1. Mednarodni znanstveni simpozij |
1. International scientific symposium

@life

Obvladovanje stresa na delovnem mestu - holističen pristop|

Managing stress at work – a holistic approach

Zbornik prispevkov z recenzijo |
Proceedings

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@life Obvladovanje stresa na delovnem mestu – holističen pristop |
@life Managing stress at work – a holistic approach

1. Mednarodni znanstveni simpozij | 1. International scientific symposium

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Janez Uplaznik
Maja Uplaznik Pantar
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@life Obvladovanje stresa na delovnem mestu – holističen pristop|
@life Managing stress at work – a holistic approach

Prizorišče | Venue
Hotel Plaza, Ljubljana

Datum |Dates
20. in 21. Maj 2013 |20st and 21st May 2013

Soorganizatorji | Co-organizers
RC IKTS Žalec

Organizacijski odbor simpozija | Members of the organization committee
Janez Uplaznik (RC IKTS Žalec)
Maja Uplaznik Pantar (RC IKTS Žalec)
Juraj Sprung (Mayo Clinic)
Vojko Strojnik (University of Ljubljana, Faculty of Sport)
Matej Tušak (University of Ljubljana, Faculty of Sport)
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Juraj Sprung, Ph.D., M.D.
John Eisenach, Ph.D., M.D.

Zahvala |Acknowledgement
"The operation is performed in the frame
of the Operative Program for Strengthening
Regional Development Potentials for the period
2007-2013, within 1st Development priority
"The Competitiveness of the companies and
Researching excellence", priority orientation
"Improving the competitiveness of companies
and Research excellence".

Dear colleagues,

on behalf of the Organizing Committee, I take pleasure to welcome you to
the 1. International Symposium on "Stress at work"
which will be held in Plaza Hotel in Ljubljana, Slovenia,
May 20-21, 2013.

Stress at working place is a global problem that needs a holistic approach. This symposium will present topics related to stress at working place from different areas including psychology, medicine, kinesiology, and nutrition, and discuss trends and challenges ahead. Attention will be given also to technologies enabling monitoring some easy accessible physiological parameters related to stress.

Examples of good practice will be also included in the program. Twenty experts from Slovenia and broad, including recognized professionals from the Mayo Clinic in the USA, will present different views on the topics.

We hope that this symposium will be a memorable experience for all of you and will provide an exquisite background for an open exchange of ideas and presentations of new knowledge.

Admission for symposium is free!
The detailed program is available in the attachment.

Sincerely yours,
Vojko Strojnik

Program of the International scientific symposium

@life 2013

Managing stress at work – a holistic approach

Monday, May 20th, 2013

8.00 Registration

8.30 Opening ceremony: Representative of the Organizing Committee
Representative of the Slovenian Government
Representative of the Mayo Clinic

Session 1: Stress characteristics 1
Chairmen: Matej Tušak (University of Ljubljana) and Paul Jimenez (University of Graz)

9.00 Paul Jimenez (University of Graz):
STRESS THREATS AT WORKPLACE

9.25 Markus Raab (Institute of Psychology Cologne):
STRESS AND PERFORMANCE

9.50 Matej Tušak (University of Ljubljana):
STRESS COPING TECHNIQUES AND STRATEGIES

10.15 Tiziano Agostini (University of Trieste):
STRESS AND SKILLED EXPERTISE

10.40 Break

Session 2: Stress characteristics 2
Chairmen: Donald Hensrud (Mayo Clinic) and Prof. Alojz Ihan (University of Ljubljana)

11.00 Alojz Ihan (University of Ljubljana):
HEALTH RESERVE

11.25 John Eisenach (Mayo Clinic):
PHYSIOLOGICAL RESPONSE TO DIFFERENT STRESSORS

11.50 Matjaž Mulej (University of Maribor):
SPORT AND RECREATION AS A FORM OF SOCIAL RESPONSIBILITY

12.15 Break

Session 3: Methodological view of stress determination
Chairmen: Mark Warner (Mayo Clinic) and Aleš Živkovič (University of Maribor)

12.30 Aleš Živkovič (University of Maribor):
MASS MARKET TECHNOLOGICAL AIDS FOR STRESS RECOGNITION AND REDUCTION: A REVIEW
12.55 Mark Warner (Mayo Clinic):
THE IMPACT OF NEW TECHNOLOGIES ON PATIENT SAFETY
13.20 Amine Issa (Mayo Clinic):
LONG-TERM MONITORING OF PHYSIOLOGICAL PARAMETERS

14.00 Lunch

Tuesday, May 21st, 2013

Session 4: Measures to reduce stress
Chairmen: Vojko Strojnik (University of Ljubljana) and Matthew Clark (Mayo clinic)

8.30 Vojko Strojnik (University of Ljubljana):
BEATING STRESS WITH EXERCISE
8.55 Maroje Sorić (University of Zagreb):
PHYSICAL ACTIVITY AND SLEEP: TO EXERCISE OR NOT?
9.20 Matthew Clark (Mayo Cinic):
HEALTH BEHAVIOR INTERVENTIONS
9.45 Donald Hensrud (Mayo Clinic):
STRESS AND DIET
10.10 John Abenstein (Mayo Clinic):
SUPPORTIVE TECHNOLOGIES FOR STRESS ASSESSMENT

10.35 Break

Panel: Stress at work
Chairwoman: Metoda Dodič-Fikfak (University Medical Center Ljubljana)

11.00 Tanja Urdih Lazar (University Medical Center Ljubljana):
WORKPLACE HEALTH PROMOTION
11.10 Metoda Dodič-Fikfak (University Medical Center Ljubljana):
MENTAL AND BEHAVIORAL DISORDERS IN CRISIS
11.20 Eva Stergar (University Medical Center Ljubljana):
STRESS AT WORK
11.30 Eva Pintarič (Zdravilišče Radenci):
PRACTICAL EXAMPLE OF STRESS PREVENTION IN A COMPANY
11.40 DISCUSSION

12.10 Break

12.25 **Panel:**
Corporate @life – A holistic approach for managing stress at work
Chairmen: Aleš Živkovič (University of Maribor) and
Vojko Strojnik (University of Ljubljana)

Presented by: Aleš Živkovič (University of Maribor)
Alojz Ihan (University of Ljubljana)
Marjan Heričko (University of Maribor)
Matej Tušak (University of Ljubljana)
Vojko Strojnik (University of Ljubljana)

13.45 End of symposium

14.00 Lunch

Vsebina zbornika | Proceedings Contents

S. Baša	**PROJECT @life**
P:Jimenez	**STRESS THREATS AT THE WORKPLACE**
A. Ihan	**HEALTH RESERVE**
JH Eisenach	**PHYSIOLOGICAL RESPONSE TO DIFFERENT STRESSORS**
A. Živkovič	**MASS MARKET TECHNOLOGICAL AIDS FOR STRESS RECOGNITION AND REDUCTION: A REVIEW**
Mark A. Warner	**HOW NEW TECHNOLOGIES WILL IMPACT PERIOPERATIVE PATIENT SAFETY**
V. Strojnik	**BEATING STRESS WITH EXERCISE**
M. Sorić	**PHYSICAL ACTIVITY AND SLEEP: TO EXERCISE OR NOT TO EXERCISE?**
Matthew M. Clark	**RESILIENCY: MAYO CLINIC STRATEGIES**
D. Hensrud	**NUTRITION AND STRESS**
J.P. Abenstein	**HOW MIGHT ANESTHESIA BE DELIVERED: LESSONS FROM OUTSIDE MEDICINE**
T. Urdih Lazar, E. Stergar	**WORKPLACE HEALTH PROMOTION – A STRATEGY TOWARDS BETTER HEALTH AND WELL-BEING AT WORK**
E. Stergar	**WORKPLACE STRESS PREVENTION AND COPING**
A. Živkovič, V. Strojnik, M. Tušak, A. Ihan, M. Heričko and J. Uplaznik	**CORPORATE @life – A HOLISTIC APPROACH FOR MANAGING STRESS AT WORK**

Naložba v vašo prihodnost
OPERACIJO DELNO FINANCIRA EVROPSKA UNIJA
Evropski sklad za regionalni razvoj

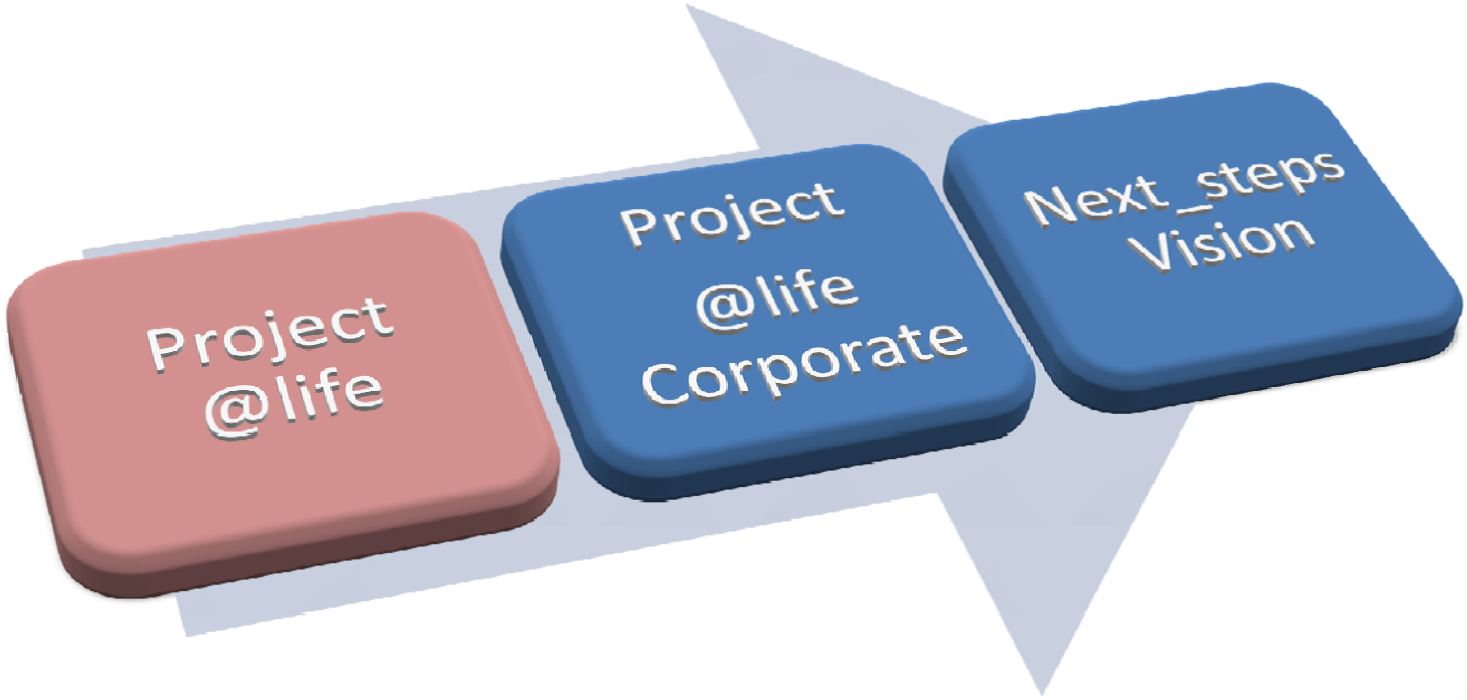
RAZVOJNI CENTER IKTS ŽALEC

Project @Life

Ljubljana, May 2013

Stane Baša

Agenda



Challenges with @Life project

- New market place (public space)
- New domains & Interdisciplinary approach
  - Medicine, Psychology, Kinesiology, Nutrition
- Adoption of IT technologies
  - Portal, video streaming, multi-platform mobile development
- Project size and complexity

RC IKT Savinja

- Mikropis Holding
- EMG d.d.
- University Maribor, Institute of Informatics
  (Faculty of Electrical Engineering and Computer Science)
- Etrust

- REPRO MS 03
- M2M
- Oring
- ProSys
- IPAK
- Municipality Žalec
- RA Savinja Žalec

- Funds from EU

Naložba v vašo prihodnost
OPERACIJO DELNO FINANCIRA EVROPSKA UNIJA
Evropski sklad za regionalni razvoj

@Life project description

- Holistic approach –comprehensive study of stress problematic
- Interdisciplinary concept
  - Medicine
  - Psychology
  - Kinesiology
  - *Nutrition*
- IT support based on latest web and mobile technologies

@Life Concept

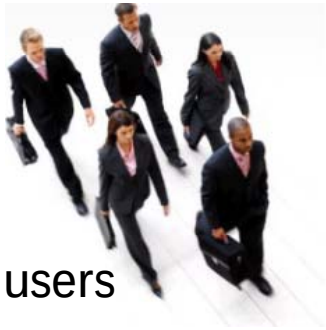
Research & Development

Distribution

Usability
Verification

Science

Corporate users



Approach

Engagement of top experts for specific areas from three universities

Activities

Methodology development

Program verification

Project objectives

- Decrease occurrence of Burn-out Syndrome & increase efficiency at work
- Higher quality and balance between business and private

- Cost reduction for healthcare system on national level

@Life Workflow

Action

Domain areas:

- Psychology
- Medicine
- Kinesiology
- *Nutrition*

Measurement

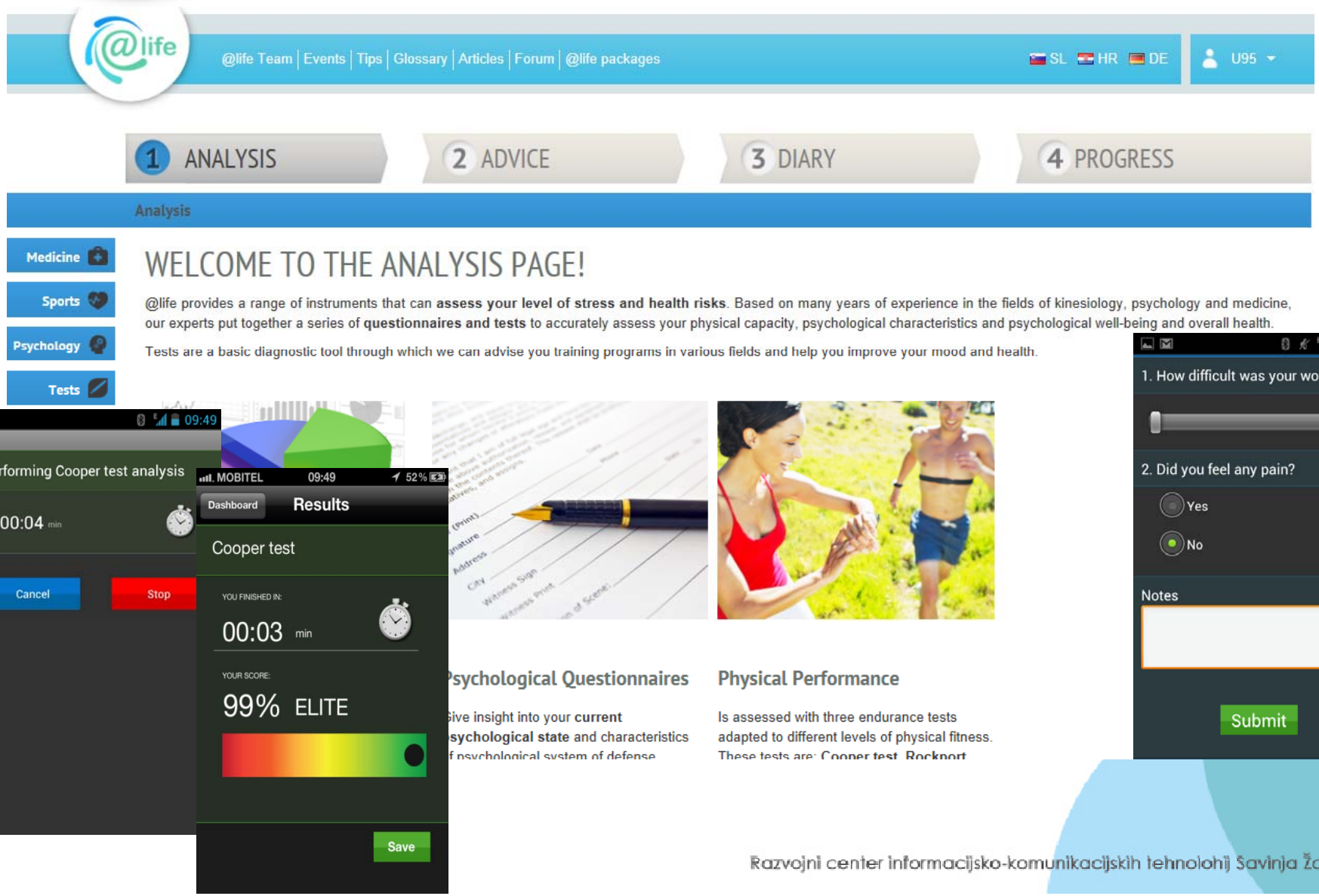
Analysis

Programming

Workouts/ activities

Information /awareness /motivation

Portal @Life- Analyses



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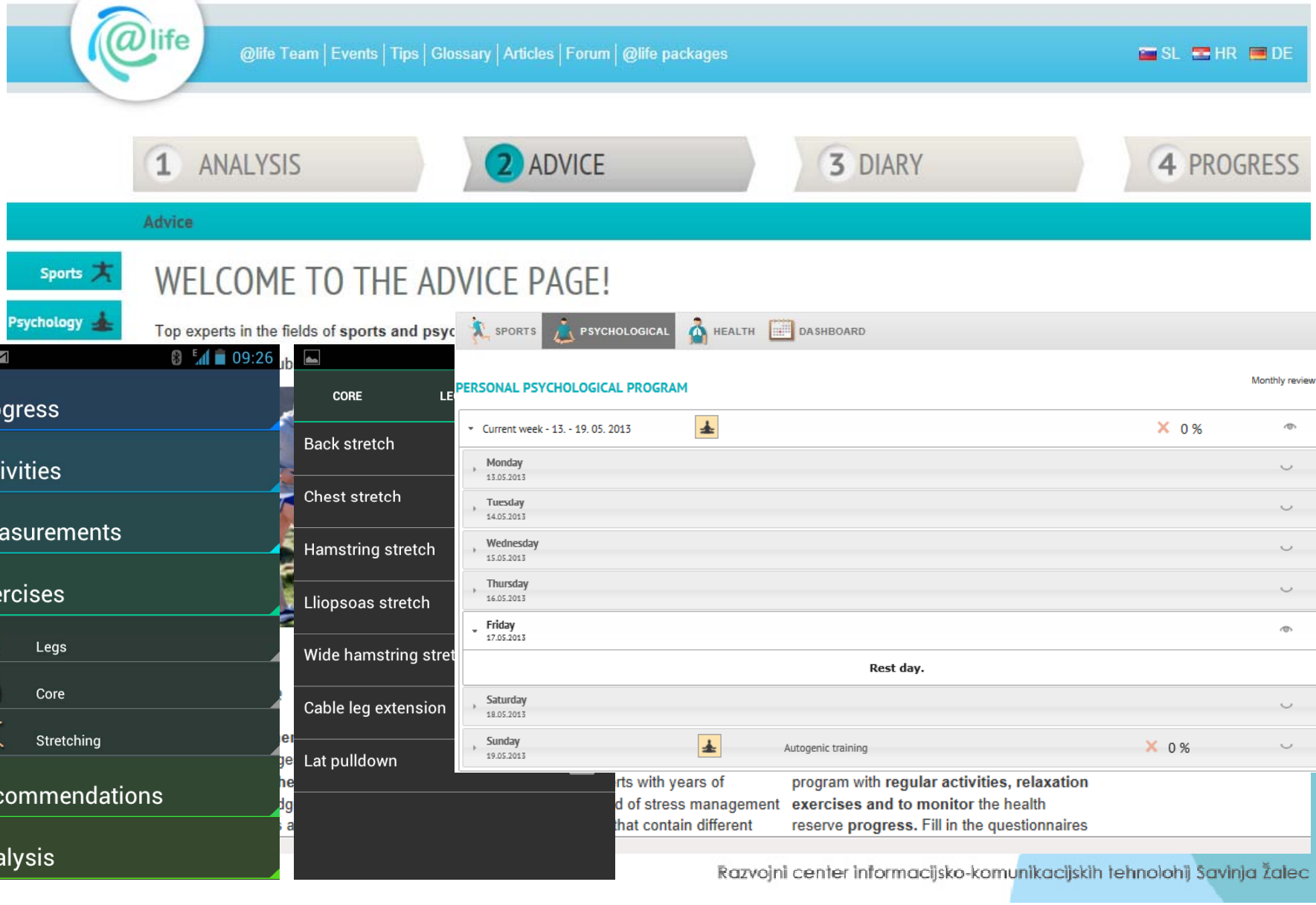
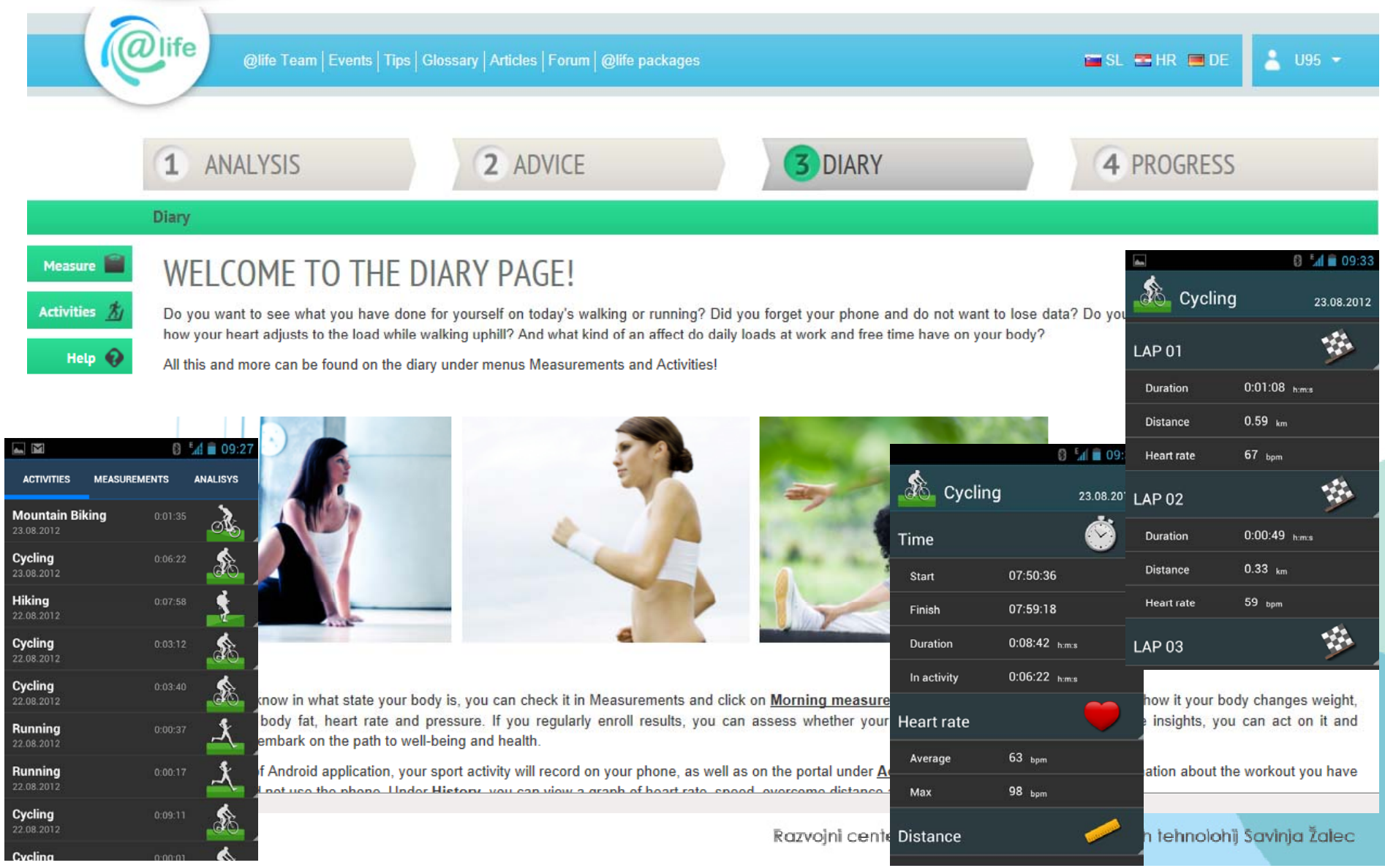
Evropski sklad za regionalni razvoj

Portal @Life- Advice



Razvojni center informacijsko-komunikacijskih tehnologij Savinja Žalec

Portal @Life- Diary



Portal @Life- Diary Example

Opombe

frontier minnesota Lake cyty. 121006

Portal @Life- Progress

@life Team | Events | Tips | Glossary | Articles | Forum | @life packages

SL HR DE U95

1 ANALYSIS 2 ADVICE 3 DIARY 4 PROGRESS

Progress

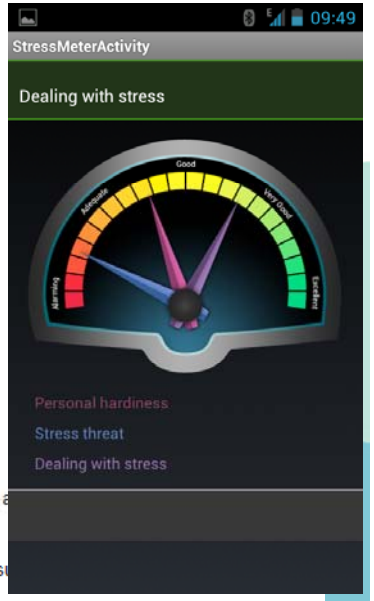
Overall

Psychology

Help

WELCOME TO THE PROGRESS PAGE!

