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WHO WILL HELP THE HELPER?
FIRE DEPARTMENT VOLUNTEERS COPING WITH STRESS

Degree Programme in Physiotherapy
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The purpose of this thesis was to determine the stress levels of the volunteer of a fire department in Satakunta region. In addition another aim was to solve which coping skills the volunteers use against stress and what do they want to change in their health behavior. The instruments used were Firstbeat BODYGUARD and a questionnaire form. The topics of theoretical part included the effects and physiology of stress, the loading factors of work, and the introduction of Firstbeat Lifestyle assessment device.

This thesis was conducted as a part of Soteekki Service Center Ruiskukunto-project which aims to improve the physical and mental capacity of the firefighter volunteers and similarly provide information about the firefighters' job. This quantitative research was conducted during the year 2013 and nine people participated in the study.

Because the fire department volunteers share the same tasks than the professional firefighters, they have to confront both physically and mentally loading situation and they have a risk to contract the corresponding professional diseases. It has to be considered that this challenging commitment has to be well integrated within their personal life, which includes responsibilities toward their work and their own families; therefore a thorough time management is important.

The Firstbeat showed that the stress level of the volunteers match the average values of the Firstbeat database but the recovery level was under the average values and lower than recommendation. However the questionnaire showed positive side of the study; the volunteers estimated that the mental and the physical load of the volunteer work do not outreach their physical or mental capacity.

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1 INTRODUCTION

The firefighters are mostly the first ones to arrive to an emergency scene; therefore they confront victims who have experienced a physical or a mental trauma or both. The volunteer workers confront the same situations at work as the professional rescuers; consequently, they are affected by the physical and mental load of the work. Furthermore the volunteer workers have their day job which needs to be attended in order to acquire the income. They are pushed and pulled from several directions but still the stress of volunteer workers has not been studied, thus this thesis concentrates on fire department volunteers' wellbeing through measuring stress.

For this purpose, nowadays there is a fairly new instrument available, Firstbeat Lifestyle Assessment device (BODYGUARD). It is used for instance, in occupational health care, to determine the stress level and the state of recovery of a person. This device is easy to use and it does not require laboratory environment. On the contrary the instrument can be connected to the person and this small heart rate measurer records information during normal daily routines and it does not disturb physical activity or sleep (Figure 1).



Figure 1. Firstbeat BODYGUARD (Website of Firstbeat, 2013)

This research was implemented as a part of Ruiskukunto-project at the Soteekki service center, which provides student orientated wellbeing services for companies. This project introduces the work of firefighters to health care students, the becoming nurses, social workers and physiotherapists, and similarly the project aims to provide

services which increase the work capacity of the firefighter volunteers and boosts up their physical wellbeing.

Happy, is that person, who experiences each day as it was a new one. Happy is that person, whose work and private life provides stimuli and satisfaction.

(Vartiovaara, 1996, 13)

2 WHAT IS STRESS?

Sometimes the situations in the daily living or at work demand extra effort and stress is a body's coping mechanism to increase the physical and mental capacity to confront and overcome these challenges. A stress initiator is called a stress factor, which can be physical, social or mental. The stress reaction and the degree of the symptoms depend on how one copes with the stress factor and how one is capable of using stress coping skills. (Firstbeat Technologies, 2011a, 26; Website of Finnish Institute of Occupational Health, 2012.) Therefore everyone does not respond in a same way to a certain stress factor, but the experience of stress in a specific situation is always subjective. In psychology people have been divided into two personality types, A and B, where A-type is more prone to stress than B-type (Kirsta, 1999, 24). Thus stress symptoms can be relieved by improving the self-observing skills and by changing working methods. In addition a generally healthy person can handle stress better than a person with suppressed immune system due to poor living habits or due to chronic loading (Firstbeat Technologies, 2011a, 26; Website of Finnish Institute of Occupational Health, 2012). According to the research done by Finnish Institute of Occupational Health in 2009 8% of the working aged Finns suffered from some kind of stress symptoms (Website of Finnish Institute of Occupational Health, 2012).

2.1 Physical symptoms

The stress stimulates the autonomous nervous system (this issue is discussed more deeply in chapter 4) and therefore can cause physical symptoms. Short term stress,

called the eustress, improves the work capacity and the work flow by increasing awareness and the capability to focus on specific tasks. The body recovers well from a short term stress if the recovery period is long enough. (Firstbeat Technologies, 2011a, 26; Tortora, 2007, 652.)

The initial stress response, the fight-or-flight response, is initiated by nerve impulses from hypothalamus, caused by external or internal stressors. The former are environmental factors, such as heat or cold and the latter are strong emotional issues such as a loss of a close family member. (Firstbeat Technologies, 2011a, 26; Tortora, 2007, 652.)

However other type of stress, called the distress, is harmful because it is chronic. The resistance reaction in a stress response helps to fight the external and internal stressors by secreting hormones from the anterior pituitary gland situated in the hypothalamus. These hormones are corticotrophin-releasing hormone (CRH), growth hormone-releasing hormone (GHRH) and thyrotropin –releasing hormone (TRH). CRH increase the level of cortisol in the body which decreases inflammation and releases glucose, amino acids, and fatty acids into the blood for energy production. GHRH and TRH stimulate indirectly the release of energy compounds into the blood, which is needed in the repair of damaged cells. When the resistance reaction fails to fight the stressor, for instance in bacterial infection or in case of a strong emotional load, it ensues to the exhaustion stage of stress reaction causing distress. Prolonged distress exposes to a coronary artery disease, musculoskeletal illnesses and depression and it causes insomnia, wasting of muscles, suppressing of the immune system, all of which can ensue even if the stressor is removed. (Tortora, 2007, 652-654; Website of Finnish Institute of Occupational Health, 2012; Kääriäinen, 2003, 1.)

2.2 Mental symptoms

In addition to the physical symptoms, stress can result in mental symptoms and fatigue. Mental fatigue is a state where all the resources have been used and there are no new resources available. This is a fact which can be compared to muscle fatigue after physical exercise and a lack of sleep or a lack of rest aggravates the both mental

and physical fatigue. Usually people understand the need of rest after great physical exertion but acknowledging the need of rest, after 80 hour work week, can be hard. However a prolonged cognitive or emotional loading at work without “a brain rest” causes stress, which threatens the work ability and personal life. (Kääriäinen, 2003, 5.) Mental fatigue is not plainly a problem of working life, but increased demands in free-time or social life can result in decreased capacity.

In a worst case scenario, serious mental fatigue can cause burn out which results in a stress syndrome with both mental and physical symptoms. However a mental fatigue does not always cause burn out and most important is to understand and to recognize the symptoms and ask for help before the situation is aggravated. (Kääriäinen, 2003, 5.)

The symptoms of mental fatigue are individual and they vary in extent and time. Moreover the physical capacity and the situation of life have an effect on the symptoms. Some of the symptoms are listed below in the Table 1. Moreover some people are more prone to become tired, because of their personal features. Therefore they are in a greater risk in becoming physically or mentally fatigued. These features are listed in the Table 2.

Table 1. Symptoms of mental fatigue (Kääriäinen, 2003, 9)

shortened memory
learning difficulties
concentration difficulties
loss of initiative at work
decrease of interest in work and personal environment
loss of dreams or imagination
flattening of feelings
increased vulnerability
decrease of professional confidence
insomnia or effected sleep
somatic symptoms

Table 2. Personal features of people who are prone to become tired. (Kääriäinen, 2003, 8)

They demand perfect or errorless performance from themselves and punish themselves
They hard for forgetting or if they feel tired
They become depressed if the quality of the work decreases
They feel that work is the measure of human dignity
They let work become first before family, hobbies or health
if fail, they compare oneself to others and feel ashamed
They feel important only if others accept himself or herself
They are prone being passive and at mercy of others
They have not learnt to relax or other stress management skills
They feel responsible for matters which cannot be effected
They feel responsible for the behavior of others
They look for single perfect solution to problems and think that contradictions are unbearable
They are super diligent for work
They work because the work itself is interesting and easy to get absorbed in
They feel that there is no way to effect on the demands at the work place

2.3 Social pressure

As stated above the stressor is not always between the ears but it can be external and social (Kääriäinen, 2003, 6). Family members, co-workers, friends and even strangers and media can effect on the beliefs and increase the pressure. Parents can pressure their offspring to study hard at school to attain good enough grades to apply to the law school and meanwhile the child just wants to become a creative artist. Father of three has many mouths to feed and he has to continue working in the same work place which has not been interesting for 15 years but he is too scared to change the profession. A single weird glance of a stranger on a street or commercials with skinny women can effect on the body image of an adolescent or of a teenager and she starts to think that she needs to lose weight instantly. On a work place an employee can be bullied or isolated by others or even by the boss and therefore the professional and the personal self-confidence can be affected. Respectfully avoiding the constant-

ly criticizing or negative coworker could feel like a convenient and easiest choice, but the bad atmosphere will linger at work and if no changes are done, hopelessness arises.

Therefore the social relationships create a pressure, which needs to be acknowledged and if it influences negatively on one's self-esteem or increases stress levels, the stressor needs to be confronted. Sometimes help and conversation with a professional is needed to overcome the challenges brought by social relationships.

3 LOADING OF WORK

3.1 The loading factors at the work environment

Ex-firefighter Pauli Eskelinen brings up the professional diseases of his field in the Finnish journal of rescuers and paramedics. The firefighters suffer from musculoskeletal problems and problems in the airways caused by airborne ultrafine particles and they have an increased risk of testicle and prostate cancer. These fine particles can transfer to the circulation through protective clothing or by breathing the contaminated air. (Eskelinen, 2012.) Moreover coronary heart disease has been found to be the primary cause of death among firefighters, because of continuous exposure to respirable particles (Baxter, 2010).

