

Dissertation

**EVALUATION OF THE PHYSICAL ACTIVITY
BIOGRAPHY**

submitted by
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Declaration

I hereby declare that this thesis is my own original work and that I have fully acknowledged by name all of those individuals and organisations that have contributed to the research for this thesis. Due acknowledgement has been made in the text to all other material used. Throughout this thesis and in all related publications I followed the guidelines of “*Good Scientific Practice*”.

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Abstract

Objectives: Beside the genetic disposition, physical activity (PA) is one of the major health factors and can take on a sizeable role in the prevention and therapy of many diseases (cardiovascular diseases, cancer, obesity-related diseases etc.). In contrast to the genetic disposition, PA can be deliberately influenced by lifestyle. Therefore, it is of high importance to assess PA patterns.

Design: In order to assess PA reliably and validly, a new questionnaire (Physical Activity Biography, PAB) was created. Part I of the PAB (Sport and Transport) enables to distinguish between endurance intensity levels and strength and high speed activity patterns throughout life. Part II (Work, Housework and Gardening) differentiates between moderate and intensive occupational PA and further assesses the amount of PA during housework and gardening during different lifetime frames. This study aims at evaluating the PAB by means of item analysis, retest-reliability and validity (criteria were physical fitness assessed by the questionnaire FFB-mot and by exercise tests).

Method: 141 participants answered the PAB. For deriving retest-reliability, 81 participants completed the PAB after a retest-interval of one month. 55 participated in exercise tests and answered the FFB-mot to determine construct validity for part I.

Results: In part I retest-reliability (ICC) above 0.7 was found for most items. For items assessing recent PA, the criteria of convergent and discriminant validity were given. In part II the ICC's were lower than for part I, which can be explained by a very homogenous sample in terms of education and place of residence.

Conclusions: Despite the complexity of the question under study, the results fulfilled the expectations concerning reliability and validity. Part I of the PAB enables to assess the amount of sport and locomotion a person has accomplished during different life time frames. Because of the protective effects of PA on various diseases, part I may become an important tool for risk assessment. Part II is to be evaluated in further studies with adequate samples.

Zusammenfassung

Einleitung: Körperliche Aktivität ist ein zentraler Gesundheitsfaktor, der neben der genetischen Disposition eine wichtige Rolle bei der Prävention und der Therapie von vielen lebensstil- assoziierten Erkrankungen (Kardiovaskulären Erkrankungen, Krebs, Diabetes) spielt. Im Gegensatz zur genetischen Disposition kann die körperliche Aktivität allerdings aktiv vom Einzelnen beeinflusst werden. Somit ist es von großer Bedeutung, Methoden zu entwickeln, um körperliche Aktivität messen zu können.

Versuchsdesign: Ein neuer Fragebogen (Physische Aktivitäts- Biographie, PAB) wurde entwickelt, um körperliche Aktivitäten reliabel und valide zu erfassen. Im Teil I des PABs (Sport und Transport) werden sportliche Aktivitäten (Ausdauer mit drei verschiedenen Intensitätsabstufungen, Sport mit hohem Kraft- und/oder Schnelligkeitsanteil) und körperliche Aktivität im Zuge von Transporttätigkeiten untersucht. Teil II (Körperliche Aktivität im Beruf, im Haushalt und im Garten) beinhaltet Fragen zur körperlichen Aktivität in Beruf, Haushalt und Garten. Mit Hilfe des PABs können Informationen zur körperlichen Aktivität von der Jugend bis hin zu den letzten 3 Wochen erfragt werden.

Ziel der Studie: Evaluierung des PABs mittels Itemanalyse (Prüfung auf Normalverteilung, Itemschwierigkeit) und Retest-Reliabilität und Validität (Kriterium war die körperliche Fitness, die einerseits über den Fragebogen FFB-mot, andererseits mittels sportmotorischer Tests ermittelt wurde).

Methode: 141 ProbandInnen beantworteten den PAB. Um die Retest-reliabilität festzustellen, beantworteten 81 TeilnehmerInnen den PAB nach einem Monat ein zweites Mal. Um die Validität zu ermitteln, nahmen 55 Personen an sportmotorischen Tests teil und beantworteten den FFB-mot.

Ergebnisse: Die Retest-Reliabilität (ICC) von Teil I war in den meisten Fällen über 0.7 und bei den Items bzgl. des Ausmaßes an körperlicher Aktivität in den letzten 3 Wochen bzw. den letzten 3 Tagen, waren die Kriterien der diskriminanten und konvergenten Validität gegeben. Wie aufgrund der Homogenität der Stichprobe in den Variablen Ausbildungsniveau und Wohnort erwartet, waren die ICCs bei Teil II niedriger als bei Teil I.

Schlussfolgerungen: Trotz der Komplexität der Fragestellung erfüllten die Ergebnisse bzgl. Reliabilität und Validität die Erwartungen. Teil I ermöglicht die Erfassung des Ausmaßes an Sport und Transport einer Person während bestimmten Lebensabschnitten. Aufgrund des unumstrittenen positiven Effekts von körperlicher Aktivität auf diverse Krankheitsbilder kann dieser Fragebogen eine wichtige Methode zur Risikoabschätzung werden. Teil II sollte in weiteren Studien mittels adäquaten Stichproben weiter evaluiert werden.

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List of Symbols and Abbreviations

<u>Abbreviation</u>	<u>Definition</u>
[kg] kilogram	base unit of mass in the International System of Units (SI)
[N] Newton	SI derived unit of force
bal	balance
BMI	Body Mass Index [kg/m^2]; defined as the individual's body weight divided by the square of his or her height
coo	coordination
ECG	electrocardiography
end	endurance
ET	exercise tests
f	female
FFB-mot	Fragebogen zur Erfassung des motorischen Funktionsstatus (Bös et al., 2002)
flex	flexibility
I	intensity
IA	item analysis
ICC	Intraclass Correlation Coefficient
jh	jumping height
m	male
m.	musculus
MET	Metabolic Equivalent; 1 MET is equivalent to $4184 \text{ J kg}^{-1} \text{ h}^{-1}$, i.e. 1.16 W kg^{-1}
mm.	musculi
N	sample size
ns.	non-significant
$\dot{V}\text{O}_{2\text{max}}$	maximal oxygen consumption
$\dot{V}\text{O}_{2\text{max,rel}}$	$\dot{V}\text{O}_{2\text{max}}$ divided by body weight ($\dot{V}\text{O}_{2\text{max}} \cdot \text{kg}^{-1}$)
p	significance level
PA	physical activity
PAB	Physical Activity Biography

P_{\max}	maximum power
$P_{\max,rel}$	maximum power divided by body weight ($P_{\max} \cdot \text{kg}^{-1}$)
Q	questionnaire
r	correlation coefficient
R	retest-reliability
SD	standard deviation
sp	speed with load of 4% of the body weight
str	strength
V	validity
z	value of the z-statistic
\bar{x}	mean
χ^2	Chi-square statistic

Introduction

Physical Activity, Physical Fitness, Exercise: Definitions

The terms “*physical activity*”, “*exercise*”, and “*physical fitness*” are often confused with each other, even though they describe different concepts (1). The epidemiological study of any concept requires a proper definition for every variable under investigation.

According to Casperson, Powell, and Christenson (1) “physical activity” (PA) includes “...*any bodily movement produced by skeletal muscles that results in energy expenditure*”. This definition is widely used in the scientific community. However, this definition may be bemusing since energy expenditure is a necessary requirement for muscle contraction and hence, for any movement of the body and not vice versa. Furthermore, PA is a complex behavior with many interrelated dimensions (2). Casperson and colleagues (1) categorize PA into occupational, sports, conditioning, household, and other activities. “Physical inactivity” can be defined as not taking part in any regular pattern of physical activity beyond physical functioning (3).

As exercise and PA have a number of events in common, they have been used interchangeably. However, exercise is a subcategory of PA. Exercise is described by Powell and Paffenbarger (2) as a “*subset of physical activity that is planned, structured, repetitive, and has the improvement or maintenance of physical fitness as an objective*”. Thus, exercise is intended to improve or maintain components of physical fitness. Casperson, Powell, and Christenson (1) identified several elements characteristic of PA and exercise respectively (table 1).

Table 1

Elements of physical activity and exercise (modified from 1)

Physical activity	Exercise
bodily movement via skeletal muscles	bodily movement via skeletal muscles
results in energy expenditure	results in energy expenditure
energy expenditure varies continuously from low to high	energy expenditure varies continuously from low to high
positively correlated with physical fitness	very positively correlated with physical fitness
	planned, structured, and repetitive bodily movement
	an objective is to improve or maintain physical fitness component(s)

Caspersen and colleagues (1) define physical fitness as “...*a set of attributes that are either health- or skill- related*” or as “... *a set of attributes that people have or achieve that relates to the ability to perform physical activity*”. The degree to which people have these attributes can be measured with specific tests (1). There are a number of measurable aspects of physical fitness (figure 1). These aspects can be divided into two groups: health related fitness and skill-related fitness (1). The different aspects of health-related fitness must not necessarily go along with each other; e.g. a person can be strong, but lack flexibility (1).

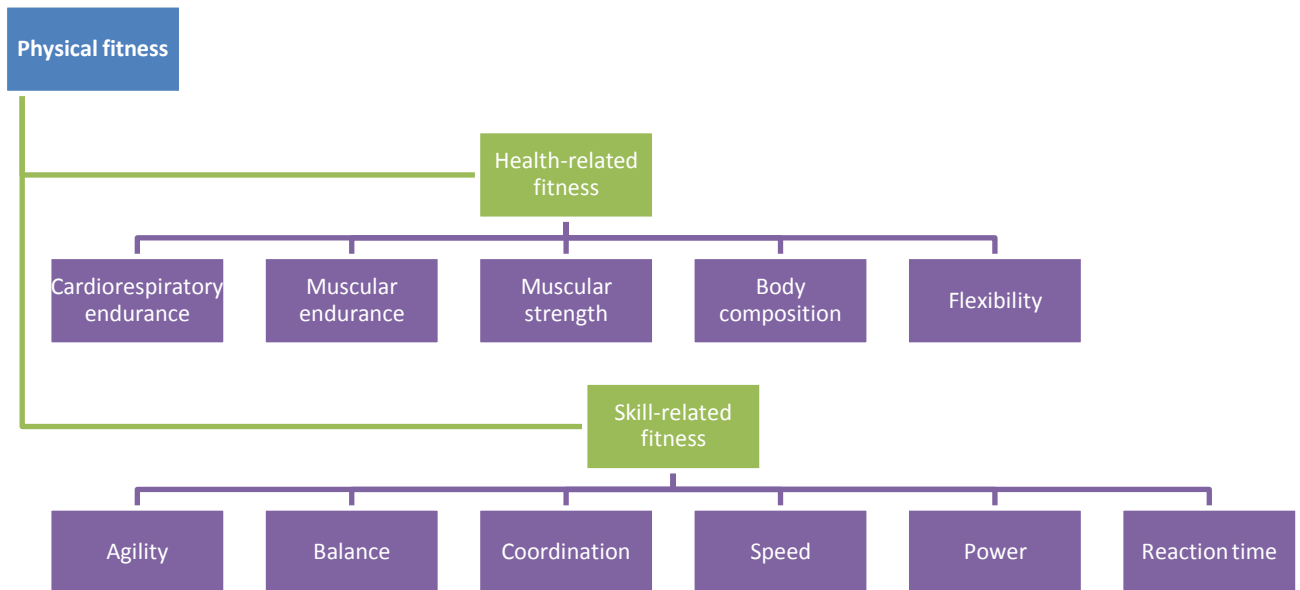


Figure 1 Components of physical fitness (1)

Numerous controlled exercise training studies revealed a strong relationship between PA and physical fitness (4). According to Blair and colleagues environmental factors, especially physical activity, are more important for determining physical fitness than genetic contributions.

Energy Expenditure

Energy is defined by Brooks et al. (5) as “...*the capacity to do work*”. All physical activities such as human locomotion or athletics are energetic events. Concerning energy processes in the body there are two important aspects (5): “*First, energy is not created, it is acquired in one form and converted to another. Second, the conversion process is fairly inefficient, and much of the energy released is in a nonusable form: heat.*” Energy expenditure of an activity can be measured in kilojoules (kJ). Kilojoules are a measure of energy expenditure (1), however, often also kilocalories (kcal) are used, which is an antiquated measure of heat (1). 1 kcal is equal to 4184 J, i.e. 4.184 kJ.

As shown in Figure 2 PA is the most significant, variable component of total energy expenditure (6). The metabolic cost of PA can vary tremendously: e.g. a sedentary person metabolizes about 1800 kcal per day, whereas an endurance athlete can use as much as 6000 kcal per day. Hence there is a threefold

difference between sedentary and extremely active people in energy expenditure (6). *“Everyone performs physical activity in order to sustain life; however, the amount is largely subject to personal choice and may vary considerably from person to person as well as for a given person over time.”* (1)

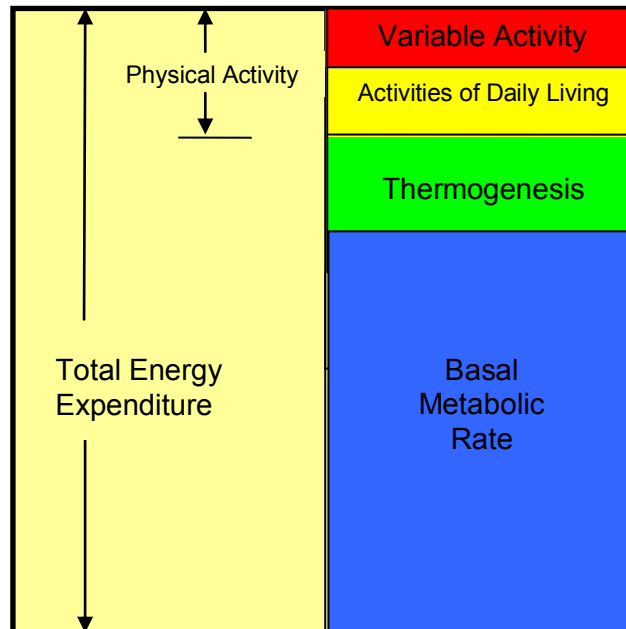


Figure 2 Components of energy expenditure of a nonathlete (modified from 7)

The Basal Metabolic Rate is the minimal rate of energy expenditure compatible with life. It is the largest component of total energy expenditure, typically 60- 75% when measured over a 24 hours' time period (6).

Thermogenesis is the production of heat that is not based on the resting metabolic rate, or PA (6). It accounts for about 15% of daily energy expenditure. The thermic effect of food is a term for the increase of the metabolic rate during the digestion, absorption, processing, and storing of food (6). This process starts after eating and ends several hours after a meal. This effect accounts for about 5 to 10% of the total energy expenditure.