Each of us cares what happens to our bodies and health, especially what the effort we put in training means and learning about ourselves as a whole.



In the tab **Overall**, you get information about your **health reserve**, which presents your current physical, medical and psychosocial performance. To look a
to complete the questionnaire about **Health problems** and one of the tests of about **physical capacity**.

Tab **Psychology** guides you through your stress profile through three levels - personality characteristics, rate of stress environment and an individual's su
well-being.

Portal @Life- Progress Example

Naložba v vašo prihodnost
OPERACIJO DELNO FINANCIRA EVROPSKA UNIJA
Evropski sklad za regionalni razvoj

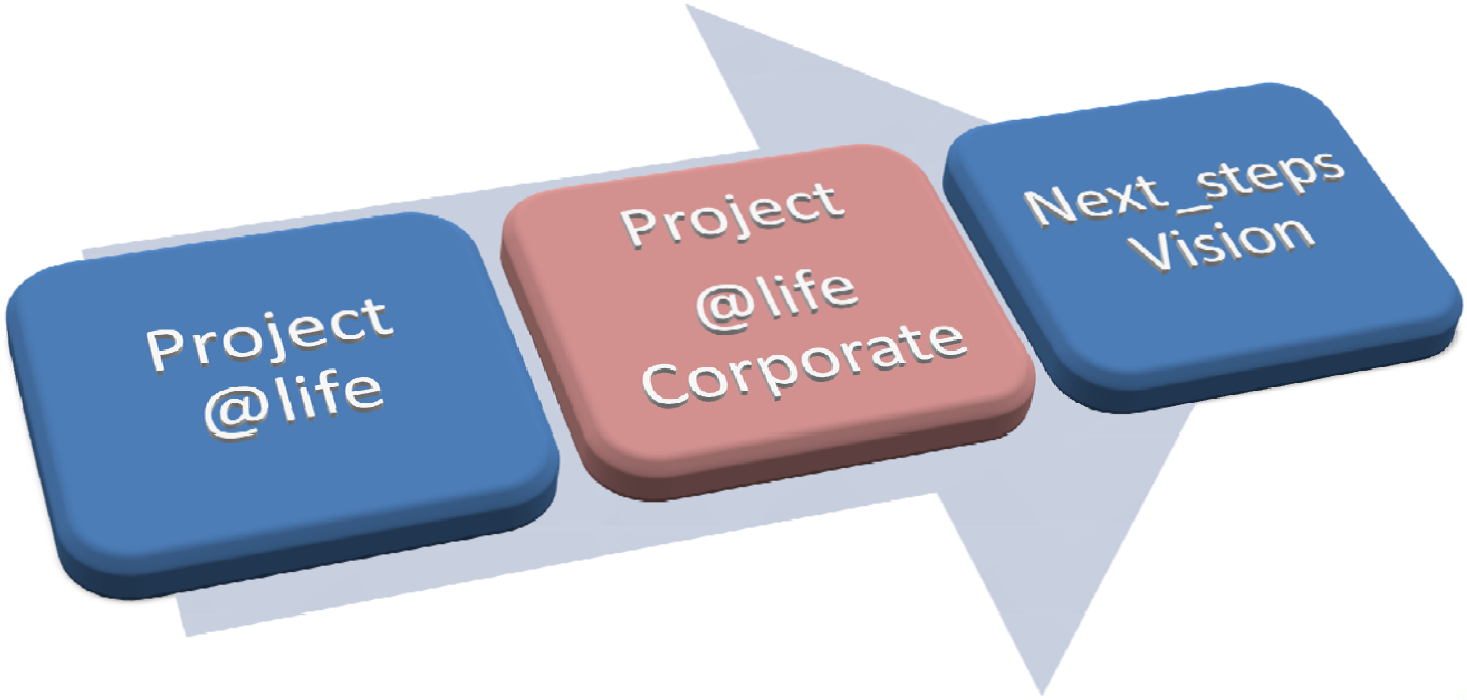
Download on the App Store

ANDROID APP ON Google play

Get it at BlackBerry App World.

Razvojni center informacijsko-komunikacijskih tehnologij Savinja Žalec

Agenda

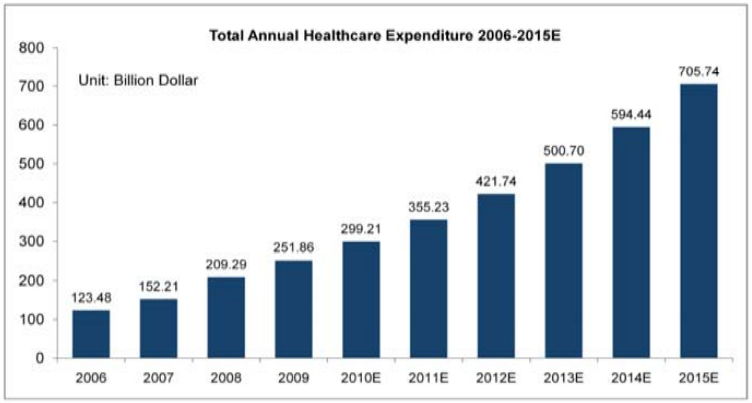


Motivation for the project

- Healthcare costs are growing, projection for US is 5,7% grow every year for the period 2011-2021
- Not much different in the European Union

- **Increased GDP:** GDP per capita projected at $58,000 by 2015, 5.5% annual growth
- **Increased Government spending on health and social care (CAGR 5%)**

1.1.3 China Total Annual Healthcare Expenditure (2006-2015E)



During the years of 2006-2010, The Total Annual Healthcare Expenditure in China experienced a high speed increase, at a CAGR of 18.72%.

Strategic Goal 4

Objective 4.3

Promote fiscal and economic sustainability of healthcare in Dubai

Business reasons for the project

- Increasing employer motivation

In 2006, 19 percent of companies with 500 or more workers reported offering wellness programs, while a 2008 survey of large manufacturing employers reported that 77 percent offered some kind of formal health and wellness program.

Consulting MHR. National survey of employer-sponsored health plans: 2006 survey report. New York: Consulting MHR; 2007

- Significant savings

A critical meta-analysis of the literature on costs and savings associated with such programs, we found that medical costs fall by about $3.27 for every dollar spent on wellness programs and that absenteeism costs fall by about $2.73 for every dollar spent.

Workplace Wellness Programs Can Generate Savings Katherine Baicker, David Cutler, and Zirui Song

@Life Corporate – mission

- @Life Corporate is comprehensive solution designed for motivating employees towards regular activities, customized to health risks related to employees groups, integrated with organization processes in corporations and supported with the latest IT technology

Vision
Mission
& Values

Based on expertise and technology of @Life

@Life Corporate-process

- Employee records
- Assessment of working places and risk factors
- Motivation policies
- …

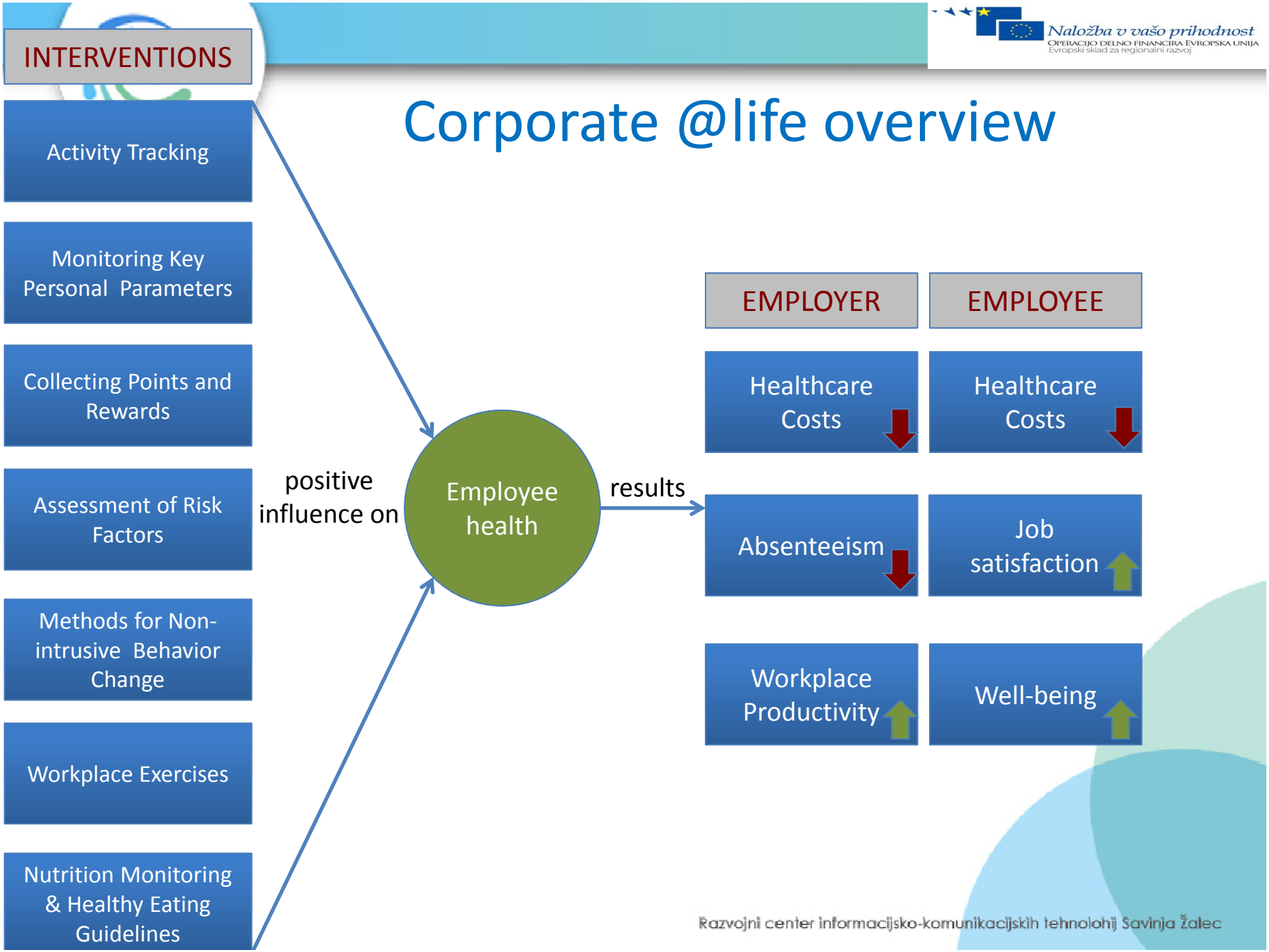
- Questionnaires
- Tests

- Yearly interview with employee
- Decision for participation on @Life
- Evaluation of past activities

- Interview with domain specialist and creation of programs

- Program execution

Corporate @life overview



IT Architecture

(1) Activity monitoring sensors

(2) Devices for measuring body parameters

(3) Fitness devices

Bluetooth

Bluetooth, http

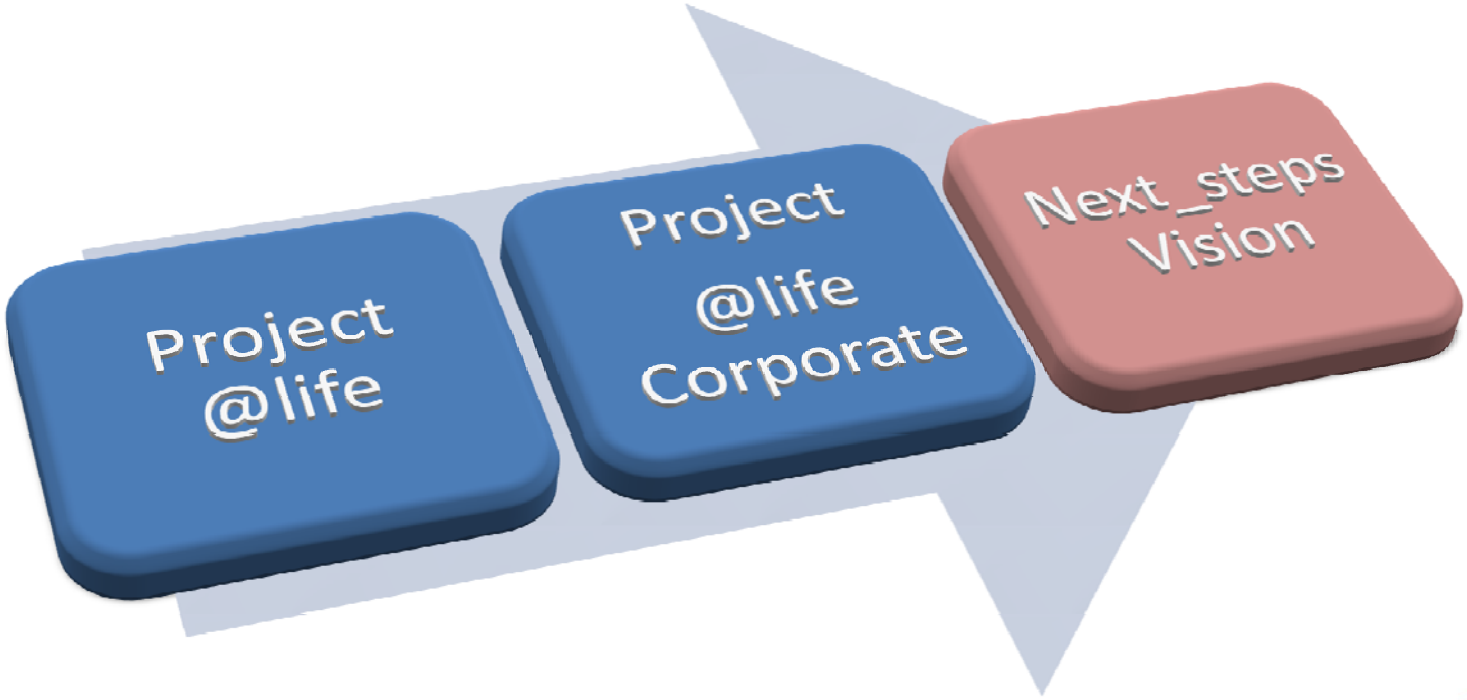
https

@life cloud

Secure data storage
Corporate Web portal
Streaming server
Backend integration

ANT+

Agenda



Next steps, vision

- In summer 2013 pilot execution in Slovenia and in the USA
- Validation and Pilot in the USA will be conducted at the Mayo Clinic in Rochester MN
- Go to market Q4 2013

- On-going support for research
- Creating opportunities for knowledge exchange (Symposiums)
- @Life Corporate integration with popular HR & ERP apps
- Customized editions for groups of people with special needs and elderly population
- Integration with social networks
- Create the awareness for healthier living among population

Thank you!

Questions?

Stress Threats at the Workplace

- Strategies for wellbeing and economic success.

Department of Psychology,
University of Graz, Austria

Dr. Paul Jiménez
paul.jimenez@uni-graz.at

20.05.2013

1. International scientific symposium
Managing stress at work – a holistic approach
@life
Investing in your future
Operation Part Financed By The European Union
European Regional Development Fund

The goal...

... and how to reach it

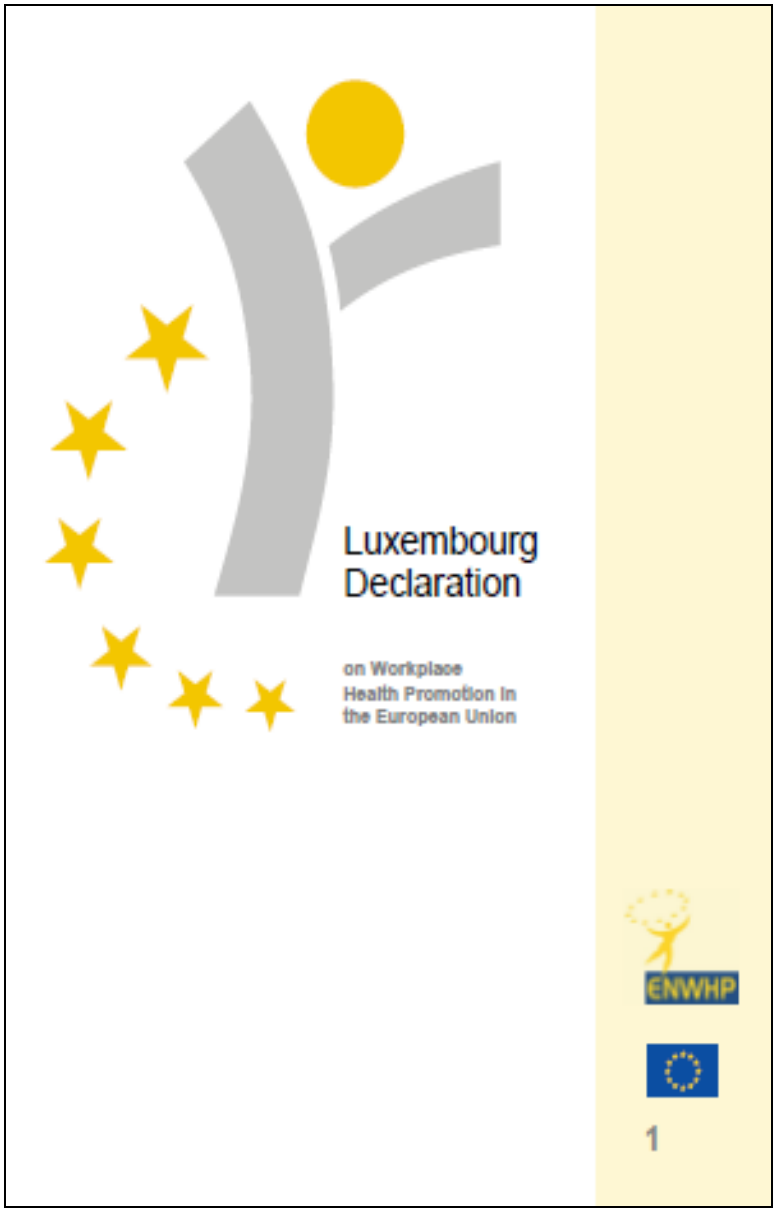
„If you want to build a ship, [..] teach them to long for the endless immensity of the sea.„

Antoine de Saint-Exupéry

How to reach the goal

without

too much STRESS?

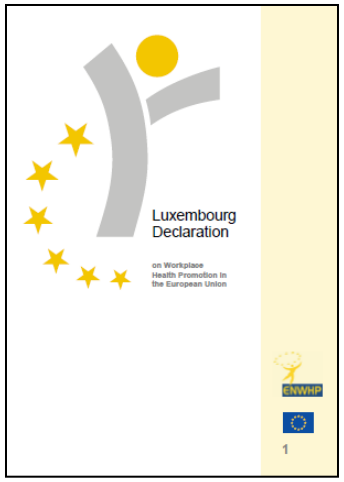


The Luxembourg Declaration on Workplace Health Promotion in the European Union

Workplace Health Promotion (WHP) is the combined effort of employers, employees and society to improve the health and well-being of people at work.

This can be achieved through a combination of:

- improving the work *organization* and the working *environment*
- promoting ***active*** participation
- encouraging ***personal*** development



Declaration

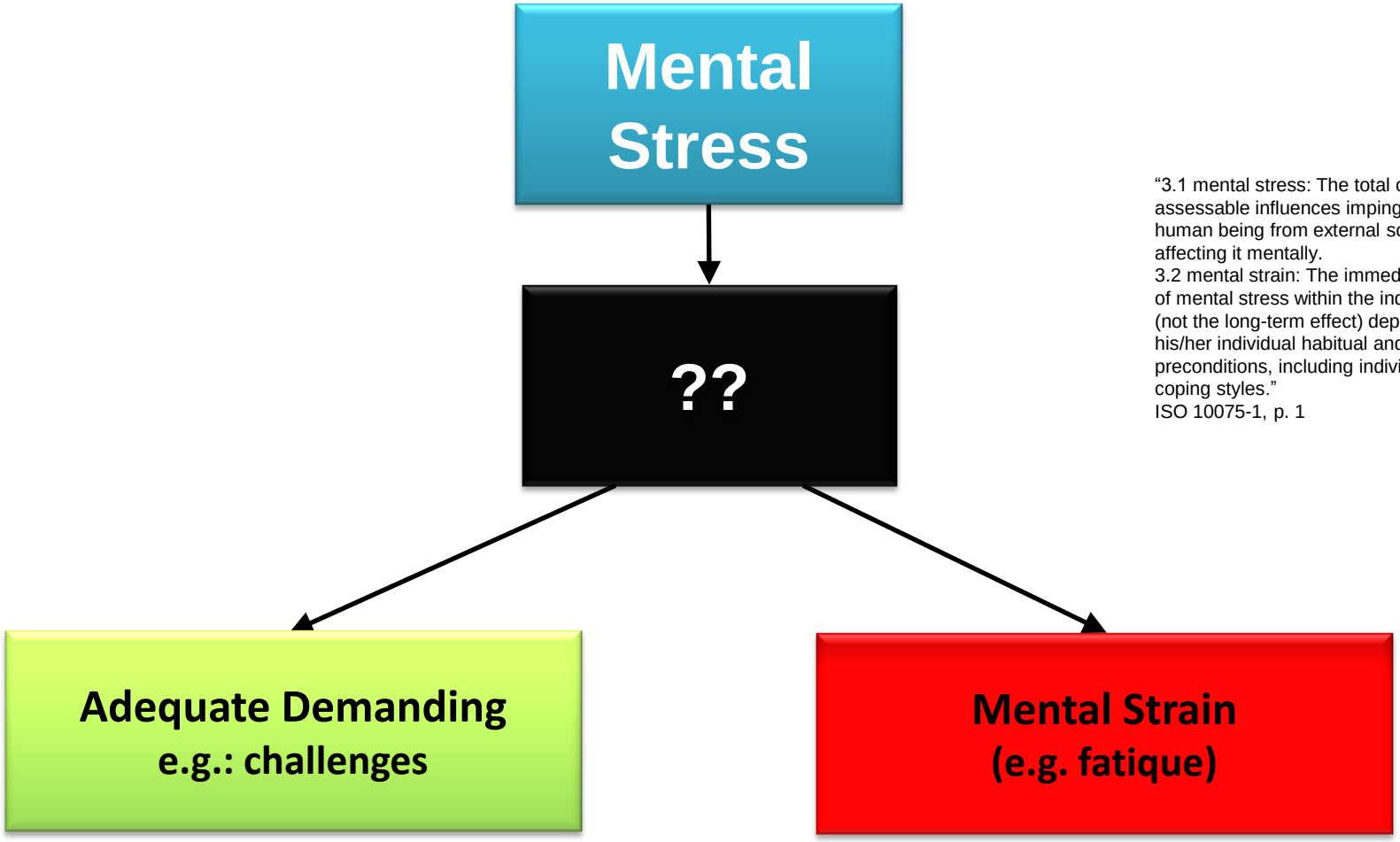
The undersigned organisation [..] agrees [..]