There is a wide research done about work related fatigue and many organizations provide information about it. Projects are done to find out about different loading factors and search for preventative interventions at work places. One motive for these interventions is money, because prolonged distress can cause work fatigue, which can lead to chronic illnesses and absenteeism. In addition human errors increase and the quality of services decreases if the staff suffers from fatigue. (Nissinen, 2008, 32.) Research shows that there is a relationship between job-related burn out and depressive disorder, thus preventative actions at work places are important to promote the employee well-being (Ahola, 2005). In addition the amount of disability pensions, caused by diagnosed depression, has doubled during the last decade, although

depression has not become more common. Significantly in 2009 depression was the most common psychiatric disorder (35%) for disability pension (Heilä, 2011).

According to Nevalainen people are not naturally lazy and they become bored if they feel that there is nothing to do. Therefore people look for something meaningful and interesting to. Success at work improves the professional and personal self-esteem but the danger lies also behind over-diligent employees. Occasionally an employee works might work harder than it is needed, because he thinks that he is not working hard enough, meanwhile the employer would be content with less. The employee can become irreplaceable and co-workers rely on that one person and that he does everybody's share of work. Finally even the "super employee" becomes tired and in bad case, burns out and the whole work place suffers. (Nevalainen, 2007, 13-14.)

Burn out means chronic fatigue which is both physical and mental. When person suffers from burn out, his professional self-confidence has been weakened, he becomes cynical and exhausted (Figure 2.) and this fatigue does not disappear with a normal night time rest or even on an annual vacation. When work does not flow in a way which it is supposed frustration and overwhelmed feelings arise. The feeling of inadequacy may aggravate the fatigue and the person is increasingly in a risk of becoming burnout which can lead to depression. (Ahola, 2004; Nissinen, 2008, 28-31.)

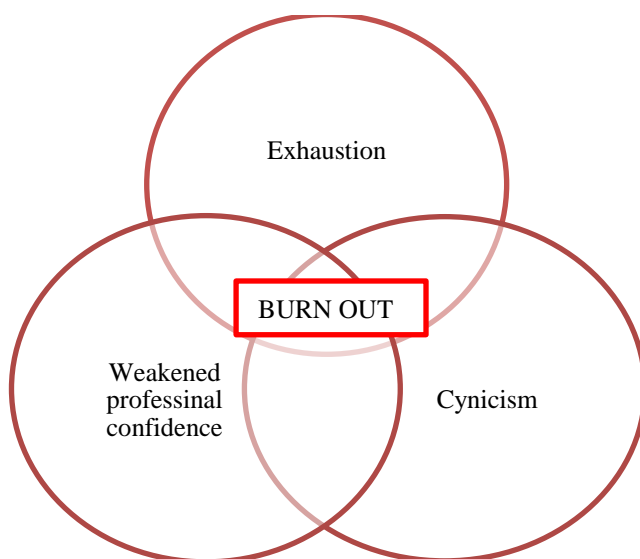


Figure 2. Three dimensional burnout (Nissinen, 2008, 28-29)

3.2 Reactions in crisis

According to Nissinen people have always needed someone to turn to with their grief. For instance already 2000 years ago Christians believed that a human sacrifice will release the sins of those who believe in him. In the 1970's Charles Figley, an American psychotherapist and psycho-traumatologist, discovered similar crisis reactions on family members when treating the veterans of the Vietnam War. Later this phenomenon was addressed as compassion fatigue, which becomes from the emotional stress when the helper reflects the experiences of client. (Nissinen, 2008, 50-55.) In working life medicalization is a common phenomenon, which means providing a professional reason or a medical diagnose for all disorders. On the contrary compassion fatigue is a normal reaction to an abnormal situation. (Nissinen, 2008, 17.) The other concept which lies under compassion fatigue is a secondary traumatic stress. (Nissinen, 2008, 50-55).

Primary post-traumatic stress is described as the experiences of the mentally traumatized person. Disorder arises when a situation or a happening which is overwhelming and it shakes the balance of a normal life. Then again secondary post-traumatic stress (SPTS) describes the experiences of the helper around the person who is affected by the psychological trauma. Interestingly both experiences and reactions show similarities. Moreover the means of management through the stress can resemble each other in both negative and positive ways which can empower or exhaust the person. The most clearly SPTS reactions of the helpers can be recognized in acute situations and actually the helper can suffer from both primary and secondary reactions, in a work of firefighters for instance. They are in danger themselves but in addition they are in a connection with the traumatized victims of the accident. (Nissinen, 2008, 50-52, 101-105.)

Occasionally the helper can suffer from the "helper syndrome" where the role as a helper of others is emphasized. The helper's role as a professional lies deep in the personality and therefore the personal needs are forgotten and inside his head the helper becomes invincible and unaffected by traumas. Ironically the narcissistic picture of oneself can cause the person to become unable to feel empathy and the helper fails to aid the victim. (Mönkkönen, 1995.) On the other hand the helper can suffer

from “silencing response” which means the inability to reflect the heavy experiences or the feelings. This may be due to the fact that the matters are too overwhelming or hard to understand or the helper does not yet have sufficient experience. (Toivola, 2004.) Open atmosphere and the possibility to share experiences among co-workers allow easing mental stress.

3.3 Loading of the volunteer work

Volunteer workers in social care or in rescue services for instance, deal with similar situations as the professionals. Therefore they are in a risk of having both the comparable physical and mental symptoms. Work related compassion fatigue has been discussed lately and Nissinen mentions that in Finland in 2005-2006 there were about half a million people working within the field where there is the risk for compassion fatigue (Nissinen, 2008, 21).

3.4 Balancing work and freetime

Often a complete time management is impossible, because the nature of the work and the family effect on the daily rhythm; however it is possible to plan how to consume time efficiently and therefore balance the work and free-time.

Kirsta suggests that after eight hours at work, one should use two hours for relaxing, meditation or exercise. When good night sleep is added to the day, mind and body have enough time to recover. Furthermore the time spent alone and the time spent in a group of people should correlate each other in order to leave time for thoughts. (Kirsta, 1999, 76-77.)

Working overtime and cutting out breaks are considered as loading factors in long term, because the brain needs time to recover as well as the body after a loading period. It is delusional to think that the work time would be more efficient if the breaks are cut out, because there would be more time to concentrate on the problem. However when overloaded, one tries to solve all the problems at the same time and rapid-

ly and situation becomes chaotic. (Räisänen, 2012, 114.) Moreover in the overloading state the capacity of the brain decreases, tension and fatigue increase and exhaustion and even burn out may occur (Kirsta, 1999, 77).

3.4.1 Coping strategies

Coping is generally defined ‘the way how person responds to stressors’ (Ross, 1994, 59). There is continuous debate which has a greater impact on the development of innate qualities of an individual, i.e. the temperament, nature or nurture (Komsu, 2006). Respectively both the genes and the childhood surroundings define also our capability to cope with stress. Both the pioneer of neuropsychology, Joseph LeDoux and social psychologist Fred Luthans state, that not more than half of the personality is defined by the genes (the nature), and the other half of the brain is developing according to the stimuli of the surroundings (the nurture). (Räisänen, 2012, 72; Luthans, 2010.) The development of the brain does not end after childhood but the constant learning continues through life. Therefore the coping skills to affect the stress levels can be learned in adulthood.

As mentioned above a stress reaction is a normal reaction in an abnormal situation. The extent of the reaction is regulated in the alarm center of the brain, the amygdala, which takes part in forming both negative and positive emotions and memories. (Figure 3.) The amygdala is activated in the situations of uncertainty and 10% of the reaction sensitivity depends on the gene which regulates the concentration of neurotransmitter serotonin. (Räisänen, 2012, 72-73.) It has been studied that those people who have this sensitivity gene, the serotonin synaptic transporter (SERT-gene), are more prone to become anxious in stressful situations (Räisänen, 2012, 73; Huttunen, 2003).

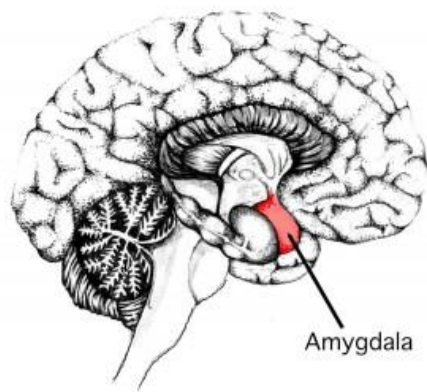


Figure 3. The location of the amygdala (GA Science Times, 2013)

Moreover the personal strategies guide through the external pressure and the challenges (the stress factors) of the daily living (Räisänen, 2012, 89). Although the level how much a person can endure stress, is inherited in some degree, the strategies, which are learned, and personality traits are linked to the stress endurance and to the capability to recover from setbacks. Fred Luthans, an American professor of social psychology and management (University of Iowa), has listed four personal resources, the psychological capital “HERO”, which also increase the stress endurance and they can boost up the productivity of an employee:

1. Hope
2. Efficacy or confidence
3. Resiliency
4. Optimism

(Luthans, 2010)

Räisänen states that when managing stress, the key point is rather to get back on one’s feet and manage negative emotions than the amount of positive moods or the amount of happiness. In hard situations the stress endurance is needed and it is consisted of the four above concepts (HERO). (Räisänen, 2012, 89.) On the other hand people, who have a negative set of mind, are not always the most stressed. If person is always on a bad mood and not expecting anything good to happen, hardly any surprises come up and no useless effort is taken. Moreover according to an American temperament study executed with infants, those people who are prone to stress have

joined characteristic in temperament; they are impulsive and they lack resilience. An individual can learn to recognize one's characteristics of temperament and therefore learn to control and cope with stress. (Räsänen, 2012, 74-75.)

Learning to control and to cope with stress is carried out through analyzing the emotions. The phrase "I'm having a bad stress" is generally used to describe the current negative feeling but stress itself is not a single emotion, but rather an individual mixture of them. Recognizing and naming individual emotions, and most of all the core reason behind the bad feeling (such as grief, anxiety, fear or hate), rationalizes why certain behavior is conducted. If the core reason is set behind, poor strategies are easily used in order to alleviate stress symptoms. These strategies are short term help, and they stupefy the so called core reasons or feelings. On a contrary stupefying the negative emotions in scaring or in threatening situations, the emotions become more intensive and the unsuccessful fight consumes mental energy, aggravates the stress response and weakens the capacity of the brain to function. In order to control the stress, the core feeling needs to be transferred from the more primitive amygdala to the cranial cortex, where the rational information processing occurs. This method is used in cognitive psychology; rather than suppressing the feelings, more preferable approach is to rationalize the extent of the feelings and to solve what could be better way to confront the problem. (Räsänen, 2012, 77-79.) Cognitive psychotherapist Alber Ellis has developed an ABC model which enables to analyze the feelings which arise in difficult situations. (Figure 4.)

