole and by influencing on one of these can also status of the rest of two be enhanced. Healthy living behaviours were recognized for a health determinant in early 1970s and since that interventions to promote healthy lifestyle have been the focus of disease prevention.

Self-care is an approach to the management of long-term health conditions and in preventing to get ill in people in risk by living in healthy lifestyle. It has been recognized for physical conditions, but it has been used to a limited extend in relation to mental health. Same health living behaviours that may better status of long-term illnesses are related to better mental health and alleviate stress. The literature review (Lucock & al. 2011) provides information on the nature of self-care from the perspective of people experiencing mental health problems. The writers developed a model of self-care for mental health problems but recognized still a need for further research.

5.1.2.1.1 Physical activity

The literature review by Penobo & Dahn (2005) states that results of the studies continue to support a growing literature suggesting that physical-activity has beneficial effects across several physical and mental health outcomes. The outcomes may be a better sleep, less depressive and cognitive symptoms and prevention of memory diseases such as Alzheimer’s disease (AD).

There are three major hypotheses for dementia and AD: the cognitive reserve hypothesis, the vascular hypothesis, and the stress hypothesis. While taking into account the accumulated evidence and the biological plausibility of these hypotheses, we conclude that an active and socially integrated lifestyle in late life protects against dementia and AD. Physical activity influences Alzheimer's disease by enhanced concentration of neurotrophins.

Physical activity and enhanced fitness to improve cognitive function in older people without known cognitive impairment (2008). Aerobic fitness training in particular, can have a positive effect on multiple aspects of brain function and cognition (Nature). Literature suggests that exercise provides multiple routes to enhancing cognitive vitality across the lifespan. Subjects with greater baseline physical activity, whether measured as blocks walked per week or as total kilocalories expended per week, were less likely to develop cognitive decline during the 6- to 8-year follow-up. There is insufficient evidence to be able to say whether or not physical activity programs are beneficial for people with dementia and thus further study is needed about this issue.

Physical activity doesn’t need to be conventional exercise to get better mental health outcomes. Less conventional exercise, including Hatha-yoga and African dance, has an effect on psychological wellbeing. The effects include reduction in perceived stress and negative affect as well as improvements in total mood scores and reduction in confusion, anger and tension. (Penebo & Dahn 2005.)

Sedentary behaviour may pose a risk to health but little is known about the effects on mental health. Hamar and Stamatakis (2013) conducted a two year follow-up study from older adults. The study suggests that prolonged passive behaviour in older age is associated with increased risk of depressive symptoms and worse cognitive function. Conversely, sedentary behaviour that stimulates cognitively, including internet use and reading, is associated with less depressive symptoms.

Sleep problems are associated with depressive symptoms and by enhancing quality and quantity of sleep, depressive symptoms can be reduced. Some sources suggest by initiating a regular moderate-intensity exercise program older adults with moderate sleep complaints could improve self-rated sleep quality. Within exercise weight lifting exercise was suggested to be effective in improving subjective sleep quality, depression, strength, and quality of life. In older population, in which perceived sleep problems are common, research is involving exercise programmes designed with the elderly in mind is needed.

5.1.2.1.2 Other healthy lifestyle behaviors

Several healthy promoting lifestyle behaviors were simultaneously studied in most of the studies reviewed. Harrington & al. (2009) conducted a survey study within the population of adults aged 18 years and over living in residential households in Ireland. This article shows that the combination of four protective lifestyle behaviors (being physically active, a non-smoker, a moderate alcohol consumer and having adequate fruit and vegetable intake) are associated with better self-rated health and healthier body weight but also with better mental health.

According to the recommendation of the American Diabetes Association people with diabetes should be physical activity and engage in healthy eating with diets rich in fruits and vegetables. Patients with self-reported diabetes who ate fruits and vegetables as recommended by the ADA reported better mental health but poor physical health. (Campbell & al. 2011.) Frequently fish consumption is often suggested to lower the risk of developing depressive symptoms. Schiepers & al. (2010) included detailed measurements of both fish intake and plasma phospholipid (LCPUFA) concentrations in their study. The study suggested that fish consumption is related to quality of life and physical wellbeing, but not in mental wellbeing, in the general population.

The nurses promote healthy lifestyle to their patients but are too often to engage in unhealthy lifestyle behaviors, which cause overweight and obesity in association with fatigue, sleep disturbances and physical limitations. They also suffer twice as much from depressive symptoms than the US general population. This data was collected from 61 new graduated nurses before attending in an employer's program, which focused on nutrition, energy management, and physical activity. Measurements show that workplace stress is related to nurses' mental health and furthermore that fewer healthy behaviors are related to elevated depressive and anxiety symptoms. (Melnyk & al. 2013.)

Engaging in healthy lifestyle behaviors may be easier to some individuals than to the population on average. The large web-based cross-sectional study of 101 257 Finns (Joutsenniemi & al. 2013) suggests that participants with high confidence in the future were more likely to engage in beneficial health-related behaviors and they had low-psychological distress in different areas of life. This gives a possibility to tailor health-related interventions according to the target population's level of confidence in the future.