The principles are:

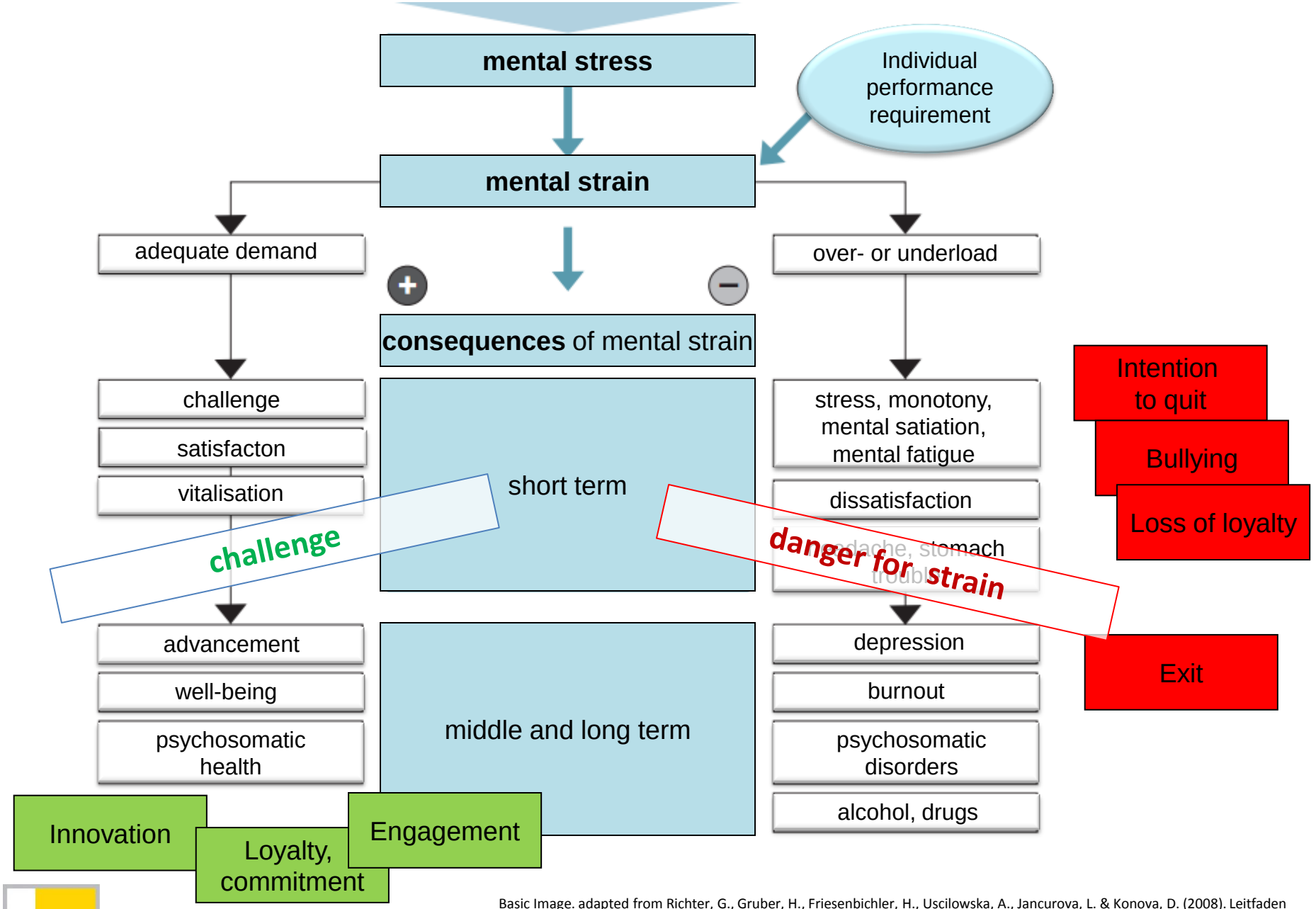
- Company **codes of conduct and guidelines** that view employees not only
- as cost factors but as **important success factors**
- [..]
- Integrated occupational health and safety services
- Inclusion of employees in health issues at all levels (**participation**)
- [..]
- Systematic implementation of all measures and programmes (project management)

Mental Stress and Mental Strain – what are the influences?

From mental stress to challenges and critical mental strain?



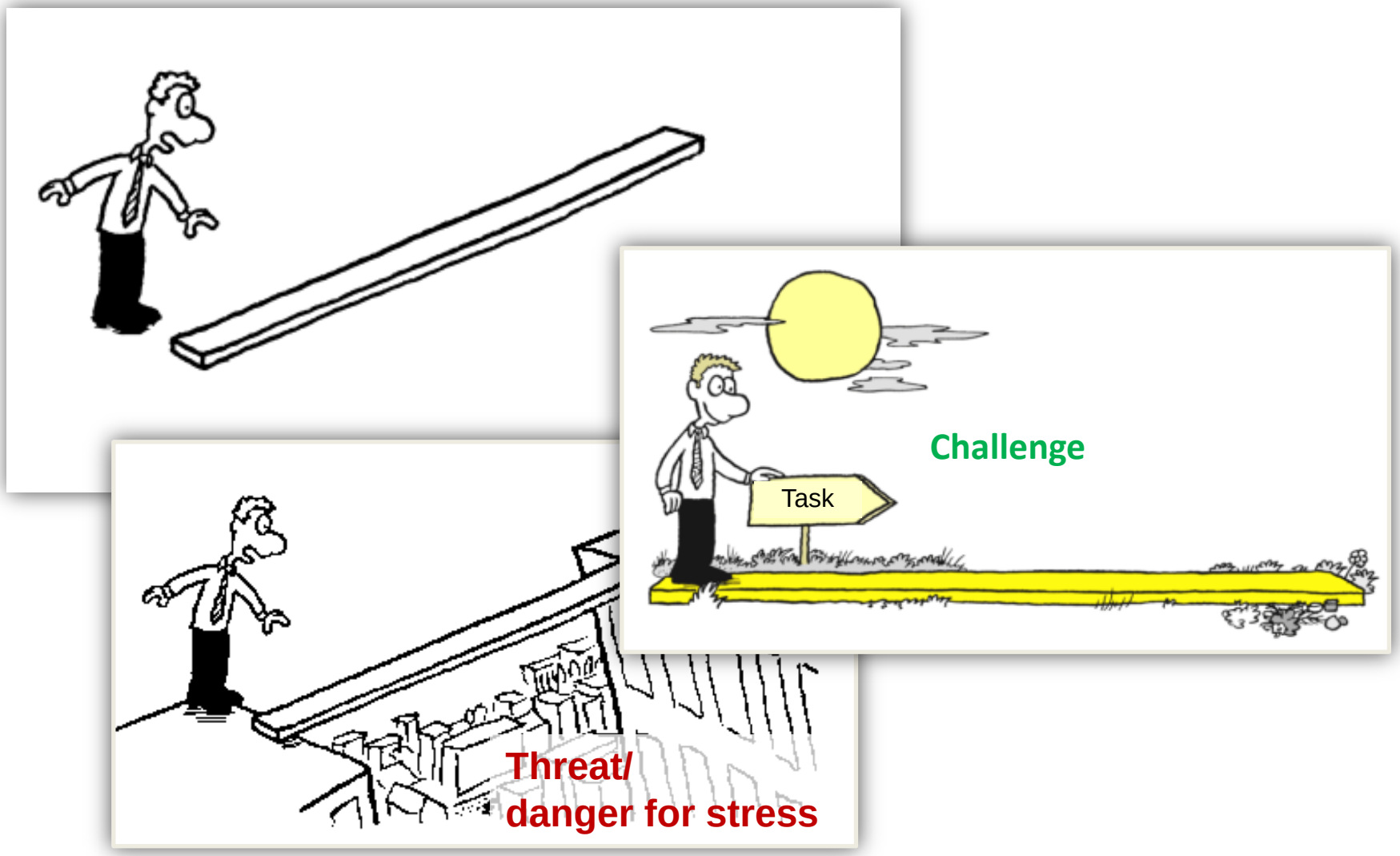
"3.1 mental stress: The total of all assessable influences impinging upon a human being from external sources and affecting it mentally.
3.2 mental strain: The immediate effect of mental stress within the individual (not the long-term effect) depending on his/her individual habitual and actual preconditions, including individual coping styles."
ISO 10075-1, p. 1



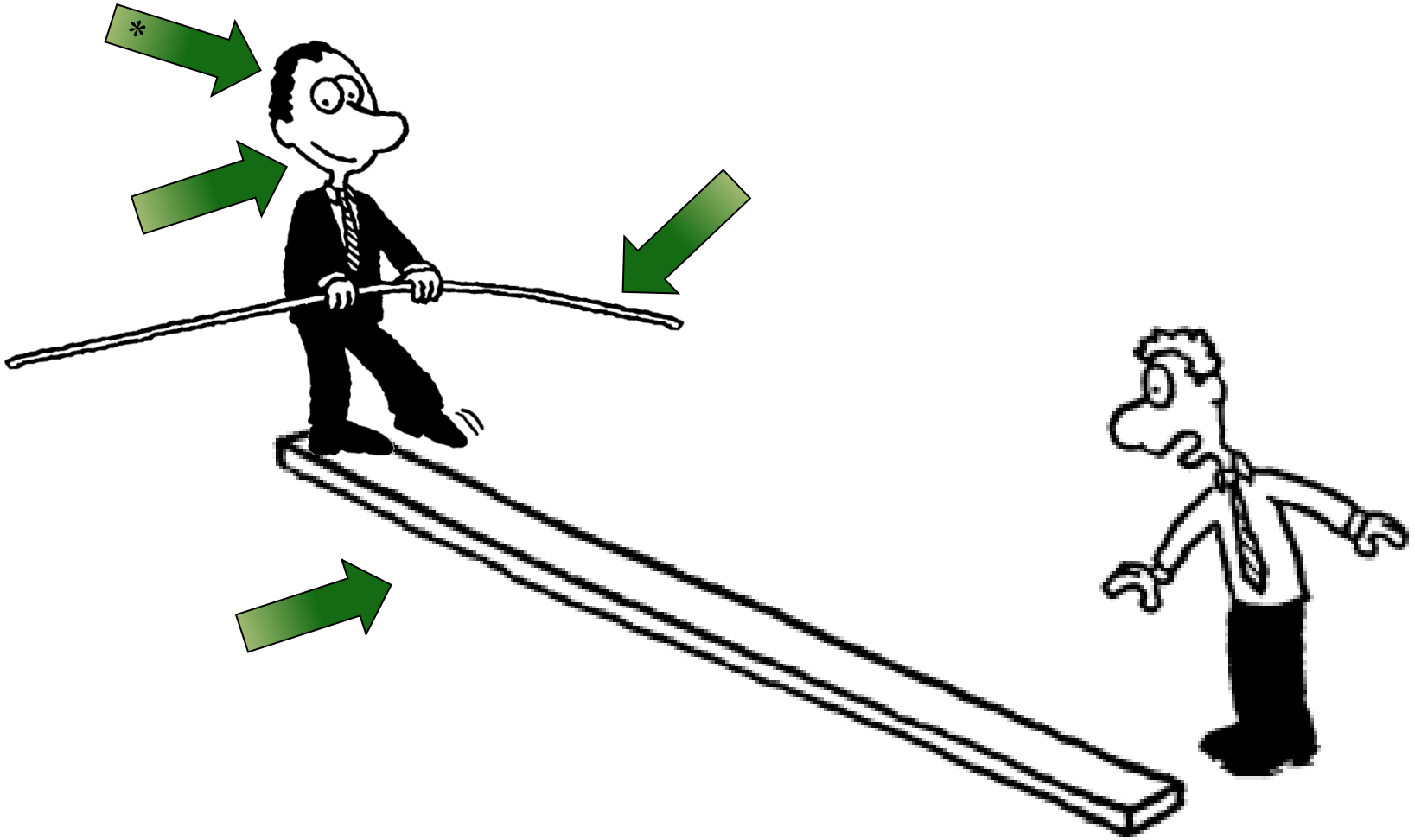
Basic Image. adapted from Richter, G., Gruber, H., Friesenbichler, H., Uscilowska, A., Jancurova, L. & Konova, D. (2008). Leitfaden für die Gefährdungsbeurteilung in Klein- und Mittelbetrieben. Psychische Belastungen Ermittlung und Bewertung von Gefährdungen; Festlegen von Maßnahmen. S. 5. Bochum Verlag Technik & Information e.K.

The way to reach the goal – our treasure

Task and Mental Stress



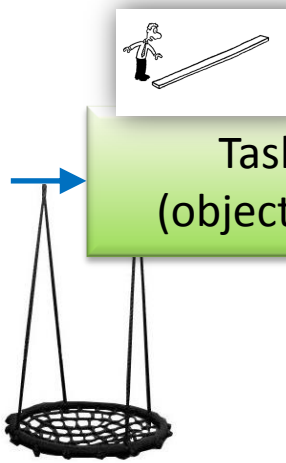
Mental Stress needs ressources



* Beside adapting environmental conditions we have to include the resources of persons in our evaluation of the work place, s. a. ISO 10075-2. Image Tiki Küstenmacher and adapted by Paul Jiménez.

How can we minimize stress?

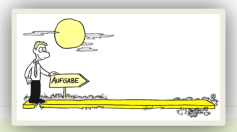
From the task to the result (Jiménez & Kallus, 2013)



Task (objective)

Evaluation

Redefinition



Task (subjective)

Coping/ mastering

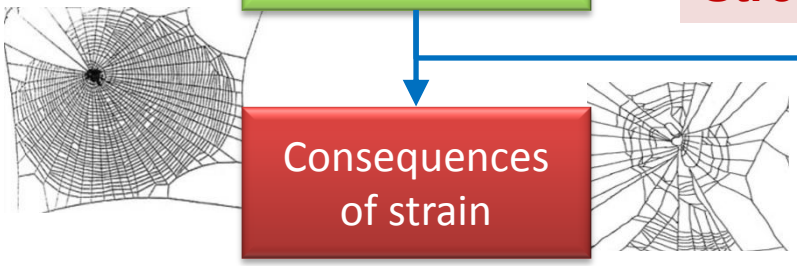
Result- Output

Recovery
Gaining Resources

Mental strain
Loosing Resources

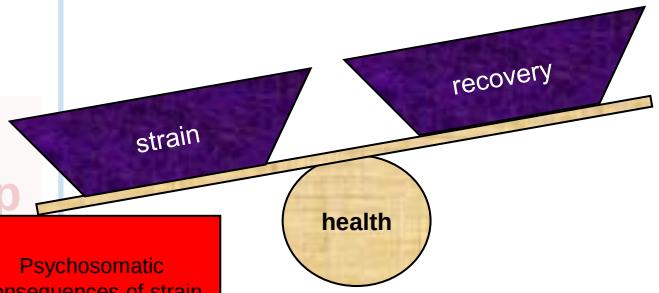
Balance of Resources

Additional consideration of situation
context
personality
constitution
experience
resources
orginal state



Consequences of strain

Balance/ Stress-Loop



Psychosomatic consequences of strain

(Recovery-Stress-Balance, see also Kallus, 1992; Kallus & Uhlig, 2000; Jiménez & Kallus 2010; Jiménez, 2013)

Who gives the tasks...?
What about stress and leading?

Mental Stress-Resources-Health Model

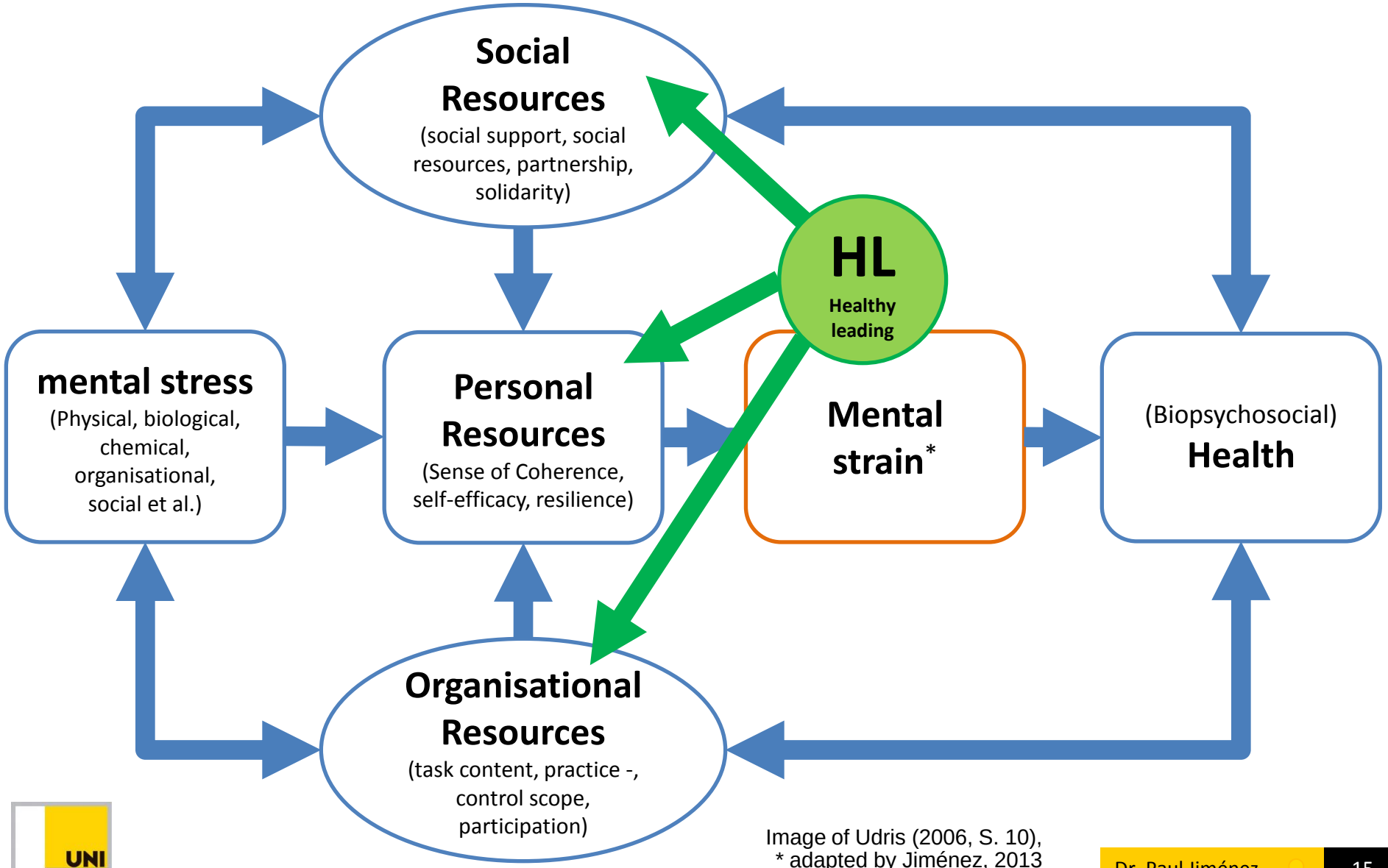
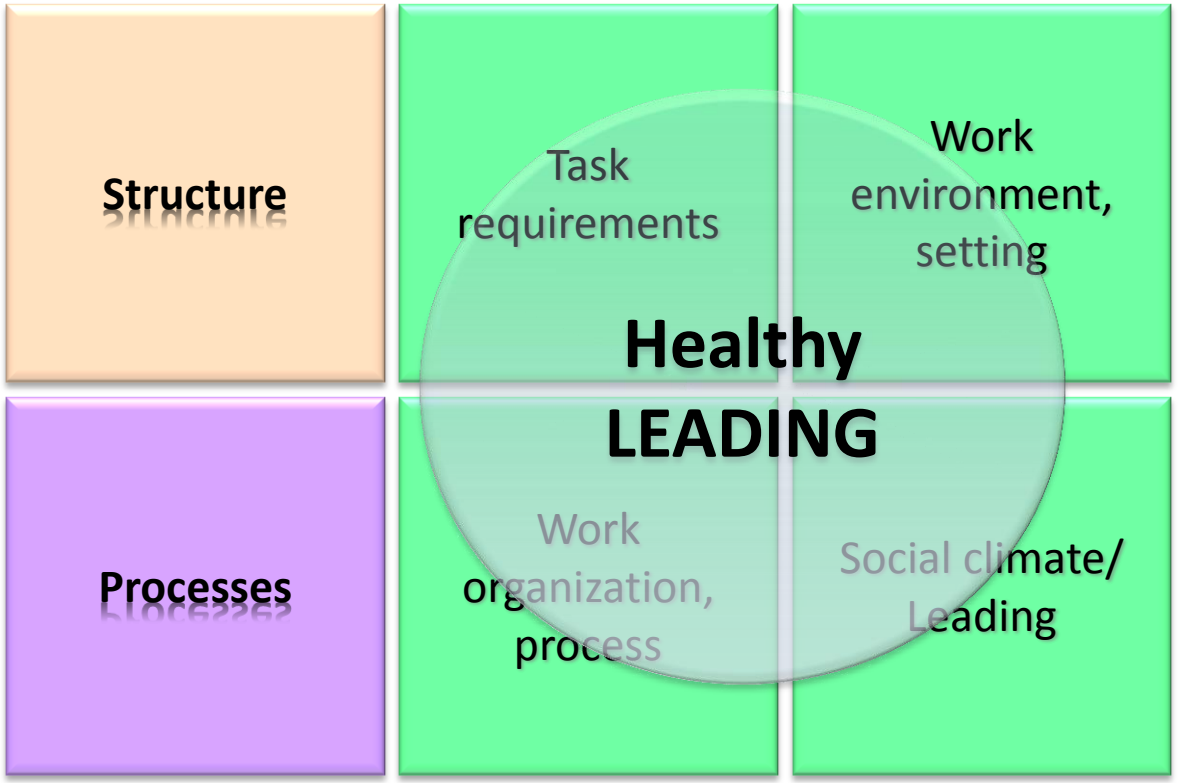


Image of Udris (2006, S. 10),
* adapted by Jiménez, 2013

Workplace evaluation of mental stress

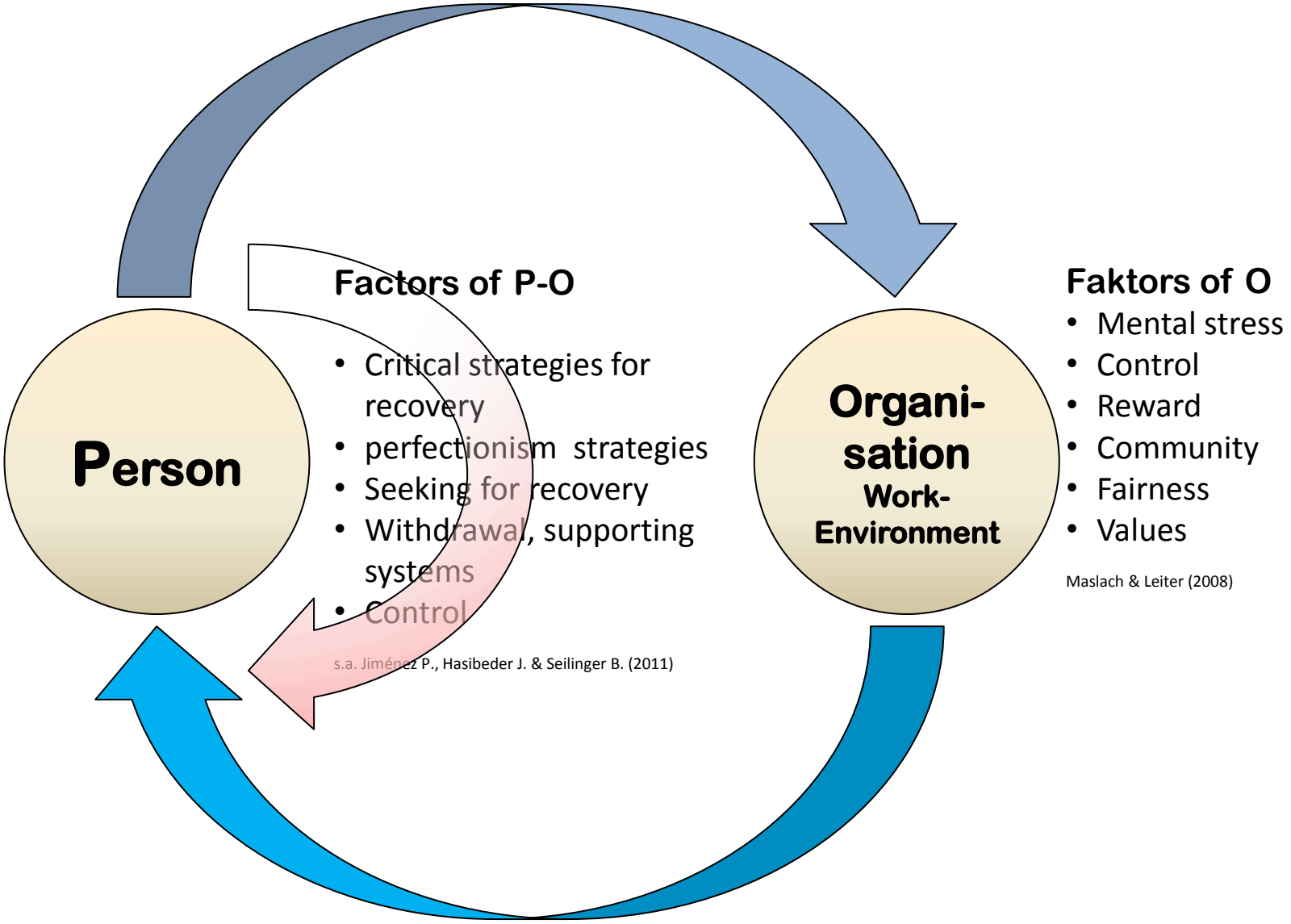
through professionals in Work and Organizational Psychology

www.boep.at
www.arbeitspsychologie.org



Areas of workplace evaluation in the „Graz Model“, Jiménez & Kallus,(2013), s.a. ISO 10075-1:A.1 und ISO 10075-2, 4.1, A.1