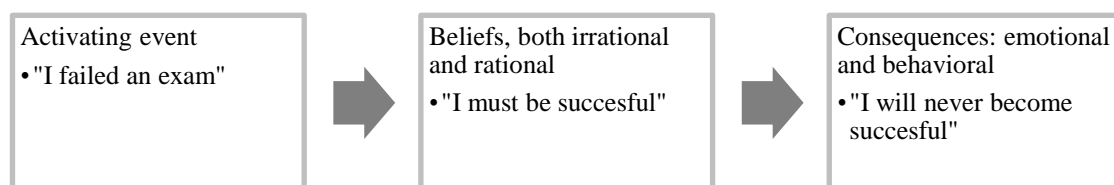


Figure 4. ABC model by Albert Ellis (Räsänen, 2012, 127; The mental health provider alliance website, 2013)

The model suggests that emotional or behavioral consequences do not directly follow events, but the feelings are the result of the beliefs in the background. Therefore by changing the irrational beliefs the unrealistic consequence will fade and they will change to a positive one. (Räsänen, 2012, 126-128.) There is no shortcut in changing

the previous beliefs, but sometimes it feels easier to try to escape the problems and to use other poorer methods to alleviate stress.

3.4.2 The poor strategies

Räisänen states that it is common to try to find easy, rapid and short term help for stress symptoms. Alcohol alleviates stress and relaxes muscles and tobacco and snacking improve the ability focus for certain tasks just for a moment but these factors do not provide a long term help. (Räisänen, 2012, 83-86.) According to Mattila alcohol effects on the sleep by inhibiting the deep sleep phase which results in a fatigue during the next day (Mattila, 2010.) This fact is established with Firstbeat measurements. In the Firstbeat lifestyle assessment reports it can be seen that alcohol delays the beginning of recovery of the heart. (Firstbeat Technologies, 2011b, 24-25.)

Furthermore tobacco and other nicotine products are expected to improve awareness and ability focus, to create satisfaction, to relax and decrease anxiety. However research proves that tobacco products' annual mortality rate is 5.000-6.000 people in Finland and globally it is the most preventable cause of death (Finnish website about substance abuse and addiction, 2010.) Moreover Räisänen states that tobacco does not improve work capacity in reality. She estimates that a smoker (smoking one full pack per day) uses 17 work days on tobacco breaks and probably eight days more on sick leave than a non-smoker in a year. In addition nicotine has been connected to different mental disorders, such as panic and anxiety disorders. (Räisänen, 2012, 84.) Short term effects of nicotine are decreased superficial circulation, hypertone, increased heart rate, and carbon monoxide in the smoke decreases physical capacity and long term effects of heavy use of nicotine are cardiovascular diseases, stroke, cancer, impotence, and chronic lung diseases (Finnish website about substance abuse and addiction, 2010).

A healthy and versatile diet is the most important factor which effects on the functional capacity (Kirsta, 1999, 92). However under stress, it is common to start unconsciously changing the diet towards the more refined products which contain more

sugar and fat. Sugar can effect on the levels of neurotransmitter serotonin, which controls the mood, causing the positive feeling of “a sugar-rush”. (Räisänen, 2012, 86; Tortora, 2007, 429.) These food products such as pizza, chocolate, chips or buns contain high amount of fat and rapid carbohydrates (or short-chain carbohydrates), which increase the blood sugar fast. As a result they stimulate the secretion of great amounts of insulin which decreases the blood sugar levels. These food products are energy-rich but they lack vitamins and other nutrient which support the immune system. Therefore comfort eating is a double-edged sword when it comes to alleviating stress. The relief is short term but the consequences are remarkable and long term, which lead to both physical and mental exhaustion and illnesses. Biologically it is vital to fill up the energy storages when loading of the body increases, such as marathon or long exam period, but even in these situations short-chain carbohydrates should not be consumed. (Räisänen, 2012, 85-86.) When it comes to comfort eating, Google shows the reality and the sad news. With one search with key words “comfort eating” or “comfort food”, the search engine provides more brownie recipes than answers to the problem. (Google search engine, 2013.)

4 AUTONOMOUS NERVOUS SYSTEM

Autonomous nervous system (ANS) effects on most of the body organs, mostly unconsciously. ANS regulates the visceral, lymphatic, endocrine, urinary, and cardio-respiratory systems, the pupils, sweat glands and the autonomic reflexes. (Tortora, 2007, 525; 528-529.)

ANS is divided to two parts, sympathetic and parasympathetic division. The balance between these two divisions, the autonomic tone, is regulated by hypothalamus, which stimulates one division while suppressing another. The sympathetic division dominates the parasympathetic division when body is under stress and on the other hand parasympathetic system is activated during sleep or rest. (Tortora, 2007, 537.) In other words, sympathetic system is known as “excitatory” and parasympathetic system as “inhibitory” division, since mostly they have an opposite effect to the body organs (Firstbeat Technologies, 2011a, 19). The autonomic nerve pathways run down

from the central nervous systems to the body organs and this is visualized in Figure 5.

4.1 The sympathetic responses

As mentioned above the sympathetic division is activated during stress, and it initiates a series of physiological responses, generally called fight-or-flight response. The activation of the sympathetic-adreno-medullary axis (SAM-axis) prepares the body to react rapidly secreting hormones: catecholamines, adrenalin and noradrenalin. The hormones effect on the body causing increased awareness. Respectively these hormones release great amounts of glucose and oxygen into blood and thus provide fuel for the skeletal muscles and the brain. (Tortora, 2007, 652-654.) Furthermore endorphins are released which alleviate pain and the stress response causes increased heart rate, sweating, dilates the airways and blood vessels of heart, lungs, brain and the skeletal muscles (Firstbeat Technologies, 2011a, 28). Moreover the blood vessels in the skin and the viscera become constricted and digestion, urinary system and reproductive system become inhibited. Lastly the stimulation of sympathetic system leads to retention of water and potassium (Na^+) in kidneys causing elevation of the blood pressure. (Tortora, 2007, 652-654.)

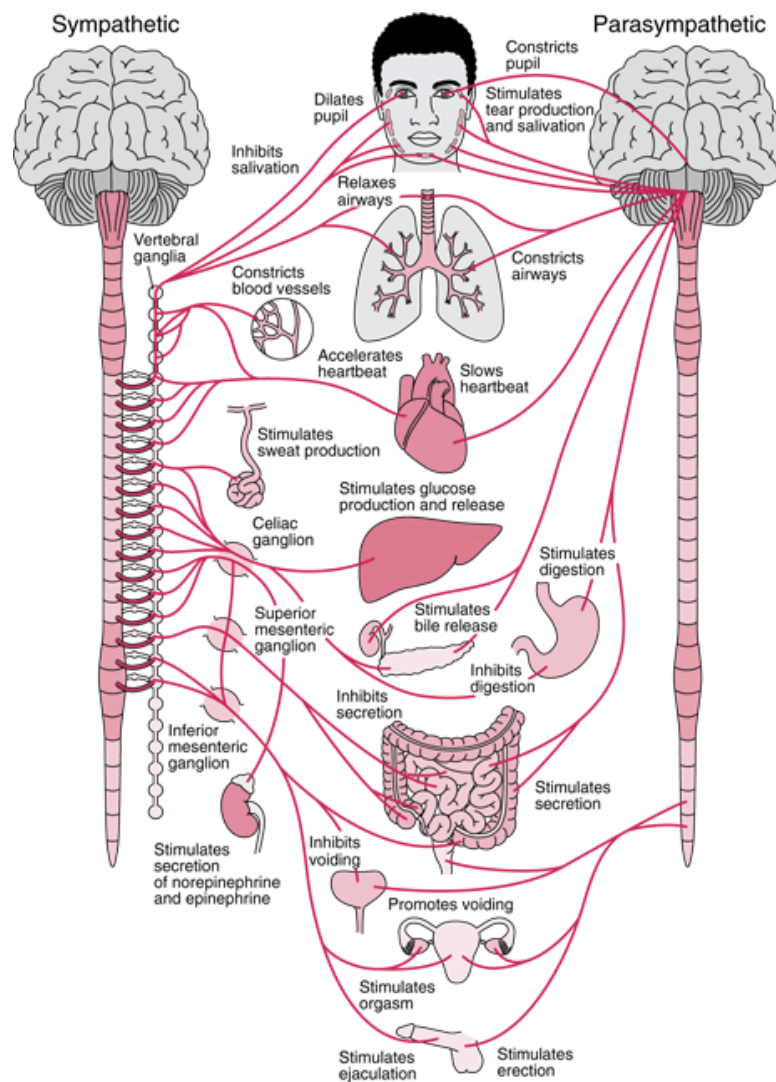


Figure 5. Autonomic nervous system (Website of the Merck Manual, 2013)

4.2 The parasympathetic responses

On the contrary, when hypothalamus activates the parasympathetic division the body restores energy during rest and recovery. The digestion is activated, the digestive glands secrete enzymes which allow the absorption of nutrients and the heart rate, the breathing rate and the diameter of airways and pupils are decreased, the kidneys filter urine and the vasodilation allows the blood flow to the sexual organs. (Tortora, 2007, 537; 529.)

5 THE HEART AND LIFESTYLE ASSESSMENT

5.1 The physiology of the heart

The heart is the most important muscle of the body, because it circulates nutrients and oxygen to all the organs and the circulatory system keeps the body warm. As with other muscles, it needs both exercise and a sufficient recovery time. As mentioned above, heart rate is regulated by the autonomous nervous system and the two divisions of ANS are activated under different kinds of conditions.