Physical Activity Levels

Physical Activity in Austria

In 2006/07 Statistik Austria undertook a big study on the health behaviors of Austrians. In the course of this study, leisure-time physical activity was assessed (amongst other health-related variables). According to the “*Österreichische Gesundheitsbefragung 2006/07*“ of Statistik Austria (8) only one third of all male and one fourth of all female Austrians are physically active in their spare time (32% and 23%, respectively). Being physically active was defined as participating in aerobic, running, or cycling activities three or more times per week which caused sweating. About one half of Austria’s population (older than 15 years) is physically active at least once a week (8) (men: 60%, women: 49%).

Furthermore, physical activity declines by age in men (8): 42.1% of all men aged between 15 and 29 are physically active; while only 12% of men aged 75 and older meet this definition. In comparison, the number of physically active women increases slightly from 25.5% at the age of 15 to 29 years to 26.8% at the age of 30 to 44 years and to 27.7% at the age of 45 to 59 years. However, declines appeared in the age groups “60 to 74 years”, and “75 years and older” (21.6, and 5.4%, respectively).

In a recent study (2008-2012), 8000 Austrians were questioned on their sporting activities. It was shown that about one third of all Austrians are not participating in any sporting activity (9). Furthermore, the number of people who exercise daily declined from 20% (2008) to 16% (2012). 23% exercise once a week. Hence 39% of all Austrians are physically active at least once a week.

The favourite sporting activities of Austrians are cycling (27%), followed by running (23%) and swimming (21%). Austria’s “national sport” skiing is ranked on fourth place (14%) followed by hiking or Nordic Walking (12%), exercising in the gym (10%), and playing soccer (7%) (9).

Global Physical Activity Levels

According to the WHO (10), 31% of all adults worldwide aged 15 years or older did not meet the PA recommendations in 2008 (men 28% and women 34%).

The prevalence of insufficient physical activity was highest in North, Middle and South America and the Eastern Mediterranean Region. In these regions almost 50% of women were insufficiently active (10). The prevalence for men was 40% in the Americas and 36% in the Eastern Mediterranean. The South East Asian Region showed the lowest percentages of physical inactivity (15% for men and 19% for women) (10). In all regions, men were more active than women, with the largest difference in prevalence between the two sexes in Eastern Mediterranean Region. Furthermore, inactivity rises with age (11).

According to the WHO (10), the prevalence of insufficient physical activity¹ increases with the level of income: High income countries have more than double the prevalence of physical inactivity compared to low income countries for both men and women, with 41% of men and 48% of women being insufficiently physically active in high income countries as compared to 18% of men and 21% of women in low income countries. The WHO (10) explains these data by the increased work and transport- related physical activities for both men and women in the low and lower middle income countries. The increase in the automation of work and life in higher income countries creates opportunities for insufficient physical activity (10).

¹ An interactive map of the WHO concerning the prevalence of physical inactivity worldwide can be found here:
http://gamapserver.who.int/gho/interactive_charts/ncd/risk_factors/physical_inactivity/atlas.html

Historical Perspective on Physical Activity

“Since the industrial revolution, the development of new technologies has enabled people to reduce the amount of physical labour needed to accomplish many tasks in their daily lives” (11). According to Hallal et al. (11), the effects of these new technologies on PA can be obvious (e.g. steam, gas, electric engines; trains, cars etc.), while others are more subtle and complex (e.g. television, computers, internet etc.). On the one hand, the technological progress led to increased productivity among workers and reduced physical hardships and disabilities caused by jobs entailing continuous heavy labour, but on the other hand, also decreased physical activity globally (11, 12).

In the course of evolution, genes were selected in an environment of high physical activity demands *“... that favored an optimization of aerobic metabolic pathways to conserve energy for a potential, future food deficiency”* (13). However, nowadays the lack of ancient physical activity levels in our modern civilization leads to an increased risk of non-communicable diseases (13). The biological mechanisms of this relationship between physical inactivity and non-communicable diseases are complex and numerous. For example, Booth et al. (13) focused in their study on two preserved, ancient, biological mechanisms, namely insulin sensitivity and fat storage. They hold the view that some of the primary consequences of physical inactivity are the development of skeletal muscle insulin resistance and an increase in body fat, which can contribute to the development of diseases, such as the metabolic syndrome, cardiovascular diseases, and type 2 diabetes.

Due to numerous studies during the 20th century, PA and exercise is becoming an increasingly important tool for disease prevention and therapy. However, this approach is not new and had already been addressed by Hippocrates, who was a Greek physician born in 460 BC. In his theory the uses and abuses of the “six things nonnatural” are essential. Hippocrates defined nonnaturals as things that are not innate, like health. Among the “six things nonnatural” are 1) air, 2) food and drink (diet), 3) sleeping and walking, 4) motion (exercise) and rest, 5) excretions and retentions, and 6) passions of the mind. According to Hippocrates, the nonnaturals should be practiced in moderation in

order to remain healthy (14). Imbalance or practicing the nonnaturals in excess was said to lead to illness or disease. These six categories are related to things that can be controlled by the individual. Galen also advised that lack of physical exercise, as well as overexertion is destructive to health (15).

Relevance of the Assessment of Physical Activity – PA and Health

“Those who think they have not time for bodily exercise will sooner or later have to find time for illness.”

Edward Stanley, Earl of Derby, speech (1873)

“Strong evidence shows that physical inactivity increases the risk of many adverse health conditions, including major non-communicable diseases such as coronary heart disease, type 2 diabetes, and breast and colon cancers, and shortens life expectancy” (Lee, 2012). Since the majority of the world’s population is physically inactive, this relationship represents a major public health issue (Lee, 2012).

Physical inactivity is the fourth leading cause of death worldwide (16). According to the WHO (10), approximately 3.2 million deaths and 32.1 million DALYs (disability-adjusted life years)² are attributable each year to insufficient physical activity. People who are insufficiently physically active have a 20% to 30% increased risk of all-cause mortality compared to those who engage in moderate intensity PA for at least 30 minutes on most days of the week (10). The review study of Lee and Skerrett (18) including 44 observational studies also convincingly confirmed the negative relationship between PA and all-cause mortality. The WHO (10) stated that meeting the PA recommendations³ is estimated to reduce the risk of ischemic heart disease by approximately 30%, the risk of type 2 diabetes by 27% and the risk of breast and colon cancer by 21% to 25%. Additionally, regular physical activity lowers the risk of stroke, hypertension,

² *“One DALY can be thought of as one lost year of ‘healthy’ life. The sum of these DALYs across the population, or the burden of disease, can be thought of as a measurement of the gap between current health status and an ideal health situation where the entire population lives to an advanced age, free of disease and disability.”* (17)

³ i.e. Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity (19, 20)

and depression and is a key determinant of energy expenditure and thus, fundamental to energy balance and weight control (10).

A large study by Lee and colleagues (21) on the effect of physical inactivity on major non-communicable diseases worldwide showed similar effects: Lee et al. (21) estimated that about 9% of all premature deaths worldwide can be attributed to physical inactivity. These 9% equate to 5.3 million of the 57 million deaths that occurred in 2008 (21). The elimination of physical inactivity would increase the life expectancy of the world’s population by about 0.68 years (21). Lee et al (21) also analyzed health benefits of PA in adults. The results of this analysis are depicted in table 2.

Table 2

Health benefits of physical activity in adults (21)

Strong evidence of reduced rates of:	Strong evidence of:
<ul style="list-style-type: none"> • All-cause mortality • Coronary heart disease • High blood pressure • Stroke • Metabolic syndrome • Type 2 diabetes • Breast cancer • Colon cancer • Depression • Falling 	<ul style="list-style-type: none"> • Increased cardiorespiratory and muscular fitness • Healthier body mass and composition • Improved bone health • Increased functional health • Improved cognitive function

Many recent studies revealed the relationship between physical fitness and mortality with the individual fitness level as a more objective measure of mortality (22). For each MET increase in exercise capacity the reduction of mortality risk is reduced by 10 to 25% (23). Exercise capacity was even found to be a stronger predictor for mortality than well-established risk factors, such as systemic hypertension, dyslipidemia, diabetes or smoking (24, 25).

To sum up, based on numerous studies, it can be deduced that lack of regular exercise and physical fitness is an actual cause of non-communicable diseases and death (26). However, exercise does not only prevent most non-communicable diseases, but can also be an important issue in the treatment of the disease: “...*the importance of physical activity as a determinant for health and diseases- and as an adjuvant in medical treatment and rehabilitation- is increasingly valued*” (27). Physical activity appears to play an important and complex role in determining health outcome (28). “*Physical activity benefits all types-old and young; men and women; hypertensive and normotensive; short and tall; fat and lean; subjects with normal and abnormal lipoprotein profile, and subjects who never smoked cigarettes, ex-smokers, and light, heavy, and very heavy smokers.*” (15)

Not only is PA effective for preventing non-communicable diseases, but it also increases health-related quality of life: adults meeting the PA recommendations (19) report less unhealthy days compared to inactive and insufficiently active adults (29). Among older adults long-term PA is related to postponed disability and independent living (30).

Due to the high relevance of PA for maintaining health and preventing non-communicable diseases, tools are required to measure this important health factor. According to Kohl and colleagues (16), the development and implementation of standardized surveillance tools for PA is essential for the progress of PA and public health.

Lagerros (27) and Lagerros and Lagiou (31) underline in their articles the high importance of PA in the world of epidemiology. According to Lagerros and Lagiou (31), accurate measurement of PA is necessary for the following public health aspects:

- Identification of causal associations between PA and health outcomes (e.g.: more PA leads to a decreased risk of cardiovascular diseases).
- Description and quantification of the dose-response relationships between physical activity and health outcomes (e.g. the higher the PA dose, the higher the risk reduction; increasing PA from sedentary lifestyle to a

moderate active lifestyle leads to a 3 fold lower risk of developing breast cancer in women).

- Documentation of changes and differences in physical activity within and between individuals, respectively, over time.
- Formulation of public health recommendations (e.g.: WHO, ACSM, ACS etc.).
- Validation of intervention programs (e.g.: did the intervention increase the amount of PA per week of a certain person).
- Comparison of PA levels between populations, particularly when cultural and language differences exist between these populations.
- Measurement of PA in children and other groups of individuals who have limited capacity of accurate self- appraisal.

“Lack of activity destroys the good condition of every human being while movement and methodical physical exercise save it and preserve it.”

Plato

Physical Activity and Cardiovascular Diseases

The “... *early hypothesis that men doing physically active work have a lower mortality from coronary heart diseases in middle age than men in less active work was met with considerable skepticism by medical scientists and practitioners.*” (32) Subsequent to the landmark study of Morris et al. (33) this skepticism began to change (32) and a large number of studies confirmed the inverse relationship between PA and cardiovascular and overall mortality (22). Morris and colleagues (33) had compared the mortality rate of civil servants in physically demanding jobs to desk clerks and were the first to demonstrate a relationship between PA and mortality.

In a large study Lee et al. (21) estimated to which extent the disease could be averted if physical inactivity was eliminated. It was found that physical inactivity causes about 6% of the burden of cardiovascular disease (CVD). According to Burtcher and Gnaiger (22) “... *there is ample evidence that physical activity is an*

independent and important factor for the assessment of the CVD risk and that increasing levels of physical fitness protect against elevations in most risk factors in subjects with and without CVD”.

Two manifestations of cardiovascular disease have been frequently investigated in relation to PA: coronary heart disease and stroke (cerebrovascular accident) (34). In his review Kohl (34) confirms that an inverse dose- response relationship between PA and the risk of cardiovascular diseases, especially coronary heart disease exists. According to Wannamethee and colleagues (35), leisure- time PA is associated with a reduction of risk for coronary heart disease of about 30- 50%. However, the impact of physical activity on stroke is not entirely clear (34). In this regard a non-linear “U-shaped” relationship is likely, but has to be tested in further studies (20, 34).

There are multiple possible biological mechanisms that can contribute to the protective effect of PA against cardiovascular diseases: Postulated mechanisms include advantageous effects on atherosclerosis, plasma lipid/lipoprotein profile, blood pressure, availability of oxygenated blood for heart muscle needs (ischemia), blood clotting (thrombosis), and heart rhythm disturbances (arrhythmias) (20). Furthermore, other effects of PA that might be related to modifications of the risk factors of cardiovascular diseases such as reduced incidence of obesity, healthier distribution of body fat, and reduced incidence of non–insulin-dependent diabetes (20). *“Regular physical activity reduces all traditional risk factors, i.e. systemic arterial hypertension, elevated low-density (LDL) and reduced high- density lipoproteins (HDL), increased triglyceride levels, insulin resistance and glucose intolerance.”* (22) PA on a regular basis can be considered as the most important condition counteracting metabolic and cardiovascular disease (36).

Several decades ago physicians recommended prolonged rest for patients with cardiovascular diseases. Nowadays regular PA and even vigorous exercise is an evidence-based part of the prevention and therapy of cardiovascular diseases (37). Patients with a cardiovascular disease are recommended to perform endurance exercise at least 3 times per week for at least 30 minutes. This exercise should include 5 minutes of warm up and cool-down calisthenics and at

least 20 minutes of endurance exercise (70% to 85% of the maximum heart rate) (15, 38). In general, exercise at a vigorous intensity level is related to greater cardiovascular benefits than exercise of moderate intensity when total energy expenditure is held constantly (15, 22). However, exercise intensity should, of course, be adapted to the conditions of the individual.

Much more research is needed to provide a deeper insight into the mechanisms linking PA to cardiovascular diseases in order to maximize the benefits of exercise training for healthy and also diseased people on an individual basis (22).

Physical Activity and Diabetes

“Changes in human behavior and lifestyle over the last century have resulted in a dramatic increase in the incidence of diabetes worldwide.” (39). There are two main forms of diabetes: type 1 and type 2 diabetes (formerly noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes) (39). Type 1 diabetes is due to an autoimmune-mediated destruction of pancreatic b-cell islets leading to an insulin deficiency (39). Diabetes type 1 patients must apply exogenous insulin for survival to prevent ketoacidosis. The prevalence of type 2 diabetes is high compared to the prevalence of type 1 diabetes, as it accounts for 90% of all cases globally (39), and the number of persons concerned is increasing (20, 39). Characteristics of type 2 diabetes are insulin resistance and/or abnormal insulin secretion. Such patients do not depend on exogenous insulin, but may require it for the control of the blood glucose levels, if that cannot be achieved by the diet alone or with hypoglycaemic agents (39). The risk of developing diabetes type 2 can be reduced by being physically active (20).

The number of people suffering from diabetes increased from approximately 153 million in 1980, to about 347 million in 2008 (40) Lee et al. (21) assume that approximately 7% of all type 2 diabetes cases worldwide are caused by physical inactivity. The importance of preventing type 2 diabetes results not just from the

disease itself, but also from its associations with obesity and cardiovascular risks, such as dyslipidemia and hypertension (39).