Depression causes a significant decrease in working and functional capacities. According to the WHO's Global Burden of Disease –study, in the early 1990's, depression was the fourth leading cause of disability, and it is anticipated to become the second important disabling disease by 2020 (1). In Finland, mental and behavioral disorders caused most of the working inabilities in 2010 (2). Although it is recognized that burnouts are caused by challenging working conditions, work-related burnouts and depression can be prevented and treated by empowering individuals to manage their wellbeing and increasing their personal resources (3). In 2009, eight percent of the Finnish employees suffered from stress with varying symptoms (4).

Preventive health care in Finland

Mieli, the national plan for managing mental health and substance abuse problems, defines the core principles and priorities for the work to be done in the areas of mental health and substance abuse until 2015. The plan is based on the fact that mental health and substance abuse problems have a

significant deteriorating influence on public health. For the first time the plan outlines common national objectives for the mental health and substance abuse work. This plan has been created by the working group appointed by the Ministry of Social Affairs and Health. (5)

In Finland, prevention of work-related illnesses and accidents is regulated by legislation. The Occupational Health Care ActThe Occupational Health Care Act aims to prevent health problems caused by working conditions and to promote work capacity and health. Preventing mental disorders and increasing mental wellbeing are always included to the preventive actions. Employers are allowed to arrange their occupational health care in alternative ways such as buying services from a health care center, private health care company or from a municipal commercial enterprise commercial enterprise, or providing the services through their own occupational health centers or in co-operation with other employers (6). The service content of the occupational health care is based on an action plan created in co-operation by the employer and the health care provider. The action plan is updated once a year. Majority of the working age population have access to the occupational health care services. Municipal health care centers take care of the unemployed and the students of polytechnic. University students are members of the Finnish Student Health Service, which provides preventive health care services, too.

Occupational health care providers investigate and assess the quality of the working conditions and the work itself from the safety and health perspectives through repeated workplace visits. Employees' health levels, working capacities and functional capacities are assessed during occupational health check-ups and during the workplace visits done by occupational nurses and physicians. Employees' mental health and wellbeing are also taken into account in the assessments. During the occupational health check-ups, individual counseling and guidance are given to the employee. If needs for additional health care actions are recognized, the employee will be referred for further examinations or treatments, if possible. Interventions for the treatment of excessive mental workload vary largely amongst different occupational health care providers.

In Finland, maternity and child health clinics have a significant role in the health promotion and disease prevention of families with children under 7 years old. The services of the clinics are free and they are provided by municipalities. During pregnancies, the wellbeing of the mother and the child is followed by the maternity clinic, and after the childbirth the families become the clients of the child health clinic. The whole family is welcomed to these clinics. In addition to following pregnancies and children's physical, mental and social skills development, also the social interactions in families are followed during the clinic visits. The parents are supported in their parenthood and in their intimate relationship.
There are no collaborative networks to support the matching of working and family lives, but these two dimensions are handled separately by the occupational health care organizations and the maternity and child health clinics.

Other channels of wellbeing services
There are already over 1000 live coaches in Finland, and life coaching is a growing business in the wellbeing area. The coaching services are targeted to healthy individuals who are interested in developing their life management skills, and want to participate in life coaching courses. The course content is often related to time and stress-management, meaningful and satisfying life, cultivation of important interpersonal relationships, relaxation through yoga and mindfulness, boosting work motivation, self-knowledge and self-development etc. Life coaching services are offered to individuals and companies, and the coaching process involves face-to-face or phone meetings with a life coach, or group meetings which take place several times a month. However, the professional background required for life coaches is not firm. *Caressa Coaching* (http://www.caressa.fi/http://www.caressa.fi/) and *Vojo* (http://vojo.fi/http://vojo.fi/) are examples of Finnish life coaching companies.

Another important channel for providing preventive mental health services are the local folk high schools. For example, in Tampere, courses on the following topics exist and they are nowadays very popular: tension releasing exercises, meditation, chakrat, taoyoga, self-satisfaction, and empowerment through photography.

Assessment tools
From the assessment point of view there exists broad spectrum of practises. When considering functioning (i.e. how well an individual is able to operate in the society), an International Classification of Functioning (ICF) exists that intends to harmonize and instruct how to model the biopsychosocial

functions of people. Since ICF is a comprehensive model, core sets for describing more specialized themes, including depression in the mental health category, have been created, tested and validated (7).

The concept of functioning is nowadays seen as an important part of the diagnosis of depression. The core set for depression was divided into two versions in ICF, comprehensive and brief. The different ICF tools are intended to serve as a universal language to be utilized in different services, thus, providing a way to harmonize electronic tools for different health problems from the functioning perspective.

In Finland, a national network around functioning called TOIMIA was formed in 2007 (8). The network aims to improve the quality of measurements and harmonize the measures and the terminology used. The results are based on the work of expert groups, which identify and evaluate measurement tools used in disability assessment in special areas, e.g. among the working-age population. The goals are to create recommendations and provide a database of tools for evaluating functioning in these specific areas. This is expected to enable the harmonization of the used practises and improve transparency. The network describes the benefits and usefulness of the work as:

“the measures are linked to ICF for conceptual analysis. The applicability of the measurement tool in clinical practice, based on the information of its psychometric properties and clinical feasibility, is expressed in verbal and visual way using traffic light symbols. The evaluated measures are available in the TOIMIA database: the forms and manuals in Finnish, the background information and information on the psychometric properties.
There is a great need of commonly agreed, valid measurement tools in social and health care and their electronic IT systems. The national TOIMIA network provides valid measurement tools by an open access database. It is an important step towards uniform practices in the measurement of functioning in Finland.”