The electrocardiography (ECG) is used in clinics to record the bioelectric currents generated by the heart. In the ECG the QRS-complex represents ventricular depolarization in which the left ventricle pushes the blood towards the periphery and the right ventricle pumps the blood to the pulmonary circulation. (Figure 6., Meditech group website, 2013.)

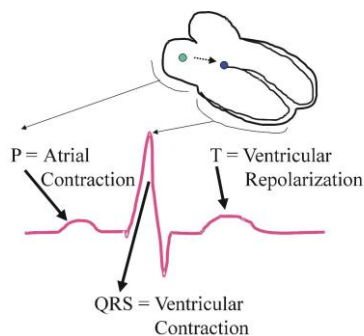


Figure 6. The electrocardiogram of heart and the QRS-complex (Meditech group website, 2013)

5.2 The lifestyle assessment

The heart rate can be determined from the ECG by counting the R-waves in minute. The heart rate variability (HRV) is determined by measuring the time intervals between two R-waves and this phenomenon is visualized in the Figure 7. (Firstbeat Technologies, 2011a, 21; Strength & Conditioning blog, 2013.)



Figure 7. R-R –interval changing in time is visualized in the ECG (Hogan, 2013)

Because the HRV depends on the autonomic nervous system, the activity of the two divisions of ANS can be estimated by analyzing the HRV in rest and under stress. The Firstbeat BODYGUARD uses the heart rate variability as a key for the lifestyle assessment and it gives recovery results in a unit called a root mean square successful difference values (RMSSD) which is a time domain measure of HRV. (Berntson, 2005.) Generally great variability is linked to sufficient recovery and little variability to poor recovery which is seen in people who are chronically stressed (Figure 8; Firstbeat Technologies, 2011a, 21).

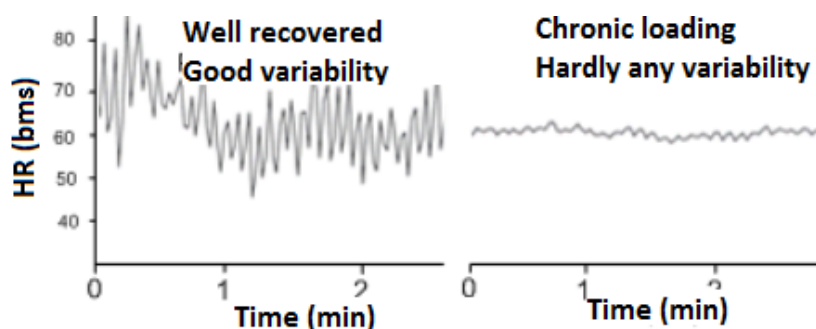


Figure 8. Chronic stress decreases the heart rate variation (Firstbeat Technologies, 2011a, 28)

It is known that stress effects on the regulations of ANS and heart rate is regulated by sympathetic and parasympathetic nervous system. Therefore by measuring the heart rate and the heart rate variability, the diurnal stress levels and recovery can be calculated. In other words, Firstbeat lifestyle assessment provides an objective measurement tool for estimating stress because it is based on the physiology. (Firstbeat Technologies, 2011a, 29.)

6 THE PURPOSE AND THE PROCESS OF THE THESIS

6.1 The purpose of the thesis

The aim of the thesis was to examine volunteer firefighter's stress levels. The purpose was to find out the stress levels of the firefighters and this was to be done through the Firstbeat and the questionnaire. Because motivation drives one make changes and promote the health, the motivational forces were determined along the study. Finally another intention was to provide tools to cope with stress and to promote the health.

The Firstbeat BODYGUARD, developed by Firstbeat Technologies, was used in acquiring the data on the volunteers' physical wellbeing. In addition a questionnaire form was used in order to provide more specific information about the examinees.

The research questions for my thesis were:

1. What are the volunteers' stress levels according to the Firstbeat BODYGUARD and the questionnaire?
2. Which coping skills the volunteers use against stress and what do they want to change in their health behavior?

6.2 The process of the thesis

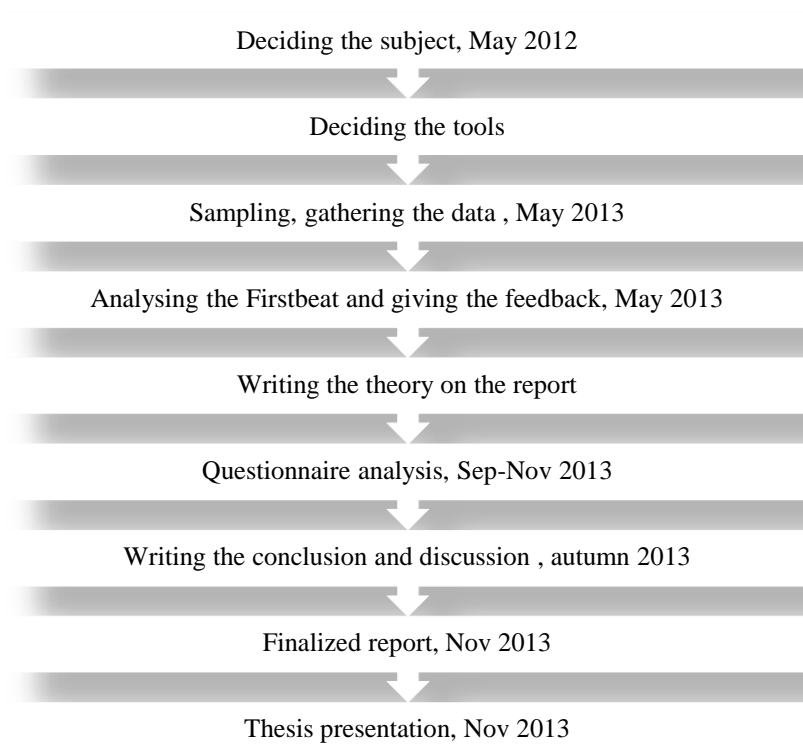


Figure 9. The process of the thesis

7 THE RESEARCH METHODS

7.1 The methods

The quantitative research method is used to determine the nature of the reality through measurements. The quantitative paradigm is based on the assumptions that there is only one single, objective reality which can be empirically tested. Second assumption is that the subject is not affected by the presence of the investigator and thirdly the results of the study must be generalizable. The method is based on theory and the instruments are used to measure the phenomenon and the resulting data must be numerical. Furthermore in quantitative research the control of the extraneous factors are maximized. (Domholdt, 2005, 55-59.)

Therefore the quantitative research method was chosen and for clarification; the purpose of the research was to describe the current stress levels of the volunteers and the timing of the data collection was prospective (Domholdt, 2005, 74-75). The quantitative paradigm was picked because the Firstbeat device provides numerical results, which can be analyzed mathematically. In addition the questionnaire was planned to form in a clear way which would be fast and easy to fill, and therefore it would be also fast and easy to analyze.

7.2 The sampling

The thesis measurements were to be done as a part of the Ruiskukunto-project by Soteekki service center, which provides student orientated wellbeing services for companies, organizations and individual clients.

The volunteers for the research were gathered with the help of a contact person, Heli Lamminen, Satakunta University of Applied Sciences (SAMK) teacher and fire department volunteer hence a sample of convenience was used. Lamminen contacted the fire department emergency service volunteers via phone and in their training sessions, finally joining a group of nine people. Five of volunteers had participated in the Firstbeat measurements in November 2012 and three of the people were not familiar with the Firstbeat BODYGUARD and one subject was not a member of the volunteer fire department but wanted to take part to the Firstbeat lifestyle assessment.

7.3 The measurement tools

Two separate measuring tools were used to determine the stress levels of the volunteers. Firstbeat BODYGUARD was chosen to measure the physical stress and the questionnaire was planned to clarify, how does the person experience stress and how does the voluntary work effect on his or her working life and free time.

7.3.1 Firstbeat BODYGUARD

In the beginning Firstbeat lifestyle assessment was developed for measuring the physical burnout called overtraining in professional sportsmen. This research was done in University of Jyväskylä in 1990's and later it was found out that the same data can be used for estimating the work related stress. Therefore the research started a whole new area of study, which defines the stress by measuring the activity of autonomous nervous system and how it regulates the physiology of the heart. (Firstbeat technologies, 2011a, 31-32.)

Firstbeat lifestyle assessment has been developed for preventative healthcare and healthcare professionals use Firstbeat for example for measuring stress, recovery, loading of work, energy expenditure and the effects of physical exercise. The lifestyle assessment is based on a specific heart rate examination. Multiple stress reactions or chronic stress cause changes in the heart rate regulation which are indicated as changes in the heart rate variation. These alterations in the physiology of the heart can be detected with Firstbeat BODYGUARD and a serious overloading state can be prevented through a professional intervention. (Firstbeat Technologies, 2011a, 7.)

When estimating the stress levels, the other physiological variables which effect on the heart, need to be excluded. Firstbeat rules out such factors as metabolic processes, changes in position, breathing rhythm, physical activity, and emotions and thoughts by combining values of heart rate, oxygen consumption and breathing frequency (Firstbeat technologies, 2011a, 29-30). After physical activity is excluded from the heart rate data, the stress and recovery levels are defined by analyzing the rest of the data. The example reports, the stress and recovery overviews, can be found as appendices 2-4.

According to Firstbeat technologies manual, for acquiring reliable results, the principles listed in the Table 3 below should be followed-

Table 3. Principles to acquire reliable results (Firstbeat Technologies, 2011a, 32)

the measuring time is three days, 72 hours, from waking up ´til waking up (from morning to morning

one reference day is about 24h ($24h \pm 4h$) for health reasons,

- it is important to see how the resources are filled during a sleeping period a resting heart rate can be recorded
- the reference values in the stress and recovery reports are given for one full day
- the days are comparable which each other

client's medication and diseases must be known

measuring artifacts must be limited to max. 25%; otherwise a new measurement must be made.

in addition to physiological stress measurements, subjective loading tools can be used

it is preferable to use a maximum heart rate recorded in physical stress test, than use the heart rate which is calculated according to an age

7.3.2 Semi-structured questionnaire

The questionnaire was given to eight of the subjects, because one of the subjects was not a fire department volunteer and therefore was excluded from the research. The questionnaire consisted of five background questions, nine multiple choice - questions, and two open questions. The whole questionnaire can be found as Appendix 1 in Finnish.