Endurance training and strength conditioning with many repetitions seem to be effective for preventing type 2 diabetes (41). For people who are already suffering from type 2 diabetes, training should be planned precisely in accordance with insulin treatment and diet (41). During the training blood glucose should not exceed 17 mmol/l or fall below 7 mmol/l. The goal is to accomplish at least 30 min of moderate- intensity endurance exercise every day or 3 to 4 hours per week. Strength training should include many repetitions and as well as a warming up and a cool down phase of at least 5 min each (41). However, specific guidelines are not available yet, as more information concerning the importance of the amount and the intensity of exercise is necessary (41).

The physiological basis for the positive relationship between PA and diabetes type 2 prevention can be found in the short- and long-term effects of PA on carbohydrate metabolism and glucose tolerance (20). Furthermore, PA can prevent or delay the onset of diabetes type 2 by reducing total body fat or specifically intra-abdominal fat, which are known as risk factors for insulin resistance (20). PA is also important for secondary prevention, i.e. the management of the disease (42). Possible biologic mechanisms of PA that are relevant for the treatment of the disease are increased insulin sensitivity and improved glucose disposal due to physical activity (20, 41).

Physical Activity and Cancer

„Overall, the research to date suggests that PA reduces the risk of developing some cancers, helps cancer survivors cope with and recover from treatments, improves the long-term health of cancer survivors, and possibly even reduces the risk of recurrence and extends survival in some cancer groups.“ (43)

Concerning the relationship between PA and cancer there is the general agreement in literature that:

PA can reduce the risk of developing certain types of cancer (44), e.g. for breast and colon cancer the level of evidence for this relationship is convincing

(45). The biological mechanisms of the association between PA and cancer are not fully understood yet (46, 47). Obviously some of these biological mechanisms might be specific for the different types of cancer: For example, according to Lynch et al. (46) PA reduces the risk of breast cancer by lowering the secretion of sex hormones, adipokines, and alternations of insulin-related factors. Colon cancer risk is lowered by the effects of PA on immune function, inflammation, insulin resistance, and vitamin D (48).

PA also improves supportive care outcomes (e.g. physical functioning, QOL, fatigue etc.) in cancer patients during and after treatment (49). Furthermore, there is growing evidence that PA can also influence disease outcomes positively, such as disease free-survival and overall survival in patients with certain types of cancer (49).

Many cancer patients benefit from an individualized exercise prescription that is adapted to the individual's preconditions, type of disease, treatment plan, and personal needs. PA for cancer patients can be considered as safe (50). They should be encouraged to avoid inactivity and remain as physically active as possible during and after treatment. Even when they suffer from sever treatment-related side-effects, they should exercise "*...to the extent they are physically able to do so.*" (51).

In general, exercise prescription should include aerobic and resistance exercises (49). It should be flexible, enjoyable and build up self-confidence. Also social aspects of exercising should be considered as well.

Cancer patients need not only to overcome "typical" exercise barriers, but also unique barriers related to the disease, such as affordability, time constraints, lack of motivation/interest (49). Hence, it can also be advantageous to incorporate determinates of PA behavior, like motivational variables (52, 53), "macro" variables, such as social support in the family, social support in the community, the built environment (52), and personality traits (54) into the exercise prescription and intervention, respectively.

Numerous studies have already addressed the relationship between cancer and PA. However, many questions still remain unanswered. Courneya and Friedenreich (2011) demand a greater insight into the biologic mechanisms that relate PA to cancer risk, supportive care, and disease outcomes, respectively. Furthermore, the optimal type, intensity, and amount of PA that is required for improved outcomes are still unclear. Additionally, no minimum dose of PA that already leads to health benefits concerning cancer could be ascertained. The accurate measurement of recent or lifetime PA is still a big challenge and the low quality of many PA assessment tools is a frequent flaw in many studies (55, 56). The use of comprehensive PA questionnaires that measure all types and intensities of PA, including sedentary behavior, over the life-time are recommended by Courneya and Friedenreich (2011b). Another recommendation deals with identifying special subgroups that benefit from PA more or less, than others. Important differences between groups and potential moderators of PA should be revealed by doing so (43).

Summarized, future studies should help to understand what constitutes the optimal, desirable and necessary frequency, duration, intensity and type of PA, and how specific characteristics of the individual (e.g. age, fitness level), the disease (e.g. cancer-site, stage) and the treatment (e.g. type of therapy, side-effects) influence the exercise prescription (49).

Quality Criteria

In earlier epidemiological studies of PA, it was often assumed that the tool that was used to measure PA was automatically reliable and valid (27). Thus, the quality criteria of these methods were not tested and unknown and the application of these methods could have led to measures of poor quality (27). Nowadays, information on reliability and validity of a measurement tool is becoming standard (27). However, attention should be paid to the way reliability and validity are tested (selection of sample, statistical methods etc.) (27, 55). A guidance for analyzing the quality criteria of PA questionnaires can be found in the article by Terwee and colleagues (55).

There are three quality factors which are very important for measurement tools: Objectivity, reliability, and validity.

Objectivity

A test is objective, if different test supervisors attain the same results when testing the same group of persons (57). In other words objectivity is the quality of being free from personal bias (58).

The objectivity of a test can be split into three subdivisions:

Objectivity of Application

The result of the test should not be influenced by the test leader (57). To increase objectivity of application, the test instructions should be standardized and the answers to potential inquiries should also be specified in the preparation of the test.

Objectivity of Evaluation (Objective Scoring)

There must be an inherent scoring system which must be used when scoring test results. Different evaluators must come to the same test score when evaluating the same test protocol (57). The objectivity of evaluation depends partly on the type of items: multiple choice items and items that determine how to score certain answers (e.g. by the use of rating scales) increase objectivity (57).

Objectivity of Interpretation

How to interpret test scores should be determined by providing standard values (57). Individual interpretations of the values should be avoided.

Strict objectivity is an unattainable goal when using questionnaires or exercise tests, as these tests always require social interactions which can unintentionally influence test results to a certain degree. Hence, working criteria depending on the variable intended to measure should be developed.

Reliability (Reproducibility, Precision)

Reliability can be defined as the ability of a measurement tool to produce the same results under the same conditions (59). Reliability is frequently evaluated by determining retest-reliability, which means that the same group of people is tested twice with the same test. A reliable instrument will, in general, produce the same or at least similar results at all times (59). However, reliability of tests of human performance or self-report questionnaires is never perfect because of biological variance due to factors such as mood, daytime, previous experience, fatigue etc. (57, 58).

Accuracy and Precision

The terms accuracy and precision have different meanings: A measurement tool should assess the target variable with sufficient accuracy and precision.

Accuracy refers to the closeness of a measured value to the actual (true) value. Precision, on the contrary, corresponds to the closeness of the measured values to each other. For example, if a soccer player always hits the left goal post instead of scoring, he or she is precise, but not accurate.

There are two types of errors: systematic errors and random errors. Systematic errors are errors that are constant and always differ from the true value in the same way (i.e. the measurement is always larger, or always smaller, than the true value) (60) and thus cannot be reduced by averaging over a lot of data, e.g. by increasing the sample size. Examples of systematic errors are time measurements by a clock that runs too fast or slow or distance measurements by

an inaccurately marked meter stick etc. A test that has very small systematic errors is said to have a high degree of accuracy. The systematic random error refers to accuracy (61).

Random errors are produced by any one of a number of unpredictable and unknown variations in the experiment, e.g. fluctuations in room temperature, differences in day time etc. Experiments with very small random errors are said to have a high degree of precision. Hence, random errors refer to precision (61).

While many measurement tools, like properly calibrated scales, measuring tapes etc. will only produce very small measurement errors, self-report measures can produce substantial measurement errors. This is due to potential influences of external or internal factors that often cannot be controlled, but can influence how people respond to the measures (59).

Validity

Validity allude to whether an instrument measures what it sets out to measure (59). For example, a test designed to measure muscular strength that actually measures endurance performance is not valid.

The higher reliability and validity are, the smaller is the measurement error of a test instrument. The term measurement error refers to the discrepancy between the numbers used to represent the variable measured and the actual value of this variable (i.e. the value one would get, if the issue could be measured directly) (59).

Validity of a measurement instrument can be assessed in a variety of ways:

Content Validity (Face validity)

Content validity is high, if the content of the items include all facets of the construct that should be assessed (57). There is no numeric description of content validity as it can only be appraised subjectively (57). For this subjective appraisal, experts on the respective field of investigation are usually appointed.

Criterion Validity

Criterion validity is given, if the result of a test assessing a latent construct is consistent with the results of the measurement of a corresponding apparent criterion (57). For example, criterion validity of a sprint power test on a bicycle ergometer is high, if the results show high correlations with the actual time in a short-distance (sprint) bike race.

Construct Validity

A test has high construct validity, if hypotheses can be deduced from the construct that should be measured, which can be confirmed by the test results (57). For example, the construct validity of a test assessing coordination should be validated: From exercise science and prescription we know that coordination has several subdimensions such as rhythm, spatial orientation, the ability to react to both auditory and visual stimulus etc. (62). Coordination abilities are the foundation of a good sensorimotor learning aptitude (62). Furthermore, certain sports like gymnastics require a higher level of coordination than others, e.g. running. The challenge of construct validity can be the testing of hypotheses with regards to content (57).

An exact and comprehensive construct validation can be done by using the "Multitrait-Multimethod-Method", which has its own validity criteria (57). For further information on the "Multitrait-Multimethod-Method " see Campbell and Fiske (63).

Methods for Assessing Physical Activity and/ or Energy expenditure

PA is a complex phenomenon which is characterized by its intensity (rate of energy expenditure), duration, frequency (per hour, per day, per week etc.), and surrounding environmental and social conditions (12). *“As physical activity takes many forms, it can be measured in a variety of ways.”* (55) The choice of method to measure PA depends on the aspect of PA that is central to the research question. (64)

This thesis deals with PA measured by self-assessment questionnaires. However, the different available methods for assessing PA or energy expenditure will be described briefly:

Lagerros and Lagiou (31) distinguish between observer-dependent and self-report methods (table 3).

Table 3

Observer-dependent and self-report methods for assessing PA or energy expenditure

Observer-dependent methods	Self-report methods
<ul style="list-style-type: none"> • Doubly-labeled water • Calorimetry • Heart rate monitoring • Ventilation • Cardiorespiratory fitness • Body temperature • Motion sensors (e.g.: Accelerometers, Pedometers) • Behavioral observation 	<ul style="list-style-type: none"> • Psychophysical rating scales (e.g.: RPE, Rate of Perceived Exertion, (65, 66)) • Physical activity records (e.g.: PA diary) • Physical activity logs • Recalls • Questionnaires

Most observer-dependent methods are based on physiological approaches to measure energy expenditure. *“Methods for determining energy cost (i.e. oxygen consumption) of various activities have been available for many years.”* (67)

The main advantage of observer-dependent over self-reports methods is the higher measurement objectivity, as self-reports are prone to faking (good or bad) tendencies that can influence the results (31). But also observer-dependent methods can influence the exercise behavior of the study participants and lead to non-representative data of habitual PA measurement (67). Problems of these methods are especially obvious when habitual PA should be assessed: Occupational and recreational PA can vary from day to day and from season to season (67). Recall methods have a lower risk of affecting the pattern being measured (31), but are susceptible to recall bias.

Many observer-dependent methods require some type of monitoring. Hence, they are harder to apply in large populations than self-report assessment tools (31). *“In epidemiology, these methods are mainly used to validate other physical activity assessment methods”* (31). Furthermore, their application in a study is more expensive than the use of self-report tools. For a more detailed discussion on observer-dependent methods, their types, advantages and disadvantage etc. the article by Lagerros and Lagiou (31) can be recommended.

According to Baranowski (68), three different types of self-report measures of PA exist: retrospective reports on self-completed forms, retrospective interviewer conducted forms and concurrent or end-of-the-day diaries. Each of this method has its own advantages and methodological problems (68).

The advantages and disadvantages of PA self-report measures (27, 68) are presented in table 4.

Table 4

Advantages and disadvantages of physical activity questionnaires according to Baranowski (1998); Lagerros (2009); Lagerros and Lagiou (2007)

Advantages	Disadvantages
modified from Baranowski (68)	
<ul style="list-style-type: none"> • Enormous versatility (many different aspects can be investigated (e.g. type of PA, physiological aspects, location of PA, social environment...)) • Method is relatively quick • Easy to obtain (only trained interviewer/ administer is necessary) • Inexpensive • Unobtrusive (at least during the conduct of the PA) • Usually nonreactive (if not applied in a longitudinal research) 	<ul style="list-style-type: none"> • The questionnaire can only be used for the designed purpose (e.g. an instrument assessing habitual PA over a year cannot be used to evaluate PA patterns over 1 week) • There are limits to the reliability and validity of self-report measures ⁴
modified from Lagerros (27) and Lagerros & Lagiou (31)	
<ul style="list-style-type: none"> • Easily distributed and administered • Convenient to the study participant (does not require a lot of time or motivation) • Does not alter the behavior of the participant being surveyed 	<ul style="list-style-type: none"> • Lack of sophistication in many PA questionnaires • Inconsistent results between studies due to misclassification, lack of precision, and/or social desirability • Exposure-measurement error ⁵

⁴ However, Baranowski (68) also admits that there are limits to any measure of activity (e.g. heart rate does not only measure activity, but also measures emotional arousal (69).

⁵ "The exposure measurement error for an individual can be defined as the difference between his measured exposure and his true exposure. The true exposure is the agent hypothesized to cause the disease and would include a specified etiologic time period of interest. Differential exposure

Advantages	Disadvantages
<ul style="list-style-type: none"> • Can provide information on a number of lifestyle factors • Testing a large number of participants is possible • Lower investment of time and money than with other methods 	

Lagerros and Lagiou (31) distinguish three different types of PA questionnaires: global questionnaires, single- item questionnaires, and comprehensive questionnaires.

Global questionnaires include close-ended multiple choice questions that ask the participants to rate their relative PA level or fitness compared to others of the same age and gender (31).

In single-item questionnaires the participant is, for example, asked to rate one's overall level of PA on a 5-point rating scale.

Comprehensive questionnaires request more in depth information (31). Some of these questionnaires provide an extensive list of different activities and ask the participants to indicate the frequency and duration of the PA in which they participate (31). Based on their data, the amount of energy expended can be calculated.

When planning a study that includes PA or energy expenditure assessment, the first step is to know what outcome measures (e.g. frequency, intensity, occupational PA, etc.) should be assessed and what kind of practical considerations (sample size, budget, age of participants etc.) must be adhered to. With this information, the decision matrix (URL: <http://dapa-toolkit.mrc.ac.uk/choosing-a-method/physical-activity/decision-matrix.html>) and the matrix on practical considerations (URL: [---

measurement error occurs when the measurement error differs between those with the disease and controls.” \(70\)](http://dapa-toolkit.mrc.ac.uk/choosing-a-</p>
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method/physical-activity/practical-considerations.html) can help to find the right measurement tool for the selected outcomes (71).