A good example of their results is a recommendation regarding the assessment of mental health disorders in occupational care. (9)

These tools would be relevant to consider when designing care and treatment processes for mental health problems, especially from the assessment perspective. Although, not applicable to mental health problems as such, the categorisations and concepts used in ICF can, as well, ease the ICT based service development and utilization. In addition, it can provide means to model user functioning as presented in figure 7:

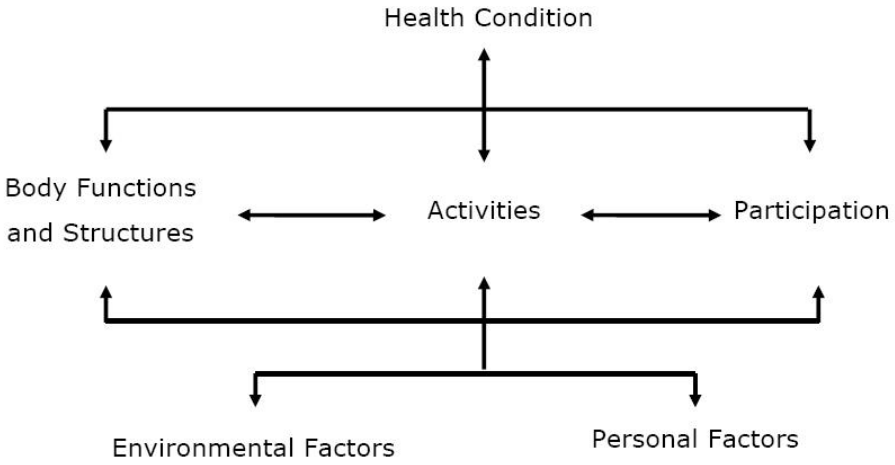


Figure 7: Framework of the ICF

Finnish technologies for mental health and wellbeing

Mielenterveystalo (www.mielenterveystalo.fi).www.mielenterveystalo.fi). The Hospital District of Helsinki has developed cognitive behavioural internet therapies that are targeted to patients that are diagnosed to suffer from mild or middle-level mental disorders. Currently, they provide therapies for treating depression and panic disorder, and they are developing programs for bipolar depression and alcohol problems. The patients explore the therapy contents and do assignments independently, but a therapist follows their progress and provides support and guidance during the intervention program.

EduMental (http://www.edumental.fi/ http://www.edumental.fi/. ½EduMental provides preventive and rehabilitation internet therapy services. *DepisNet* is targeted for youngsters that struggle with everyday life pressures and have symptoms of depression or anxiety. The service focuses on primary prevention and wellbeing, and aims to improve the life management skills of young people. The therapy content includes information and assignments. The individual does the tasks independently and then sends them to a health professional for feedback. The service provides the opportunity for youngsters to discuss their problems with a health professional and to receive peer support. *MieliNet* is another internet therapy service targeted to patients recovering from serious mental problems.

eTerveyskeskus & eKlinikka (eHealthCareCenter & eClinic) provides electronic health care services to citizens. The service concept has been tested on a small scale only, and part of the services is under development. The services are being integrated with the national Personal Health Record, *Taltioni*, where citizens can, for instance, keep a diary on exercise, rest, and nutrition. Citizens can schedule a meeting with a doctor or nurse electronically, and as need arises consult a medical professional via the web in eClinic (http://www.eklinikka.fi/).http://www.eklinikka.fi/). The goal of the services is to empower citizens to take an active role in managing their health and wellbeing.

OIVA (http://www.oivamieli.fi/http://www.oivamieli.fi/) is a personal wellbeing application for improving mental and physical wellbeing through increased psychological flexibility and physical exercises. Oiva is based on the Acceptance and Commitment Therapy (ACT) methods. It contains 46 short text/audio/video exercises designed for everyday life, reminders and a diary. Currently OIVA runs in Android and iOS devices (June 2013). Web and Windows Phone versions are under development. OIVA has been validated in a RCT with stressed adults (N=300) to be equally effective as face-to-face group sessions in reducing stress and improving the quality of life. OIVA is developed by the University of Jyväskylä and VTT.

Wellness Index - Wellness Index summarises the person's wellbeing status based on several different wellbeing variables as a single index number (see the below figure 8). The index compares the current state wellbeing (as a percentage) to an ideal state of health. Wellness Index is based on VTT's patented technology for computing an objective index from diverse data sets.