The multiple choice questions were scaled from 1-5: 1 totally disagree, 2 partially disagree, 3 neither disagree nor agree, 4 partially agree and 5 totally agree. The multiple choice questions included questions about the motivation and the compatibility of the volunteers, about the atmosphere at the fire department and about the physical and mental loading of the volunteer work and its effects on the physical and mental capacity on the volunteer. The open questions were: "Why do you volunteer at the fire department?" and "What methods do you use to relax?"

8 HYPOTHESIS AND THE RESULTS

The hypothesis of the research questions were that the Firstbeat shows increased stress levels and the results of the questionnaire correspond the findings of the Firstbeat. Secondly the subjects use both negative and positive coping skills against stress and they want to lose weight and increase the amount of physical activity.

There were nine subjects who volunteered to participate in the research (P1-P9). Eight out of nine subjects were members of the volunteer fire department, therefore one subject (P6) was excluded from the sample. In addition this person was not handed the questionnaire, unlike the other subjects.

8.1 The results of the Firstbeat

The Firstbeat BODYGUARD recorded the heart rate variation successfully (days with measuring error <15%) on six people out of eight. The resource balance (%) and the quality of recovery (ms) are visualized in the Chart 1 and Chart 2.

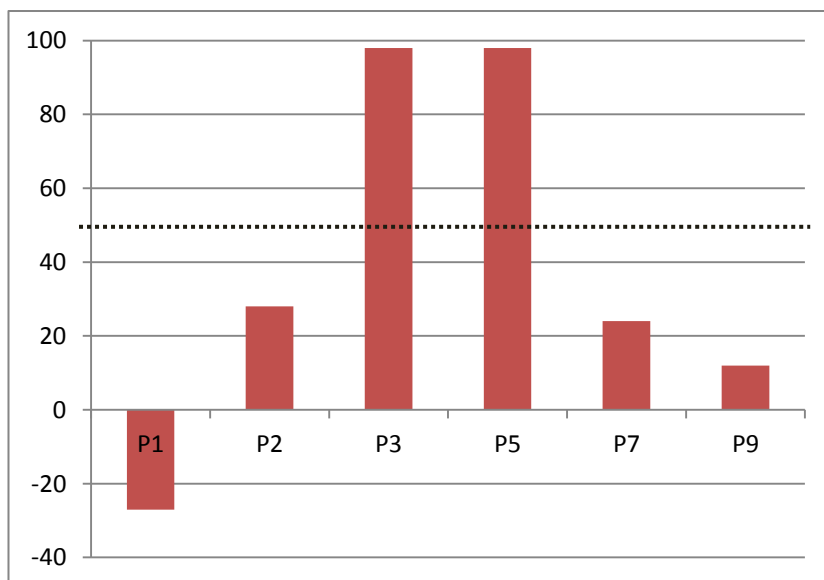


Chart 1. The personal resource balance during sleep (%)

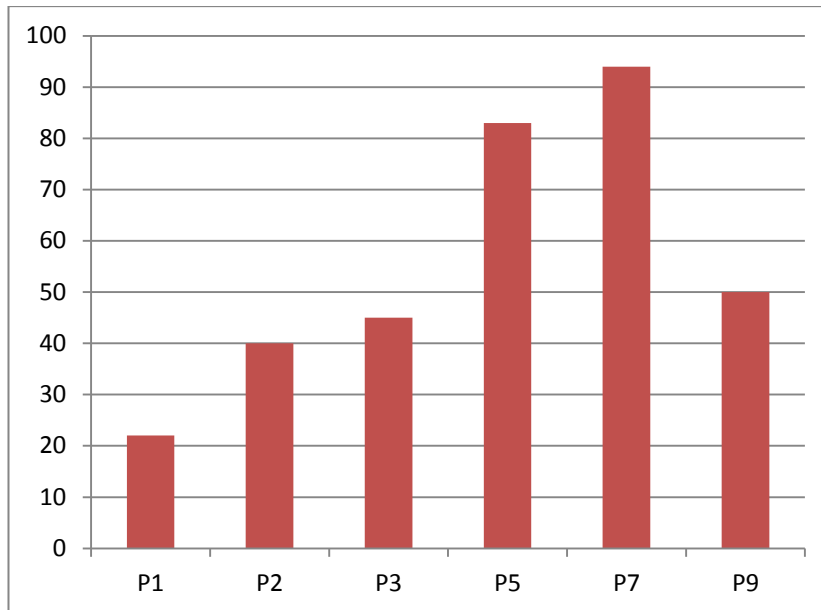


Chart 2. The quality of recovery (RMSSD) during the sleep (ms)

The recommended amount of exercise is 30 minutes per day, with an average load and the lifestyle assessment gives sixty exercise points if the recommendation is filled. The subjects were given the following three day means and the mean values are visualized in the Chart 3.

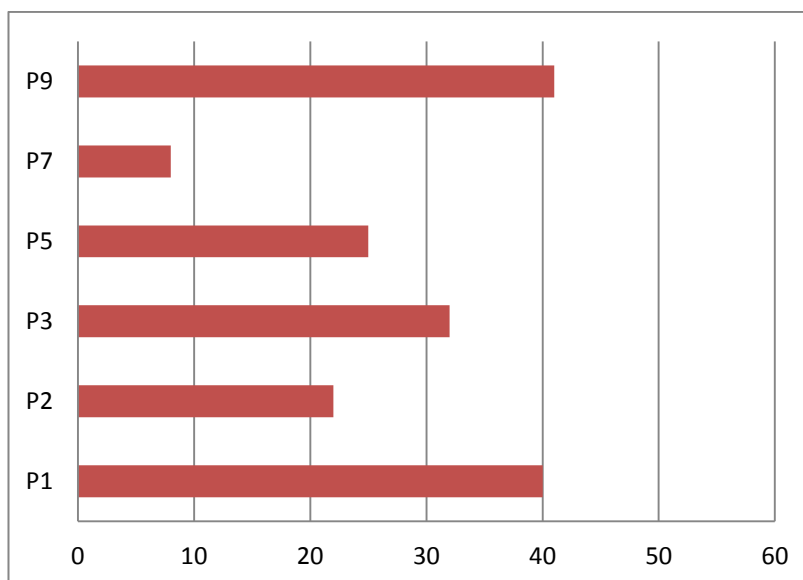


Chart 3. The mean values of the exercise points (Recommendation 60 points per day)

The time used for daily activities (hyötyliikunta) at work (on a scale: weak 0-5 min, average 6-10 min and good >10 min) and time used for recovery at work (on scale: weak 0-14 min, average 15-29 min or good >30 min) are reported in the Table 4

Table 4. Time used for daily activities (hyötyliikunta) and for recovery at work

Subject	Time for daily activities	Recovery at work
P1	good (4h 17min)	weak (0min)
P2	N/A	N/A
P3	good (33min)	good (1h 49min)
P5	N/A	N/A
P7	weak (0 min)	good (3h 21 min)
P9	weak (5 min)	weak (6min)

In addition to the individual results, the results of the group were concluded and presented to the volunteers. The results are listed in the Chart 4.

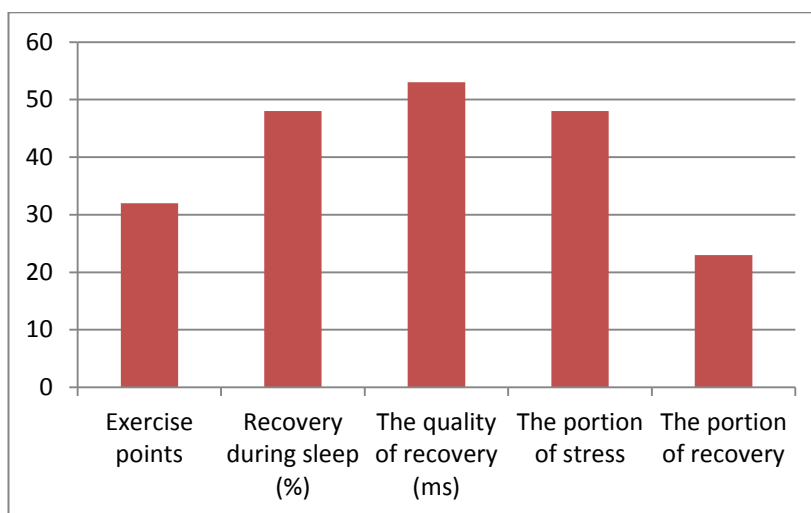


Chart 4. Firstbeat group results

After the Firstbeat lifestyle assessment the subjects were guided to set goals for the future. Some of the subjects set multiple goals. The goals are listed in the Table 5.

Table 5. The goals for the future.

The goal	n
Increase the amount of leisure time activity	5
Increase the amount of recovering periods at work	2
Increase the amount of recovering activities to leisure time	4
Leave work issues at the work place	1
Regular meals	4
Drinking enough water (3l/day)	4
Lose weight	1

8.2 The results of the questionnaire

Seven out of eight subjects returned the questionnaire resulting in an answer percentage of 87,5%. Six out of seven subjects answered all the questions, leaving one who left the open questions blank.

The answers of the background questions are listed in the Charts 5-7 below. Because of ethical reasons the sex and the professions of the subjects are not presented in this report since they could act as personal identifiers. However it can be mentioned that six out of seven subjects worked in a physically demanding job.