Person AND Organisation/Environment



Stress and the importance of Healthy Leading

Employee oriented leadership and effects

Showing empathy (Scott et al., 2010)

Effects on employees

- physical problems ↓
- general well-being ↑
- motivation to achieve goals ↑

Considering „Work-Family Balance“(Berkman et al., 2010)

Effects on employees

- risk factors of heart disease (z.B. diabetes, overweight, blood pressure, smoking, cholesterin) ↓
- sleeping quality ↑

Autonomy / control (Nahrgang et al., 2011)

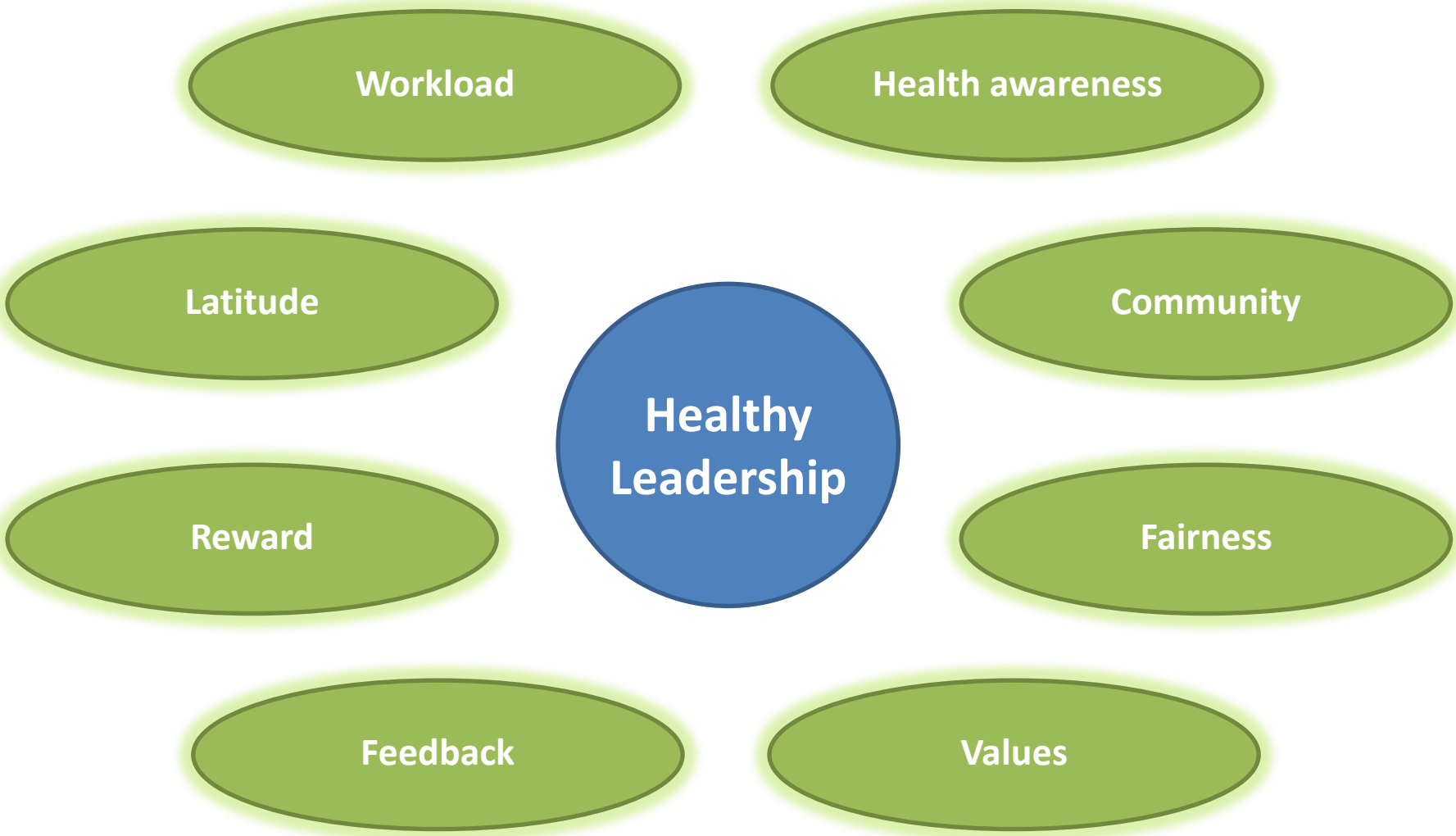
Effects on employees

- burnout ↓
- engagement ↑

Stress and Healthy Leading

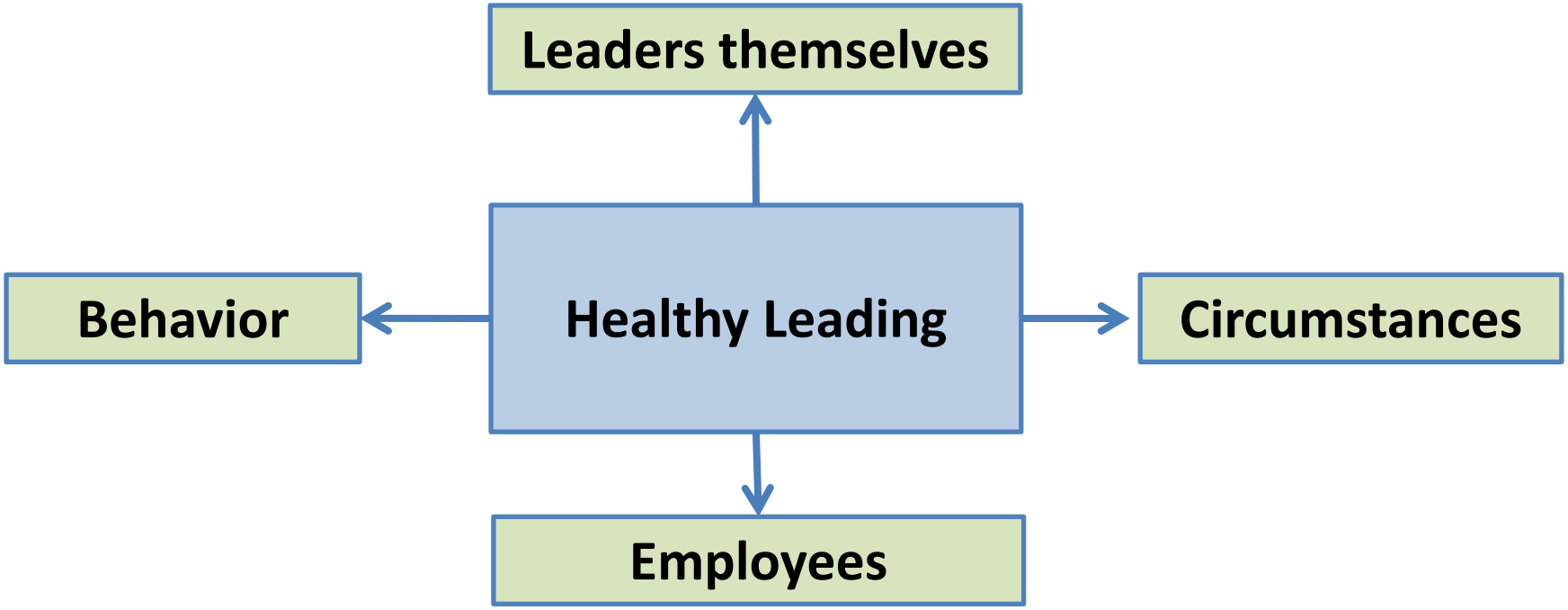
Key factors of Healthy Leading

- integrated perspective (physical, mental and social level)
- humane and relationship-oriented leading
- leading in a structured way (clear aims)
- knowledge about procedures, principles and rules in group dynamics
- emotional and instrumental support
- open communication (constructive critic, information transfer between all hierarchies, showing interest in employees)
- leader has to be a role model
- setting the stage for the motivation of employees
- giving everybody the opportunity to participate



Health Relevant Leadership Dimensions (HRLD). See Jiménez (2013); Jiménez, (2012); Winkler & Jiménez, 2012); HRLD based on AWS (Leiter & Maslach 1999; Leiter 2008)

Discrepancy of leadership



Role model: „Practice what you preach“

Health Relevant Leadership Dimensions (HRLD). See Jiménez (2013); Jiménez, (2012); Winkler & Jiménez, 2012);
HRLD based on AWS (Leiter & Maslach 1999; Leiter 2008)

Motivation.

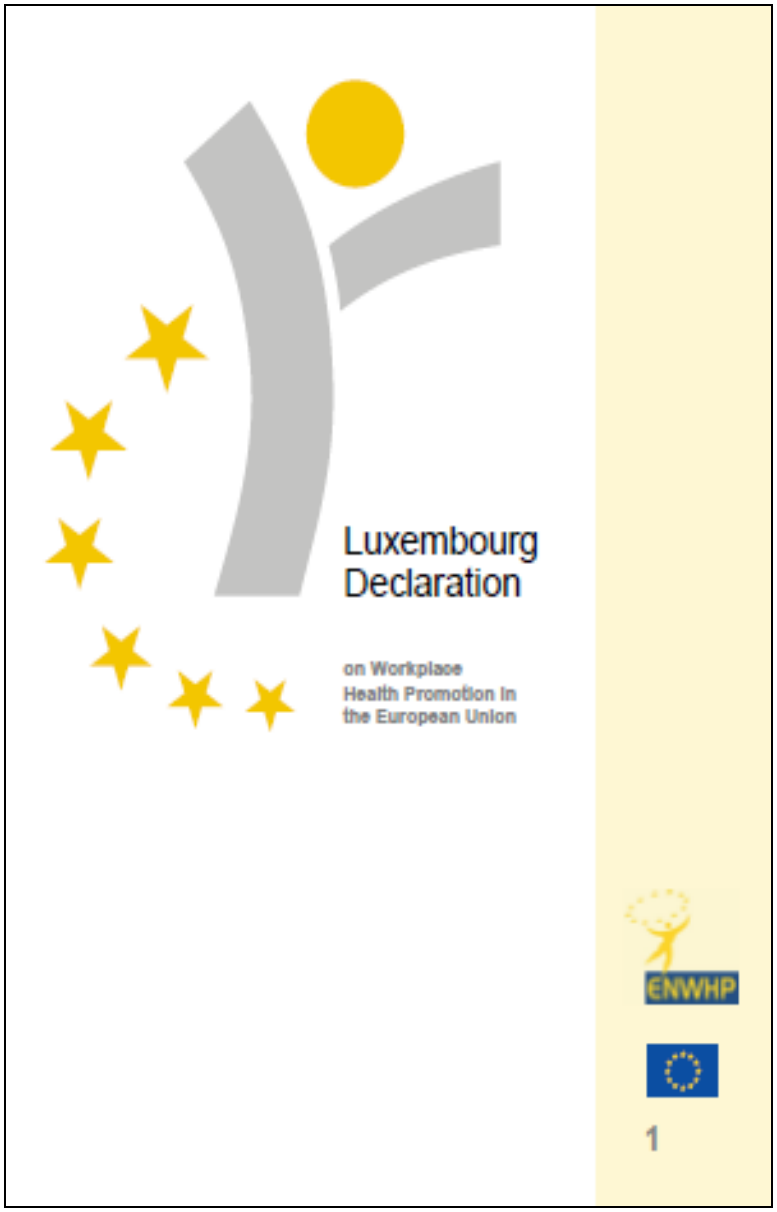
How to „motivate“ people?

- to reach the ***goal***
- to look for their ***health***

Leadership and Motivation

If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea.

Antoine de Saint-Exupéry



Help people – to help themselves

Workplace Health Promotion (WHP) will be the key and

Systems which help people and the organization will raise the ROI

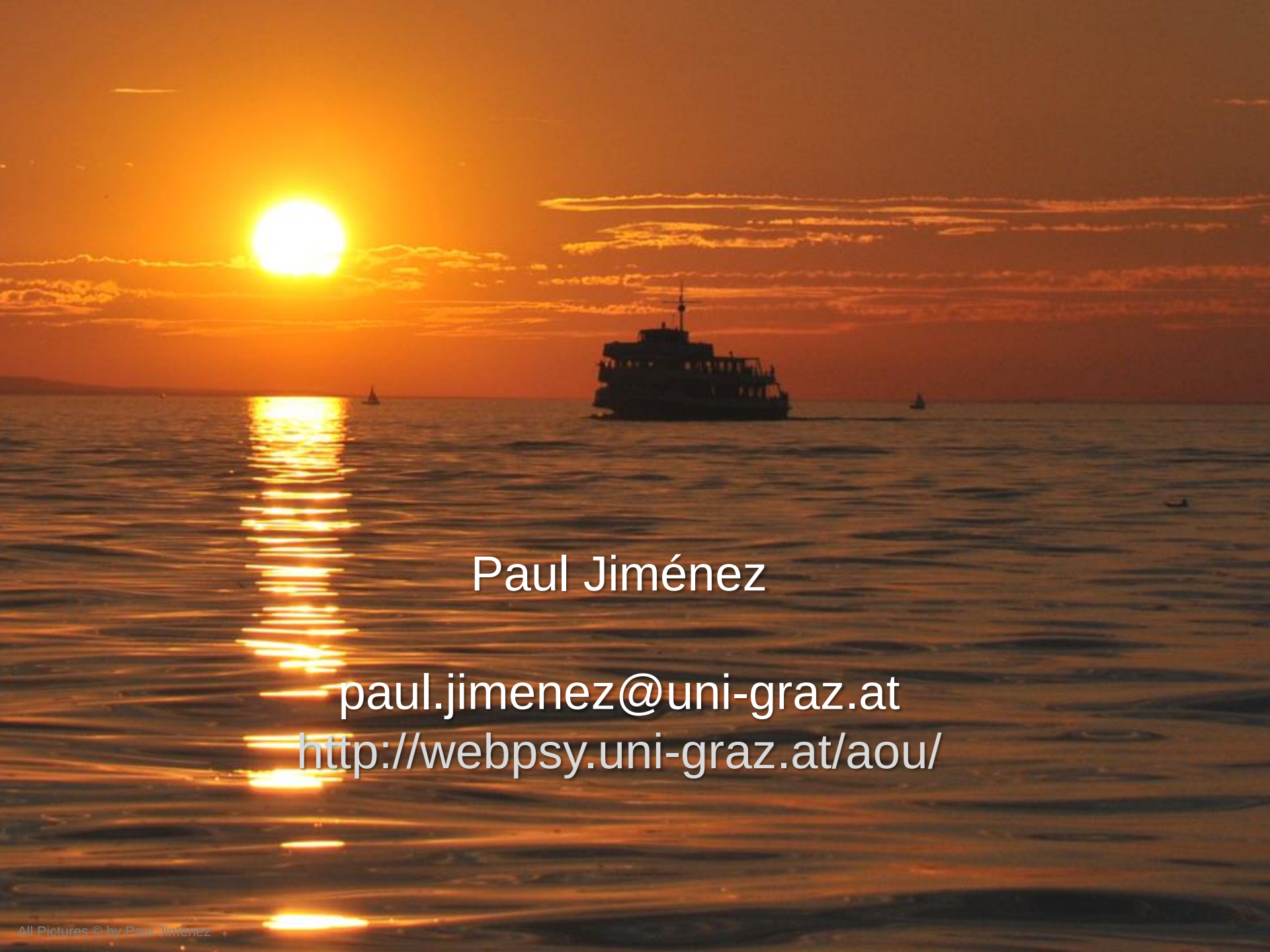
Key factors

- *Leaders which influence*
  - *themselves*
  - *and their*
- *Employees*

So what?

Conclusions

- Stress has many sources – we have to strengthen the ***environment*** and the ***person***
- Individual *strategies* against stress can be influenced by the organisation
- **Leaders** are very important key factors for environmental stress factors
- Leaders can be **health promoters**
- **Motivation for health** can be raised by leaders
- **Leaders have to be supported**



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HEALTH RESERVE

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Keywords: Stress, homeostasis, allostasis, inflammation, heart rate variability, CRP, interleukin-6

Abstract. Stress is a condition in which homeostasis of the organism is at risk because of external or internal stressors. Stressor can be defined as any type of change that causes physical, emotional or psychological strain. Failure to eliminate interference caused by stressors establishes a new, altered stage of homeostasis – allostasis, characterized as difficult functioning due to chronic and inefficient effort to neutralize stress. Recent data based on a long-term observation showed that healthy workers who were exposed to stress at work displayed significantly elevated inflammatory parameters and faced an increased risk of cardiovascular diseases. Doing sports regularly significantly reduced inflammatory activity; however, sport alone is not enough to eliminate the influence of work-related stress on cardiovascular diseases. Additional stress-relieving methods and integrated approach may be required. From that perspective, homeostasis and homeostatic fragility is becoming an important concept in understanding chronic health changes (diabetes, chronic inflammatory disease, chronic infections, age-related changes) related to stress. Physiological impact of stress and/or reduced homeostatic reserve can be followed by a number of physiological markers: decline in muscle mass, relative increase in the proportion of fat, reduced glucose tolerance, poor control of blood sugar and lipids, basal metabolic rate, basal heart frequency, decreased heart rate variability (HRV), increased plasma level of inflammatory mediators (CRP, interleukin-6) and reduced plasma level of sex hormones. Among them, heart rate variability (HRV) is widely available marker of ‘‘sympathovagal balance’’ that predict autonomic reactivity to stress.

Introduction

Stress response provides and maintains stability in the body (homeostasis)

Stress is a condition in which homeostasis of the organism is at risk because of external or internal stressors. Stressor can be defined as any type of change that causes physical, emotional or psychological strain. (1) Although stress response is a powerful and focused mobilization of physiological homeostatic mechanisms (neurohormonal, cardiovascular, metabolic, inflammatory) to preserve homeostasis; the

cost of stress-induced strain and response (energy loss, metabolic, health and behavioral disturbances) may be considerable and even intolerable for an organism. Relatively mild stress-related disturbances may be well controlled by a harmless stress-induced excitation followed by appropriate adaptation responses (emotional, behavioral, physiological). The opposite is true for stress response, which fails to neutralize disorder – due to its excessive intensity or weak/inefficient adaptation/homeostatic response. If stressors persist, the organism is experiencing chronic damage because of uncontrolled stressors and additionally because of the physiological cost of chronic stress response (hormonal, metabolic, emotional, behavioral, social disorders). (2)

Failure to eliminate interference caused by stressors (e.g. cold, social distress, harassment by others, overwork) establishes a new, altered stage of homeostasis – allostasis. Allostasis is characterized as difficult functioning due to chronic and inefficient effort to neutralize the cause of disorder (e.g. constant time pressure resulting in errors in the workplace) and on the other hand due to continuous and burdensome activation of stress response. Both, uncontrolled stressor and resulting chronic stress response require large amounts of additional energy (e.g. emotional self-control, constant attention and tension, inability to focus on current tasks, neglecting nutritional, social, recreational and other needs). Frequently associated metabolic disturbances (fats, glucose, inflammatory cytokines) also arise due to influence of stress hormones and changes in the functioning of the vegetative nervous system. (3)

Effort to maintain allostasis may exceed performance of the organism

Altered state of homeostasis (allostasis) may enable the maintenance of seemingly unchanged way of life, but the energy input to maintain altered allostatic state may overcome the organism's capacity. For example, adrenalin activities, stimulants, sedatives or drugs are widely used remedies for temporary preservation of allostasis despite intolerable stress. Also intensive sports training may sometimes be considered as a remedy to achieve allostasis despite an uncompensated chronic stressor, e.g. overwork. A well-programmed sport training gives the body some extra capacity and vigor allowing relatively healthy and stable allostatic resistance to chronic overwork;

however, the energy input to maintain health is much higher. Hence the question is how long should an individual (determined by unavoidable age-related decline in physical abilities) maintain a state of forced training just to resist a health damaging stressor, e.g. overwork. In other words - when is the time to eliminate the stressor (e.g. overwork), if we do not want the stressor to eliminate us. (4)

Stressful situations at work can have a negative impact on the cardiovascular system and the metabolism.

Recent data from the MONICA/CORA study, based on a long-term observation of more than 950 people showed that healthy workers who were exposed to stress at work displayed significantly elevated inflammatory parameters and faced twice the risk of cardiovascular diseases. (5, 6) The study found a clear association between stress, elevated concentrations of inflammatory marker CRP (C-reactive protein), and risk of cardiovascular diseases. Moreover, job stress led to harmful psychological effects such as depression and sleep disturbances as well as unhealthy behavior, for example, physical inactivity. Doing sports regularly, for at least one hour per week, significantly reduced inflammatory activity. However, the differences in terms of risk of cardiovascular diseases between people who suffered from work stress and those who did not still remained – sport was not able to eliminate the influence of perceived work stress on cardiovascular diseases. Additional stress-relieving strategies may be required.

Sport alone is not enough to eliminate the impact of work stress on cardiovascular diseases. Additional stress-relieving methods may be required.