Physical Activity Assessment by Questionnaires

Historical Perspective on PA Assessment

Early studies testing the impact of PA on health showed first associations of these two variables. However, PA was initially measured with rough methods (27). These first studies focused on the relationship between PA during work and certain diseases or mortality. *“Assessment of physical activity during working hours kept its position as a primary way of measuring physical activity for many years...”* (27) The problem with this approach is that according to Lagerros (2009) nowadays a full-time worker spends only about 20% of the total hours per year at a workplace. Furthermore, the amount and intensity of PA during work declined during the last decade, hence other types of PA became a more important indicator of total PA (27). However, according to Montoye (1971) the eight hours per day spent at work account for the greatest part of the total activity calories of many people. Nevertheless, in homogenous groups concerning PA (e.g. office workers) leisure-time PA can play an important role for distinguishing people according to PA and energy expenditure (Montoye, 1971).

According to Lagerros (27), during the last decades research has moved from description of simple relationships to more advanced questions. Very specific questions concerning the relationship between PA and health are nowadays investigated (27):

1. Which aspects of PA are of importance?
2. What level of physical activity is necessary to stay healthy?
3. Does timing matter; does PA in different life stages have different impact on disease?

Additionally, also another related issue received higher attention: *“Which factors affect the habits of health- enhancing physical activity?”* (27)

In order to answer these questions an accurate measurement of all types of PA, i.e. occupational, leisure-time PA, PA in the course of transport, is necessary. As the instruments of the early descriptive phase do not always meet the demands of the more advanced phase, newly improved, valid and reliable methods are needed (27).

Physical Activity Questionnaires

“The application of physical activity (PA) questionnaires is the most widely used method for the assessment of PA in population studies” (LaPorte et al., 1985), and according to Lagerros & Lagiou (31), questionnaires are the “method of choice in large epidemiological studies”. An ideal physical activity assessment tool would measure all dimensions (frequency, type, duration, intensity) in all domains (leisure time, occupational, transport, household and gardening PA) (64).

*In 1997, the scientific journal *Medicine & Science in Sports and Exercise* devoted a supplement to more than 30 different instruments for self-reported PA (72). A large number of different questionnaires assessing physical activity are obtainable (55, 72, 73) and new tools continuously appear as a result of the growing interest on PA (31). However, “... most likely due to the fact that physical activity is a complex exposure to measure” no PA questionnaire can be adequate for every situation and every population (31). Terwee et al. (55) state that many questionnaires are poorly designed and the content and measurement properties are often either unsatisfying, not tested or reported incompletely and the choice of an appropriate questionnaire for a specific task may be difficult (55, 74).*

*According to Casperson, Powell, and Christenson (1) PA includes “...any bodily movement produced by skeletal muscles that results in energy expenditure”. Nevertheless, only few studies up to now have focused on all components of PA (55, 74) , such as sports, transport, occupational physical activity, housework and gardening. The most frequently used German PA questionnaires are the *Freiburger Fragebogen zur körperlichen Aktivität* (75) and the German version of the *IPAQ (International Physical Activity Questionnaire, 76)*. However, these instruments only assess recent PA and also include open questions; hence automatic processing and the use in large epidemiologic studies may be difficult.*

There are only few questionnaires (28, 77-79) that aim to assess lifetime PA (80). All of them are designed to be interviewer administered, “... a technique often not practical for epidemiologic studies conducted among large numbers of participants” (80).“ (81)

An extensive list on many PA questionnaires and their corresponding validities can be found here: <http://appliedresearch.cancer.gov/paq/validation.html> (82).

Assessing Biographical Physical Activity

“Lifetime physical activity energy expenditure (PAEE) is an important determinant of risk for many chronic diseases but remains challenging to measure.” (83)

While a number of questionnaires assessing recent PA are known to be valid and reliable (80, 84), tools for measuring PA have not been tested as comprehensively (56, 85). An overview of the most important lifetime PA assessment methods available should be provided here:

One of the first attempts of measuring historical PA was done by Kriska and colleagues (28). Before, studies only focused on current levels of PA or examined only occupational historical PA, but did not include preceding leisure time PA (28). The Retrospective Physical Activity Survey by Kriska et al. (28) contains 4 questions. It divides the life span into four time periods: 14-21, 22-34, 35-50 50+ and asks about the amount of leisure-time PA during these time periods (28). Every activity reported by the respondents, in the questionnaire was converted into kilocalories of energy expenditure, and kilocalories per week approximations from all activities during this time period were derived.

Cumming and Klineberg (79) assessed the type and frequency of PA performed at the ages of 20 and 50 years by interview. In their evaluation study retest-reliability of long-term recall of PA was tested among 63 elderly participants with a retest interval of 1 to 3 months. The retest-reliability was generally poor and lower reproducibility was associated with higher age and being male (79).

Friedenreich (77) investigated retest-reliability of lifetime PA assessed by interview in a group of 113 healthy middle-aged women who completed two interviews within 6 to 8 weeks. The Lifetime Total Physical Activity Questionnaire investigated PA conducted from childhood through to the year before the interview. Good retest-reliability across different types of activity, intensity levels and during different time periods was found. The retest-reliability coefficient for the

amount of hours per week spent in total lifetime PA was .74, for lifetime occupational PA was .87, for household PA was .77, and for exercise/sports activities was .72.

The Historical Leisure Activity Questionnaire (HLAQ), a modified version of the questionnaire used by Kriska et al. (1988) was evaluated in the study of Chasan-Taber et al. (80). The HLAQ was according to Chasan-Taber et al. (80) the first self-administered PA questionnaire assessing lifetime PA. It was tested with a sample of 134 female college alumnae at the age of 39 to 65, who answered the questionnaire twice one year apart. Four prior age periods were assessed: menarche to 21 years, 22-34, 35-50, and 51-65. Derived ICC's were .82 for total lifetime PA, .80 for lifetime moderate- intensity activities, .86 for lifetime vigorous- intensity activities and .87 lifetime recreational activities and .78 for lifetime household activities.

In the context of the Colorectal Cancer Quality of Life Study, Lynch and colleagues (56) assessed the amount of habitual leisure-time PA of colon cancer patients in the years preceding the diagnosis by telephone interviews. For this purpose, items of the Active Australia Survey were used and adapted to the study. 112 participants completed two interviews with an interval of one month between interviews. The ICC ranged from .4 for vigorous gardening to .77 for moderate PA.

In all of these studies evaluating lifetime PA assessment methods mentioned above, only reliability was assessed. *“However, in addition to reliability, validity of historical physical activity questionnaires is essential for accuracy.”* (86) The lack of validity studies is probably due to the higher complexity in the design of the study design, as well as the larger time constraints.

In the study of Friedenreich and colleagues (77) the validity of long-term recall of physical activity was not tested since they *“...did not have the methods available to make this assessment”*. To examine validity, Friedenreich et al. (1998) argue, either a cohort of respondents is necessary for whom self-reported past PA is available or for whom past physical fitness measures have been taken. Furthermore, historical PA would need to have been measured using similar parameters as reported in this questionnaire (i.e. type of activity, frequency, intensity, duration of activity).

Winters-Hart and colleagues (86) compared historical PA recall (assessed by the interviewer- administered Historical Physical Activity Questionnaire; HPAQ)

to original PA questionnaire results (Paffenbarger Physical Activity Questionnaire), which were collected at four times over a period of 17 years in 163 white, postmenopausal women. Spearman correlations between the historical PA and the original PA questionnaires ranged between .39-.62. With a decrease in the time length of recall, the magnitude of the correlations increased.

In another study, construct-related validity of self-reported historical walking, running, and jogging (WRJ) activity was determined on the basis of data from the Aerobics Center Longitudinal Study (Dallas, Texas) (87). It was found that historical WRJ can be assessed with reasonable validity when compared with treadmill performance and that there is no decay in the accuracy of this reporting for up to 10 years.

Besson et al. (83) designed and validated the Historical Adulthood PA Questionnaire (HAPAQ) against objective PA measurements from the same individuals. A population-based cohort consisting of 100 individuals in Cambridgeshire, UK was recruited. In this sample, PA measurements using individually calibrated heart rate monitoring, had been obtained in the past, once between 1994 and 1996 and once between 2000 and 2002. In an interview historical PA within the domains of work, home, transport, sport and exercise was recalled using the questionnaire. The subjects were asked closed questions repeatedly for several discrete time periods from the age of 20 to their current age. The average physical activity energy expenditure from the two periods of objective measurements was compared to the self-reported data from the corresponding time periods in the questionnaire. Significant Spearman correlations were observed between the HAPAQ and the heart rate-based total physical activity energy expenditure for both time periods ($r_{98} = 0.44$; $P < 0.001$).

Purpose of the study

“There are numerous studies on the relationship between PA and health and there is solid evidence that PA can reduce the risk of developing non-communicable diseases, like cardiovascular diseases, breast, colon and other forms of cancer, type-2 diabetes etc. (41), and PA can also increase life expectancy (21, 34, 35, 88). Further, PA also plays an important role in therapy and in rehabilitation of non-communicable diseases (89, 90).

In a recent study (91) a multiple choice questionnaire (three questions measuring PA during the previous month) showed that even low-volume PA (15 min per day) was associated with a 14% risk reduction of all-cause mortality and a 3 year longer life expectancy. Application of a questionnaire capable of assessing PA over the whole life might increase the benefits of such a study or related ones substantially because the development of non-communicable diseases is a long-term process which cannot be mapped by means of a questionnaire assessing only recent PA.” (81)

For detailed investigations of the effects of PA patterns on non-communicable disease prevention and therapy, a questionnaire fulfilling the demands summarized in table 5 is a substantial extension which enables to assess the role of the life-time distribution of PA for preventing or reducing the development of non-communicable diseases.

Table 5

Special demands on the questionnaire (81)

Suitable for adults and elderly people

Assessment of the amount of physical activity

Assessment of physical activity intensity

Distinction between different types of physical activity

Assessment of total physical activity (transport, sport and work)

Capable of measuring the amount of physical activity patterns during certain life-time frames (from one's youth till the latest 3 weeks)

German language

Use of rating scales for automatic processing

“As no existing questionnaire fulfills these demands, we decided to design a reliable and valid questionnaire that can be used for all groups: athletes, healthy people, and also for groups of patients, e.g. cancer patients. We considered assessment of PA over a short and long time period as was suggested by Kriska and Caspersen (74) in order to obtain the best estimate of PA levels throughout life.

The possibility to distinguish between different types of PA (endurance, transport, speed, strength) a person has carried out in the past can be important for various reasons: (a) to get to know the prevalence of different types of PA of a person and (b) differences in PA patterns between individuals or groups, or (c) to monitor changes of PA patterns after certain training interventions. Furthermore, such a questionnaire can be used to investigate health benefits with respect to different types of bodily training (92, 93) and thereby public health recommendations may be improved (31): for example, it is still unclear whether there are special types of PA that reduce e.g. cancer risk more than others: “To date, there is no suggestion that one type of physical activity provides greater benefit than another” (48) and ‘...the precise exercise prescription, in relation to type, intensity, duration and frequency needed for cancer protection remains unknown’ (94).” (81)

Methods

Development of the Questionnaire

“Several considerations and pilot studies preceded the questionnaire described below in order to eliminate or reduce possible problems as early as possible.” (81) During the development phase the questionnaire was tested and revised several times and a short version of the questionnaire was constructed based on the experiences had. The main steps undertaken during this process are depicted in table 6. The questionnaire versions of step 4 and 6 have been evaluated in three studies and are further described in detail.

Table 6

Main steps of the questionnaire development

Steps	Version	Content/changes	Testing
1	PAB draft 03 04 08	part of this questionnaire was based on the theory of reasoned action (49) <u>scales:</u> <ul style="list-style-type: none"> intensity of PA competitions social influences attitude towards PA habitual PA 	<ul style="list-style-type: none"> N= 20 item analysis and feedback by the participants <ul style="list-style-type: none"> Presentation at Human Performance Research Graz expert discussion
2	PAB draft 15 05 08	part 1: attitude towards PA, habitual PA, social influences, competitions part 2: sports (with high endurance, strength and/or speed impact) during youth and the previous 3 years part 3: sports during certain time frames (20-40 years, 40-60 years, over 60 years)	<ul style="list-style-type: none"> N~ 60 used at Oncology Graz, cancer patients item analysis, revision
3	Questionnaire of physical activity draft 27 01 09	new idea: measure recreational PA by listing up different PA done during certain time frames and recalling the amount of these activities	did not meet the criteria (table 5)

Steps	Version	Content/changes	Testing
4	PAB draft 11 05 09	part 1: sports and locomotion part 2: physical activity at work, at home, gardening part 3: performance (physical fitness), competition and physical activity during childhood part 4: body weight	N= 59 normal population retest after 1 month (N= 32) item analysis retest-reliability validity using FFB-Mot and exercise tests <hr/> N= 24 physical education students retest after 1 month (N= 16) item analysis retest-reliability revision
5	PAB short version draft 04 05 10	part 1: habitual physical activity during the previous year part 2: physical fitness (based on FFB-mot, Bös et al., 2002)	N= 32 normal population tested during a city festival "Feiertag des Sports" in Graz
6	PAB draft 06 10 10	some minor item changes in part 3 based on the results of step 4	N= 60 physical education students

Note: Numerous interim versions, which have not been used in a study, are not displayed here.

The PAB part I “... measures a person's amount of PA from childhood on throughout life. In the PAB the amount of sport activities (endurance with low intensity, medium intensity, and high intensity; sports with high impact of speed and/or strength) and locomotion by bike or by foot (transport) are assessed.” (81) In order to make clear what is meant by low, moderate and high intensity, the information given in table 7 was provided for the participants.

Table 7

Description of the PA categories of the PAB (81)

Endurance sports	
Low intensity	slight increase in breathing frequency, talking is possible
Moderate intensity	medium increase in breathing frequency; sweating; talking is aggravated
High intensity	large increase in breathing frequency, profuse sweating, talking is hardly possible
Examples	all endurance sports like long distance running, swimming, cycling, cross country skiing, hiking in mountainous areas, fast walking etc.
Sports with high speed and/or strength demands	
Description	Some sports demand not just endurance, but also speed and/or strength
Examples	ball games like football, volleyball, basketball, tennis; or wrestling, judo, resistance training, field events like sprinting, jumping, throwing etc.

“The questions are related to different time domains (previous three years, previous three weeks and during one's childhood/youth, between the age of 20 and 40 years, between the age of 40 and 60 years and above the age of 60 years). The participants are asked to answer the questions on a 5-point rating scale (0 - 4), at which the graduation indicates the amount of hours a certain type of activity has been performed per week.” (81) For this information see table 8.

Table 8

Items of part I „Sport and Locomotion“ of the PAB (81)

Beginning of the items	Type of activity	Time frame
How many hours per week on average have you been doing...	...endurance with low intensity...	...during the latest 3 years?
	...endurance with medium intensity...	...during the latest 3 weeks?
	...endurance with high intensityduring your youth?
	...sports with high impact of speed and/or strengthbetween the age of 20 and 40 years?
	...locomotion by bike or foot...	...between the age of 40 and 60 years?
		...above 60 years?