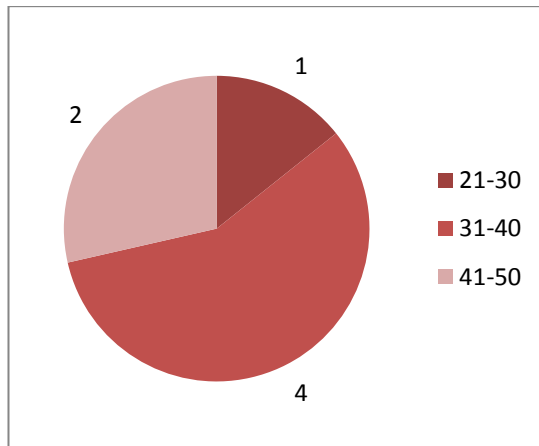


Chart 5. Age groups of the volunteers

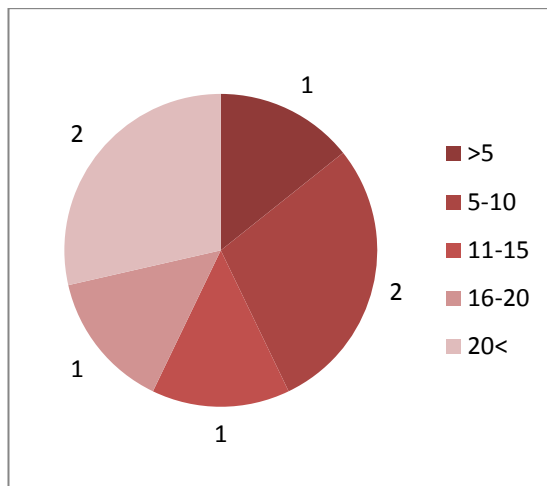


Chart 6. Experience of the volunteers at the rescue service in years

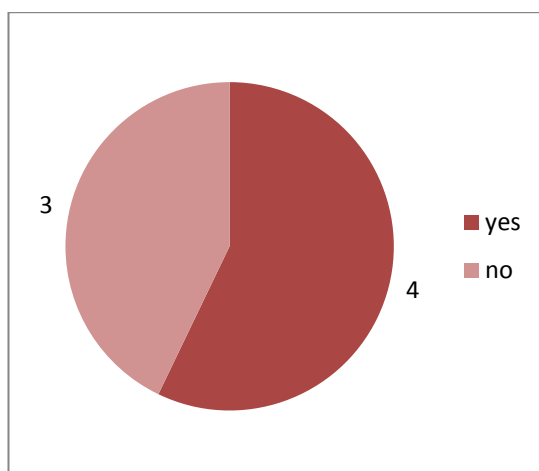


Chart 7. Licensed to smoke-dive

The multiple choice questions included nine questions which are presented in the Table 6 and the answers of the multiple choice questions are presented in the Chart 8.

The answer options were on the five point disagree-agree scale:

1. Totally disagree (TDA)
2. Partially disagree (PDA)
3. Cannot say (CS)
4. Partially agree (PA)
5. Totally agree (TA)

Table 6. The multiple choice questions

The question
a. I feel that my work at the fire department is meaningful
b. I feel that I have the professional skills which I need at the emergency service
c. The amount of the volunteer work is suitable
d. I get enough feedback of my work at the fire department
e. Emergency situations are emotionally too loading
f. I can speak openly with other volunteers if some things stay on my mind
g. Emergency situations are physically too loading
h. Volunteering at the fire department effects on my work capacity
i. Volunteering at the fire department effects on my family or free time

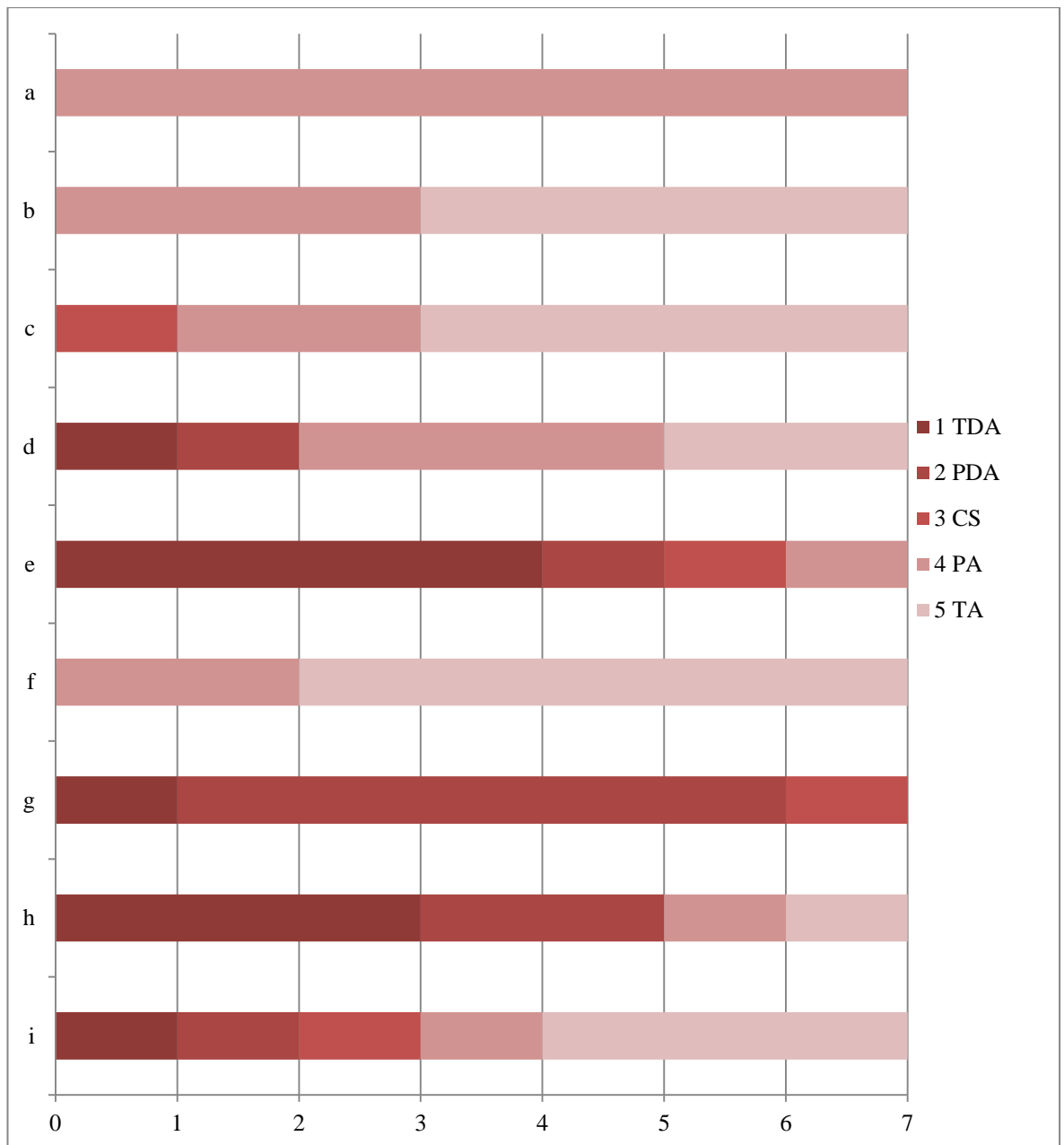


Chart 8. The multiple choice question answers on the five point Disagree-Agree – scale.

The subjects commented some of their answers. For example, e. Emergency duties are emotionally too loading; If you answered 4 or 5, how often? The subjects answered 4 (partially agree) and commented “Some of the duties can be ruff, if the victim is a child or someone you know. Some of the duties can stay in mind and then you tend to think them through afterwards”

The answers to the open questions were categorized and the results are given in the Table 7. Some subjects mentioned several factors.

Table 7. The answers of the open questions categorized in themes

The question	The answer	n
Why do you volunteer at the fire department?	willingness to help	4
	good hobby	3
What methods do you use to relax?	TV	2
	Sauna	2
	“just relaxing”	2
	a hobby	1
	exercise	2
	family time	1

8.3 Conclusion of the results

The study revealed both negative and positive findings. The group analysis showed that the volunteers' stress levels corresponded the Firstbeat average values. However the personal resources did not fill up during the night time rest in four out of six subjects, in addition only in half of cases the quality of recovery was more than the age group average value and none of the subjects reached the recommendation of the exercise points (60). In the group analysis the results can be compared with the recommendation, and a positive finding was that the stress levels meet the average values and the quality of the recovery during sleep exceeds the average values

The group result conclusions are found as Appendix 5 and 6, and there the most critical points can be noted. These volunteers recover well during the night time, but the free time does not include periods, which would serve as counterbalance to the loading of the work. Secondly the volunteers do not participate enough in such physical activities which would increase their physical capacity. In the future this might become a problem, when aging begins to degenerate the body and therefore decrease the physical capacity.

However the questionnaire provided many positive results. All the subjects partially agreed that they experience the voluntary work is meaningful, and they totally agreed or partially agreed that they have the skills which are required at the fire department service. In addition most of the volunteers (6/7) thought that the amount of volunteer work is suitable and the most of the volunteers agreed that volunteer work is not physically or mentally too demanding. Moreover most of the subjects agreed that they get enough feedback, nevertheless two of the subject did not agree in this with others and one mentioned to get only the criticizing feedback. On the other hand all of the subjects agreed that they can speak with other volunteers in case some of the cases stay in mind. Five out of seven volunteers thought that the volunteer work does not effect on their working capacity. However one subject brought up the positive side; at the fire department the physical capacity is maintained and measured regularly. However the last question, the effect of the voluntary work on free time, distributed the answers. Nevertheless three out of seven totally agreed that the volunteer work takes a lot of time from other activities. What is left is a delicate equilibrium between fire department, other hobbies, family and work.

9 DISCUSSION

The suggestion for this topic came from the Soteekki service center, which conducts an on-going project. The aim of the Ruiskukunto-project is to develop the work capacity of the firefighters and to introduce what kind of situations the firefighters confront at rescue missions. Therefore the thesis answers to a demand from the working life.

9.1 The methodological considerations

However determining the research questions and specifying them was hard work because this was the first time to perform any kind of research. Secondly the writer had missed the research course which could have helped in the preparation phase. In ad-

dition studying the difference and the characteristics of the qualitative and quantitative research methods should have been done.