Beside MONICA/CORA study, Lawrence S et al. in the Cochrane Review from 2010 also concluded lack of randomly controlled trials comparing the effectiveness of sports interventions to alleviate PTSD (post-traumatic stress disorder). The search identified only five studies, none of which met the inclusion criteria. Currently, there are no randomly controlled trials comparing the effectiveness of interventions that utilize sports to alleviate PTSD symptoms. This is despite the growing number of organizations that are delivering a variety of sport and game programs to traumatized populations. The financial, logistical and technical resources required for randomized evaluations of such

programs may have precluded such evaluations to date. However, such evaluations are critical so that we can consider offering a wider scope of interventions than that currently offered by traditional trauma-related disciplines. (7)

Currently it can be concluded that stressful situations at work have a negative impact on the cardiovascular system and the metabolism; however, sport alone is not enough to eliminate the impact of work-related stress on cardiovascular diseases. Additional stress-relieving methods and an integrated approach may be required. From that perspective, homeostasis and homeostatic fragility is becoming an important concept in understanding chronic health changes (diabetes, chronic inflammatory disease, chronic infections, age-related changes) related to stress. Homeostatic fragility is a physiological syndrome accompanied by reduced homeostatic reserve and less efficient neutralization of stressors due to weaker and less organized physiological mechanisms. By reducing homeostatic (health) reserves the state of robust homeostasis (typical for a healthy, young individual) moves into the state of fragile homeostasis mostly due to exhausting impact of chronic diseases, aging and chronic stress together with the effort to resist and maintain allostasis. Further decrease of homeostatic reserve causes the state of chronically unstable homeostasis, where even a small disturbance can fatally disturb the homeostasis. (3, 4)

Physiological indicators of stress and/or reduced homeostatic reserve

Several studies of chronic patients and elderly people have the purpose to define physiological parameters, markers of reduced homeostatic reserve of the organism. Among them the most significant are decline in muscle mass, relative increase in the proportion of fat, reduced glucose tolerance, poor control of blood sugar and lipids. Due to strenuous maintenance of allostasis, basal metabolic rate (relative to the maximum) is relatively increased - most of the available energy is consumed to maintain physiological allostasis, hence the lack of energy for other life activities. Other typical indicators of stress and/or reduced homeostatic reserve are increased basal heart frequency, decreased heart rate variability (HRV), increased plasma level of inflammatory mediators (CRP, interleukin-6) and reduced plasma level of sex

hormones. Parameters of physical capacity (VO_2 max, the Cooper test, Conconi test) are significantly reduced. (8)

Since the allostasis, i.e. the adaptive response of the organism to a stressful agent, is produced by the joint activity of the central nervous system, the hypothalamus–pituitary–adrenal axis and the immune/proinflammatory system, stress has been studied by a variety of disciplines with differing research traditions. Among them, heart rate variability (HRV) is a widely available marker of ‘‘sympathovagal balance’’ that predicts autonomic reactivity to stress. The state-of-the-art reports the following evidences : (1) the heart period variability defined as the High Frequency (HF, range between 0.15–0.50 Hz) spectral component, is a marker of vagal modulation; (2) the heart period variability defined as the low-frequency (LF, range between 0.04–0.15 Hz) component is a marker of sympathetic modulation and (3) the reciprocal relation existing in the heart period variability spectrum between power LF band and power HF band is a marker of the state of the sympathovagal balance modulating sinus node pacemaker activity. (9)

Heart rate variability was found as a useful predictor of mortality in pre-hospital trauma patients. It was found that patients who died had lower pulse pressures and higher parasympathetic than sympathetic modulation compared to patients who survived traumatic injuries when the heart rate, arterial pressure and SpO2 did not differ. Morris et al. studied the correlation between heart rate variability and deteriorating physiological reserve (change in lactate values over time) in trauma victims. They found that 55.9% had decreased HRV and that deteriorating physiological reserve is associated with reduced HRV. These studies showed the importance of an intact autonomic nervous system on outcome in victims of severe trauma. (10)

Also in our study (11,12) we confirmed the valuable role of HRV in evaluating the effect of interhospital air and ground transportation of artificially ventilated neonates. Fifty-eight critically ill neonates that were transported by day- and night helicopter, or day- and night-ground transportation were followed by 24-hour holter electrocardiogram monitoring. Our results clearly demonstrated that higher HRV indices determine lower heart rate values and a shorter length of stay in the intensive care unit compared to lower HRV indices. Studies on HRV in premature and mature infants clearly show the

importance of a stable autonomic nervous system in infants during maternal care and feeding, and to enable the infant to adapt to external events, maintain homeostasis and conserve energy.

Physical capacity is the basic medical reserve that allows stable allostasis in case of heavy loads

Capacity for sports effort is the basis of health reserve, which means the capacity to adapt to the interferences which could otherwise seriously disturb homeostasis and cause a dysfunctional state - disease. Intense physical exertion requires a thorough reorganization of bodily functions, energy consumption as well as many other metabolic pathways. Physical effort is therefore a natural test for many bodily adjustments enabling homeostasis. An organism capable of a demanding physical effort may have fewer difficulties overcoming many physiological efforts and disturbances (major infection, trauma, surgical procedure, starvation etc.) without slipping into a disease.

Physical capacity is obtained with appropriate sports workout, for example with three quarters of an intensive effort at least 3 times a week. Progress can be easily measured with methods that objectively measure sports capacity. By gaining appropriate physical capacity the organism is more resistant to interferences, on the other hand, many diseases can be detected earlier as dropping of performance is easily recognized by individuals that regularly practice sports. Impairments such as anemia, lung or heart disease, nutritional deficit or metabolic disorders are quickly recognized by active individuals that follow their physical performance.

With active and regular monitoring of health state, sensing its weaknesses (blood pressure, sugar and fat in the blood, weight ...) and appropriate preventive measures (diet, habits, body weight, vaccination) our long-term health capacity remains, despite occasional (re)loads, without health problems. People with metabolic disorders must take special care of their physiological capacity. Diabetics must carefully regulate their blood sugar level, people with impaired fat metabolism must follow precise measurements and proper professional instructions, too thin people should gain weight especially by strengthening muscles, and obese people should reduce the amount of body fat.

Psychosocial capacity

Psychosocial capacity is an important foundation of health reserve, which is unfortunately not clearly enough exposed because of social prejudices. Psychosocial capacity represents personality and social foundations that allow us to independently and responsibly care for our life and health. Long-term health and tranquility cannot be achieved without good living, working and economic conditions, and without a supportive social network (family, friends, social institutions), on which we can rely in health and disease.

A mature personality and high personal hardiness are essential for proper response to stress. Stress response is one of our own reactions which do not come from the outside; we "make" it ourselves. A mature personality is able to judge its decisions in most life situations, i.e. decide whether or not to get in a stressful situation and what will be the cost. Only a mature and self-confident personality is able to strategically protect itself from self-destructive stress. As the master of oneself, the individual has to be the master of one’s stress hormones. Many problems with stress overloads are experienced by people who are not skilled in managing themselves and their life but have a feeling that life and their surroundings constantly "force" them into decisions, even though they would want it to be otherwise.

Conclusion

Stressful situations at work have a negative impact on the cardiovascular system and the metabolism; however, sport alone is not enough to eliminate the impact of work-related stress on cardiovascular diseases. Additional stress-relieving methods and integrated approach may be required. From that perspective, homeostasis and homeostatic fragility is becoming an important concept in understanding chronic health changes (diabetes, chronic inflammatory disease, chronic infections, age-related changes) related to stress. The physiological impact of stress and/or reduced homeostatic reserve can be followed by a number of physiological markers: decline in muscle mass, relative increase in the proportion of fat, reduced glucose tolerance, poor

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PHYSIOLOGICAL RESPONSE TO DIFFERENT STRESSORS

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Keywords: Sympathoexcitation, laboratory stress, physiology, catecholamines, sympathetic nerve activity

Abstract. Laboratory stress maneuvers are time-honored methods to characterize component pathways of complex cardiovascular regulation. Collectively, maneuvers such as orthostatic stress, emotional stress, cold pain stimuli, and isometric handgrip release parasympathetic tone and activate sympathetic adreno-medullary pathways. In spite of these similarities, each stressor has unique aspects regarding the stimulus, the central and peripheral processing of the stimulus, and physiological output. The overall goal of these stressors in human studies is to characterize intermediate physiological traits with relevance to distant, complex phenotypes such as hypertension and heart disease. This review focuses on the types of stress administered in our laboratory, the physiological responses to these stressors, the importance of these stressors to cardiovascular health, and briefly addresses the question of whether behavioral interventions can reduce the stress response to these maneuvers.

Introduction

Cardiovascular reactivity to common laboratory stress maneuvers is measured to assess intermediate physiological phenotypes with prognostic significance toward more distant complex phenotypes, such as hypertension, heart disease, and stroke [1-4]. Insight from laboratory stress investigations has greatly advanced the understanding of cardiovascular control, ranging from heritability of blood pressure during stress [5] to sympathetic nervous system activation and cardiovascular regulation in aging [6-8]. The human physiology laboratory at Mayo Clinic has been investigating the physiological responses to laboratory stressors for many years [9, 10].

Laboratory Stressors

*Orthostatic stress.*The head-up tilt (HUT) test is a passive orthostatic challenge that moves the subject from supine rest to approximately 60º upright on a tilt table. The

supine rest period is recommended to be at least 20 minutes, and the upright position varies depending on whether the objective is physiological screening (5-10 minutes duration) or clinical testing of orthostatic intolerance (20 minutes or more). To simulate gravitational challenge without counter-regulation from leg muscle contraction, the legs are suspended (subject seated on bicycle seat). More commonly and likely more clinically relevant is the use of a foot board to allow subjects to stand during tilt, but subjects are instructed to keep their leg muscles relaxed. Subjects are returned to the supine position when feeling ill or displaying signs of impending syncope.

Mental stress. The purpose of laboratory mental stress testing is to evoke active psychogenic stress without somatic pain or locomotion. It aims to simulate emotional stress in everyday life, although this strategy is criticized for being largely dependent on subject volition and behavioral coping, and cannot achieve appropriate representation of many secondary stressors that are encountered in everyday life, such as relationship, health, and financial stress. The strength of laboratory mental stress testing is a controlled setting with controlled subject conditions (i.e., fasting, no caffeine) and the ability to gather “high-resolution” physiological data.

Subjects are placed in a semi-recumbent chair with the legs approximating the level of the heart. After instrumentation and familiarization of the test, subjects rest quietly for at least 20 minutes. Our lab utilizes the final 5 minutes of quiet rest to collect the ECG tracing for heart rate variability (HRV). Once all monitors are calibrated and functioning, the test begins with baseline measure, followed by 5 to 15 minutes of a challenging cognitive task, followed by 5 to 10 minutes of recovery.

Cold pressor. Cardiovascular reactivity to cold limb immersion and the prediction of incident hypertension or cardiovascular disease has been a focus of large-scale clinical trials including a study at Mayo originating in the 1930s [11]. This passive but noxious stimulation via ice water immersion of a hand or foot provides a profound but safe painful stimulus. A unique property of this test is that active cognitive participation, orthostatic challenge, and physical activity are avoided. After a quiet rest of at least 2 minutes, the hand or ankle is submersed in ice water (approximately 4º C) for 3-5

minutes. While the foot is used for subjects lying supine, we prefer the hand due to the semi-recumbent position in our protocols and the consistent degree of immersion as marked on the crease of the anterior surface of the wrist which is quite similar among individuals.

Isometric handgrip. Also known as the exercise pressor reflex, this isolates a regional skeletal muscle bed and directs isometric or static contraction of the muscle to fatigue. To allow adequate time to measure the physiological responses and account for individual variability in handgrip strength, the target force of contraction is calculated to 30-40% of maximal force in kilograms. Our experience is that individuals are able to sustain 40% of maximal contraction steadily for 2 to 6 minutes. Similar to the cold pressor, the pre-handgrip baseline is at least 2 minutes. An interesting and additional test is called the post-exercise circulatory occlusion (PECO) test. For this test, a pneumatic cuff (which may be a simple manual blood pressure cuff) is placed above the elbow on the same arm used for contraction. Immediately on handgrip exhaustion, this cuff is inflated to supra-systolic pressure (approx. 250 mmHg) for 90 seconds. Upon release of the cuff, the recovery period is a final 2-5 minutes.

Physiological Response to the Stressors

Orthostatic stress. The immediate physiological response to HUT is rapid baroreflex-mediated increase in HR and sympathetic vasoconstrictor nerve activity which increases norepinephrine spillover into the circulation, preserves mean arterial pressure (MAP) and may even increase diastolic pressure in healthy individuals [12-15]. In a large phenotyping study of healthy young adult men and women without history of syncope, it is remarkable that approximately 10% of these individuals did not tolerate HUT for the full 5 minutes. An isolated faint most commonly presents as a sudden “vaso-vagal” response where blood pressure decreases (sympathetic withdrawal and reduction of vasoconstriction) and heart rate decreases (vagal activation). The mechanism for this response has never fully been elucidated but the paradoxical

slowing of the heart rate in response to decreased filling is termed the Bezold-Jarish reflex. An example of this from our laboratory is illustrated in **Figure 1**.

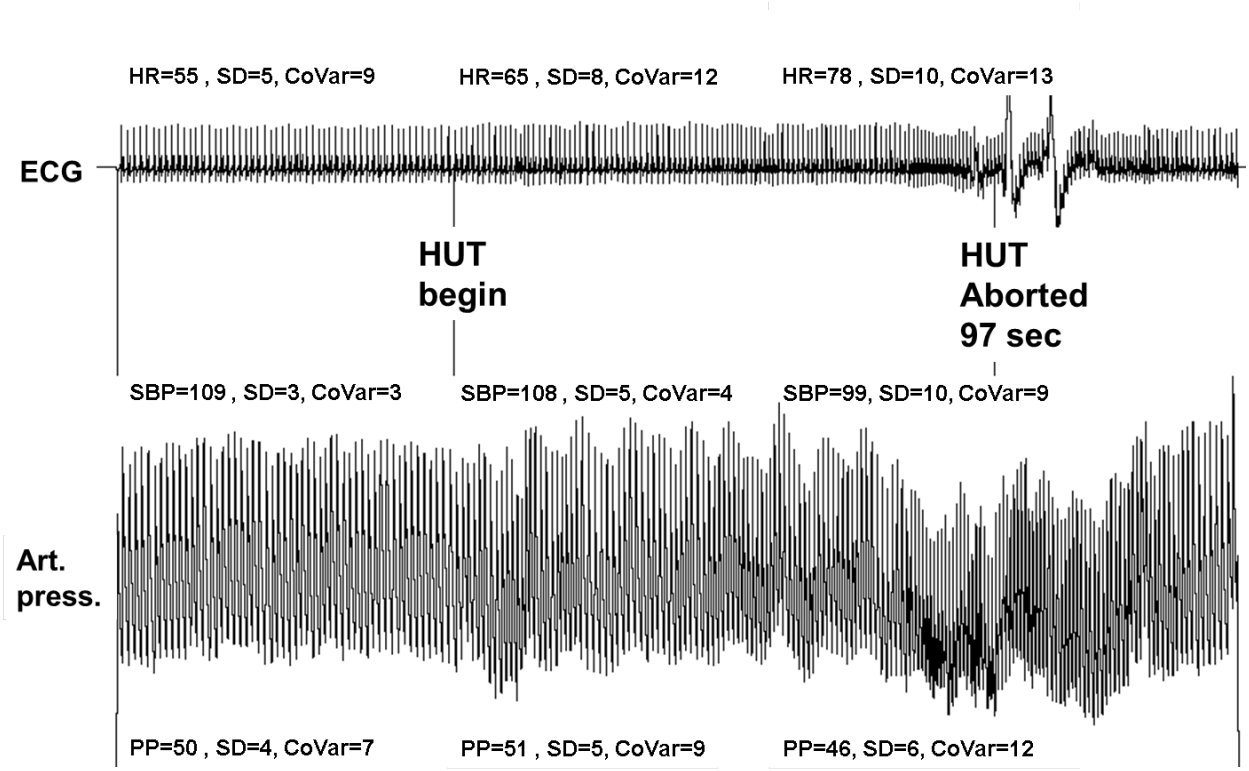

Figure 1. Heart rate (HR, top tracing), and arterial pressure (brachial arterial catheter, bottom tracing) in a healthy young adult with no history of syncope, undergoing a passive 3-min head-up tilt test to 60º. Upon initiation of tilt, it is apparent that HR is gradually increasing. With variability of each measure reported as standard deviation (SD) and coefficient of variation (CoVar), it is also apparent that HR, systolic blood pressure (SBP), and diastolic blood pressure (DBP) are becoming less stable throughout the first 90 seconds of the tilt. What is less appreciated on this condensed tracing is the vagal component of the "vaso-vagal" phenomenon of a paradoxical vagal withdrawal and sudden slowing of HR which evoked subject complaints of pre-syncope and halting of the test.

Mental stress. **Figure 2** illustrates a thin, fit, normotensive healthy 22 year old man before, during, and after a 3 minute Stroop colored word test. Blood pressure and plasma catecholamines were obtained via a brachial arterial catheter. Heart rate variability was determined from the ECG signal recorded at 200Hz. Resting BP was

129/67 mmHg and resting HR was 59 bpm. Out of 146 healthy men and women, this individual had the highest HR, BP, and norepinephrine response to mental stress. The epinephrine response was the second highest in the cohort. Analysis of HRV revealed a profound increase in the LF:HF ratio indicative of increased sympathetic and decreased parasympathetic modulation of HR.

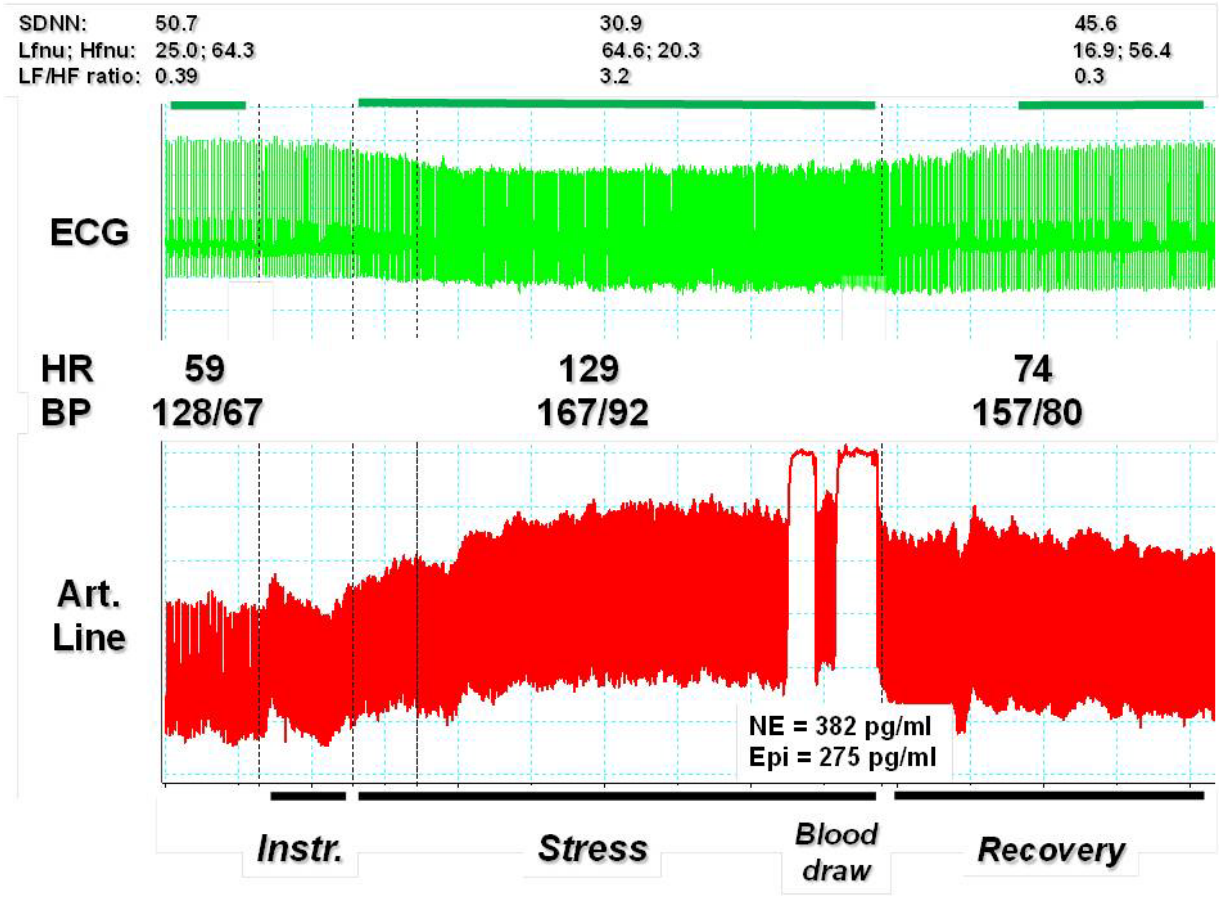

Figure 2. Pre-stress baseline, 30-sec instructions, Stroop colored word test, and 2 min recovery in a 22-year old healthy normotensive fit man. Heart rate variability values at rest, during stress, and during recovery are listed at the top with changes suggestive of a profound shift in sympatho-vagal modulation of HR during the stressor. Out of 146 healthy young adult men and women, the hemodynamic and arterial plasma catecholamine variables were ranked either 1 or 2 among the cohort; see text for details.

A unique and intriguing aspect of the physiological response to mental stress is that is reasonable to postulate that sympathetic activation would cause vasoconstriction and reduced blood flow to skeletal muscle, particularly since these muscles are metabolically inactive during mental stress. However, blood flow to skeletal muscles increases, as demonstrated by an increase in forearm blood flow (FBF) using forearm venous occlusion plethysmography. Generally accepted mechanisms evoking forearm vasodilation during mental stress include a combination of unchanged or decreased forearm sympathetic nerve traffic, β_2-adrenergic receptor mediated vasodilator effects from circulating epinephrine, and mechanical factors causing local release of nitric oxide [16]. Our lab has shown that the tachycardia response to mental stress has substantial influence on FBF and forearm vascular conductance, an effect that is likely related to mechanical stimulation on the forearm vasculature [17]. The reproducible finding that radial nerve MSNA is decreased or unchanged, yet splanchnic nerve activity is increased, together has disproven the conventional notion of a unitary (or whole body) sympathetic response to mental stress. This makes teleological sense, in that the defense reaction prepares one for fight or flight, thereby re-directing blood flow away from visceral organs toward skeletal muscle.

Cold pressor test. This test has a unique physiological response in that blood pressure and total peripheral resistance are elevated, yet the HR increase is modest. This suggests a predominantly alpha-adrenergic receptor component to the pressor reflex, in contrast to the other maneuvers that activate both cardiac and peripheral alpha and beta adrenergic receptors. Furthermore, the modest HR response is greatest in the first minute, and the systolic, diastolic, and mean arterial pressures are greatest in the second minute of ice water immersion. All of these measures decrease in the third minute, suggesting that the most painful portion of the cold test is the first two minutes, with a tapering effect of hemodynamics likely to be associated with numbness and/or tolerance of the cold.

Isometric handgrip. Immediately upon forearm muscle isometric contraction, vagal withdrawal increases HR, a term called central command. Subsequent responses include a re-setting of baroreflex control of the circulation, so that HR remains elevated in the face of increasing blood pressure. In contrast to rhythmic contraction or dynamic exercise, the isometric contracted muscle bed creates a mechanical limitation to vascular blood supply. This in turn stimulates the metabolic receptors in the relatively ischemic muscle bed, which along with the painful sensation of muscle fatigue, sends afferent signaling to the central nervous system to increase the attempt at perfusion of the skeletal muscle by further increasing HR and blood pressure. Central command, pain, and muscle bed ischemia collectively drive this sympathoexcitatory process to further heighten the hemodynamic response until release of the handgrip and relaxation of the muscle. However, if upon exhaustion an upper arm cuff is inflated to supra-systolic levels, the phenomenon of post-exercise circulatory occlusion (PECO) will demonstrate a return of HR to resting levels as central command is no longer engaged. What remains is termed the “metaboreflex,” a powerful afferent signal of group III and IV muscle afferent nerves that drive blood pressure up to levels that approximate the blood pressure that was seen just before exhaustion. This strategy allowed our lab to determine that polymorphic variation in the beta-2 adrenergic receptor gene influences the HR and cardiac output response to handgrip during the contraction phase, but not in the metaboreflex phase, suggesting that the genotype-dependent differences were due to alterations in central command and baroreflex re-setting [18, 19].

Importance of laboratory stressors to cardiovascular health

The discussion will now focus on the relevance of psychological stress testing in predicting the development of hypertension and cardiovascular disease. Data from the “pre-genomic” era established the importance of cardiovascular reactivity to psychogenic stress, which likely have substantive implications in the broader context of chronic emotional stress, job strain, and socioeconomic stress in public health and

disease [1-4, 20-22]. Increased job strain and exaggerated pressor responses to laboratory-based mental stress have been shown to be predictive of future incidence of hypertension [1, 20]. Acute laboratory maneuvers that evoke mental stress have significant effects on cardiac autonomic modulation. Specifically, acute mental stress leads to decreased time and frequency domains of HRV, and a shift toward higher sympathetic to parasympathetic control of heart rate [23, 24].

The relationship between work-related psychosocial factors and the development of ischemic heart disease (IHD) was systematically reviewed in 33 articles with 51 analyses of studies involving male participants, 18 analyses involving female participants, and 8 analyses with both genders. A balanced evaluation of the studies indicates moderate evidence that high psychological demands, lack of social support, and strain are risk factors for IHD among men. Studies performed during recent years have not shown evidence for lack of control as a risk factor for IHD. Several studies have shown that job strain is a risk factor, but in the more recent ones, these associations can be fully explained by the association between demands and disease risk. Insufficient evidence was found for a relationship between IHD and effort-reward imbalance, injustice, job insecurity, or long working hours. Studies involving women are too few to draw any conclusion concerning work stress and IHD [25].