Note: The beginning of the items was always the same, the type of activity and the time frame varied; Items were answered using a 5-point rating scale 0... 0 hours; 1...1 hour; 2... 2 hours; 3... 3 hours; 4... 4 hours or more.

In order to shield the data from getting too much influenced by untypical weeks, we do not ask about the last week, but about the average activity per week during the latest three weeks

Part II “Körperliche Arbeit im Beruf, Haushalt, Garten” (Physical Activity at Work and at Home, Gardening; table 9) requires self-assessment concerning the amount of time a person has spent on doing moderate physical labour (e.g. working in a warehouse), heavy physical labour (e.g. construction work), housework and gardening. The questions are related to the same time domains as in part I, but the time frame concerning the latest three weeks was excluded. The rating scale ranges from 0 (0 hours) to 4 (16 hours or more).

Table 9

Items of part II “Physical activity at work, at home, gardening” of the PAB

Beginning of the items	Type of activity	Time frame
How many hours per week on average have you been doing (on average)...	...moderate labour during work...	...during the latest 3 years?
	...heavy labour during work...	...during your youth?
	...moderate or heavy houseworkbetween the age of 20 and 40 years?
	...moderate or heavy work in the garden...	...between the age of 40 and 60 years?
		...above the age of 60 years?

Note: The beginning of the items was always the same, the type of activity and the time frame varies. Items were answered using a 5-point rating scale 0... 0 hours; 1... 1-5 hours; 2... 6-10 hours; 3... 11-15 hours; 4... 16 hours or more.

Design

“The PAB was evaluated by analyzing normal distribution, item difficulty, retest-reliability of one month, and factor analysis. There is a strong relationship between PA and physical fitness (95), in particular between current fitness and recent physical activity, and therefore construct validity was tested by means of a correlation analysis between the item responses in the PAB and the results of physical fitness tests and, in addition, with another questionnaire (FFB-mot) testing self-assessed fitness.” (81)

Participants

The PAB was evaluated by testing three different samples (altogether 141 participants). The characteristics of these samples are depicted in table 10 in which the applied quality criteria tests are also indicated. *“Sample A consisted of 33 healthy men and 22 healthy women (59 people were tested, 4 very old ones were excluded because of a large age gap to all others). The participants have not been participating in any sports competitions at a higher level and also were not currently studying exercise science or physical education. They received a free folder including all of their test results and an individual rating of their physical fitness status. Sample B consisted of exercise science or physical education students and sample C were budding students, who just passed the entry tests for the exercise science or physical education program at the local University.” (81)*

Table 10
Characteristics of the tested samples (81)

Characteristics												Quality criteria		
sample	N	sex		age		BMI		lifestyle				IA	R	V
								physical health*	psychological health*				Q	ET
		m	f	\bar{x} (SD)	Range	\bar{x} (SD)	Range	\bar{x} (SD)	Range	\bar{x} (SD)	Range			
A: normal population	55	33	22	34.6 (11.7)	18-56	23.7 (3.4)	18.1-33.7	1.55 (.50)	1-2	1.44 (.57)	1-3	X	X	X X
B: physical education stud.	26	19	7	22.5 (2.4)	19-28	18.9 (2.8)	18.9-30.1	1.50 (.51)	1-2	1.54 (.58)	1-3	X	X	X
C: physical education stud. (1 st sem.)	60	40	20	20.9 (3.6)	18-38	22 (1.9)	18.4-28.4	1.26 (.44)	1-2	1.21 (.46)	1-3	X		X

Abbreviations: N: sample size; m: male, f: female; SD: standard deviation; BMI: body mass index; IA: item analysis; R: retest-reliability; V: validity; Q: questionnaire; ET: exercise tests; X: analysed.
 * assessed with 4 point rating scale (1... very good; 4... poor).

Measures

Questionnaires

“Three questionnaires were used in this study. One questionnaire included questions concerning demographical data and medical history. The second one was the new self-assessment questionnaire PAB (Physical Activity Biography). The third questionnaire, the Physical Fitness Questionnaire (96) (Fragebogen zur Erfassung des motorischen Funktionszustandes, FFB-Mot) deals with current physical fitness and contains 24 items and 4 scales: Strength, Endurance, Flexibility, and Coordination. The participants were asked how problematic conducting a certain PA would be for them. The rating scale ranges from 1 (I cannot do this activity) to 5 (I have no problems).” (81) Retest-reliability (Pearson correlation) of the FFB-mot with a retest-interval of two weeks turned out to be .89 for women and .9 for men (96). The internal consistency of the scales lies between .79 and .88 for men and .79-.84 for women (96). Concerning criteria validity, correlations of the FFB-mot sum score with self-assessed health of about 0.5, with back pain of about -.47 and with intensity of sporting activities of about 0.31 (women) and .49 (men) (96).

Exercise Tests

“In addition to the FFB-Mot questionnaire, physical fitness was also assessed by means of exercise tests in sample A:

Endurance was tested on a cycle ergometer using a stepwise increase of load every minute according to Hofmann and Tschakert (97) in which heart rate, ECG, lactate, and spirometric data and Lactate Turn Points 1 and 2 were determined. For the analysis of construct validity, obtained values (in respect of body weight) for $\dot{V}O_{2max}$ ($\dot{V}O_{2max,rel.}$) and for maximum power ($P_{max,rel}$) were used.

Flexibility of the muscle groups: m. erector spinae, m. rectus femoris, m. trapezius, m. triceps surae, m. pectoralis, mm. adductores, mm. ischiocruales, m. iliopsoas were tested using standard flexibility tests (modified from 98, 99). Both sides were tested separately and a three- point rating scale (1... far beneath normal range; 2... beneath normal range; 3...within normal range) was used. The

scores of the eight muscle groups and the two sides were summed up, thus the flexibility scores ranged from 16 to 48. A higher score indicates a better flexibility.

Balance was determined using four simple tests. The participants were asked to stand still in certain positions for at least 10 seconds. While standing in those positions they were not allowed to jump or move their foot or feet. Prior to every exercise, the participants had one minute to practice each task. Every exercise was tested first with both feet and then with the right foot and finally with the left foot. The exercises were: standing with open eyes; standing with closed eyes; standing on one's tiptoe(s) with open eyes, and standing on one's tiptoe(s) with closed eyes. They could try to complete each task in two attempts. For every task that could be successfully completed, the participants got one point. Zero to 12 points could be reached.

Speed was assessed using the Sprint Power Test (100, 101). This test was designed to quantify the maximum short-time muscle power. A mechanical weight ergometer (Monark 874E weight) and an electronic device (Power Analyser) for measuring the velocity of the flywheel and thus the power output were used. The participants did a sprint power test at a four % (of their body weight) load (100, 101). The test took only a few seconds.

For strength, three different tests were used: Strength of the hands was assessed using a pinch strength dynamometer. Both hands were tested in a sitting position with the elbow of the tested arm on a desk. The elbow angle was 90°, two attempts were allowed. The mean values of the best results of each hand divided by body weight were used. Arm strength was tested by measuring remaining weight (on a Kistler ground reaction force plate) when the person tried to lift the body by pulling up with one arm (elbow was in rectangular position). The differences of body weight and remaining weight on the plate divided by body mass [N kg^{-1}] was used. The participants had one attempt per arm and both arms were tested. Jumping power was tested by doing squat jumps on the Kistler force plate (101). The participants had three attempts to reach their maximal jumping height." (81)

Testing

“The experimental protocol was approved by the ethics committee of the local Medical University. The participants were informed about the study and asked to sign an informed consent before they answered the three questionnaires (demographical questionnaire, PAB and FFB-Mot). Additionally, the actual physical fitness status (in terms of endurance, speed, strength, balance, and flexibility) was assessed in sample A. The order of the exercise tests was: endurance, flexibility, balance, speed, and strength. Between the tests there was enough time for the participants to recover from the previous test. To determine the retest-reliability of the questionnaire, the participants were asked to answer the PAB again when they got their test results one month after the tests. Within one month 34 of all 55 participants (61.8%) participated in the retest. Participants of sample B were also asked to answer the PAB for one more time after one month. At this second testing time, 16 of the 26 students (61.5%) participated. The participants of sample C were only tested once and answered all three questionnaires.” (81)

Statistical Analyses

“The data was analyzed using the Statistical Package for the Social Sciences (SPSS; version 16; SPSS Inc., Chicago, IL, USA). The probability for a Type I error was 0.05 for all tests. Means and standard deviations (SD) were obtained for the items. The mean value of an item can also be used as an indicator for item difficulty. Item difficulty should be at a moderate level to warrant good differentiation between the participants (102). Further, the shape of the distribution of the answers was investigated by analysing skewness and kurtosis. Item difficulty of all items concerning sport was expected to be higher for sample A compared to sample B and C who consisted of exercise science and physical education students.” (81) For part II we expected the items assessing the PA during work to have very high difficulties, because only few of the tested people described themselves as physically active during work in the demographical questionnaire (table 11).

Table 11

Physical activity during work

	seated activity	moderate PA	intensive PA	missing data
sample A	45 (83.3%)	9 (16.4%)	0	1 (.3%)
sample B	10 (38.5%)	7 (26.9%)	7 (26.9%)	2 (7.7%)
sample C	28 (46.7%)	22 (36.7%)	1 (1.7%)	9 (15%)

Furthermore, the same statistical situation for the questions on gardening was anticipated, since most people living in a city like Graz usually do not possess a garden. Item difficulty of housework was expected to be higher during youth, because people at this age usually do not have their own household. In general, the item difficulties of the items dealing with housework were expected to be lower than for all other items.

Normal distribution should be at least given for sample A for part I. The distributions of the ratings of part II's items were expected to be skewed to the right for all samples.

Moreover, quality criteria of the items were examined:

Reliabilities of the single items were analysed by using retest-reliability. For lifetime PA Terwee et al. (55) consider a retest interval up to one year as appropriate. *“In this study a retest interval of one month was chosen in order to meet the demands that the time interval between the test and retest is short enough to ensure that participants had not changed their PA levels, but long enough to prevent recall (93). For determining retest-reliability, the Intraclass Correlation Coefficient (ICC) was used in this study, because it does not overestimates reliability by ignoring systematic differences between the two measurements like e.g. the Pearson Correlation Coefficient (55). A value higher than 0.7 was considered as good (55).”* (81) An ICC higher than 0.7 was expected for all items, apart from the items asking about physical activity during the last 3 weeks. This expectation was due to the fact that the amount of PA done can vary from week to week since the retest-interval was one month, people, who were answering the PAB for the second time, were probably reporting different physical activity habits than one month before.

“For determining validity, items of part I obtained with sample A were correlated (Spearman-Rho) with the results of the exercise tests and also with the scales of the FFB-Mot. Only those items were validated that asked about the person’s late past (previous three weeks, previous three years). Using a Multitrait-Multimethod-Matrix the criteria of convergent and discriminant validity were investigated (63). There are no guidelines on how high the correlation coefficients indicating validity of PA assessment questionnaires should be (55). As validity is always lower than reliability, which should be over 0.7, and because of the questionnaire complexity which results from the aim to assess various types of PA, a correlation coefficient of 0.4 and higher was chosen to be sufficient for validity (93).” (81) When analysing validity it must be kept in mind, that we used physical fitness as a criteria for physical activity. Physical fitness is not only influenced by physical activity, but also other factors, like genes. This can reduce the magnitude of the relationships.

According to Terwee et al. (55) observations at the workplace are the most optimal method for evaluating questions about a person’s occupational PA: As no observations could be arranged and no other reasonable validity criterion could be found, part II was not validated in terms of construct or criterion validity. However, face validity was assessed by asking two experts on physical activity about the relevance and appropriateness of the questions and ratings for both parts.

“Factor analysis (Principal Component Analysis, orthogonal rotation) was used in order to detect possible factors. The number of factors was determined using the Kaiser criterion, (Eigenvalues of all factors larger than 1). Additionally, a graphical examination of the scree plot was carried out. As not all participants could answer all items (because they were not old enough) a pair-wise exclusion of missing values was chosen. Only 23 persons could answer questions which deal with PA at the age of 40 years and older. Therefore, only items of the time frames previous three years, previous three weeks, youth, and between 20 and 40 years (=20 items) were included. A Bartlett Test of Sphericity was conducted to test whether the correlation matrix corresponded to the identity matrix.” (81)

Results

Item analysis

Part I

“Item difficulty can be classified as moderate for sample A, whereas for sample B and C the difficulties were lower, indicated by higher mean values” (81) (table 12). “Items assessing the amount of endurance with high intensity in most cases had higher difficulties than the other items. Sports with high speed and/or strength demands had high difficulties for sample A and in comparison lower difficulties for sample B and C. Additionally; it was observed that the difficulties of the items increase with the people’s age in the time frames. Apart from two items in sample A (transport during the previous three years: $z_{kurtosis} = -2.09$; $p < 0.05$; sports with high speed and/or strength demand during the previous three weeks $z_{skewness} = 2.67$; $p < 0.01$), normal distribution analysed by skewness and kurtosis was given for all items and samples.” (81)

Table 12

Item difficulties of part I (modified from 81)

Time frame	Activity	Sample A		Sample B		Sample C	
		N	Item difficulty	N	Item difficulty	N	Item difficulty
previous 3 weeks	Endurance with low intensity	55	1.87	25	2.6	58	1.9
	endurance with moderate intensity	55	2.18	26	2.19	58	2.41
	endurance with high intensity	51	1.31	24	1.75	58	2.21
	sports with high speed or strength demands	52	1.25	25	2.4	58	2.69
	transport	54	1.87	25	2.24	58	2.6
previous 3 years	endurance with low intensity	54	1.98	25	2.44	60	2.33
	endurance with moderate intensity	55	2.00	26	2.46	60	2.47
	endurance with high intensity	53	1.02	24	1.96	60	2.28
	sports with high speed or strength demands	54	1.41	25	2.76	60	3.07
	transport	55	2.13	26	2.27	60	2.65
between 40 & 60 years	endurance with low intensity	24	1.62				
	endurance with moderate intensity	24	1.92				
	endurance with high intensity	23	1.09				
	sports with high speed or strength demands	23	1.13				
	transport	22	1.50				
between 20 & 40 years	endurance with low intensity	49	1.98	24	2.5	25	2.28
	endurance with moderate intensity	49	2.16	25	2.4	25	2.44
	endurance with high intensity	48	1.12	24	2	25	2.28
	sports with high speed or strength demands	49	1.35	24	2.46	25	2.96
	transport	49	2.04	24	2.25	25	2.68
youth	endurance with low intensity	55	1.96	25	2.44	59	2.49
	endurance with moderate intensity	55	2.24	26	2.31	58	2.41
	endurance with high intensity	53	1.32	25	2.04	58	2
	sports with high speed or strength demands	53	1.72	25	2.68	59	2.78
	transport	55	2.20	25	2.44	59	2.63

Part II

The item difficulties of all questions of part II “physical activity at work, home and gardening” were very high for all samples tested (table 13). Moderate or heavy housework reached the lowest item difficulty values in all time frames for sample A and C, whereas sample B showed the lowest values, when asking about moderate labor during work. Most of the items were not normally distributed. Their data distribution differed from normal distribution in terms of skewness and kurtosis. Most of them were skewed to the right and leptokurtic.