If the research methods would have been familiar, creating the questionnaire would have been easier and I would have probably used the E-form to make it easier for me. In addition this would have resulted in more profound questionnaire form. Secondly the questionnaire form should have been piloted with another group, which could have helped to discover the questions which need to be reformed. With the current questionnaire form some of the subjects left the open questions empty, but instead of open questions, there could have been semi-structured questions too. For instance, instead of “Why do you volunteer at the fire department?” there could have been:

“I participate because of...:

1. I meet friends
2. I like to help people
3. it gives something else to think about after work
4. something else, what:”

Or instead of “What methods do you use to relax?” The better option would have been:

“I relax by...:

1. exercising,
2. reading
3. watching the TV,
4. having a smoke
- 5, having an alcoholic beverage
6. napping
7. sauna
8. something else, what.”

Moreover the background question about the profession could have been formulated in a way which would have given an answer if their work is physical or sedentary or if the work is physically, cognitively, or otherwise mentally more challenging. The

answer to this would have given an idea under what kind of stress the person is during the work.

Thirdly a follow up meeting, for example a month after the feedback meeting, could have helped in giving a more holistic picture about the people and about their personal aims considering their health behavior. In addition a follow-up could motivate in maintaining the aims or creating new ones, either more challenging or easier to reach.

Furthermore the reliability and validity should have been considered more in the planning phase of the thesis. In order to increase the reliability of the measurement devices they need to be calibrated. The Firstbeat BODYGUARD is calibrated automatically when instruments were charged, but the questionnaire was not piloted with another group which might have revealed the weak points of the questionnaire and the variables were not recognized before beginning of the study.

9.2 Experienced loading of volunteer work and hobbies vs. loading of the work

A quick poll among the friends of the writer through social media channel revealed that hobbies and volunteer work is usually an activity which mostly releases tension and “charges the batteries” for school or work. The writer agrees that hobbies provide an enjoyable place and social surroundings. Similar findings were discovered in the questionnaire because the volunteers evaluated that the work amount and the emotional and physical loading of duties is suitable. The hypothesis is not supported by this fact, but it can be probably explained. The volunteer work is not the stress factor of these individuals but the stress factors arise from somewhere else: work or other personal factors.

The heterogeneous group among the voluntary fire department consists of many different professionals, which brings variety. The gender dominance of male creates an open and straight forward atmosphere where all comments are allowed to say out loud. The subjects of the jokes can be anything and the strong humor is a provide

counter balance for serious rescue missions which demand taking huge responsibility, full concentration and the use of mental and physical capacity. Moreover the questionnaire answers prove that within the group they have mostly a supportive atmosphere which motivates and also carries through the hard circumstances which they need to confront on the rescue mission.

The volunteers mentioned to release stress through physical activity, social contacts, sauna, watching the TV, hobbies or “just relaxing on couch”. These methods are clear and practical and some really physical ways to relax. Nowadays when the stress is more recognized phenomenon more meditative methods become more popular.

Yoga, mindfulness and meditation bring the Oriental approach for releasing stress, in which the thinking is focused on person him or herself and just on being present in this moment. Some of these methods were suggested to the subjects when talking about which ways could be used for relaxation, but they were belittled straight away. This proves that not everybody is ready to listen to the inner talk and the reasons can vary. Maybe it is too unfamiliar, weird or even too scary to let one really listen to her or his inner thoughts. Moreover promoting the physical wellbeing is easier and practical because the effects can be seen; the weight and the circumference of waist are easier to measure after two months than the mental wellbeing.

Although the volunteer work takes a great deal of one’s free time, people do not seem to stress about that if it is found to be meaningful, enjoyable and the place where own skills can be used to help others and boost up self-esteem. In addition hobbies provide the surroundings where people with similar interest meet and build up the social network. Therefore people report the time taking hobby to rather be a way of life than “just a hobby” and it releases you from the daily routines and acts as a therapy to increase the mental and physical capacity. Furthermore the warm and tight group, where there is room for open discussion will support through the harder times too and as the Finnish rock band sings:

“Friends are the flowers of life...” (Lapko, 2012)

9.3 Some factors effecting on the results

Since the Firstbeat BODYGUARD gives a report of a three day period, the results would have been really different if the volunteers would have participated to a rescue mission or extinguishing a fire. This might have changed also the answers to the questionnaire and it would have provided more specific information about the physical loading of the volunteer work. In addition because the measuring was not done in controlled surroundings (i.e. the subjects could choose which activities their days include) the true, weekly stress levels might be different. The time used for recovering, or physical activity might differ from the subjects' normal daily routines. For instance, one of the subjects was on sick leave at the time of the measurement, so no recording of work hours was included.

9.4 The perspective of professional growth

This thesis provided a chance to conduct a small study with actual clients, who needed guidance in health related issues and suggestions how to improve their wellbeing. The Firstbeat measuring had been done for five of the volunteers already before and they wanted to have a follow-up report. Hence it seemed the clients were interested in participating the measurements and their wellbeing. A fact of which made the thesis meaningful for the writer too. In addition the work wellbeing related topic helped in the process of the thesis, because it is one field of physiotherapy of interest. Secondly it was interesting to learn to use the Firstbeat BODYGUARD and to implement the measuring for real clients.

The project gave a realistic idea how hard work conducting a research can be even though it would be part of an on-going project. It was a surprising to notice that how much preliminary work a study demands and that the knowledge about research methods would have been needed in order to conduct a successful research. The project was mainly conducted independently but the help was asked in sampling. The Soteekki's need for Firstbeat measurements was presented by the thesis supervisor Mari Törne, but the idea of including the approach of volunteer related stress was brought up by the student.

Moreover while writing the thesis report the difficulties of finding reliable sources of information came up. However the school library and the Duodecim database, “Terveysportti” offered professional views and literature about wellbeing and stress.

9.5 The need for further research

This study concentrated on determining the stress levels of the fire department volunteers. As a part of the Ruiskukunto-project there would be need to continue this study and find out what is the physical capacity of the fire department volunteers and if the physical capacity correlates with experienced or measured stress levels. The study could be also applied to other volunteer and the professional fire departments in Satakunta region.

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THE QUESTIONNAIRE

Perustiedot

1.Ikä (ympyröi): 18-20 21-30 31-40 41-50 51-55 yli 55

2.Sukupuoli (ympyröi): mies nainen

3.Ammatti:

4.Vuosia hälytysosastossa (ympyröi): alle 5 5-10 11-15 16-20 yli 20

5.Savusukellus pätevyys (ympyröi): kyllä ei

Tutkimuskysymykset

6.Vaihtoehtokysymykset (ympyröi);

*Arviointiasteikko*1. Täysin eri mieltä 2. Jokseenkin eri mieltä 3. En osaa sanoa 4. Jokseenkin samaa mieltä 5. Täysin samaa mieltä
Voit tarkentaa vastaustasi kysymyksen alle

a.Koen panokseni VPK:ssa merkittäväksi?..... 1 2 3 4 5

b.Koen että minulla on hälytysosaston tehtävissä vaadittava ammattitaito?..... 1 2 3 4 5

c.Hälytysosaston aiheuttama työmäärä on sopiva?..... 1 2 3 4 5

Jos vastasit 1 tai 2, tarkenna miten:

d.Saan riittävästi palautetta panoksestani ja työstäni VPK:ssa?..... 1 2 3 4 5

Kommentit:

e.Hälytystehtävät ovat henkisesti liian rasittavia?..... 1 2 3 4 5

Jos vastasit 4 tai 5, kuinka usein?

f.Voin puhua avoimesti muun hälytysosaston kanssa jos asiat jäävät painamaan?.... 1 2 3 4 5

g.Hälytystehtävät ovat fyysisesti liian rasittavia?..... 1 2 3 4 5

Jos vastasit 4 tai 5, kuinka usein

h.Työni VPK:ssa vaikuttaa työkykyyni?..... 1 2 3 4 5

Miten?

i.Työni VPK:ssa vaikuttaa perhe-elämäni/vapaa-aikaani?..... 1 2 3 4 5

Miten?