A recent meta-analysis of prospective studies revealed that greater reactivity and poor recovery after laboratory stressors is associated longitudinally with poor cardiovascular risk status or progression of cardiovascular risk [26]. Interestingly, this study performed a sub-analysis that compared the prognostic relevance of specific types of mental stress, and found that the only form of mental stress that reached significance for predicting cardiovascular risk was the cognitive task category, and the significant predictors were systolic and diastolic blood pressure reactivity. Reactivity to stress interviews, public speaking, emotion induction, and combined tasks were not associated with future cardiovascular risk.

Can behavioral interventions reduce the reactivity response to these maneuvers?

The literature on this topic is far less developed than the evidence supporting the above topics. Therefore, this final exploratory question will be discussed briefly and will conclude the lecture.

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MASS MARKET TECHNOLOGICAL AIDS FOR STRESS RECOGNITION AND REDUCTION: A REVIEW

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Keywords: mental stress, stress detection, wireless sensors, mobile applications, wearable sensors, heart rate variability, @life

Abstract. Recent advances in mobile and sensor technology provide new opportunities for individuals willing to monitor and manage their health as well as for open-minded health care providers looking for new methods and approaches like continuous monitoring of patients' health status. An interesting innovation in mental stress recognition and reduction would be an affordable, wearable, non-invasive, continuous stress monitoring solution. This paper provides an overview of research procedures and findings in the domain of mental stress. Literature review findings suggest that mass-market heart rate chest belts accompanied with a suitable smartphone could detect stress with up to 80 % accuracy.

Introduction

With broad availability of different mobile devices and inexpensive, reliable and energy-efficient wireless sensors the healthcare professionals are faced with new possibilities to gather patients' data. These possibilities could be presented as:

1. Historical data - individuals could establish and maintain their own record of important healthcare parameters. In case of illness the data could be presented to the healthcare professional that will have additional information for the decision-making process.
2. Diagnosis-driven data - the health state of the individual is not clear enough to make a decision, therefore the individual is asked to perform additional measurements using wearable sensors in everyday life for a shorter period of time.

3. Post-treatment data - the data is collected and reviewed on a regular basis in order to detect sudden health-related changes after particular intervention in a timely manner. A variation of this monitoring procedure is continuous indoor and outdoor monitoring of health, activity, mobility and mental status with the possibility of automatic health change alarms based on predefined target values.

Regardless of the motivation that drives the data collection process the collected data must be trustworthy. In practice this could be extremely complex thus every component must conform to the highest security, reliability and accuracy standards resulting in significantly higher costs. Consequently, the available technological advances would be abandoned or not fully utilized in the healthcare domain, and would mostly be used as gadgets for personal use. The aim of this paper is to provide an overview of existing wearable sensors for stress detection followed by the presentation of a mass-market solution for stress reduction called @life that was developed at Research and development Center IKT Savinja in cooperation with the University of Maribor, University of Ljubljana and Karl-Franzens-Universität Graz.

Overview of wearable sensors and mobile health systems

This section briefly introduces wearable sensors and mobile health system concepts.

In [1] a detailed overview of the smart wearable sensors for health monitoring is presented. The sensors could be worn by an individual as an accessory, implantable, portable, embedded in the user's outfit as part of clothing, embedded in pieces of object, furniture or the floor of the house [1]. Different sensors could form a network that monitors a vast number of physiological, biochemical, motion sensing and contextual parameters. There are two types of networks: (1) wireless body area network (BAN) is deployed on the body of the patient in order to collect data and (2) personal area network (PAN) that adds

smart phone sensors and other sensors for gathering contextual information. The most common parameters measured using wearable sensors are:

- Body or skin temperature,
- Heart rate and Heart rate variability,
- Galvanic skin response,
- Electromyogram (EMG),
- Electroencephalogram (EEG),
- Respiration rate,
- Blood glucose,
- Heart sounds,
- Oxygen saturation,
- Motion and activity.

Next generation sensors add processing capabilities to the basic wearable sensor functionalities - measurement and wireless communication. An interesting research demonstrating most recent achievements is presented in [4] demonstrating an integrated system for portable electrocardiography (ECG) monitoring with an on-board processor for time-frequency analysis of heart rate variability.

No matter how smart, sensors alone are not sufficient for the advanced mobile health system. The most common solution is to add a smart phone or Personal Digital Assistant (PDA) as the unit with processing and presentation capabilities. The health features on mobile platforms could be classified into one of the following groups [8]: tracking health information, involving of healthcare team, leveraging social influence, increasing the accessibility of health information and utilizing entertainment. One example is mobile personal health record. The applications implemented as stand-alone mobile applications for three predominant mobile platforms namely iOS, Android and Blackberry are evaluated in [7]. Authors report that allergies and medications are commonly included in the records while family history and insurance are less common. According to the same research, the shortcomings of current applications are: data elements and application features are often incomplete, not tethered and not properly secured

[7]. In [2] the authors presented the design of the mobile u-health service system based on the sophisticated service platform architecture. The idea was tested on the mobile stress and weight management services.

Mental Stress Recognition with Wearable Sensors

Stress is a physiological response to the mental, emotional or physical challenges that is considered as a positive response to the everyday events. The aim is to intensify concentration, respond to the situation and return to the normal state. However, the modern way of life significantly increased the frequency of stress-related events that often result in physiological symptoms, illness and diseases such as diabetes, asthma, heart diseases and depression [9, 12, 13, 15, 18, 19, 23, 24]. According to [12] stress comes in three forms: (1) Acute that is caused by acute short-term stress factors, (2) Episodic acute that occurs more frequently and/or periodically and (3) Chronic that is a result of long-term stress factors. With invasive methods that measure adrenaline and cortisol it is unfeasible for physicians to continuously monitor stress levels throughout the day as well as over longer periods like weeks and months [15]. With wearable sensors continuous monitoring becomes an interesting possibility for physicians to assess effects of stress and define the most effective interventions. Further on, it could help individuals to manage stress and take advantage of this physical phenomenon in their everyday life.

Table 1 provides a comprehensive overview of different research studies testing several wearable sensors' settings in order to achieve sufficient accuracy of the stress state classification. The findings suggest that wearable sensors could be used for stress detection as well as in continuous stress monitoring. Stress detection is possible with commercial heart rate chest belts performing Heart rate variability (HRV) analysis. However, for continuous monitoring or real-life field detection, which includes daily activities the data from the heart rate monitor (HRM) should be upgraded with the information from the accelerometer. For more accurate detection Galvanic Skin Response (GSR) sensor could be

included into the platform. Future research should be directed in validation of proposed methods using inexpensive commercially available sensors in real-world applications like detection of work-related stress or continuous monitoring of stress related disorders.

Table 1: Methods, approaches and results of stress detection researches using wearable sensors

Method	Sensor type	Aim	No. of subjects	Env.	Results	Ref.
ECG EEG HRV	WISE (custom) Polar chest belt (commercial)	evaluation of military members undergoing intense training	n/a, preliminary study	L	HRV might represent an inexpensive methodology for the objective assessment of human reactions under stress	[9]
ECG EMG EDA respiration	custom platform	assess driver's relative stress level	27 drives in total, 24 with all valid data, 6 and 3 participants	RW	97.4 % accuracy, Heart rate and skin conductivity metrics provided the highest correlation with stress	[11]
GSR	n/a	managing stress at work	5 people over four weeks	RW	for reliable assessment of stress level additional information is required	[12]
HRV	Polar T31, 3 lead ECG monitor	to use heart rate monitors to detect stress	3 people, four experimental conditions	L	0.99 correlation coefficient between Polar T31 belt and 3 lead ECG, 83 % success rate in detecting stressful events within subjects and 69 % between subjects	[13]
HR, HRV respiration EMG EDA	Polar WearLink, custom units 3-lard ECG	long term ambulatory monitoring of several physiological parameters	29 in total, 21 in laboratory test and 8 in the ambulatory setting	L, FT	good responsiveness to mental workload, posture and physical activity	[15]
ECG (HRV)	Holter ECG unit	comparison of laboratory HRV and autonomic response to real-world acute emotional stressors	56 subjects	L, FT	robust correlation (r=0.7 – 0.8) between laboratory and acute stress HRV	[17]
ECG (HRV)	n/a	investigation of different HRV measures for mental stress detection	6 subjects each in normal and stress state	L	mRR, mHR, nLF, dLFHF and SVI could be used as measures for mental stress index	[18]
PSS questionnaire ECG (HRV) respiration	chest belt, piezoelectric film sensor (SleepSense)	evaluation of 19 physiological features for classification of stress and non stress conditions	30 subjects	L	classification accuracy of almost 80 %, significant reduction of important physiological features down to 7	[19]

skin conductance EMG	EMG, ECG (commercial gel electrodes)					
GSR	custom	design and verification of the device to detect skin resistance	16 subjects	L	76.56 % success rate in state detection, difficult to differentiate stress state from making an effort	[20]
ECG (HRV) GSR movements	Shimmer sensor platform (ECG, GSR, 3-axis accelerometer)	to test whether the activity information can compensate for the interactive effects of mental stress and physical activity	20 subject, 3 activities, normal and stress state	L	92.4 % accuracy of mental stress classification, 80.9 between subjects, HRV and GSR parameters upgraded with accelerometer data and processed with Decision Tree give best results	[21]
ECG (HRV, HR) movement	three-lead ECG 3-axis accelerometer	evaluation of the stress state suitable for continuous monitoring	6 subjects	L	90.5 % accuracy in stress level classification	[22]
ECG GSR	Shimmer	automatic detection of mental stress using two biosensors	20 subjects, 2 sessions of different emotional content	FT	4 feature (2 GSRE, 2 ECG) used for classification with accuracy of 69 % using Lazy IB1 learning algorithm	[23]
ECG GSR movements	Shimmer sensor platform (ECG, GSR, 3-axis accelerometer)	to test activity-aware mental stress detection	20 participants, 3 activities in normal and stress state	L	92.4 % accuracy in mental stress classification and 80.9 % accuracy between subjects	[24]

Table legend:

ECG - Electrocardiogram, GSR - Galvanic Skin Response, HRV - Heart Rate Variability, HR - Heart Rate, EMG - Electromyography, PSS- Perceived Stress Scale, L - Laboratory environment, FT - Field test, RW - Real-world environment, EDA - Electro Dermal Activation, mRR - Mean of RR intervals, mHR - Mean of Heat Rates, nLF - normalized Low Frequency spectrum, dLFHF - difference of normalized low frequency spectrum and normalized high frequency spectrum, SVI - Symphatovagal balance Index

Using @life for Stress Reduction

In the previous section the overview of advanced stress detection possibilities using wearable sensors is provided. This section presents a solution called @life as a next step in stress management. The solution includes a mobile application and web portal that, in combination, offer good support for stress management. In its current version @life [26] uses psychological questionnaires to detect stress and provide some out-of-the box programs that include physiological measurements, daily physical exercises and psychological exercises for relaxation. The aim of the program is stress reduction and prevention. Using the latest technology users can gather data from their daily exercises, monitor their long-term progress and collect important physiological information. It is expected that the @life platform will soon be upgraded with stress detection based on the HRV and additional stress management features that could be used in everyday stress-related challenges.

Conclusion

Stress is a common problem that in its chronic form could have serious health consequences. This paper provides a review of the most interesting research findings related to automatic stress detection based on wearable sensors. The findings clearly show the future direction in stress detection. In most applications three commercially available and relatively inexpensive sensors could form the body area network that measures as little as three parameters and calculates seven or more values that enable good stress classification. Such a body area network could be paired with a mobile application on a smartphone for further processing and evaluation of parameters as well as additional services for stress reduction, prevention and management. @life [26] is a commercially available solution for stress management that will soon be upgraded with stress detection capabilities using HRV.

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HOW NEW TECHNOLOGIES WILL IMPACT PERIOPERATIVE PATIENT SAFETY

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Introduction

It is possible to review today's techniques and to contrast them against innovations in surgery and the preoperative and postoperative care that we will be providing in the future. These innovations will primarily involve miniaturization of technologies and tools, advanced radiation and pharmacology delivery techniques, and new materials that will impact perioperative care.

Minimally Invasive Procedures

Transgastric procedures and others that involve natural orifice entry to the body (natural orifice trans-endoscopy surgery or NOTES) utilize emerging technology. Currently, transgastric procedures in humans have been limited to appendectomies and simple intraabdominal procedures, but more complex procedures have been successful in animals. Most of these patients have undergone these procedures with propofol sedation and no airway protection. These patients have minimal post-procedural pain that has been successfully treated with acetaminophen only. Young adults undergoing this procedure typically have recovered quickly and been released home within two hours of their procedures. Most have returned to school or work the next day.

Pharmaceutical and Radiation Delivery

Nanotechnology, especially nanocrystals, has the potential to deliver medications to target tissues with a minimum of toxicity. For example, aspirin can be directed directly

to acute thrombotic areas in coronary arteries and decrease myocardial infarction size. New forms of radiation delivery, from focused ultrasound to proton and large neutron beam escalation, can precisely hit and impact tumors with almost no collateral damage. A number of tumors that previously were excised can now be selectively treated non-invasively.

Next Steps

These and other technological advances will reach populations in different ways and at different times. Local issues such as availability of resources and trained personnel will determine when and if these new technologies are introduced. The changes that will occur should reduce costs and also improve our patient outcomes.

BEATING STRESS WITH EXERCISE

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Keywords: stress, exercise, cardiovascular, neuromuscular, training, active break, daily activities

Abstract: There are multiple relations between stress and exercise. Stress may often result in physical disorder or pain, mostly related to neuromuscular or cardiovascular origin. Physical activity may serve for prevention as well as for rehabilitation. Neuromuscular disorders may be prevented with strength and power training along with flexibility and balance exercise. Cardiovascular disorders may be prevented with endurance exercise. Physical activities may be organized in different ways. The most effective way is physical training which may provide substantial long-term functional and structural changes. It is principally aimed to increase neuromuscular and cardiovascular performance and capabilities. Another organizational way is active breaks during working time. It has no potential for adaptation but is mainly meant to prevent fatigue during working time and reinvigorate. Another way to increase physical activity is to perform daily physical activities which may include active instead of passive transport, household activities etc.

Introduction

Stress on the physical level is often reflected by various psychosomatic diseases and diseases of the cardiovascular system [1,2]. Joint and muscle pain related to stress can be a consequence of psychological and physiological factors. In Slovenia, about 50% of employed persons have to deal with stress, and about 10% of employed persons suffer from it (Statistical office of the republic Slovenia). These numbers may still grow since in more developed economies up to 25% of employed persons (as in Germany) suffer from consequences of stress or burnout [3]. This shows that occupational stress represents a significant problem for individuals, companies and the whole society.

Although the association between work stress and heart disease (coronary heart disease, stroke and hypertension) seems to be well-established, the underlying mechanisms remain unclear [2]. Possible pathways are through the direct activation of neuroendocrine responses to stressors or more indirectly through unhealthy behaviors, such as smoking, lack of physical exercise or excessive alcohol consumption [4].

Traditionally, heavy manual handling has been considered the principal cause of musculoskeletal pain in occupational settings. Later, sustained posture and repetitive movement were accepted as important risk factors in many work situations. Even more recently, mental stressors were added to the list. The relative importance of different risk factors is in part dependent on the body region under strain: heavy lifting (low back), walking and standing (legs), and repetitive work tasks (arms and shoulders) are predominantly important as risk factors for musculoskeletal pain at specific body locations [5].

Physical activity as prevention

A sedentary lifestyle is a major modifiable risk factor for coronary heart disease (CHD) as established by the American Heart Association [6]. Therefore it seems quite natural to assume that increased and properly managed physical activity would reduce the risk factor for CHD. In recent years, substantial data have been gathered to show that higher levels of physical activity, participating in exercise training, and higher overall cardiorespiratory fitness provide considerable protection in the primary and secondary prevention of coronary heart disease [7]. Research shows that physical exercise increases tolerance for physical strains. This is reflected through body weight control, serum fat level, psychosocial stress, increased blood pressure and insulin resistance in diabetes [8]. Regular physical exercise also has a favorable effect on the balance of the autonomic nervous system [9]; it reduces the risk of narrowing of the arteries, improves tissue perfusion or improves symptoms and has a protective function for cardiovascular patients.

Prevention of back pain problems includes ergonomic postures, but more importantly also exercises for muscle strength and flexibility, which are related to controlling the position of the pelvis and torso as well as the pressure in the abdominal cavity [10]. Physical activity does have beneficial effects on preventing the consequences of stress because it increases the level of strain tolerance and has positive consequences on the quality of life and work reintegration.

Physical activity therefore represents an effective way for reducing the consequences of occupational stress [11] and promotes an active lifestyle that helps to prevent and overcome different health problems.

Physical activity as a part of rehabilitation

Once health problems occur, physical activity may be an efficient tool to restore impaired function or diminish health problems. Exercise training is associated with numerous pulmonary, cardiovascular, and skeletal muscle metabolic adaptations that are beneficial to patients with heart failure [12]. In patients with stable heart failure, exercise training can relieve symptoms, improve exercise capacity and quality of life, and reduce disability, hospitalization and mortality [13].

There is solid evidence supporting exercise training in the management of musculoskeletal conditions. Exercise programs' efficiencies are generally higher for knee osteoporosis, low back pain, fibromyalgia, and shoulder pain and were significantly in favor of exercise for both pain and function. For neck pain, hip osteoarthritis, rheumatoid arthritis, and ankylosing spondylitis, the exercise effects are generally smaller and not always significant. Training effect may increase with the number of exercise sessions as has been shown for low back pain and knee osteoarthritis [14].

Physical activity as a part of rehabilitation is efficient when it is coordinated with other health specialists. Its additional advantages include availability, low cost and possibility to perform physical activity continuously throughout the lifespan.

Organization of physical activity

Exercise and physical activity are closely related terms, however, there are important differences in their meanings. The term 'physical activity' includes everyday activities that can contribute to well-being, whereas 'exercise' is physical activity that is planned, structured and performed over a certain time period. But this is not the only distinction between them. Exercise or even better 'exercise training' possesses the

highest adaptation power and is preferentially used when an adaptation is needed. To build up endurance, strength, flexibility or balance, exercise training will be a choice. Mostly, exercise training will be utilized during one's free time. During working hours an active break may be a form of choice. It can prevent fatigue or pain and help to recover. However, due to its short time, it takes only a few minutes and has no potential for adaptation. Reducing sedentary lifestyle by introducing household activities and active commuting is another way to promote health. Their adaptation power is rather limited in comparison to exercise training, but still important to maintain health. Epidemiological studies strongly support an inverse association between occupational and leisure time physical activity and all-cause and cardiovascular mortality in men [15].

Exercise training

Exercise training related to stress is aimed to increase endurance, strength, flexibility and balance. Regarding the changes in the body function, endurance training will address the cardiovascular system by improving heart function, maintain proper blood pressure, increase oxygen uptake, improve fat and glycogen metabolism, etc. Endurance will be improved with walking, running, cycling, cross-country skiing, and other activities that are sufficiently intensive and are performed regularly with proper duration. Endurance training is usually performed outdoor, however, indoor possibilities are available as well (treadmill, elliptical ergometer, cycle ergometer, rowing ergometer, climbing ergometer). According to ACSM [16], endurance exercise should follow these recommendations:

- Exercise should last at least 150 minutes of moderate-intensity exercise per week.
- This can be met through 30-60 minutes of moderate-intensity exercise (five days per week) or 20-60 minutes of vigorous-intensity exercise (three days per week).
- One continuous session and multiple shorter sessions (of at least 10 minutes) are both acceptable to accumulate the desired amount of daily exercise.
- Gradual progression of exercise time, frequency and intensity is recommended for best adherence and least injury risk.
- People unable to meet these minimums can still benefit from some activity.

These are the minimum requirements for endurance exercise. More sophisticated exercise systems are presented by Cooper [17], which includes extensive exercise intensity scales. Similar systems can be obtained also from producers of heart rate measuring equipment as Polar, Suunto, etc. or other companies offering exercise software (e.g. @-life).

Strength training is aimed to make us stronger with increasing muscle mass and/or muscle activation and make muscles endure more at high forces (local fatigue). By this it addresses the neuromuscular system. Increasing muscle activation is rather simple since we only need high enough loads. Increase in muscle mass is much more demanding since the load must be exactly inside prescribed borders including intensity, repetition number in sets, rest between sets, and included muscle mass [18]. Strength training is normally performed in a form called “stage method”, where all sets of a single exercise are performed first and then moved to another exercise. Alternative and less effective organization form of strength training is so called “circuit training”. Strength training is normally performed in fitness centers, however, there are also home strength training machines available. Strength exercises utilizing body weight are simple to perform almost everywhere and can also be quite effective.

A comprehensive strength training system that is simply applicable and effective in various populations was presented by Schmidtbleicher [19]. Strength training is also supported by training software, from simple exercise managers to more complex expert training machines (e.g. @-life).

Muscle stretching is aimed to ensure proper length of the muscles. Too short muscles often result in bad posture. Spasms and increased muscle tone can be relieved with stretching. Stretching can be the main workout of an exercise unit, but can be effectively performed during warming-up and cooling-down of each exercise unit as well. As with strength training, different stretching methods have specific effects and can be applied for specific occasions. Warm muscles are an important issue in stretching, otherwise stretching may be hazardous for muscle and connective tissue.

Balance training (known also as sensory-motor- or proprioceptive training) has been gaining popularity in recent years. It is meant for better joint stabilization (injury prevention or as part of rehabilitation) or improved whole-body balance, which is important at older age. Of course, for different goals different setups are appropriate. Balance training can be performed as a stand-alone exercise unit or worked together with other abilities.

Ball games affect more physical adaptabilities simultaneously. However, their potential for body adaptation is somehow limited in terms of more specific exercise training as presented above. They are most effective when tackling endurance, muscle activation and coordination skills. Although well-programmed exercise training is normally safe, injuries may occur more frequently in ball games. In comparison with individual exercise, ball games have a strong social component that makes them attractive.

Efficiency of adaptation to exercise strongly depends on exercise training programming. This can be performed by an expert or by software. The expert, using his expert knowledge and information about the person, can prepare an individually tailored exercise training program. This is considered as the most efficient way of programming. Exercise training programming performed by software is also based on expert knowledge; however, it cannot go into such individual details as the expert. A possible advantage of software expert knowledge is that it can be obtained from the best experts.

Active work breaks

Total sedentary time is associated with several cardiovascular risk factors, whereas breaking up sedentary time (independent of total sedentary time and moderate-to-vigorous intensity activity) is beneficially associated. Therefore it seems important to avoid prolonged, uninterrupted periods of sitting time for cardiovascular health [20] and low back pain prevention [21]. Active work breaks are simple and efficient way to reduce negative effects of prolonged sitting.

During the break, three tasks can be achieved: promoting blood flow, stretching shortened muscles and activating overstretched muscles. These tasks can be tailored to individual needs and possibilities at the workplace with no special equipment needed.

Information technology may be used for timing the active breaks. It can be triggered with computer terminal or smart phones which enable using more sophisticated algorithms.

Other physical activities

Another possibility to increase physical activity are household activities (such as gardening, cleaning, chopping wood, lawn mowing, etc.) and commuting in an active way such as walking or cycling to work or shop instead of by car, using stairs instead of elevators, etc. These activities, especially in the household, are usually of moderate intensity and in many times seasonal. Therefore it may not always be possible to provide enough stimuli as stated by ACSM (see above). However, these activities help to reduce inactivity and are important for health.

Conclusion

Physical active life has substantial potential to prevent or reduce stress and its negative symptoms. Many varieties of physical activities make it possible to suit almost everybody's needs and thus incorporate them in our lives. Expert exercise counseling with exercise training software supported with information technology is accessible to almost everyone.

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Physical activity and sleep: to exercise or not to exercise?

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Keywords: sleep onset, sleep quality, exercise intensity,

Abstract: About one-third of our entire life is dedicated to sleep. Hence, the importance of adequate sleep for well-being and normal daily functioning is undisputed. Moreover, disturbed sleep has been linked to several adverse health outcomes including obesity and increased cardiovascular and metabolic risk (1). Both physical and psychological stress have been shown to negatively affect sleep (2). Given the changes in lifestyle that have occurred during the last decades, it is not surprising that in a modern society sleep complaints are reported by almost half of the adult population (3). Consequently, the importance of improving sleep is being increasingly emphasized.