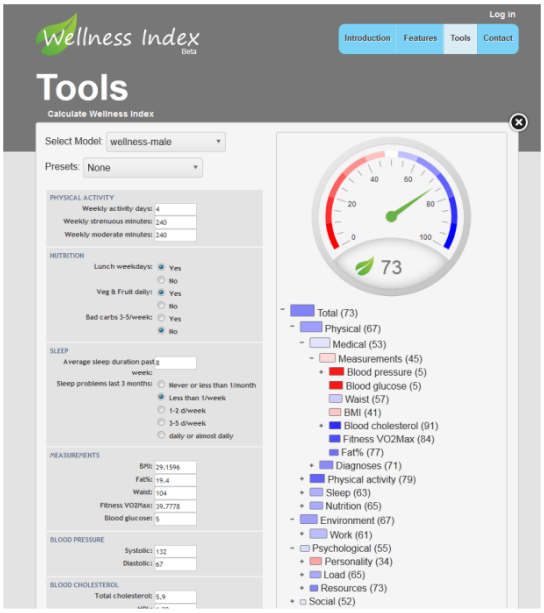


Figure 8: Wellness Index

Firstbeat (http://www.firstbeat.com/).http://www.firstbeat.com/). Firstbeat provides a Livestyle Assessment tool for measuring stress and recovery, physical workload and activity, and for evaluating lifestyle-related risk factors. The assessments can identify the early signs of stress and overload before more serious exhaustion or burnout take place, allowing healthcare and wellness professionals to design targeted and customized steps to help their clients. Key application areas of the analysis include supporting the overall coping of employees, development of working conditions, physical activity guidance and comprehensive lifestyle evaluation. The assessments are based on accurate analysis of the heartbeat.

Vojo (http://vojo.fi/?p=57http://vojo.fi/?p=57) is an iPhone application that helps people to recognize and share meaningful moments in their lives, and to understand what makes them feel good, thus impacting wellbeing and vitality.
ODUM (http://www.odum.fi/in-english/) Health System allows the comprehensive development and maintenance of the personnel's fitness for work in companies. The system provides company management, HR departments and occupational health services with support and practical tools to identify risks and improve your staff's fitness for work.

Perheaikaa.fi (https://www.perheaikaa.fihttps://www.perheaikaa.fi) is a web service that is focused on parents who are planning or expecting a baby, or who already have little children in the family. The parents are able to attend online chat sessions, see online video lectures, and participate in chat forum as well as to register for live courses. The site is maintained by the Family Federation of Finland.

5.1.3 Health prevention for obesity

The prevalence of obesity has tripled in many countries of the WHO European Region since the 1980's. The number of people who are affected continues to rise at an alarming rate. According to country estimates for 2008, over 50% of both men and women in the WHO European Region were overweight, and roughly 23% of women and 20% of men were obese. These numbers make obesity one of the greatest public health challenges of the 21st century. (Eurostat 2008)

5.1.3.1.1. Definition

The body mass index (BMI) is a measure of a person's body shape that correlates fairly well with body fat. It is calculated as the result of dividing body weight (in kilograms) by body height (in metres) squared. The International Obesity Task Force (IOFT) defines that a person with a BMI between 25 and less than 30 has overweight. People with a BMI equal or greater than 30 are obese. (IOFT)
A BMI > 25 is accompanied with a significantly increase in risk of chronic diseases such as cardiovascular disease, type-2 diabetes, hypertension, coronary-heart diseases and certain cancers. At the individual level overweight and obesity are also associated with a variety of psychological problems. (Eurostat, 2008)

5.1.3.1.2. Cause

In most cases overweight and obesity are caused by an energy imbalance of calories consumed and calories expended. Globally, there has been:

- an increased intake of energy-dense foods that are high in fat; and
- an increase in physical inactivity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization. (WHO, 2013)

5.1.3.2. Prevention and treatment

In the prevention and the treatment for obesity the main focus is on lifestyle changes. Globally this comes down to more physical activity and healthier diet. To optimize the results the prevention and treatment have to be individually adjusted and focus on durability. To realise and maintain those changes a person should become intrinsically motivated and learn how to do self-monitoring.

5.1.3.2.1. Physcial activity

Prevention

In 2010 the World Health Organisation published 'Global recommendations on physical activity for health'. Below you can find a summary of recommendations by age group.

5-17 years old

For children and young people of this age group physical activity includes play games, sports, transportation, recreation, physical education or planned exercise, in the context of family, school, and community activities.

1. Children and young people should accumulate at least 60 minutes of moderate to vigorous-intensity physical activity daily.
2. Physical activity of amounts greater than 60 minutes daily will provide additional health benefits.
3. Most of daily physical activity should be aerobic. Vigorous-intensity activities should be incorporated, including those that strengthen muscle and bone, at least three times per week.

18-64 years old

For adults of this age group, physical activity includes recreational or leisure-time physical activity, transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play games, sports or planned exercise, in the context of daily, family, and community activities.

1. Adults should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week, or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week, or an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.
4. Muscle-strengthening activities should be done involving major muscle groups on two or more days a week.

65 years old and above

For adults of this age group, physical activity includes recreational or leisure-time physical activity, transportation (e.g. walking or cycling), occupational (if the person is still engaged in work), household chores, play games, sports or planned exercise, in the context of daily, family, and community activities.

1. Adults aged 65 years and above should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week, or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
2. Aerobic activity should be performed in bouts of at least 10 minutes duration.
3. For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobc physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.
4. Adults of this age-group with poor mobility should perform physical activity to enhance balance and prevent falls on three or more days per week.
5. Muscle-strengthening activities should be done involving major muscle groups on two or more days a week.
6. When adults of this age group cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow. (WHO, 2010)

Treatment

In the treatment of overweight and obesity the focus is on starting to be physical active. Below you can find the FITT-principle to optimise the results. As many patients may present with comorbiditiesn it may be necessary to tailer the exercise prescription accordingly. (Centre of health protection, Department Health, 2012)

Frequency:

≥ 5 days per week of aerobic exercise to maximise caloric expenditure.