Avoimet kysymykset

7. Miksi osallistut VPK:n hälytysosaston tehtäviin?

8. Kerro mitkä ovat sinun tapasi rentoutua?

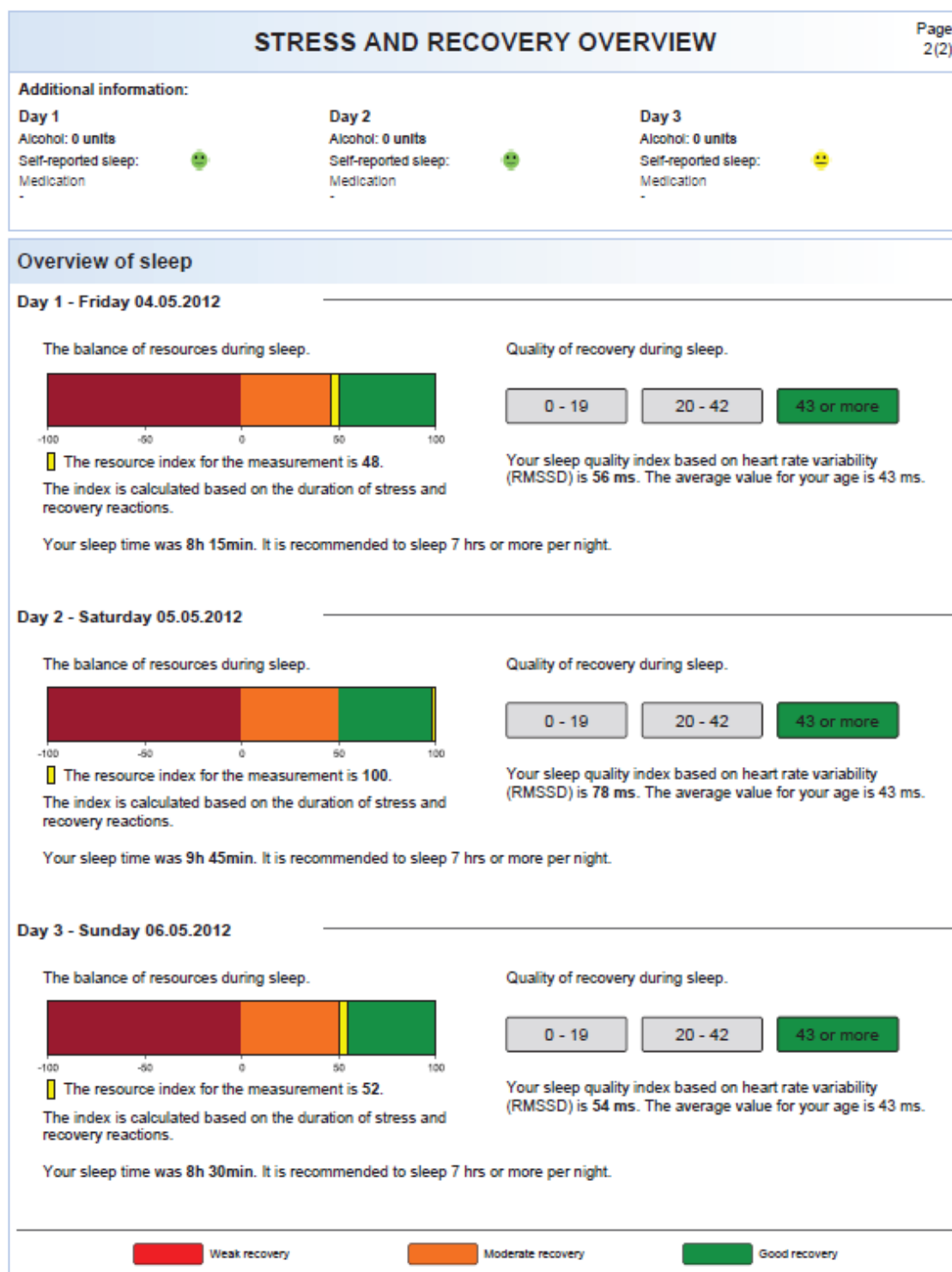
Erittele jos mahdollista, esim. töiden, urheilusuorituksen, VPK -harjotuksen tai päivystyksen jälkeen

Anna palautetta lomakkeesta kääntöpuolelle

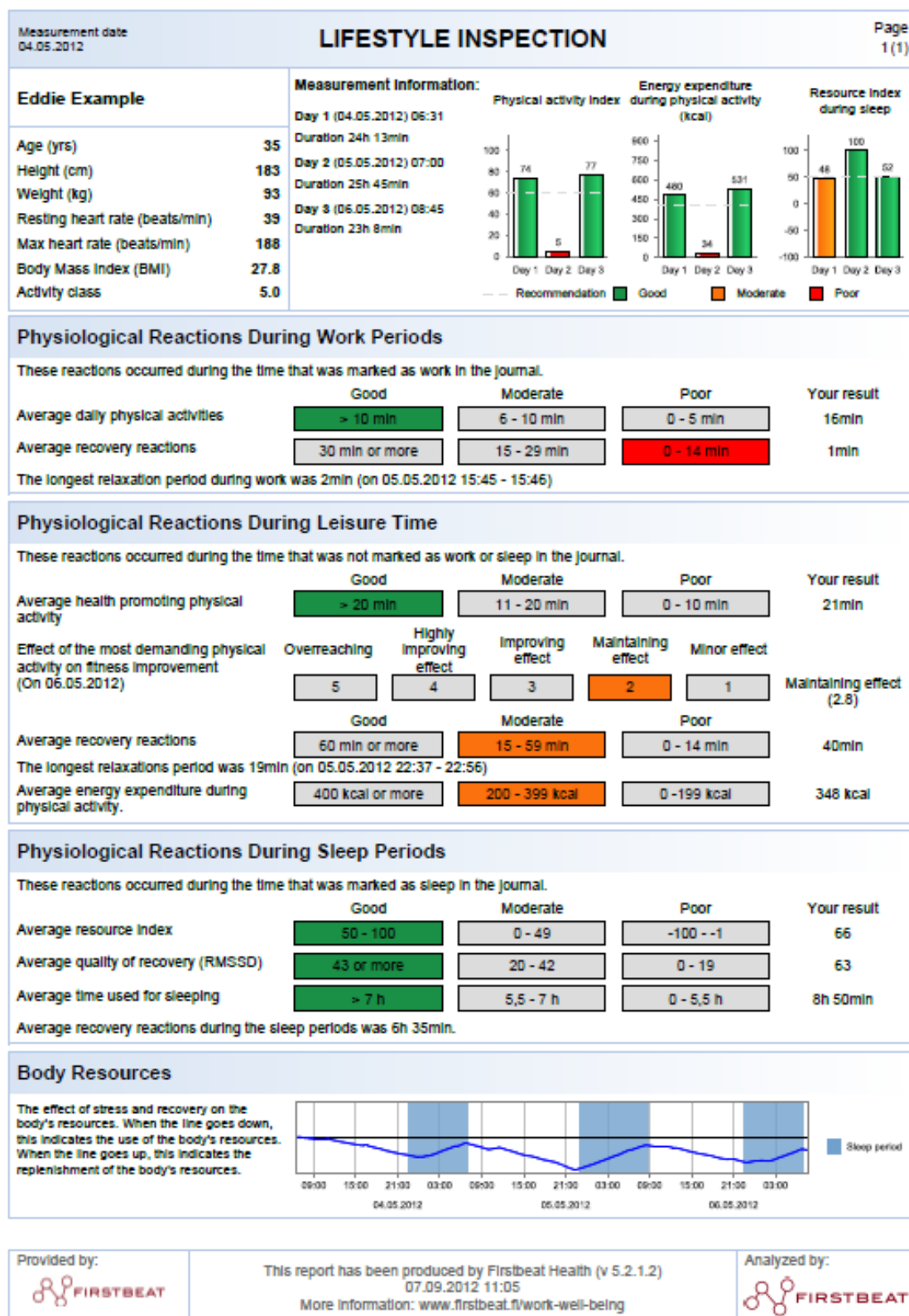
EXAMPLE REPORT 1/3



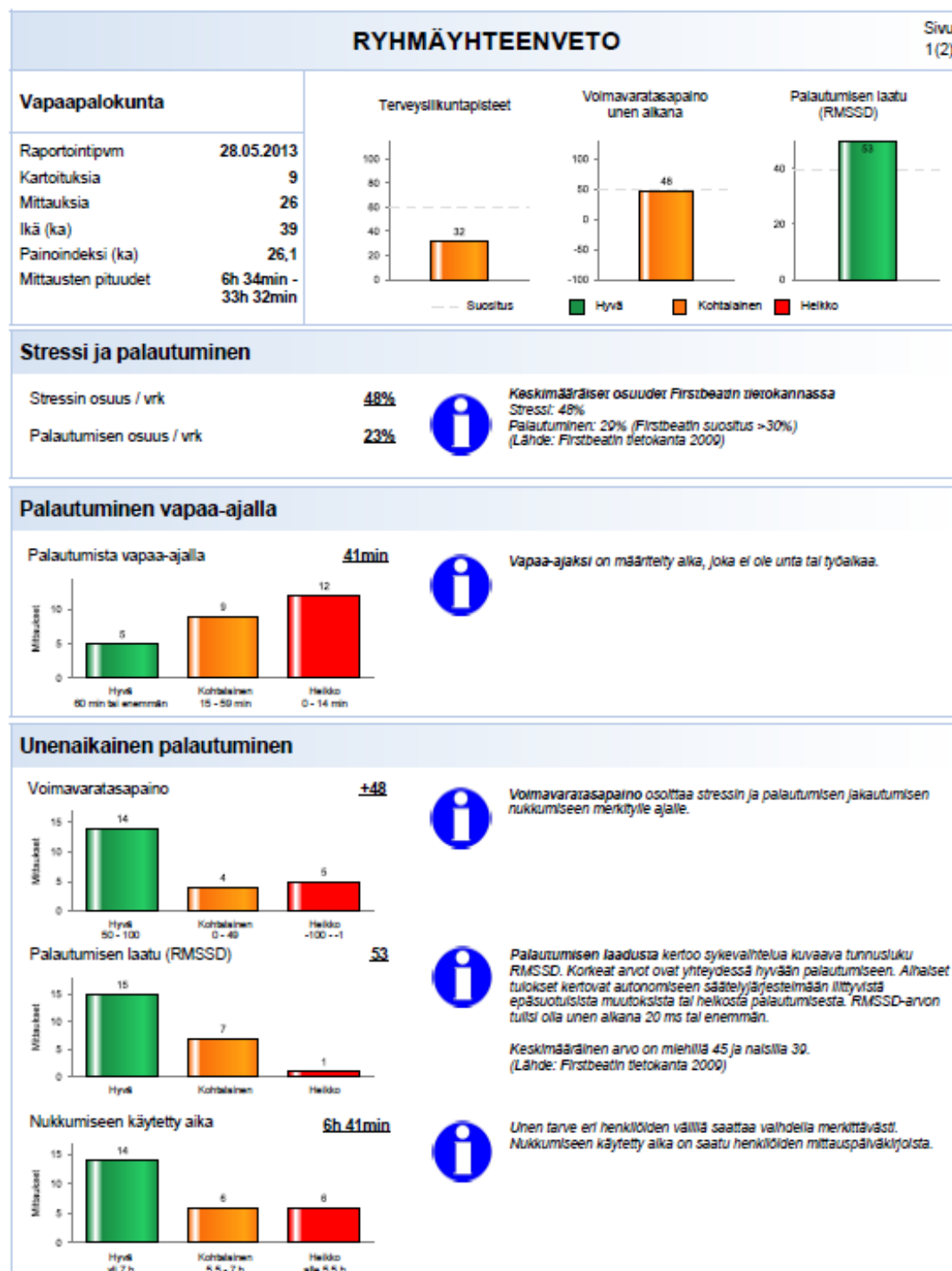
EXAMPLE REPORT 2/3



EXAMPLE REPORT 3/3



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GROUP RESULT CONCLUSION PAGE 2/2