Table 13

Item difficulties of part II

Time frame	Activity	Sample A		Sample B		Sample C	
		N	Item difficulty	N	Item difficulty	N	Item difficulty
previous 3 years	moderate labour during work	54	.31	23	1.04	57	.88
	heavy labour during work	54	.09	23	.57	57	.35
	moderate or heavy housework	55	1.13	23	.74	57	1.14
	moderate or heavy gardening	55	.67	23	.57	57	.61
between 40 & 60 years	moderate labour during work	24	.50				
	heavy labour during work	24	.08				
	moderate or heavy housework	24	1.04				
	moderate or heavy gardening	24	.50				
between 20 & 40 years	moderate labour during work	48	.56	23	1.26	25	1
	heavy labour during work	48	.21	22	.73	25	.36
	moderate or heavy housework	49	1.14	22	.91	25	.92
	moderate or heavy gardening	49	.65	22	.64	25	.52
youth	moderate labour during work	53	.36	25	1.08	57	1.09
	heavy labour during work	53	.21	25	.84	57	.42
	moderate or heavy housework	54	.74	25	.72	57	1.05
	moderate or heavy gardening	54	.56	25	.72	57	.63

Reliability

The reliability of the questionnaire was analysed using retest-reliability (table 14 & 15). The same group of people answered the questionnaire twice. The time interval between the two testings was one month.

Part I

“An ICC higher than 0.7 was given for most items. Items which did not meet this criterion were items assessing endurance with low or medium intensity.

Sample B achieved lower ICC’s than sample A.” (81)

Table 14

Intraclass Correlation Coefficients of part I

sample	3 weeks		3 years		40-59 y		20-39 y		youth	
	A	B	A	B	A	B	A	B	A	B
N	32-34	15-16	29-33	14-15	14-15	0	29-31	14	30-33	15
end low I	.81†	.55+	.82†	.23	.78†	-	.65†	.62	.60†	.55
end medium I	.61†	.38	.60†	.38	.93†	-	.67†	.62	.64†	.80†
end high I	.86†	.86†	.80†	.87†	.92†	-	.76†	.82†	.84†	.89†
strength/speed	.93†	.74†	.72†	.81†	.96†	-	.84†	.77†	.81†	.86†
transport	.88†	.87†	.88†	.81†	.79†	-	.78†	.93†	.78†	.94†

Abbreviations: end: endurance; I: intensity; N: sample size; sample A: normal population; sample B: exercise science students.
Note: + p < 0.1; * p < 0.05; † p < 0.01.

Part II

ICC’s higher than .7 were given for about half of the items of part II. The items concerning housework and gardening had higher ICC scores than the two items dealing with moderate or heavy labour during work.

Table 15

Intraclass Correlation Coefficient of part II

Sample	3 years		youth		20-39 y		40-59 y	
	A	B	A	B	A	B	A	B
N	32-34	12	32-34	12-14	29-31	12	15	0
moderate labour during work	.68†	.45	.62†	.44	.44+	.85†	.81†	-
heavy labour during work	.58†	.59	.40+	.75†	.45+	.74*	.25	-
moderate or heavy housework	.77†	.86†	.62†	.93†	.73†	.95†	.90†	-
moderate or heavy work in the garden	.83†	.04	.65†	.34	.71†	.54	.89†	-

sample A: normal population; sample B: exercise science students.
Note: + $p < 0.1$; * $p < 0.05$; † $p < 0.01$.

Validity

Correlations (Spearman's-Rho) between the items and the validity criteria were calculated (table 16). "Correlations with exercise test results higher than 0.4 were found in the following items: Endurance with high intensity during the previous three years and $P_{max,rel}$, endurance with high intensity during the previous three weeks and $P_{max,rel}$, sports with high speed and/or strength impact during the previous three years and $\dot{V}O_{2max,rel}$. The latter correlation was not expected.

Also some correlations higher than 0.4 were found which were not expected: Sports with high speed and/or strength impact during the previous three weeks and previous three years and the endurance scale.

Convergent and discriminant validity of items concerning the previous three years: Concerning convergent validity of the endurance questions, items dealing with endurance with medium and high intensity during the previous three years showed significant correlation coefficients with the tested $\dot{V}O_{2max,rel}$ and $P_{max,rel}$, and the endurance scale of the FFB-mot. There were also significant correlations found with hand strength (with endurance with high intensity; $r_{52} = 0.29$; $p < 0.05$) and the strength scale of the FFB-mot (with endurance with moderate intensity; $r_{54} = 0.31$; $p < 0.05$; with endurance with high intensity; $r_{54} = 0.28$; $p < 0.05$). However, these correlation coefficients were lower than the expected ones. Endurance with low

intensity during the previous three years correlated significantly only with the endurance scale of the FFB-mot ($r_{54} = 0.27$; $p < 0.05$).

Sports with high speed and/or strength impact during the previous three years correlated significantly with related exercise tests namely hand strength, arm strength, speed, and jumping height. However, there were also significant coefficients with the tested endurance parameters. These coefficients were by trend even higher than the coefficients with related constructs. Additionally, this item correlated significantly with all scales of the FFB-mot, whereas the correlation with the strength scale was the highest ($r_{54} = 0.54$; $p < 0.01$).

Convergent and discriminant validity of items concerning the previous three weeks: Endurance with low intensity during the previous three weeks showed neither significant correlations with the exercise tests, nor with the scales of the FFB-mot. Endurance with medium intensity during the previous three weeks correlated significantly with $\dot{V}O_{2max,rel}$. ($r_{54} = 0.28$; $p < 0.05$) and with the endurance scale of the FFB-mot as well ($r_{54} = 0.37$; $p < 0.01$), no significant correlation was found with $P_{max,rel}$, ($r_{54} = 0.25$; ns.), but with the strength scale of the FFB-mot ($r_{54} = 0.30$; $p < 0.05$). Endurance with high intensity during the previous three weeks correlated significantly with the endurance parameters of the exercise tests and the endurance scale of the FFB-mot; there were also significant correlations with the other scales of the FFB-mot: strength, coordination, and flexibility.

The item asking about sports with high speed and/or strength impact during the previous three weeks was only significantly related to hand strength and jumping high. There was no significant correlation with arm strength and speed, but significant correlations with the endurance parameters of the spirometric test. The items correlated with all four scales of the FFB-mot. Also, for this item the correlation with the strength scale was the highest. ($r_{54} = 0.51$; $p < 0.01$).

Concerning transport during the previous three years and the previous three weeks there was no significant relationship with any of the validity criteria.

Summing up: Most of the items of the questionnaire were moderately correlated with exercise tests and scales of the FFB-Mot that measure similar constructs (convergent validity) and showed lower correlations with constructs that should not be related to them (discriminant validity). Therefore, the criteria of convergent and discriminant validity were fulfilled.” (81)

Table 16

Convergent and discriminative validity of sample A; part I

PAB	exercise tests								FFB-Mot				
	endurance		strength		flex	bal	sp	jh	end	str	flex	coo	
	$\dot{V}O_{2\max}$ kg	P_{\max} kg	hand	arm			V_{\max}						
3 weeks	end low I	.13	.21	.25	.12	-.01	-.11	.11	-.02	.20	.08	.23	.25
	end med I	.28*	.25	.01	.11	-.12	-.15	.17	.01	.37†	.30*	.24	.18
	end high I	.38†	.51†	.24	.05	.02	.15	.18	.24	.65†	.3†	.29*	.36*
	str/speed	.35*	.31*	.25*	.16	-.06	-.07	.17	.35*	.41†	.51†	.32*	.41†
	transport	-.08	-.08	.23	.08	.02	-.17	.01	.08	-.04	.09	.17	.16
3 years	end low I	.12	.21	.15	.15	.07	.04	.19	.11	.27*	.10	.08	.18
	end med I	.30*	.35†	-.02	.11	-.13	.11	.15	.16	.44†	.31*	.23	.15
	end high I	.30*	.47†	.29*	.27	-.01	.10	.15	.09	.62*	.28*	.24	.24
	str/speed	.40†	.36†	.36†	.32*	-.02	-.01	.29*	.36†	.47†	.54†	.33*	.39†
	transport	-.13	-.04	.08	-.09	-.06	.04	-.15	-.17	.06	.06	.16	.12

Abbreviations: I: intensity; end: endurance; str: strength; flex: flexibility; bal: balance; sp: speed with load of 4% of the body weight; jh: jumping height; coo: coordination.

Note: * $p < 0.05$; † $p < 0.01$.

Factorial Analyses

“In order to find out whether the different types of PA during different time frames assessed by the PAB could be found as independent factors, a factor analysis was conducted.” (81)

Because of the high number of missing values pairwise exclusion of missing values was chosen. Only few people (N=23) could answer questions which deal with sport and transport (part I) or occupational PA (part II) at the age of 40 years and older. Therefore, only items of the time frames: last 3 years, last 3 weeks, (youth) and, between 20 and 40 years (=20 items) were included.

Part I

“The Bartlett Test of Sphericity was significant which means that the given correlation matrix differed significantly from the identity matrix ($\chi^2_{190} = 1479.36$; $p < 0.01$). The factorial analysis found four factors with Eigenvalues larger than 1 (Kaiser Criterion). The scree plot also justified retaining four components. 71.6% of

all variance could be explained by the four factors.” (81) Table 17 shows the factor loadings after the Varimax rotation for part I. “The items that clustered on the same factors suggest that component one represents lifetime endurance with vigorous intensity, component two lifetime PA during transport, component three lifetime sports with high speed and/or strength impact and component four lifetime endurance with low intensity. All different types of PA that have been assessed loaded on independent factors, except for endurance with medium intensity and endurance with high intensity; these two PA categories loaded on the same factor. The internal consistency of the scales with values between 0.84 and 0.9 can be considered as good. “ (81)

Table 17

*Communalities (h^2) and factor loadings of the rotated principal components
($N=141$)*

<i>Time frame</i>	<i>PA</i>	<i>Components</i>				
		<i>h^2</i>	1	2	3	4
prev. 3 weeks	end low I	.66	.25	.2	-.02	.74
	end mod I	.65	.67	.14	-.12	.40
	end high I	.71	.81	.04	.25	.03
	str./speed	.80	.20	.02	.87	-.01
	transport	.74	.09	.82	.18	.19
prev. 3 years	end low I	.80	.18	.13	.03	.87
	end mod I	.71	.74	.01	-.01	.41
	end high I	.68	.76	.06	.29	.13
	str./speed	.84	.17	.07	.90	.03
	transport	.76	.11	.84	.08	.21
20- 40 years	end low I	.84	.16	.15	.01	.89
	end mod I	.72	.70	.15	-.03	.45
	end high I	.82	.87	.03	.25	.09
	str./speed	.87	.20	.22	.88	-.04
	transport	.83	.05	.88	.16	.18
youth	end low I	.52	.22	.41	.09	.54
	end mod I	.55	.55	.42	-.08	.27
	end high I	.55	.63	.35	.17	.02
	str./speed	.64	-.03	.08	.79	.03
	transport	.64	.14	.79	-.01	.05
<i>Eigenvalue</i>			7.24	3.15	2.52	1.41
<i>% of variance</i>			22.40	17.10	16.49	15.65
α			.90	.89	.90	.84

Part II

The Bartlett Test of Sphericity for part II was significant ($\chi^2_{66} = 889.95$; $p < 0.001$). Based on the Kaiser criterion and an analysis of the scree plot four factors were obtained. Table 18 depicts the resulting factor loadings and communalities of the 12 analysed items. Component 1 seem to represent lifetime gardening, component 2 lifetime PA during housework, component 3 lifetime moderate labour and component 4 lifetime heavy labour. Every type of physical activity loaded on a distinct factor. All factor loadings were definite and high. The same types of physical work loaded on the same factor independently from the time frame. All scales showed high reliabilities, all Cronbach's α were above .80.

Table 18

Communalities (h^2) and factor loadings of the rotated principal components
($N=136$)

Time frame	PA	h^2	Components			
			1	2	3	4
prev. 3 years	moderate lab.	.82	.06	.02	.88	.19
	heavy labour	.75	-.08	.09	.11	.85
	household	.86	.19	.90	-.02	.10
	gardening	.90	.92	.23	.07	.03
20-40 years	moderate lab.	.79	.01	.15	.87	.12
	heavy labour	.83	.19	.25	.19	.83
	household	.88	.19	.90	.03	.20
	gardening	.86	.86	.29	.12	.14
16-20 years	moderate lab.	.73	.08	-.09	.83	.16
	heavy labour	.86	.18	.11	.24	.87
	household	.73	.29	.79	.08	.14
	gardening	.83	.89	.16	-.03	.07
	Eigenvalue		4.60	2.53	1.54	1.17
	% of variance		21.89	20.96	19.67	19.43
	α		.91	.89	.83	.86

Discussion

Item Analysis

Part I

“Item difficulty of sample A was moderate and slightly higher than for samples B and C, which was to be expected because sample B and C consisted of physical education students, who were trained on a higher level than the participants in sample A. It was found that items assessing endurance with high intensity showed higher item difficulty for most items (i.e. a low average amount of PA time per week was stated) than those asking about endurance with low or moderate intensity. Training sessions with high intensity are more demanding than sessions with lower intensity and people need more time for recreation. They are rather conducted by athletes and individuals following special training goals. According to Sjöström and colleagues (103) adults spend more time on moderate intensity PA (including walking) compared to vigorous PA. The items concerning sports with high speed and/or strength demands showed rather high difficulties in sample A and rather low difficulties in samples B and C. This might be due to the fact that many exercise science or physical education students were currently or have been participating in such sports (like volleyball, handball, basketball, soccer, tennis, badminton etc.) in a club or team; this was stated by them in the demographical questionnaire (currently participating: sample B: 10 out of 26; sample C: 26 out of 60; have been playing in the past: sample B: 14 out of 26; sample C: 29 out of 60). Normal distribution was given for all items and samples (except for two items in sample A).” (81)

Part II

Most of the items of part II did not meet the criteria of being normally distributed and having a moderate item difficulty. This does not necessarily mean that this part of the questionnaire was designed badly or did not work. The observed effect is rather due to the fact that the samples consisted of very homogenous groups in terms of education. 78.2% of all participants of sample A and all of the participants of sample B and C graduated high school and obtained

an Abitur (university- entrance diploma) or finished a study at university. People with high education levels are less likely to work in physically demanding jobs. The results also reflect social changes in society such as the decline of PA levels at work in industrialized countries (104). Sample B showed highest mean values concerning physical labor during work. This might be due to the fact, that people in sample B were currently studying exercise science or physical education. They probably considered studying as their job and since there are many different practical courses in the study program of exercise science or physical education at the University of Graz they reached higher scores concerning this question.