Exercise has been widely promoted as an activity that can improve sleep quality [4]. Aerobic exercise is the preferred mode of exercise, but no details about the exact dose of exercise are specified [4]. Epidemiological data show that sedentary people report sleep complaints more frequently compared with their physically active counterparts [5]. Similarly, exercise intervention studies usually induced significant improvements in sleep duration and quality [6]. This was mostly accounted for by a decrease in sleep onset latency i.e. the time needed to fall asleep. In addition, exercise is followed by changes in sleep architecture with more slow-wave sleep and a reduced amount of REM sleep time being recorded. Early studies were mostly confined to good sleepers or young athletes and showed relatively small effects (6), partly because there was little room for improvement to begin with. More recent studies shifted the focus to old people and individuals with sleep disturbances or clinically diagnosed sleep disorders. In these specific groups the effects of exercise training appear to be markedly greater [7]. The most effective mode of exercise seems to be aerobic endurance exercise, although it should be emphasized that other modes of exercise are studied to a far lesser extent. Some initial evidence for a dose response relationship of exercise and sleep exists, but further studies are needed to better describe the frequency, duration and intensity of exercise needed to elicit the greatest improvement in sleep. Moreover, despite earlier concerns about engaging in physical activity shortly before bedtime, recent studies show that even vigorous late-night exercise does not impair sleep [8], at least in good sleepers.

In conclusion, exercise seems to be an effective strategy for improving sleep in general population and probably an even more effective therapy in patients with several sleep disorders. Still, the existing data are insufficient to define the optimum duration and intensity of exercise as either a preventive, or a therapeutic strategy. Therefore, further clinical trials are warranted to better describe the relationship of sleep and exercise as well as the modulators and mediators of this relationship.

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RESILIENCY:

Mayo Clinic Strategies

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Resiliency Domain Leader
Mayo Clinic

May 21, 2013 Ljubljana, Slovenia

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Resiliency: The individual's ability to cope with stress and adversity. A process that allows the individual to learn and grow from life's challenges

Donald Meichenbaum, PhD, 2012
Roadmap to Resiliency: A Guide for Military, Trauma Victims and Their Families

Mayo Clinic Wellness: Integration of Three Domains

- **Fitness:** Strength, Flexibility, Balance, Aerobic and Lifestyle Activity
- **Nutrition:** Cardiovascular, Cancer, Sports Performance and Weight Management
- **Resiliency:** the topic of this talk

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Mayo Clinic is one of the best companies to work for in the United States. So can a Mayo Clinic employee have a high stress level?

Could an employee of your company, or student or faculty member of your university have high stress?

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Life Events Survey (47-items)

- 62% of wellness center members endorsed change in work situation over past year
- 45% serious illness of a loved one
- 44% change in sleeping habits
- 43% major change in financial status
- 33% major change in closeness of family relationship

Methodology

Study design: Survey of 13,882 employees

Setting: Employee wellness center

Sampling: Employees joining a wellness center, average age 39 years, BMI of 26.9, and 63% were female

Measures: A series of questions about current health status and health behaviors

Analysis: Two-sample t-tests assuming unequal variances

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Why is Resiliency so Important?

Relationship between stress level, quality of life and health behaviors in Mayo Clinic Employees

Clark MM, Warren BA, Hagen PT, Johnson BD, Jenkins SM, Werneburg BL, & Olsen KD. Stress level, health behaviors, and quality of life in employees joining a wellness center. *American Journal of Health Promotion,* 2011, 26:21-25.

Results for Health Status

High Stress**:** Of the 13,882 employees, 16.3% (2,147) reported having a high stress level; 0 to 10 scale

Health Status Differences:

Overweight:	49% vs. 40%
High blood pressure:	12% vs. 10%
High cholesterol:	16% vs. 13%
Tobacco usage:	4.4% vs. 3.7% (non-significant)

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Health Behaviors and Quality of Life

	Low Stress	High Stress
Overall QOL	7.9	6.9
Fatigue	6.3	5.3
Fatigue/stairs	7.7	6.9
Physical activity	5.3	4.6
Nutritional habits	6.4	5.7
Confidence	7.8	7.2
Support	7.7	7.1

Or is your daily life a balancing act?

Does your work-life balance look like this?

Dan Abraham Healthy Living Center
For Mayo Clinic employees & affiliates

- Fitness and wellness facility
- Subsidized by Mayo Clinic
- Built in 2007
- More than 115,000 square feet
- More than 16,500 members
- Multi-disciplinary team
- Two fitness floors
- Five group fitness studios
- Two pools
- Wellness evaluation suite
- Relaxation suite
- Healthy café
- Demo kitchen

Quality of Life and Wellness Center Usage 1151 employees

- Low Users: Less than once every two weeks
- Decrease in Physical QOL
- Decrease in Mental QOL
- High Users: 2-3 visits per week
- Improved Physical QOL
- Improved Overall Health

Clark and colleagues, May 2013, *American Journal of Health Promotion*

Effectiveness of a Multidisciplinary Worksite Stress Reduction Program for Women

Werneburg, BL, Herman, LL, Preston, HR, Rausch, SM, Warren, BA, Olsen, KD, and Clark, MM. *Stress and Health,* 2011; 27: 356-364.

Program Format and Objectives

- Objectives
  - Identify causes of personal stress
  - Develop a range of strategies for long-term stress management
  - Set and implement action based goals
- Format
  - 20 minutes group discussion
  - 20 minutes education/skill building
  - 20 minutes relaxation technique
  - Take-home field work

Program Sessions

- Week 1: Overview of Stress & Women's Roles
  - Relaxation technique: Deep breathing training
- Week 2: Physical Activity/Nutrition/Sleep
  - Relaxation technique: Resistance tube exercises
- Week 3: Personal Values/Time Management
  - Relaxation technique: Chair yoga


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Program Sessions

- Week 7: Handling Anger
  - Relaxation technique: Guided imagery #1
- Week 8: Gratitude
  - Relaxation technique: Self-massage
- Week 9: Managing Worry
  - Relaxation technique: Mindful walking



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Program Sessions

- Week 4: Assertiveness
  - Relaxation technique: DAHLC relaxation suite tour
- Week 5: Conflict Resolution
  - Relaxation technique: Tai Chi
- Week 6: Positive Thinking
  - Relaxation technique: Progressive muscle relaxation


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Program Sessions

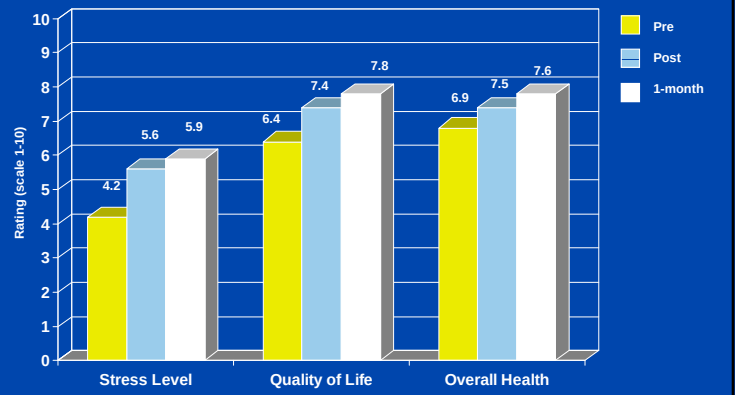
- Week 10: Discovering Purpose
  - Relaxation technique: Purposeful meditation
- Week 11: Relapse Prevention/EAP
  - Relaxation technique: Guided imagery #2
- Week 12: Personal Spirituality
  - Relaxation technique: Chair massages



Program Completion

- 138 total enrolled, 14 total Stress Less programs
- 104 completers, 48 years old, most employees
  - Attendance of ≥ 8 of 12 sessions
- 77% completion rate
- Most of non-completers missed the cut-off by one session

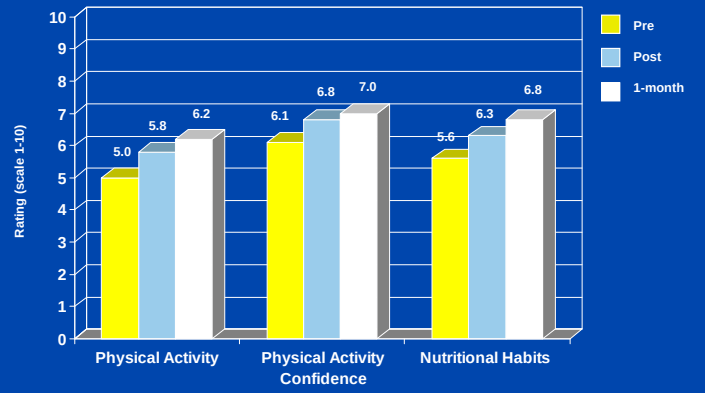
Stress Less Outcomes



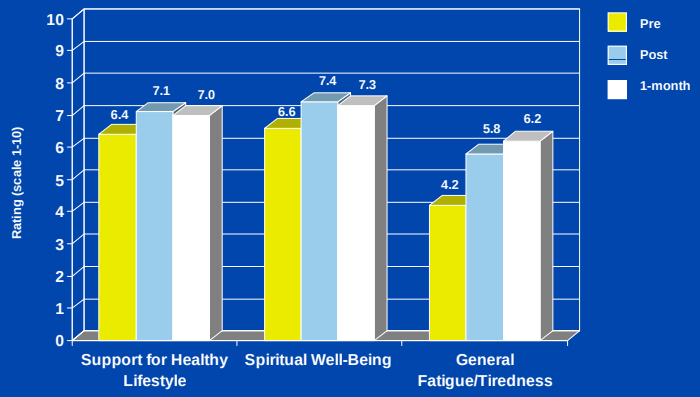
Results of Perceived Stress Scale and Current Health Behaviors

Measure	Week 1 Start	Week 12 End	Week 16 Post-Program
PSS Mean	22.7	16.2	14.6
PSS goal: Reduction over time Potential scores could range: 0 – 40 (nat'l avg. 13.7)			
CHB Mean	56.6	65.8	68.7
CHB goal: Increase over time Potential scores could range: 0 - 110			

Stress Less Outcomes



Stress Less Outcomes



What's Stressing Men?

- Two focus groups
- N = 27
- Top 5 Topics of Interest
  - Nutrition and stress
  - Healthy eating
  - Finances
  - Work/life balance
  - Healthy stress coping strategies

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Ride-It-Out
Stress Management for Men

Presented at the annual meeting of The Art and Science of Health Promotion, April 2012, San Diego

How is Men's Stress Different from Women's Stress?

- Men internalize stress more than women
- Men often find it challenging to identify that they are having difficulty managing their stress
- Men tend to believe they have to solve problems versus discuss feelings and implications of stress

What Was Developed?

- *Ride-It-Out*
- A 12-week comprehensive wellness program using cycling and stress reduction techniques to lower stress levels

Ride-It-Out Participant Characteristics

Total n = 84		
Age (years)	n	%
20-29	12	14.5%
30-39	14	16.9%
40-49	20	24.1%
50-59	28	33.7%
60-69	8	9.6%
70-79	1	1.2%
Male	21	25%
Female	63	75%

12 Ride-it-Out Session Topics

- Workplace stressors
- Motivation to change
- Time management
- Procrastination
- Work-life balance
- Thoughts-Emotion-Behavior
- Positive thinking
- Communication
- Conflict resolution
- Self-care
- Spirituality
- Relapse prevention

Improvements:

	Pre	Post	One-month
Perceived Stress Scale	18.2	14.6	13.5
Current Stress Level	4.8	5.4	6.0
Confidence to Manage Your Stress	5.8	7.1	7.3
Quality of Life	7.2	7.9	8.0

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Power of Thoughts

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Stress Management and Resilience Training Program: SMART

Train Your Brain, Engage Your Heart, Transform Your Life.

A two step program to enhance attention; decrease stress; cultivate peace, joy and resilience; and practice presence love.

Amit Sood, MD. Chair Mayo Clinic Mind Body Initiative

SMART 12 Week Program

- Origins of stress
- Gratitude
- Joyful attention
- Compassion
- Acceptance
- Meaning and purpose
- Forgiveness
- Relationships
- Meditation
- Patience and anger management
- Spirituality
- Take-away thoughts

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SMART for Physicians: Waitlist Control

- 32 of 40 physicians completed the program
- One 90 min session, practice for 8 weeks
- Perceived Stress: 28.2 to 22.8
- Quality of Life: 7.6 to 8.0
- Conner Davis Resilience Scale: 69.6 to 79.4

Sood, A, Prasad, K, Schroeder, D, & Varkey, P. Stress management and resilience training among department of medicine faculty: A pilot randomized clinical trial. *Journal of General Internal Medicine*, 2011, 858-861.

Motivational Improvements for Health Behavior Change from Wellness Coaching

Start of Wellness Coaching		Completion of Wellness Coaching
Mental/Emotional Fitness		
Importance	9	9
Confidence	8	9
Life Satisfaction		
Importance	8	9
Confidence	7	8

Mayo Clinic Wellness Coaching Program

- Certified Wellness Coaches
- 12 week in-person wellness coaching sessions.
- Identifying personal goals, that may change over time.
- Strength based and motivational interviewing.

Mettler, Preston, Jenkins, Werneburg, Olsen and Clark, "in press" *American Journal of Health Behavior*

Fundamentals of Resiliency

- Accept that resiliency needs to be an ongoing goal
- Be open to a range of resiliency strategies
- Physical activity for stress management
- Healthy Sleep
- Work life balance
- Positive relationships and social support
- Spirituality

NUTRITION AND STRESS

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Abstract. Nutrition and stress interact in a number of ways. Stress may promote unhealthy patterns of eating through various mechanisms and relationships. Conversely, unhealthy patterns of eating may result in obesity and other adverse health conditions that may contribute to stress. The relationship between stress and diet can be complex and result in different types of sustained unhealthy behavior patterns and vicious cycles. A healthy diet can reduce the risk of hyperlipidemia, hypertension, obesity, diabetes mellitus, coronary artery disease, stroke, many cancers, and other health conditions. A healthy diet can also reduce stress and improve the quality of life directly and indirectly through improving these health conditions. Based on objective data, an optimal dietary pattern includes generous amounts of fresh or frozen vegetables and fruits along with whole grain carbohydrates, nuts, legumes, fish, heart-healthy unsaturated fats, low-fat fermented dairy products (if consumed), and moderate amounts of coffee and alcohol (if consumed). Meat, high-fat dairy products, refined carbohydrates, and processed foods would be minimized in the diet. This type of dietary pattern would improve health through many mechanisms including macronutrients in health-supporting forms and amounts and increased intake of phytochemicals and other beneficial nutrients. This type of dietary pattern can be low in energy density, an important factor in maintaining a healthy weight. The Mayo Clinic Healthy Weight Pyramid represents this healthy pattern of eating. The Mayo Clinic Diet is a weight management program that includes The Mayo Clinic Healthy Weight Pyramid and evidence-based strategies that encourage sustainable healthy lifestyle changes. Although objective data can be described, subjective factors ultimately determine what people eat. To best facilitate long-term healthy dietary changes consideration should be given to practicality and enjoyment. Multiple different strategies can be individualized and applied to achieve long-term health goals and reduce stress.

HOW MIGHT ANESTHESIA BE DELIVERED: LESSONS FROM OUTSIDE MEDICINE

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Introduction

Considering the results of the 2012 elections in the United States, it is almost certain that the American health care system and the medical specialty of anesthesiology is going to have to respond to change. Fortunately, anesthesiologists live a life of constant change. Years ago, when I was taking the Cook County Review Course, ASA's Distinguished Service Award winner, Dr. Ron Miller, told us that he loved to give talks at Review Courses because the questions never changed, just the answers. I've reflected on that comment over the years as my colleagues and I are asked to constantly change the answer by caring for ever sicker patients for new, challenging procedures, using new pharmacologic agents, in unfamiliar locations, with procedural physicians that are new to us and the procedure they are performing.

I believe that our acceptance of constant change is going to be severely tested. The United States have embarked on a unique social experiment. For the last thirty years the output of our medical schools and residencies has been fairly flat. Our available physician FTE's have shrunk due to changes in work-life balance. At the same time, patient populations are growing rapidly, getting older and sicker, and the baby-boom generation is on the cusp of Medicare, the US government's health insurance for the elderly. Medicine is rapidly diversifying its portfolio of painful procedures that require anesthesia services and these procedures are spreading throughout our medical facilities. The consequence of these changes is a rapidly growing mismatch of supply and demand for anesthesia services and anesthesiologists.

We are going to have to quickly adapt to meet this demand or the medical market will find other ways to provide these services. Unfortunately, the response will likely include the growth of anesthesia dabblers, charlatans, and poachers. Historically, those industries that have successfully responded to this kind of supply/demand mismatch have used technology to significantly increase productivity, in other words more output per worker. Anesthesiologists must figure out new and better ways to provide medical care that is safer and more productive. I believe better processes and improved technologies that leverage the knowledge and skills of anesthesiologists will be the foundation of increasing clinical productivity. If we insist on our current practice paradigm of one well-trained clinician at every patient bedside, for every moment of an anesthetic, I predict we will be gradually, but relentlessly, marginalized and potentially made irrelevant. However, if the practice of anesthesiology embraces change, modernizes how it delivers medical care in the operating and procedural suite, in intensive care units, and throughout our medical facilities, we will not only survive the anticipated changes in healthcare, I predict we will flourish and grow.

Increasing Efficiency

If one examines how other industries have changed their processes, it is a common phenomenon to use technology to allow one well-trained individual, who previously would personally perform an activity, to oversee more than one process concurrently. For example, in the past a welder, putting together metal parts of an automobile or other machine, would manually place each weld individually all day long. This manual process was seen throughout manufacturing. Today, robots that are programmed and overseen by highly trained professionals automatically do most of manufacturing. They use technology to monitor the process and are provided enough information so that they can intervene when something goes wrong. These developments have occurred in small steps over many decades. Today the modern factory floor bears little resemblance to assembly lines of the past.

With existing technologies, we can begin to change how we deliver anesthesia in order to leverage the skills, knowledge, and experience of well-trained anesthesiologists. Virtually, all modern physiologic monitors are capable of being interfaced to a local area network (LAN). The information on the LAN can be forwarded to a central location (i.e. a “cockpit”) where one individual can oversee a number of concurrent procedures. The cockpit can be supported on the ground by other anesthesiologists that can communicate with the individual in the cockpit (e.g. voice over internet phone) and who are available to go to the patient bedside based on the individual needs of the patient. Instead of having to “round” by going room to room in order to identify problems, hopefully prior to patient harm, the anesthesiologist in the cockpit can keep track of a number of patient’s physiologic parameters, identify those that are moving in the wrong direction and direct the anesthesiologist on the floor, tell them what the problem appears to be and that they should go to the patient’s bedside to evaluate and intervene.

The information flowing to the cockpit can be augmented with additional information, including ventilator parameters, such as respiratory rate, tidal volume and peak inspiratory pressures, laboratory results, fluids and medications administered from the

electronic medical record, and audio-visual hookups to the operating room allowing the cockpit to observe what's going on in the OR, including the surgical field, and communicate with the clinician at the bedside. Today, most anesthesiologists care for only 1-2 patients concurrently. With the addition of an oversight cockpit linked and supported by off-the-shelf technology it may be possible to provide high-quality healthcare to 4 or 6 or even 10 patients per anesthesiologist. Most likely, the number of concurrent patients will be limited by the requirement for hands-on procedures such as anesthesia induction, intubation, line placement, and emergence and extubation.

Most high-technology industries make use of data analysis to track and evaluate its manufacturing processes. It is routine for chemical engineering plants to have computer-based monitoring of temperatures, flows, pressures and so on. Similar computer-based tracking is utilized by manufactures of silicon chips, and automobiles. When these computer-based tracking and evaluation systems identify that there is a problem with the monitored process it sends alerts to individuals overseeing the process.

Similarly, anesthesia and surgery is a continuum of care. Physiologic parameters are usually presented as single values, sometimes presented as trends over time. The bedside clinician routinely misses parameters that change slowly over time. Multi-modal analysis, such as a rising heart rate and lower blood pressure suggesting hypovolemia, can be used to facilitate early identification of adverse trends and events. The development of computer-based electronic decision support have been shown to improve health care delivery in nonoperative settings [1-3] and there is no reason that similar data analysis, pattern recognition, and notification will not improve anesthesia care delivery. When coupled with cockpit oversight, computer-based decision support will improve anesthesia care and decrease personnel needs.

For reasons of efficiency and safety, many manufacturing processes are managed remotely. For example, because of high temperatures and pressures the adjustments of reagent flows are remotely controlled in the manufacturing of many pharmaceuticals.

Similar remote process adjustments are utilized with robotic manufacturing. The recent introduction of electronic anesthesia machines will allow for the remote control of fresh gas flows, concentration of inhalation agents, ventilator parameters, and so on. Current infusion pumps offer interfaces that allow for remote adjustment of infusion rates. If IV anesthetics are prepared as infusions instead of in syringes, infusion rates and boluses could be controlled remotely from the cockpit. Fluids could similarly be controlled. As with computer-based clinical decision support, the introduction of remote control of anesthesia will allow for more efficient care.

The next step in modernization of anesthesia delivery will be closed-loop control. These systems are commonly utilized in many manufacturing processes. It's routine to have computers adjust flows, heating and cooling, and pressures to assure a consistent environment for the manufacturing process. There has been great interest in the use of closed-loop control of anesthesia for many years [4-5]. Secondary to the introduction of improved physiologic and anesthetic gas analysis, new physiologic parameters (e.g. BIS monitoring), and a greater understanding of the anesthetized patient, there is growing interest in the use of closed-loop control of anesthesia beyond the investigative environment [6-8]. Particularly for the maintenance phase of an otherwise uncomplicated anesthetic and surgical procedure, further developments of closed-loop control anesthesia could be entirely hands free, only requiring the intervention of anesthesiologists for induction, emergence, and adverse events. Expanding closed-loop control to fluid management and mechanical ventilation could expand the footprint of "hands-free" anesthesia. Obviously, with the utilization of validated closed-loop systems the number of concurrent procedures that could be safely managed could expand even further.

As these advances are developed and deployed (i.e. cockpit oversight, computer-based electronic decision support, remote control of anesthesia, and closed-loop control) the requirement for fully trained clinicians at the patient bedside will most likely decrease over time and may disappear entirely. Instead of having a qualified anesthesia provider at every bedside for every minute of an anesthetic, the requirement

may shrink to only at those times where hands-on care is required (e.g. line placement, intubation). Outside of these hands-on requirements, bedside care could be relegated to allied health technicians with modest training whose activities are directed from the cockpit or the rotating anesthesiologist. The logical end-point of these developments is to eliminate the need for in room personnel during the maintenance period of a procedure. Of course, it is difficult to know how far technologic developments will decrease current personnel needs or the level of training required for safe and effective anesthesia care. None-the-less, when one looks at other industries, new technologies will allow for substantial decreases in the need for highly trained, expensive, and scarce anesthesiologists and other clinicians.

Automated Bedside Procedures

There has been some speculation that the use of surgical robots will substantially impact the surgical practice and secondary to its decreased invasiveness diminish the need for anesthesia [9]. While this may be possible in the long run, when one considers the wide variation of human anatomy and the impact of disease on anatomy, this development won't be seen for many decades. Historically, automated activities start with those that are the most straightforward and reproducible (e.g. welding by a robot in the same location).

The placement of venous and arterial catheters can be broken down into very simple steps: identify a cylindrical structure immediately subcutaneously, determine pulsatile versus nonpulsatile flow, place tip of a needle into the cylindrical structure, advance a catheter, and confirm successful catheter placement. Such a device using ultrasound imaging, Doppler flow, and pressure transducers could be designed to successfully place vascular catheters. Further refinements will allow the technology to place catheters into the central circulation. With ongoing improvements such devices will successfully cannulate increasingly difficult anatomy (i.e. paralleling industrial developments), the requirement for hands-on personnel will decrease. The logical end-

point will be that only a few patients with particularly difficult anatomy will require vascular access by a physician via imaging in a procedural suite.