Intensity:

- Moderate- tot vigorous-intensity aerobic exercises should be encouraged.

- Some individuals may prefer doing vigorous exercise as it is less time consuming, but vigorous exercise is probably not appropriate for the very obese (BMI> approximately 35 kg/m2).
- Individuals choosing to incorporate vigorous intensity activity into their programme should do this gradually and after an initial 4-12 week period of moderate-intensity activity.

Time:
- To prevent obesity, people may need 45 to 60 minutes of moderate intensity aerobic activity each day unless they also reduce their energy intake.
- Patients who are overweight or obese should be prescribed a volume of 45 to 60 minutes of moderate-intensity activity a day (corresponding to approximately 225 to 300 minutes/week of moderate-intensity physical activity or lesser amounts of vigorous physical activity or lesser amounts of vigorous physical activity.
- People who have been obese and have lost weight should be advised they may need to do 60-90 minutes of activity a day to avoid regaining of weight.
- Sedentary individuals should build up their physical activity targets over several weeks, starting with 10 to 20 minutes of physical activity every other day during the first week or two, to minimise potential muscle soreness and fatigue.

Type:
- Walking is an excellent form of physical activity for overweight and obese people (for obese, sedentary individuals, brisk walking often constitutes moderate-intensity physical activity.)
- Weight-bearing physical activity may be difficult for some individuals with BMI over approximately 35 kg/m2, particularly for those with joint problems. For these individuals, gradually increasing non-weight-bearing moderate intensity physical activities (e.g. cycling, swimming, water aerobics, etc.) should be encouraged.

5.1.3.2.2. Diet

Nowadays there is an easy access to low-priced, high-calorie foods. Therefore the main focus in dietary therapy will consist of instructing people on how to modify their diets to achieve a decrease in caloric intake. Important for this recommendation is to use a moderate reduction in calorie intake to achieve a slow but progressive weight loss. Finally the composition of the diet should be modified to minimize other cardiovascular risk factors.
Research showed that a low-calorie diet is more successful in achieving weight loss over the long term than a very low-calorie diet. By implementing a low-calorie diet weight loss will consist of about 75 per cent fat and 25 per cent lean tissue. A deficit of 500 to 1000 kcal/day will produce a weight loss of 70 to 140 grams/dag, or 490 to 980 grams/week. A deficit of 300 to 500 kcal/day will produce a weight loss of 40 to 70 grams/day, or 280 to 490 grams/week. A patient may choose a diet of 1000 to 1200 kcal for women and 1200 to 1500 kcal for men.
To optimise the results of a low-calorie diet it's important to give consideration to a person's food preferences. Care should be taken to be sure that all of the recommended dietary allowances are met. Dietary education will be the key to success in achieving adjustment to an low-calorie diet. Therefore the following topics should be discussed:
- Energy value of different foods;
- Food composition (macronutrients);
- Reading nutrition labels to determine caloric content and food composition;
- New habits of purchasing;
- Food preparation;
- Avoiding overconsumption of high-calorie foods;
- Maintain adequate water intake;
- Reducing portion sizes; and
- Limiting alcohol consumption. (NIH, 1998)

<u>Eating disorders</u>
Binge eating disorder is one of the most common eating disorders in person's with obesity. Sometimes good a structured dietary plan can take care of this but most of the times those people should be referred to a health professional who is specialised in binge eating treatment. (NIH, 1998)

5.1.3.2.3. Motivation

Motivation is needed to ensure that behaviour changes in diet and physical activity level will occur and that these are durable. There should be a clear distinction between intrinsic and extrinsic motivation. Intrinsic motivation is the desire or urge of someone to reach a certain target by certain actions. The motivation comes from the activity itself. One other words, doing something that they love to do, for pleasure or satisfaction. The motivation here causes the act. When giving an extrinsic stimulus, such as a financial compensation or a verbal compliment the motivation becomes extrinsic. Therefore intrinsic motivation is preferable. Extrinsic incentives or rewards may also undermine the intrinsic motivation..
The most important motivation theory in behaviour change is the self-determination theory (SDT). (Deci & Ryan, 1985, 2000) The SDT theory describes the process of human motivation. SDT distinguishes three natural requirements that are necessary for the optimal functioning and growth of a human being. These basic needs are innate and universal:

- need for autonomy (autonomy)
- need for solidarity ('belongingness')
- need for competence (competence)

When these basic needs are met, behaviour changes are obtained easier. (R2I, 2013).

5.1.3.2.4. Self-monitoring

Next to personal contacts with a coach or health professional, self-monitoring is important. Self-monitoring is observation and recording of one's own behaviour. Self-monitoring of both eating habits and physical activity is a key step in changing a lifestyle. People should be taught to record the amount and types of food they eat, the caloric values, and nutrient composition. Keeping a record of the frequency, intensity, and type of physical activity likewise will add insight to a personal behaviour. Extending records to time, place, and feelings related to eating and physical activity will help to bring previously unrecognized behaviour to light. (NIH, 1998) Pedometers, 'Runkeeper', … are good examples of new technologies for self-monitoring.

5.1.4 Hearing loss

Over the past few decades, much has been learned about the implementation of hearing loss prevention programs. The eight components of a successful hearing loss prevention program include: 1) noise exposure monitoring, 2) engineering and administrative controls, 3) audiometric evaluation, 4) use of hearing protection devices, 5) education and motivation 6) record keeping, 7) program evaluation, and 8) program audit.