Reliability

Part I

“Retest-reliability was satisfying ($ICC \geq 0.7$) for most items. However, there were rather low ICC values for items dealing with endurance with low or medium intensity. It was probably difficult for the participants to distinguish between endurance with low intensity and endurance with medium intensity. This is not surprising because endurance with low and endurance with medium intensity merge and there is no strict borderline between them. Further, the description of intensity regimes is not a part of everyday’s conversation in the population, and the accuracy of verbal descriptions of intensity levels is limited.” (81) Altschulter and colleagues (105) demonstrated that many participants understand the word “intensity” in terms of emotional or psychological intensity rather than physical effort. Hence, the perceived intensity with which a participant reported doing a specific activity often bore little relationship to the objective intensity. *“The ability of the participants to distinguish between these intensity levels may be increased by giving more examples, rather than descriptions. The effect that sample B achieved lower ICC’s than sample A can be explained by the higher homogeneity of the participants concerning sports and PA and the lower sample size.”* (81)

Part II

The items dealing with physical activity during work have lower reliability than those asking about gardening and housework. This effect may occur,

because the participants had problems distinguishing between moderate and high intensity labour during work. In order to solve this problem more information and more examples on these two item categories should be provided. Another possible solution could be the combination of these two items into one. However, this solution could lead to a new problem: the rating scale ending with 16 or more hours of labour per week, which could become too inaccurate for certain groups e.g. heavy workers who e.g. spend 30 h per week and more working under physically demanding conditions. Additionally, there was a rather low variability in the ratings which could have also led to low correlation coefficients. In further studies more inhomogenous samples concerning the education level and the amount of physical activity during work should be tested. Moreover, in order to get more meaningful results concerning gardening and housework urban and rural population should be investigated. Retest- reliability analyses with larger sample sizes, consisting of at least 50 participants, should be conducted as suggested by Terwee and colleagues (55).

In order to evaluate part II with an adequate sample and to increase our knowledge concerning the quality criteria of the PAB, further research is necessary and should be carried out in the future. For this purpose, a request for a continuative research project was prepared and should be submitted to the Styrian federal state government (Appendix B).

Validity

According to van Poppel et al. (55) the following criteria of content validity for PA questionnaires have to be achieved: the questionnaire should measure at least duration and frequency of PA and for measuring total PA the questionnaire should cover activities in all settings (work, home, transport, recreation and sports). In general, these two criteria are given for the PAB: The product of duration and frequency of an activity results in the amount of this activity. Duration and frequency are therefore indirectly assessed by asking about the total amount of physical activity per week. Furthermore, the questionnaire covers settings such as transport, work, household, gardening and sports. Recreational PA as another

important setting was not taken into account, because other studies did not find it as an independent factor (106)

Content validity for both parts was analyzed: discussions with two experts on PA about the suitability of the items in the questionnaire were carried out and the results were included in the construction of the questionnaire.

“Demonstrating adequate validity criteria is very challenging when creating PA questionnaires. Especially for those questionnaires dealing with lifetime PA, this was only possible with complex and time-consuming longitudinal studies over decades.” (81) According to Winters-Hart et al. (86) one way to validate a historical PA questionnaire could be to *“... compare the historical questionnaire with subjective or objective data collected in the past.”* However, obtaining foretime data was impossible in this study and only items concerning recent PA were analyzed in terms of construct validity.

Van Poppel et al. (93) name objective measures of PA such as doubly labeled water, accelerometers or pedometers as construct criteria with the best level of evidence (level 1 and 2) for PA questionnaires. Other frequently used *“...constructs not really measuring current PA”* (55), such as the Body Mass Index (BMI) or the Maximal Oxygen Uptake ($\dot{V}O_{2max}$) or another questionnaire, a PA diary or interview are considered as less adequate validity criteria (level 3) (93). In case of the PAB the use of those level 1 or 2 criteria is not reasonable: Lifetime PA is assessed and it is almost impossible to make people carry an accelerometer or a pedometer throughout years. Additionally, the questionnaire does not only assess the amount of time walking or running, but also forms of static PA like strength training or aspects of physical work. Pedometers probably will not accurately register energy expenditure during activity not involving the lower limbs (12). A steelworker, for instance, might not walk a lot, but nevertheless is physically very active during work. *“Accelerometers for the assessment of physical activity, are based on the measurement of body movement, that is, the dynamic component of physical activity.”* (93). Accelerometers cannot be used to measure the static component of exercises, like lifting weights or carrying loads. It was hypothesized that, in normal daily life the effect of static exercise on the total level of physical activity would be negligible (107). This fact may account for the average person, but not for heavy workers or weight lifters. The measurement of

the amount of energy expended, and respectively the amount of physical activity would be underestimated. According to Ainsworth's compendium of PA (108) working in a steel mill corresponds to an energy expenditure of 8 METs, which is the same energy expenditure as running with 5 miles per hour. Lifting weights with vigorous effort is described as energy expenditure of 6 METs which is the same energy expenditure as doing a jog and walk combination (with a jogging component less than 10 minutes) or bicycling with 10 to 11.9 mph. Therefore, it is reasonable to say that static PA is not negligible and should also be assessed properly.

The doubly labeled water method can only measure the average metabolic rate over a period of time not longer than 2 weeks. Consequently, it cannot be used for validating items asking about PA during longer time frames, for instance during the last 3 years. Additionally, according to Terwee and colleagues (2010) the doubly water methods is not a perfect gold standard. They quote that the measured energy expenditure is not only caused by PA, but also by the basal metabolic rate and the thermic effect of food. Furthermore, the doubly water method is not perfectly reliable and valid (55), but very expensive (109).

Consequently, the PAB must have been validated using other validation criteria. *"In this study, construct validity was determined by comparing the results of the PAB with actual physical fitness assessed by exercise tests and a physical fitness questionnaire. Based on numerous controlled exercise training studies, Blair (4) stated that there is a strong relationship between PA and physical fitness: "Physical activity and physical fitness are closely related in that physical fitness is mainly, although not entirely, determined by physical activity patterns over recent weeks or months" (4). According to Blair (4) prospective studies on the relationship between physical fitness and mortality show higher inverse associations than studies on PA and mortality. He explained this effect by a smaller amount of misclassification when measuring physical fitness compared to PA. Physical fitness is measured with more objective methods (e.g. exercise tests), while PA is usually measured by subjective self-report methods (e.g. diary, questionnaires) (95). Summing up PA and physical fitness are closely related, whereas physical fitness can be measured more precisely. Consequently, the assessment of PA was not evaluated with another method testing PA, but with a more precise,*

related parameter: physical fitness. According to Forsén et al. (110), many other studies on PA questionnaires also used some kind of physical fitness variables, namely various health or physical function variables, like chair stand, 6- minutes walking test, BMI, $\dot{V}O_{2max,rel}$ etc. as comparison instruments.

According to the Multitrait-Multimethod-procedure (63) we expected to find higher correlation values between similar types of variables assessed with different methods (convergent validity) and lower coefficients between different types of variables assessed with the same or different methods (discriminant validity). This held true for many coefficients, but not for all. The coefficients were rather low and the criterion of a correlation coefficient higher than 0.4 was not always fulfilled. Items assessing endurance with medium and high intensity were not only related to endurance performance determined by means of spirometry and the endurance scale of the FFB-mot questionnaire, but also to the strength scale of the FFB-mot, however with a lower coefficient. Sports with high speed and/or strength impact appeared to be a very broad category as it correlated not only with related criteria, like hand strength, arm strength, speed, jumping height, and the strength and coordination scale of the FFB-mot, but also with $\dot{V}O_{2max,rel}$ and $P_{max,rel}$, and all four scales of the FFB-mot. The speed/strength items correlated at the same or even a higher level with the endurance variables of the incremental cycle test when compared to the results of the strength and speed exercise tests. In this regard, it is important to mention that the effects of different types of training can be overlapping. For example, not only endurance training can improve the $\dot{V}O_{2max,rel}$, but also training for speed (111); further, it is well-known that strength training can improve endurance performance (112). The effects of a special type of PA may vary largely depending on intensity, duration, load, current fitness status, and individual characteristics: “We are all individuals and, whereas physiological responses to particular stimuli are generally predictable, one individual’s precise response and adaptation to those stimuli are largely unpredictable and will vary from those of others” (113). It must be considered that a special type of PA can influence many aspects of physical fitness (endurance, speed, coordination, strength etc.), in particular when persons do not start out from a high performance level. Nevertheless, there are certain PA types that influence particular dimensions of physical fitness more than others, therefore higher correlations between these variables were expected. It should be taken into

account that also the genes are considered to be an important factor concerning the development of physical fitness (114, 115). The results obtained may also be explained by the allocation of different types of sports to the items: the participants were told to relate ball sports like basketball, soccer etc. to sports with high speed and/or high strength impact. However, for these kinds of sports also the factor endurance is very important. For such complex sorts of sports it is very difficult to allocate them to a certain type of exercise. Nevertheless, this questionnaire aims to figure out a distinct category for strength and speed, although the assessment of this faces principal problems and limitations.” (81)

Factor Analysis

“In the factor analysis four factors were found. One factor included endurance with moderate and high intensity whereas the other factors only included one type of PA each, namely endurance with low intensity, PA with high speed and/or strength impact, and transport. As the retest-reliability of the items dealing with endurance with medium intensity was low and the factorial analysis showed that both medium and high intensity endurance items loaded on the same factor, it might be reasonable to merge these two questions in a new version of the PAB into one. However, as the mean values for all time frames of the items endurance with medium intensity and endurance with high intensity were above 2 and 1, respectively, combining these variables could lead to skewness of the distribution of the ratings and lower item difficulty, which would reduce the differentiation ability of the items. Therefore, we decided to keep the present intensity graduation of the endurance items, but endurance with medium and high intensity should be combined when calculating factors. “ (81)

The factorial analysis of the items of part II also revealed four factors: moderate intensity labour, high intensity labour, housework and gardening. The factors correspond to the types of PA assessed.

The PAB and PA Recommendations

“Many recommendations about the minimum amount of PA to gain health benefits refer to the terms moderate and vigorous PA. For example, the American College of Sports Medicine (ACSM) recommends: “To promote and maintain health, all healthy adults aged 18 to 65 yr need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 min on three days each week” (19). Furthermore, endurance exercise should be amended by resistance and flexibility training: “In addition to aerobic exercise, people should engage in resistance training and flexibility exercises at least twice a week, which will promote the maintenance of lean body mass, improvements in muscular strength and endurance, and preservation of function, all of which enable long-term participation in regular physical activity and promote quality of life” (116).

This questionnaire could help to assess the amount of these types of PA and assist individuals to find out whether they have met the recommendations or not. According to Haskell et al. (19), the ACSM exemplifies aerobic PA with moderate intensity as brisk walking, which noticeably accelerates the heart rate. Vigorous-intensity aerobic PA can e.g. be achieved by jogging and causes rapid breathing and a substantial increase in heart rate (19). These types of aerobic PA can be easily assessed by the PAB: The amount of leisure-time aerobic PA with moderate intensity can be tested by analyzing the items concerning endurance with low intensity and transport. The leisure-time vigorous-intensity PA can be measured with the items concerning endurance with medium and high intensity. Resistance-type training can be assessed with the items dealing with sports with high speed and/or strength demand.” (81)

Assessing Metabolic Equivalents of Task by the PAB

“As most questionnaires use the Metabolic Equivalent of Task (MET) to estimate the energy expenditure of different types of PA (76), the PAB should also enable its users to do so. 1 MET is equivalent to $4184 \text{ J kg}^{-1} \text{ h}^{-1}$ (108, 117), i.e. 1.16 W kg^{-1} , and this is considered as resting metabolic rate obtained during quiet sitting. We scanned through the Compendium of PA (108) and listed exemplarily different types of PA and their MET values and allocated them to the different item

categories of the PAB." (81) (see Appendix A) *"From these lists, average METs for each type of items were deduced [...]."* (81) The resulting list is displayed in table 19. As a second outcome *"... these values can be used to estimate a person's energy expenditure based on their answers in the PAB."* (81) The deduced information on the average amount of different types of PA during certain time frames can be easily transformed into METs by multiplication.

Table 19

Average METs for the different types of items for part I and II

Item	Average METs
Part I	
Endurance with low intensity	5
Endurance with moderate intensity	7
Endurance with high intensity	11
Sports with high speed and / or strength impact	9
Transport	3
Part II	
Moderate labour	3.5
Heavy labour	7
Household	3.5
Gardening	5

"However, it has to be pointed out that such an approach would ignore that high speed or strength training with its specific effects may have impact on prevention and treatment of diseases which cannot be expressed in terms of average energy expenditure." (81) The Compendium of PA (108) is a frequently used tool to estimate the METs of an activity and is utilized in numerous questionnaires assessing PA (76, 118). Using METs as a measure of energy expenditure has both, advantages and disadvantages: An advantage of the METs as a ratio of work metabolism to basal metabolism is that it *"...eliminates the necessity of considering the subjects body weight, converting the work to calories, et cetera."* (67) It is assumed that a certain kind of PA performed by a heavy

person raises his/her metabolism to the same extent as the same task performed by a light-weight person (67). However, the caloric expenditure can be different.

A limitation of METs is that data on certain types of PA is still lacking (67). Furthermore, energy cost for the same type of PA can vary depending on skill, equipment, environmental conditions, terrain etc. (67). Physical activities can also be carried out in different manners among various cultures (67), so MET tables have to be amended when applied in non-American cultures.

Moreover, it should be kept in mind that the adequacy of this scientific convention is questionable (119). For example, the values concerning the resting metabolic rate of the compendium were found to overestimate the mean average values of 769 healthy participants by 20% to 35% (119). Because of these limitations it is more reasonable to use METs to allocate people into different PA categories than to assume to measure precise quantitative values (67).

Limitations

“The construction of a questionnaire analyzing biographical PA is a very complex process, hence this study has several limitations: Certain trainings sessions, e.g. soccer training, can include endurance training and training for speed or strength. Thus, it is sometimes hard to allocate such training session to a certain type of PA provided in this questionnaire.

Of course, longitudinal reliable data on the amount of PA during certain lifetime frames are notoriously hard to get. Therefore, in the present study only the actual fitness status of the time of the questionnaire evaluation could be assessed.

A larger sample size for the study would empower the statistical analysis; however the number of participants could not be enlarged as desired, because of the complexity of the investigation.

The items were only tested for people aged between 18 and 56, thus, the items concerning the time frame “above 60 years” could not be evaluated yet. In a further study the PAB should be tested with a group of elderly people too. For elderly people, answering the questionnaire can be quite difficult as they have to recall how much and what kind of PA they did many decades before. Older people may have a larger recall bias than younger people when answering questions about early life time frames (86). According to Kriska and Caspersen (74), questionnaires focusing on leisure and occupational PA are rather valid for younger and healthier populations. For older or diseased populations, questionnaires dealing with low-level leisure activities and activities of daily living (like cooking, bathing etc.) could be more accurate (120). Hence, the items concerning recent PA may be not suitable for such populations.