Similar developments can be anticipated in regard to airway management. Complications and deaths secondary to failed airway management remain one of the most common reasons for adverse anesthesia outcomes and litigation. Recently, a number of devices, which make use of fiberoptic imaging, have been introduced on the market to facilitate intubation. While there are differences among these devices, they all have at their core the ability to see around the corner and present an image of the airway and vocal cords. Technology could be developed to automate the process of securing the airway. The use of image analysis, ultrasound, and so on could allow for the correct identification of the vocal cords and trachea followed by the placement of an endotracheal tube. This kind of technology would, at first, be used to secure uncomplicated airways but would steadily be improved so that only the most difficult airways requiring surgical intervention would require hands-on care.

Regional anesthesia would not be left out of these developments. Placement of spinal, epidural, and peripheral nerve blocks could also be automated with the use of ultrasound, image analysis, and pressure transducers. Coupled with computer-based drug delivery systems, once a needle or catheter is successfully placed the optimal dose of regional anesthetics and other agents could be delivered. The patient's physiologic and neurologic response to administered medications could confirm placement and that the appropriate dose has been delivered.

Implications

Although these kinds of developments would appear to threaten the very existence of the medical specialty of anesthesiology, nothing could be further from the truth. The threat to anesthesiology is the inability of our physicians to provide needed services in a cost-effective manner. The use of centralized monitoring and control of anesthetics, particularly with the support of computer-based decision support and automated

processes could decrease the required number of anesthesiologists for so-called routine procedures. However, when one considers the increasing complexity and acuity of our patients and the procedures they undergo, the requirement for anesthesiologists to provide hands-on care for those patients that do not follow the expected course-of-care (e.g. severe bleeding after cardiopulmonary bypass, hemodynamic instability during hip replacement) will continue. Similar to what is seen in a modern automobile plant or how modern aircraft are flown, the processes that are routine are automated. Those that diverge from the expected (e.g. installation of customized options, mechanical failure of the aircraft) require the intervention of well-trained professionals. Technologic advances will increase the demand for anesthesiologists and eliminate the unfortunate image that most of what we do is routine and could be done by a technician.

Conclusion

Since the advent of the industrial revolution, one industry after another has changed how they produce their respective product or service. These developments have followed a uniform course, increase productivity, decrease personnel needs, increase quality, decrease costs, and over the last several decades massive increase in the use of information technology and the automation of routine activities. Medicine has traditionally been behind these kinds of developments, but the rapidly evolving healthcare environment will not allow us to reject these advances. Our patient population is growing rapidly, becoming older, sicker, and demanding a greater pallet of procedures. This growth in demand is outstripping our ability to deliver anesthesia services. Anesthesiology will either deliver highly productive, high value, and high quality medical services or we will be leapfrogged and marginalized by those that can.

Looking to industries that have already made this transition, the medical specialty of anesthesiology can also make similar changes in how it delivers care. Currently available technology allows for the use of centralized oversight (i.e. a cockpit) of anesthetics and communication with anesthesiologist “on the floor”. This could increase the number of concurrent procedures per anesthesiologist. The addition of computer-

based decision support, control of anesthetic, fluids, et al from the cockpit, closed loop control of the anesthetic and automated procedures would allow for further increase in the number of concurrent procedures, a decreased need for well-trained in-room providers, and may even allow for some procedures to be entirely done remotely. These developments would appear to be a recipe for the elimination of anesthesiologists. In fact these developments will guarantee the future success of anesthesiologists by allowing us to concentrate on those patients that require the knowledge and skills of a physician and relegate routine and straightforward procedures to strategies and technologies that maximally leverage the abilities of anesthesiologists.

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WORKPLACE HEALTH PROMOTION – A STRATEGY TOWARDS BETTER HEALTH AND WELL-BEING AT WORK

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Abstract. The development of health promotion is closely linked to the growing importance of the biopsychosocial health concept in the second half of the 20th century. According to the Ottawa Charter for Health Promotion, workplace is one of important settings for health, where different initiatives can be successfully introduced in order to influence lifestyle and other social, economic, environmental and personal factors that contribute to health. Workplace health promotion is a combined effort of employers, employees and society, its aim being to improve health and well-being of people at work. It is a relatively new concept for Slovenia, but it is expected to gain more interest among employers and other stakeholders due to the newly imposed legal obligation.

Introduction

Health promotion is a relatively new term in the Slovenian public health field. Until the mid-1990s, the term generally used in Slovenia was health education, even though the activities in this field started to go beyond the boundaries of health education long before that and its content was already very similar to the current definition of health promotion following the Ottawa Charter.

The medical historian Henry E. Sigerist was among the first who used the term “health promotion”. As early as 1945, he defined four major tasks of medicine which include: 1) health promotion, 2) disease prevention, 3) treatment of patients and 4) rehabilitation. In his opinion, health can be promoted by ensuring a decent living standard, good working conditions, education, physical activity and possibilities for resting and recreation. In order to achieve this goal, he called upon statesmen, employer and employee representatives, educators and physicians to act [1].

Health promotion was first introduced as an organized activity in 1974, when the Canadian health minister Marc Lalonde published the document *A New Perspective on the Health of Canadians*. This was the first government policy paper identifying health promotion as the most important strategy for better health. It was later followed by similar documents in some other countries, including Sweden and the United States, and contributed to a growing international enthusiasm for the new approach [2].

Health promotion as a new approach to health

Biopsychosocial health model

The development of health promotion is closely linked to a growing importance of the biopsychosocial health concept in the second half of the 20th century, when it started to successfully compete with the long prevailing biomedical model.

The biopsychosocial model considers biological, psychological and social factors as equally important determinants of health and ill-health. It takes into account both the processes on micro- and macro-levels, and their mutual interaction that results in different stages of health. Health and illness are influenced by many factors. Body and mind cannot be considered as separate worlds because they both clearly influence human health through mutual interaction. According to this model, illness is not a deviation from a certain sound state. Furthermore, health is not something given to an individual but it can be achieved through careful consideration of one's biological, psychological and social needs that have to be met [3].

In contrast to some earlier definitions, health is not something static from the health promotion perspective but rather a result of constant balancing of three areas: mental, physical and social. It is relative, as it reflects the degree to which a person is able to adapt to changing circumstances and is able to perform important tasks framed by their genetic basis, physical and cultural environment.

Definition of health promotion

The most comprehensive explanation of health promotion and its strategies was developed at the first international conference on health promotion in 1986, when the Ottawa Charter for Health Promotion was adopted. The Charter identifies the prerequisites for health, methods to achieve health promotion through advocacy, enabling and mediation, as well as five key action areas [4].

The Charter defines health promotion as a strategy of intermediation between people and their environment to improve health. It is a process of enabling people to increase control over their health and its determinants, and thereby improve their health. Health promotion derives from the concept that considers health as an expression of degree to which individuals or groups are able to fulfill their aspirations and meet their needs, and to change their environment and cope with these changes. The concept includes influences on lifestyle and other social, economic, environmental and personal factors that contribute to health. Thus, the concept requires an intersectoral approach. The five key areas of action are:

- designing, educating and training people, working in the local environment and moving the focus of activity of (primary) health care from treatment to prevention;
- development of healthy public policy at different levels and in all sectors;
- reorienting health services towards health promotion and disease prevention;
- building supportive environments for health, i.e., environments that enable, encourage and make healthy choices easier;
- development of personal skills where personal and social development is provided for on the basis of information, education and training in order to enable people to make health-friendly decisions;
- strengthening community actions where relevant and effective activities of needs prioritizing, making decisions, planning and implementing measures for better health are in place [4].

Green and Kreuter defined health promotion as a combination of educational and environmental incentives for health enhancing activities and living conditions [5]. Premik considers health promotion a very important part of public health that can be understood as “science and art, how to prevent illness, extend active life period and to improve health through organized activities of the society” [6].

Settings for health

According to the Ottawa Charter, health cannot be limited only to the health sector or “closed” within the Ministry of Health. As an upgrade of the risk management approach, the approach of health promotion in different settings was introduced. The setting for health is a place or a social framework where people perform their daily activities and where different environmental, organizational and personal factors interact, thus influencing health and well-being [7]. Health is built (or lost) in different life settings – in a family, in a city, in a workplace, in a school or kindergarten, on a farm. Different sectors and not just health sector are responsible for all these settings. Health promotion thus depends a great deal on intersectoral cooperation.

The Ottawa Charter also marks a move from a traditional view of an individual as a passive receiver of health education towards a new approach to people as active public who are able to take control over their health and make decisions for health through information, health education and competence building [4].

Workplace health promotion

History of workplace health promotion

In the 1980s, health promotion began to slowly spread to the working environment. In the United States, the first health promotion programs were based on the programs of healthy lifestyle. They were mostly aimed at top management and after the Second World War and up until the end of the 1970s, they offered the opportunity to take exercises in modern equipped gyms within companies [8]. In the early 1980s, when

these programs began to include all employees, less than 10% of companies carried out health promotion programs which were mostly focused on encouraging physical activity. Until 1994, as many as 80% of American organizations with more than 50 employees introduced the programs which dealt not only with physical activity but also with a healthy diet, maintaining body weight, stress management, smoking cessation and self-treatment. Around the turn of the century, the share of companies with health promotion programs increased to 90%. The development of science which supported health promotion and gathered “evidence” about the effects of workplace health promotion on health and financial indicators [9] was especially outstanding.

As early as the mid-1980s, the United States kept a record of the performance of workplace health promotion programs which were fairly widespread due to economic incentives given to companies. Health promotion programs and activities were focused mostly on risk factors for the development of heart diseases and cancer and on interventions oriented towards changes in employees’ lifestyle. The programs included only few interventions regarding the changes in working environment or work organization, health promotion activities were poorly connected with the system of health and safety at work, and only little attention was paid to the inclusion of employees [10].

The year 1992 was dedicated to health and safety at work, therefore the European Foundation for the Improvement of Living and Working Conditions published a study in which Wynne and Clarkin explained the importance of workplace health promotion for employees’ health and well-being [11]. The results of the study were discussed at an international conference held in Dublin in the same year. In the final document prepared after the discussion, guidelines for the further development of workplace health promotion were formulated with a focus mostly on four areas: marketing of workplace health promotion and incentives needed for it, organizational changes needed for health, professional development for work in the field of workplace health, implementation – strategies, tools and methods [12].

The development of workplace health promotion in Europe was given a new impetus when the European Network for Workplace Health Promotion was established in 1996. The foundation of the Network was connected with passing the action program about “Health promotion, education, information and training” with the help of which the European Union tried to improve the standards of public health in Europe paying special attention to workplaces. The Network now consists of as many as 31 European countries represented by national contact points including different organizations and institutions, e.g. for health and safety at work, public health or employees’ health. In these years, the Network can boast several important achievements: it provided a definition of workplace health promotion in Europe, developed standardized quality criteria for workplace health promotion programs and published several reports which included examples of good practice in various industrial sectors. It developed a European array of tools for a successful workplace health promotion and identified strategies which would be helpful in retaining employees in the world of work for a longer period of time. Apart from that, the Network helped to establish networks for workplace health promotion in individual countries [13].

Despite all these documents and contribution of numerous researchers and practitioners, it can be concluded that the measures in the field of workplace health promotion are still focused mostly on changing the viewpoints and behavior; also the evaluation studies are mostly conducted in this field. Considerably fewer initiatives deal with adapting and improving work organization and working environment. The findings about European workplace health promotion published by Breucker and Schröer at the end of the 1990s are still at least partly valid. These are: health promotion is still a relatively new activity in companies; there are considerable differences between the countries as regards its spread and concepts used; workplace health promotion is an umbrella term for various strategies which are pursued in different ways by different players inside and outside organizations [14].

Definition of workplace health promotion

Workplace health promotion is a combined effort of employers, employees and society, its aim being to improve health and well-being of people at work [15]. This can be achieved by a combination of better work organization and working environment, strengthening of mutual cooperation of workers and by encouraging personal development [16]. In other words, it can be said that it refers to the accomplishment of the mission chosen by the European Network for Workplace Health Promotion (ENWHP) as its aim, i.e., healthy workers in healthy organizations.

The ENWHP also emphasizes that workplace health promotion includes the commitment of the organization to improving the health of the workforce, communicating suitable information to employees, creating policies and practices which enable healthy choices, and to the realization that organizations exert influence on people [16].

The American Association for Health Education defines health promotion as any planned combination of educational, political, environmental, regulatory or organizational mechanisms which support activities and conditions for life that enhance the health of individuals, groups and communities [17].

Workplace health promotion in Slovenia

Fit for work

In Slovenia, workplace health promotion began to develop more intensively in 2004, when the Clinical Institute of Occupational, Traffic and Sports Medicine started the activities needed to create the first holistic program – Čili za delo (Fit for work; the Slovenian expression is adapted from English names of similar programs). The intention to set up the program Fit for work was mentioned as early as 2003 in the Resolution on the national workplace health and safety program [18], which also stated that the program would start to be drawn up in the same year by the Ministry of Health in cooperation with the Clinical Institute of Occupational, Traffic and Sports Medicine and

other institutions. The Clinical Institute of Occupational, Traffic and Sports Medicine began to work on this program independently in 2004; for this reason, it had to employ new staff and look for appropriate financial resources.

The program was developed in three stages due to an easier implementation and mostly due to financial constraints:

- research and analytical stage (from October 2004 to April 2005) when research into the attitude of Slovenian management towards health and workplace health promotion was carried out;
- the Phare project (from May 2005 to September 2006) within which the contents of the program and the modules of education for healthy work and life were developed;
- implementation stage (since January 2007) during which the following has taken place: training of advisers on workplace health promotion, raising awareness of employees and employers with the help of professional meetings and intensive campaigns, developing and maintaining the network for workplace health promotion which supports the implementation of the program.

Fit for work remains the umbrella program of health promotion at the Clinical Institute of Occupational, Traffic and Sports Medicine and is constantly supplemented with new contents and new approaches as well as methods of work (www.cilizadelo.si).

In 2004, the Clinical Institute of Occupational, Traffic and Sports Medicine joined the ENWHP, which means that new possibilities opened up to cooperate in international projects which focus mostly on the exchange of know-how and experience, creation of new health promotion programs and training for health promotion as well as looking for and spreading the cases of good practice. Let us enumerate some of them.

Workplace health promotion as legal obligation

Despite numerous benefits, public policies did not pay special attention to (workplace) health promotion in the last decades and WHP was imposed as employers'

duty by the 2011 Health and Safety at Work Act. Article 6 of the Act states that the employer should plan and carry out workplace health promotion, whereas Article 32 requires that the employer should ensure necessary resources for health promotion and the method of monitoring its implementation. At the same time, this is the first Act in which workplace health promotion is also defined as systematically oriented activities and measures carried out by an employer to maintain and strengthen physical and mental health of employees [19]. Even though employers and experts were not prepared for this Act, it represents an additional incentive and challenge leading to measures taken to improve employees' health.

This task should be tackled professionally and efficiently and the reference books entitled Healthy Employees in Healthy Organizations, which were published in 2012 by the Clinical Institute of Occupational, Traffic and Sports Medicine in cooperation with the Ministry of Health, can also contribute to it. These reference books lead the employers and their advisers in a simple and understandable way through the process of planning and implementing workplace health promotion programs in medium-sized and large enterprises and organizations, in small enterprises and organizations as well as in microenterprises. They were published in the form of booklets, which facilitates ease of handling and quick lookup for required information.

Conclusions

The main aim of health promotion is better health of people and consequently a better quality of life and work. The fact that costs for health care and social security are on the decrease due to good health promotion programs should also not be ignored. Management of costs related to illnesses, treatment, sick leave, disability, occupational diseases and premature deaths is an important argument for the introduction of health promotion programs.

Researchers have come to the conclusion that absence from work of participants in the health promotion programs decreases by 12 to 36%. They have also calculated the ratio between the investments in the workplace health promotion programs and savings due to fewer sick days; it ranges from 1 : 2.5 to 1 : 10.1. At the same time, research

shows that every euro spent on people's health saves between 2.50 and 10.00 euros [20].

In Slovenia, we can also boast successful examples of good practice where we could look for similar indicators of efficiency. However, it should be admitted that they are rare and that a real development of workplace health promotion is still in its infancy. In order to exploit the whole potential offered by this approach, an agreement should be reached on its definition and role. Besides, it would be necessary to determine what kind of competences and consequently what kind of education would be needed by workplace health promoters.

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WORKPLACE STRESS PREVENTION AND COPING

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Keywords: Workplace health promotion, stress, prevention, coping, planning, individual level, organizational level.

Abstract. Workplace stress prevention and coping approach that was developed at the Clinical Institute of Occupational, Traffic and Sports Medicine within *Fit for work* program will be presented.

Organizations that promote workplace health incorporate health as one of the leading values in their business strategy and strive to create a work environment that supports employees' health. They organize educational activities and cooperate with the occupational doctor as well as a safety engineer. A special »health team« or »health group« is appointed to design and implement workplace health promotion (WHP) program.

The health team designs WHP programs on the basis of a thorough health analysis of the organization. Health analysis is based on measurable (e.g. % of sick leave, severity of illness, accidents at work…) and estimated (e.g. risk assessment, answers to various questionnaires regarding satisfaction at work, relationships in an organization, use of psychoactive substances and addiction…) health indicators in combination with the characteristics of the organization (e.g. number of employees, organizational structure, information and communication system, management model…) and all other data that could contribute to the “diagnosis”.

In case the health analysis shows that workplace stress is a problem, the health team plans a program which consists of:

- expected benefits of the program,
- program philosophy,
- scope and objectives of the program,
- target group and implementation team,
- actions to create a supportive environment,
- education and training of employees,
- duration of the program,
- evaluation and documentation of the program.

While planning the health team takes into account the following aspects:

- various causes of stress (ecological, technological, organizational, psychosocial, personality characteristics and life circumstances of the individual),

- experiencing stress (unpleasant feelings, physiological processes),
- individual response to stressors (autonomous, behavioral and hormonal response; psychosomatic diseases).

The health team plans actions for stress prevention and coping on the organizational as well as individual level.

Possible actions on the *organizational level* are related to:

- work organization,
- ecological actions,
- technological actions,
- information and communication system,
- education system,
- stress education and training,
- organization of supportive actions (e.g. psychosocial service, organization of physical activities at the workplace and after work, healthy nutrition, hydration).

Possible actions on the *individual level* are related to:

- stress education,
- strengthening of internal power based on positive self-concept,
- values, objectives and priorities reflection,
- effective time management,
- positive approach to problem solving,
- seeking and accepting support and help from other individuals and groups,
- correct relationships and effective communication,
- fitness and healthy lifestyle,
- relaxation – efforts balance,
- lifelong education in order to work effectively,
- career planning.

Corporate @life – A holistic approach for managing stress at work

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Keywords: corporate wellness programs, workplace disease prevention, stress prevention, holistic approach, @life

Abstract. Workplace disease prevention and wellness programs are recognized as a key element in reducing medical as well as absenteeism costs while improving employees' health and morale. There are many different approaches in terms of corporate and personal goals, healthcare methods, offers for participants, organizational policies, industry sectors covered, technical support and other key elements of corporate disease prevention and wellness programs. The aim of Corporate @life is to develop a novel, holistic approach that integrates the latest advances in mobile technologies with well-known web (as well as onsite) solutions and methods. Those conventional methods that have had proven success in corporate programs will be adapted for use in mobile applications on smartphones and tablets with cloud-ready backend support that integrates with existing enterprise IT solutions and uses key information to improve productivity. The aim of the panel is to present current state and discuss open issues publicly with the participants of the panel in order to collect valuable information for further development of Corporate @life as well as challenges for the research community.

Introduction

In recent years the interest for workplace interventions aimed at improving the health of employees and lowering health spending has increased significantly [1]. Subsequently, researchers have been trying to confirm the efficiency and effectiveness

of corporate programs. Recent meta-analyses, together with systematic reviews, have confirmed that programs are valuable for employers as well as employees [1, 2, 4, 5] although one systematic review reported modest improvements for specific variables, i.e. overweight and obesity [4]. Further on, evidence from different individual studies have shown the positive impact of specific interventions on the observed risk factors - cardiovascular and diabetes [3], high blood pressure, high cholesterol, tobacco use [7], reduced or eliminated need for medications for diabetes, hypertension and hyperlipidemia [8].

Although the research community frequently investigated workplace interventions, there are no studies of all-encompassing approaches using sophisticated IT solutions. A holistic approach to workplace interventions includes physical activity, psychological exercises, nutrition, biometric screening and systematic risk assessments, dual-centric approaches of work and life, recent motivational concepts and tailor-made programs. With the given complexity and large-scale target groups, the use of an advanced computer-based solution is considered a key success factor. With the fast adoption of smartphones and tablets on one hand and cloud computing on the other, technology is ready to cope with professional challenges in corporate wellness programs.

Background and long-term goals

There is strong evidence that corporate disease prevention and wellness programs will play an important role in future public and private healthcare medical plans. According to National Health Expenditure (NHE) data, healthcare costs will keep growing. Subsequently, company costs will increase, making investments in worksite disease prevention and wellness program initiatives more interesting. Existing research has confirmed that the return on investment (ROI) is positive - on average 3.27 for medical costs and 2.73 for absenteeism. Reports on different corporate programs indicate the need for improvements that will be addressed within Corporate @life. The first goal is to consolidate different methods, approaches and initiatives into one holistic approach. The second goal is to develop a framework for building adaptable, high-value corporate programs. The last key goal is to enable a rapid implementation of the programs based on the latest mobile and cloud-ready technologies, collect and validate empirical data and implement the improvements. The Corporate @life programs are expected to lower costs by improving productivity, lowering absenteeism and work-related injuries as well as improving employees' health and well-being.

Overview of worksite interventions

Worksite interventions were studied in numerous scientific papers, several systematic reviews and meta-analyses. The key findings could be summarized as follows:

- Assessment of Health Risks with Feedback should be used in conjunction with other worksite health promotion programs. The magnitude of effects that an employer will experience after implementing specific interventions depends on the intervention type and duration, participation rate, participants' characteristics and other contextual factors. High-risk participants will experience greater health gains. In general, interventions are more effective for the following outcomes: tobacco use, alcohol use, not wearing a seatbelt, dietary fat intake, blood pressure, cholesterol, summary health risk estimates, worker absenteeism and healthcare service use, whereas the effectiveness of fruit and vegetable intake, body composition and physical fitness could not be confirmed [5].
- The more intense modes of interventions provided to participants increased the impact of the program. Worksite health promotion programs that aimed at improving nutrition or physical activity (or both) resulted in a modest reduction in weight at the 6-12 month follow-up (weight -2.8 pounds, 95% and BMI -0.5, 95%). These findings seem to be applicable to both male and female employees in different worksite settings [4].
- Some workplace physical activity interventions can improve both health and important worksite outcomes. Significantly positive effects were observed for physical activity behavior (0.21), fitness (0.57), lipids (0.13), anthropometric measures (0.08), work attendance (0.19) and job stress (0.33) [2].
- The most common programs were obesity and smoking. More than 60% of the programs explicitly focused on weight loss and fitness. 75% of the programs focused on more than one risk factor, including stress management, back care, nutrition, alcohol consumption, blood pressure and preventive care, in addition to smoking and obesity [1].
- With the introduction of workplace wellness programs, the medical costs fell by about $3.27 for every dollar spent on wellness programs and absenteeism costs fell by about $ 2.73 for every dollar spent [1].
- Large firms (more than 1,000 workers) are more likely to implement workplace wellness programs than small companies [1].

Only one study was found applying systematic approaches to the development of complex interventions that address workplace health problems [8]. This study presents an approach to the initial stages of a workplace program development that integrates health promotion and disease management. It is based on concept mapping and program logic modeling in order to offer a dynamic approach to the development and implementation of the programs.

Corporate @life is novel in comparison to existing studies, as it will address different interventions in an innovative and holistic way. The holistic approach will be built upon research results that have compared different intervention aims among each other. The new approach will be tested against selected individual interventions in order to prove its effectiveness.

Conclusion

With today's advances in information technology, workplace disease prevention and wellness programs are entering a new era. It is possible to offer effective and efficient solutions that improve employees' health and lower total healthcare costs. Since healthcare domain in many countries including Slovenia is faced with serious financial problems, solutions like Corporate @life could play an important role in future employees' medical plans as well as employers' quest for medical costs savings. However, the key success element is an open dialogue between all stakeholders including enterprises, public and private insurance companies, healthcare providers and government.

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