Occupational hearing loss is the most common work-related illness in the United States. Approximately 22 million U.S. workers exposed to hazardous noise levels at work, and an additional 9 million exposed to ototoxic chemicals. Most occupational health regulations recommend removing hazardous noise from the workplace whenever possible and using hearing protectors in those situations where dangerous noise exposures have not yet been controlled or eliminated.

Use of the term occupational hearing loss reflects a change since 1990. No longer is noise considered to be the only source of hearing loss associated with work. Exposures to chemicals, such as aromatic solvents and metals such as lead, arsenic, and mercury can result in hearing loss.

Combined exposures to noise and chemicals can cause more hearing loss than exposure to either agent alone. Vibration and extreme heat are also potentially harmful to hearing when combined with noise. To better respond to the potential hearing hazards and hearing loss risk many of today's workers face, an additional ingredient (Hearing Loss Prevention Program Audit) has been added to the recommended approach for preventing hearing loss.

Corporations that have embarked upon buy-quiet programs are moving towards the creation of a workplace where there will be no harmful noise. Many companies are automating equipment or setting up procedures that can be operated by workers from a quiet control room free from harmful noise, chemical agents, and heat. When it is not possible to remove the harmful agent or relocate the worker to a safe area, the worker must be protected. In the arena of hearing loss prevention, protection is a many-faceted process that includes exposure assessment, provision of protective equipment,

assessment of hearing with appropriate management and follow-up actions, worker education and training, and continuous evaluation of program effectiveness.

The emphasis on prevention rather than conservation also reflects a change. The shift from conservation to prevention is not minor. Conserving hearing means to sustain the hearing that is present, regardless of whether it is impaired or not. Prevention means to avoid creating hearing loss. Conservation can start when one is first exposed to an occupational agent that is potentially harmful to hearing. Prevention starts long before the first exposure. Conservation comes from a program that is created and imposed. An emphasis on prevention evolves from beliefs that it is not necessary to suffer an impairment, illness, or injury to hold a job and that it is within one's own purview to employ techniques, use behaviors, and rely upon personal protective equipment to prevent impairment, illness, or injury.

Finally, there have been substantial changes since 1990 related to the recommended definition of hazardous noise (85 vs 90 dBA), the use of the equal-energy principle in integrating noise exposures, and the definition of standard threshold shift (STS). The combined result of such changes as these has been to stir the core tenets of hearing loss prevention. To keep step with the new directions in hearing loss prevention, it became apparent that the time had come to recast the "Practical Guide."

5.1.4.1 Hearing loss

Hearing loss exists when there is diminished sensitivity to the sounds normally heard. The terms hearing impairment or hard of hearing are usually reserved for people who have relative insensitivity to sound in the speech frequencies. The severity of a hearing loss is categorized according to the increase in volume above the usual level necessary before the listener can detect it.

Deafness is defined as a degree of impairment such that a person is unable to understand speech even in the presence of amplification. In profound deafness, even the loudest sounds produced by an audiometer (an instrument used to measure hearing by producing pure tone sounds through a range of frequencies) may not be detected. In total deafness, no sounds at all, regardless of amplification or method of production, are heard.

Deafness, hearing impairment, or hearing loss is a partial or total inability to hear is caused by many different factors, including but not limited to age, noise, illness, chemicals and physical trauma. There is a diagnosis to determine the severity of the hearing impairment, and it is measured in decibels. It may be ranked as mild, moderate, moderately severe, severe or profound. There are a number of measures that can be taken to prevent hearing loss, but in some cases it is impossible to reverse or prevent. Many new technological advancements have been made to improve the hearing of those who are hearing impaired.

ICT based devices that can improve hearing:

- Hearing aids, which amplify the incoming sound, will improve hearing ability.
- Cochlear implants improve outcomes in people with hearing loss in either one or both ears. Cochlear implants artificially stimulate the cochlear nerve by providing an electric impulse substitution for the firing of hair cells.
- Individuals can communicate by telephone using telecommunications device for the deaf (TDD). These devices look like typewriters or word processors and transmit typed text over regular telephone lines. Other names in common use are textphone and minicom.
- There are several new telecommunications relay service technologies including IP relay and captioned telephone technologies. A hearing-impaired person can communicate over the phone with a hearing person via a human translator.
- Real-time text technologies, involving streaming text that is continuously transmitted as it is typed or otherwise composed. This allows conversational use of text. Software programs are now available that automatically generate a closed-captioning of conversations. Examples include discussions in conference rooms, classroom lectures, and/or religious services.
- Videophones and similar video technologies can be used for distance communication using sign language. Video conferencing technologies permit signed conversations as well as permitting a sign language.

- For mobile phones, software apps are available to provide TDD/textphone functionality on some carriers/models to provide 2-way communications.
- The advent of the Internet's World Wide Web and closed captioning has given the hearing impaired unprecedented access to information, e.g. Wireless, Internet and mobile phone/SMS text messaging

5.1.4.2 Hearing aid devices

For people with hearing loss, the most immediate and apparent effect of noise is its impact on interpersonal communication. There is no such thing as "desirable" sound for the hearing-impaired person at a time when they're trying to communicate. They are not immune to the other problems that may be caused by noise, but for them its interference with communication is something that occurs daily, every time they talk to somebody in a noisy place. In this instance, the nature of the noise doesn't matter, whether it is considered "desirable," i.e., music (and the selection is irrelevant), or undesirable sounds such as the racket produced by a pneumatic drill. People wearing hearing aids have to communicate under every acoustic circumstance.

If the sense of hearing is getting overloaded and overwhelmed with background noise there are some steps you can take to lessen the impact of the pesky disturbance. A number of helpful tips can assist the hearing impared person:

- Two hearing aids instead of one: “A number of advantages of wearing two hearing aids include better ability to hear sound from either side, increased loudness of sound when two ears are listening, and ability to locate where sounds are occurring. Using two hearing aids will improve speech understanding in noise for most people.
- Hearing aids with digital signal processing. Hearing aids with digital signal processing (DSP) are able to differentiate between speech and noise, lowering the volume when they identify noise. Many people who wear this type of technology report that background noise seems to fade and the quality of speech is better, though not perfect. The majority of hearing aids sold today are digital hearing aids.
- Hearing aids with directional microphones: With this option, the user can switch the hearing aid from a setting that picks up sound from all directions - front, back, and sides- to one that picks up primarily sounds coming from the front of the hearing aid user. As a result, less background noise is heard.

There are a number of different ways for a hearing aid user to improve speech perception in the presence of competing sounds. One, as has been alluded to, is to attempt to get the offending sounds reduced. A second technique is to use strategic seating in an unavoidably noisy location by trying to find the quietest spot in the room. But this is not possible in many places. A third method would be to employ a close-talking mike, such as a personal FM system. This is probably the most effective technique of all, since it directly boosts the speech-to-noise ratio. A fourth option is to use hearing aids that include directional microphones. These really do work, but also require strategic seating for maximum effectiveness. And a fifth solution is to use hearing aids equipped with a digital noise reduction (DNR) circuit.

In an ideal DNR system, the hearing aid will reduce only the undesired noise while leaving desired speech signals intact. In this ideal situation, the hearing aid is supposed to "know" what sounds it is expected to "hear" and pass on to the listener and what sounds it should reject. To reach this goal, engineers and scientists have focused on the acoustic differences between speech and noise and devised sensors that respond to these differences. While noise can vary in an almost infinite number of ways, we know that the nature of speech is syllabic, with relatively intense vowels followed by weaker consonants and pauses. In normal speech, there are about four to six such syllables (or "modulations") per second.

In the most common type of DNR implementation, speech is differentiated from noise by an analysis of the modulations. In a quiet environment, the intensity range of these modulations is at a maximum. In this instance, the hearing aid "knows" that the signal is purely speech. However, when other sounds are present, the situation changes. These sounds can consist of other people talking, music, or just everyday background sounds. The presence of these other sounds tends to flatten the modulations;

that is, the competing sounds fill the gaps between syllables or even override the vowel peaks. The full range of the modulated speech signal is no longer observed.

When the extent of the modulations is reduced, the DNR circuit "knows" that noise is present. When this occurs, the hearing aid automatically turns itself down. The amount of gain (amplification) reduction usually depends upon how much the noise affects the modulations. Usually, the greater the effect upon the modulations, the more the gain is reduced. We should understand that while this gain reduction reduces the amplification of the competing noises, it also decreases the energy in the speech signals. In other words, DNR circuits affect both speech and noise in exactly the same way. There is no way that I know of that a DNR circuit can eliminate only the noise from a simultaneous speech and noise signal. (Noise reduction earphones can do this but they require a predictable noise source in order to operate, unlike the normal acoustical environment of a hearing aid user.)

Fortunately, modern hearing aids are "multi-band" and since the DNR circuit works within each separate band, it is possible to reduce the amplification in the noisiest channels only. The amount of gain reduction depends upon a number of acoustical factors, with different manufacturers using their own decision rules. Primarily this would depend upon how much noise is present, but other factors, such as the overall levels of the speech and noise, may also be considered. It is a common practice for a DNR circuit to vary the amount of gain reduction depending upon a band's frequency location. Frequencies more important for understanding speech are not reduced as much as frequency bands less important for the understanding of speech.

All DNR aids, then, are not alike. Some hearing aids provide 16 dB or more in gain reduction, while others will reduce the gain by only 5 dB at the same frequencies. They also differ in how rapidly they increase and decrease the gain and how they affect different types of sound. For example, Ruth Bentler compared two DNR aids in the degree to which they reduced speech, noise, and music at different frequencies. The two hearing aids differed not only from each other but also in the extent to which they reduced the gain of speech, music and noise across frequency. In other words, all hearing aids that contain a DNR system are not alike in this respect (nor in many others as well). It is not known how these two aids, and by implication other hearing aids with DNR systems, would compare in respect to objective testing and subjective preferences in a real-life situation.
There has been a fair amount of research performed on DNR systems in hearing aids. From what I can see a consensus appears to be emerging: people do prefer listening in a noisy situation while wearing a hearing aid that includes a DNR circuit. Hearing aid users report that the background noise does appear to recede and that incoming speech does "sound" better with the DNR system. The entire listening experience is not quite as stressful or as fatiguing as it ordinarily would be. These subjective preferences have been found when people wear DNR hearing aids under both high and low-noise conditions.

5.1.4.3 Noise reduction devices

One of the most annoying things about earphones is how you have to turn them up when you're in a noisy area. Turning up the volume can run down your batteries and, more importantly, damage your hearing. Noise-canceling headphones help block outside audio interference so you can continue to listen to your music at comfortable levels even in a loud environment.

Active noise control (ANC) uses a microphone in the earpiece to measure how much ambient noise is present. The headset then generates an "antinoise" signal that is opposite of the ambient sound. This interfering signal, in addition to the soundproof design of the audio accessory, creates a silent barrier around your ear. This is perfect for blocking out the sound of an airplane engine during a flight, the hum of a noisy air conditioner in your home, or any other place where constant outside noise is a problem

3M is one of the manufacturers of ear muffs used for working in high noise environments. The newest 3M Peltor Earmuffs feature Noise Reduction Ratings ranging from 21 dB to 31 dB. These headphones hush ambient sounds by creating frequencies that obviate the noise at the ear. They won't eliminate everything, but the better models significantly reduce the whoosh of airplanes' air-conditioning systems and crowd chatter. Noise-canceling headphones come in all forms, from full size to ear buds,

and since you no longer have to crank up the volume to overcome background noise, this type of headphone lets you listen at lower levels.
Noise cancellation makes it possible to enjoy music without raising the volume excessively. It can also help a passenger sleep in a noisy vehicle such as an airliner. In the aviation environment, noise cancelling headphones increase the signal-to-noise ratio significantly more than passive noise attenuating headphones or no headphones, making hearing important information such as safety announcements easier. Noise-cancelling headphones can improve listening enough to completely offset the effect of a distracting concurrent activity.
Noise-cancelling headphones typically use Active noise control to cancel the lower-frequency portions of the noise; they depend on more traditional methods such as soundproofing to prevent higher-frequency noise from reaching the ear. This approach is preferred because it reduces the demand for complicated electronic circuitry that would be required for noise cancellation at higher frequencies, where active cancellation is less effective. To truly cancel high frequency components (coming at the ear from all directions), the sensor and emitter for the cancelling waveform would have to be adjacent to the user's eardrum, which is not currently technically feasible

By the 1950s, systems were created to cancel the noise in helicopter and airplane cockpits. Noise-cancelling aviation headsets are now commonly available.
Currently, most noise-cancelling headsets use analogue technology. This is in contrast to other forms of active noise and vibration control in which digital processing is the standard method.
A number of airlines provide noise-cancelling headphones in their business and first class cabins. Noise cancelling is particularly effective against airplane engine noise. In these cases, the headphones are about the same size as normal headphones. The electronics, located in the plane hand rest, take the sound from the microphone behind the headphone, invert it, and add it back into the audio signal, which reduces background noise, resulting in a more enjoyable audio experience.

The development is a special case of the differential microphone topology most commonly used to achieve directionality. All such microphones have at least two ports through which sound enters; a front port normally oriented toward the desired sound and another port that's more distant. The microphone's diaphragm is placed between the two ports; sound arriving from an ambient sound field reaches both ports more or less equally. Sound that's much closer to the front port than to the rear will make more of a pressure gradient between the front and back of the diaphragm, causing it to move more. The microphone's proximity effect is adjusted so that flat frequency response is achieved for sound sources very close to the front of the mic – typically 1 to 3 cm. Sounds arriving from other angles are subject to steep midrange and bass rolloff. Commercially and militarily useful noise-canceling microphones have been made since the 1940s by e.g. Roanwell, Electro-Voice and others.

6 Conclusions

This deliverable contains an overview of the state-of-the art on health prevention. It provides an overview about (1) preventive measures and their effects on health, (2) the current available preventive technologies, and (3) the current preventive measures implemented within various European Healthcare systems.

Based on an analysis carried out in T1.2 we have analysed today’s implementation of preventive medicine by analysing literature reports and also by involving public/local health authorities and health care providers.

The general conclusion on the impact of physical activity is that even a small change toward less sedentary behaviour is beneficial. Furthermore it can be concluded that some activity is better than none, and more is better than some. Even light-intensity activity appears to provide benefit and is preferable to sitting still.

Given that physical activity is having a positive impact on health we analyzed the technologies and systems providing and promoting a healthy lifestyle. These technologies can be grouped into (1) Ambient/fixed sensors, (2) wearable sensors (monitoring) and (3) interactive technologies (user feed-

back). Many such technologies are currently being developed in e.g. EU R&D projects (from which we have identified 17 ongoing or completed projects).

Some of the technologies have already matured into commercially available products arising from both SMEs as leading global players like Adidas and Nike. In the report we have identified a list of nearly forty such products.

In the current health prevention implementation and shift from Lifestyle to Care section we have focused on the three pilots to be carried out in the project. These are:

- Finland: Occupational therapy (stress management)
- Belgium: Overweight/obesity
- Spain: Elderly – Cardiovascual condition

In order to be able to make use of these technologies we have focused on ICT based tools that might be interfaced to the WITH-ME system. Since a significant user group will be elderly people who traditionally suffer from hearing loss we investigated various means of protecting the hearing as well as means of improving the hearing. The latter to ensure that the WITH-ME system will be usefull also for persons suffering from hearing loss.

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