It may be useful to evaluate the PAB also with other high quality PA questionnaires (93), like e.g. the IPAQ (76), although they do not consider PA biography and also different types of PA.

The questionnaire has been presented in German and tested in a German-speaking population; a version in English exists already, however the applicability in English-speaking populations is to be tested.” (81)

Self-report questionnaires, like the PAB, are culturally dependent; hence, they are not directly applicable to other populations, ethnic groups or geographical regions.

Conclusion

It is difficult to compare the results of the PAB with other studies evaluating different PA questionnaires: Some studies used different analytic methods to generate their results, like Spearman correlation (79, 83, 86) or Pearson correlation coefficients (77). Some studies tested selective samples, e.g. colon cancer patients (56), middle aged women (80) or used interview-based methods (56, 77, 79, 83).

Nevertheless, despite the complexity of the study question, the results of the PAB fulfilled the expectations concerning item difficulty, normal distribution, reliability and validity. *“The PAB is the only questionnaire that can assess biographical and recent physical activity with adequate reliability and validity with only two pages of questions. This is a major incremental benefit when compared to other questionnaires used today. Further, it is easy to administer, analyse and interpret the results. As only rating scales are provided for answering the questions, automatic processing is possible and the PAB can be used to test a large sample with low costs and efforts. Because of the PAB’s shortness it can also be embedded in larger test batteries.”* (81)

“The questionnaire introduced here is the only questionnaire which aims to measure biographical PA and which is designed to distinguish between different types of PA. Although this is a very complex question, the results fulfilled the expectations concerning item difficulty, normal distribution, reliability and validity.” (81) Part I of the PAB can be used as a self- assessment tool to determine the amount of recreational PA and PA in the course of transport a person has accomplished. The applicability of part II has to be tested in further studies. *“The risk of developing non-communicable diseases depends largely on the PA biography (121). Among these diseases are e.g. cardiovascular diseases (Blair et al., 1996), certain types of cancer (122), non–insulin-dependent diabetes mellitus (123), certain bone diseases (124), mental disorders (125) etc. In this context the PAB may become an important measurement tool for risk assessment.*

Although the evaluation of a questionnaire dealing with such a difficult question, involves a very large effort, it appears to be warranted to further develop this questionnaire and to evaluate it with larger samples, including elderly people in order to increase the informative value.” (81)

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APPENDIX A: METs

(I) Examples for the types of PA assessed in part I (Sports and Locomotion) and the corresponding METs and codes according to Ainsworth et al. (2000):

Endurance with low intensity

Code	Physical Activity	METs
01020	bicycling, 10-11.9mph, leisure, slow, light effort	6.0
02012	bicycling stationary, 100 watts, light effort	5.5
17200	walking for exercise, 3.5 mph, level, brisk, firm surface	3.8
17210	walking, 3.5mph, uphill	6.0

Endurance with moderate intensity

Code	Physical Activity	METs
19090	skiing, cross country, 4.0-4.9 mph, moderate speed and effort, general	8.0
12020	jogging, general	7.0
12010	jog/walk combination (jogging component of less than 10 min)	6.0
01030	bicycling, 12-13.9 mph, leisure, moderate effort	8.0
02013	bicycling, stationary, 150 watts moderate effort	7.0

Endurance with high intensity

Code	Physical Activity	METs
12090	running, 8mph	13.5
02014	stationary bicycling, 200 watts, vigorous effort	10.5
19100	skiing, cross country, 5.0-7.9 mph, brisk speed, vigorous effort	9.0
01040	bicycling, 14-15.9 mph, racing or leisure, fast, vigorous effort	10.0
01050	bicycling, 16-19 mph, racing / not drafting or >19 mph drafting, very fast, racing general	12.0

transport

Code	Physical Activity	METs
17161	walking from house to car or bus, from car or bus to go places,	2.5

	from car or bus to and from worksite	
17270	walking, to work or class	4.0
01010	Bicycling, <10 mph, leisure, to work or for pleasure	4.0

Sports with high speed and / or strength impact

Code	Physical Activity	METs
19160	skiing, downhill, moderate effort, general	6.0
19170	skiing, downhill, vigorous effort, racing	8.0
15605	soccer, competitive	10.0
15610	soccer, casual, general	7.0
15690	tennis, singles	8.0
15710	volleyball	4.0
15711	volleyball, competitive, in gymnasium	8.0
15320	handball, general	12.0
15040	basketball, game	8.0
15050	basketball, general	6.0
15100	boxing, in ring, general	12.0
02050	weight lifting (free weight, nautilus or universal-type), power lifting or body building, vigorous effort	6.0

(II) Examples for the types of PA assessed in part II (Physical Activity at Work, at Home, Gardening) and the corresponding METS and codes according to Ainsworth et al. (2000):

moderate labour

Code	Physical Activity	METS
11875	teach physical education, exercise, sports classes (non-sport play)	4.0
11130	electrical work, plumbing	3.5
11070	chambermaid, making bed (nursing)	2.5
11485	masseur, masseuse (standing)	4.0

heavy labour

Code	Physical Activity	METS
11030	building road (including hauling debris, driving heavy machinery)	6.0
11050	carrying heavy loads, such as bricks	8.0
11100	coal mining, general	6.0
11300	forestry, general	8.0
11710	steel mill, working in general	8.0

household

Code	Physical Activity	METS
05030	cleaning, house or cabin, general	3.0
05021	mopping	3.5
05043	vacuuming	3.5
05130	scrubbing floors, on hands and knees, scrubbing bathroom, bathtub	3.8

gardening

Code	Physical Activity	METS
08050	digging, spading, filling garden, composting	5.0
08095	mowing lawn, general	5.5
08165	raking lawn	4.0
08200	shovelling snow, by hand	6.0

APPENDIX B: Request for promotion of a research project

Ansuchen um die Förderung eines Forschungsprojekts

Name:

MMag. Sandra Rogen

Projekttitel:

Erfassung der Retest-Reliabilität der Physical Activity Biography- Teil II

Beschreibung der Studie:

Körperliche Aktivität ist ein zentraler Gesundheitsfaktor, der, neben der genetischen Disposition, eine wichtige Rolle bei der Prävention und der Therapie von vielen lebensstil- assoziierten Erkrankungen (Kardiovaskulären Erkrankungen, Krebs, Diabetes) spielt (Kohl et al., 2012; Lee et al., 2012). Im Gegensatz zur genetischen Disposition kann die körperliche Aktivität allerdings aktiv vom Einzelnen beeinflusst werden. Somit ist es von großer Bedeutung Methoden zu entwickeln, um körperliche Aktivität messen zu können.

Ein neuer Fragebogen (Physische Aktivitäts- Biographie) wurde entwickelt, um körperliche Aktivitäten, wie sportliche Tätigkeiten, Transport, körperliche Aktivität im Beruf, im Haushalt und im Garten zu erfassen. Mit Hilfe des PABs können Informationen zur körperlichen Aktivität von der Jugend bis hin zu den letzten 3 Wochen erfragt werden.

Ziel der Studie: Evaluierung beider Teile des PABs (Teil I: Sport und Transport; Teil II: Arbeit, Haushalt und Gartenarbeit) an einer Stichprobe von 150 Personen mittels Itemanalyse (Prüfung auf Normalverteilung, Itemschwierigkeit) und Retest-Reliabilität eines Monats.

Request for promotion of a research project

Name:

MMag. Sandra Rogen

Project title:

Assessment of retest-reliability of the Physical Activity Biography- Part II

Beside the genetic disposition, physical activity is one of the major health factors and can play a large role in the prevention and therapy of many diseases (cardiovascular diseases, cancer, obesity-related diseases etc.) (Kohl et al., 2012; Lee et al., 2012). In contrast to the genetic disposition, physical activity can be deliberately influenced by lifestyle. Therefore, it is of high importance to assess physical activity patterns.

In order to assess physical activity reliably and validly, a new questionnaire (Physical Activity Biography, PAB) was created. Part I of the PAB (Sport and Transport) enables to distinguish between endurance intensity levels and considers strength and high speed activity patterns throughout life. Part II (Work, Housework and Gardening) differentiates between moderate and intensive occupational PA and further assesses the amount of PA during housework and gardening during different lifetime frames (youth till age ≥ 60 years; previous 3 years, previous 3 weeks).

This study aims to evaluate the PAB in a sample of 150 participants by means of item analysis (normal distribution and item difficulty) and retest-reliability of one month.

Es wird um die Finanzierung folgender Beträge, die im Zuge der Projektdurchführung anfallen, ersucht:

Application for financing the following expenditures, resulting from the research project:

1. Verbrauchsmaterialien für die Fragebogenuntersuchung	
<i>Consumption items for the research project (mainly questionnaires)</i>	
Kopierkosten/ <i>costs of photocopying</i>	250 €
2. Personalkosten/ personal expenditures	
Psychologin für Auswertung und Interpretation der Ergebnisse	
A psychologist for the analysis and interpretation of the results	
auf Werkvertragsbasis/ <i>on contract basis</i>	
300 Stunden (40€/ Stunde)/ <i>300 hours (40€/hour)</i>	12 000 €
3. Probanden Entgelt/ study participants	
(Fahrtgeld und je 1 Stunde Untersuchung an 2 Testzeitpunkten)	
<i>(Travel expenses and 1 hour participation in the study at each of the two testing times)</i>	
150 Probanden ⁶ (40 € pro Proband)	6 000 €
<i>150 participants⁷ (40 € per participant)</i>	6 000 €
GESAMTKOSTEN/ TOTAL COSTS:	<u>18 250 €</u>

⁶ 120 ProbandInnen (Walter, Eliasziw & Donner, 1998) plus 30 ProbandInnen als Reserve.

⁷ 120 participants (Walter, Eliasziw & Donner, 1998) plus 30 participants in reserve.

Literatur/References:

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APPENDIX C: PAB English version

Part I and II of the PAB (Physical Activity Biography)

English Version



Physical Activity Biography

PAB

Code: _____
Date: _____
Date of Birth: _____
<input type="checkbox"/> female <input type="checkbox"/> male

draft 27 02 13A engl

Instruction:

Part I „Sport and Locomotion“

Please answer the questions by marking the respective boxes. Tick only one box per question. Make sure that you work through all the questions and respond to them honestly and conscientiously. Keep in mind that all sporting activities (also physical education classes at school, exercise classes at the gym etc.) are relevant and need to be reported.

Rating Scale:

0... 0 hours 1... 1 hour 2... 2 hours 3...3 hours 4...4 hours or more

PLEASE read carefully! Help for answering the questions:

Endurance sports (e.g.: running, swimming, cycling, cross country skiing, hiking, fast walking etc.)

- with low intensity:* slight increase in breathing frequency, talking is possible
- with moderate intensity:* medium increase in breathing frequency; sweating; speaking is aggravated, but possible
- with high intensity:* large increase in breathing frequency, profuse sweating, speaking is not possible anymore

Sports with high speed and/or strength demand

Some sports demand not just endurance, but also strength and speed (f.i. ball games, skiing etc.) Please declare these sports only at the questions concerning “*sports with high speed and/or strength demand*”.

How many hours per week during the **latest 3 years** have you been (on average)

	0	1	2	3	4
doing endurance with low intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with medium intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with high intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing sports with high impact of speed and/or strength?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cycling or walking for transport reasons (shopping, going to work etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How many hours per week during the **latest 3 weeks** have you been (on average)

	0	1	2	3	4
doing endurance with low intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with medium intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with high intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing sports with high impact of speed and/or strength?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cycling or walking for transport reasons (shopping, going to work etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How many hours per week during **your youth** have you been (on average)

	0	1	2	3	4
doing endurance with low intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with medium intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with high intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing sports with high impact of speed and/or strength?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cycling or walking for transport reasons (shopping, going to work etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

In the following part, please only respond to those questions which you can answer according to your age. Tick the appropriate boxes:

Please only answer the following questions, if you are 20 years or older:

How many hours per week **between the age of 20 and 40** have you been (on average)

	0	1	2	3	4
doing endurance with low intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with medium intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with high intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing sports with high impact of speed and/or strength?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cycling or walking for transport reasons (shopping, going to work etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please only answer the following questions, if you are 40 years or older:

How many hours per week **between the age of 40 and 60** have you been (on average)

	0	1	2	3	4
doing endurance with low intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with medium intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with high intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing sports with high impact of speed and/or strength?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cycling or walking for transport reasons (shopping, going to work etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please only answer the following questions, if you are 60 years or older:

How many hours per week **since you are 60 years old** have you been (on average)

	0	1	2	3	4
doing endurance with low intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with medium intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing endurance with high intensity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
doing sports with high impact of speed and/or strength?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
cycling or walking for transport reasons (shopping, going to work etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part II „Physical Activity at Work and at Home; Gardening“:

This rating scale applies to the following questions:

0... 0 hours 1... 1-5 hours 2... 6-10 hours 3... 11-15 hours 4... 16 hours or more

How many hours per week during **the latest 3 years** have you been doing

	0	1	2	3	4
moderate labour (e.g.: working in a warehouse) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
heavy labour (e.g.: construction work) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy housework?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy gardening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How many hours per week **between 16 and 20 years** have you been doing

	0	1	2	3	4
moderate labour (e.g.: working in a warehouse) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
heavy labour (e.g.: construction work) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy housework?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy gardening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please respond only to those questions, which you can answer according to your age:

Please only answer these questions, if you are 20 years or older:

How many hours per week **between 20 and 40 years** have you been doing

	0	1	2	3	4
moderate labour (e.g.: working in a warehouse) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
heavy labour (e.g.: construction work) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy housework?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy gardening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please only answer these questions, if you are 40 years or older:

How many hours per week **between 40 and 60 years** have you been doing

0	1	2	3	4
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

moderate labour (e.g.: working in a warehouse) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
heavy labour (e.g.: construction work) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy housework?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy gardening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please only answer these questions, if you are 60 years or older:

How many hours per week **since you are 60** have you been doing

	0	1	2	3	4
moderate labour (e.g.: working in a warehouse) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
heavy labour (e.g.: construction work) at work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy housework?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
moderate or heavy gardening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Thank you for your participation!

APPENDIX D: PAB German Version

Part I and II of the PAB (Physical Activity Biography)

German Version



Physische Aktivitäts- Biographie PAB

Name: _____

Datum: _____

Geburtsdatum: _____

weiblich männlich

draft 12 10 11

Anweisung zu Teil I „Sport und Fortbewegung mit eigener Kraft“:

Bitte beantworten Sie die Fragen durch Ankreuzen des jeweiligen Kästchens. Achten Sie darauf, alle Fragen zu bearbeiten und beantworten Sie diese ehrlich und gewissenhaft. Denken Sie bei der Beantwortung der Fragen an alle sportlichen Tätigkeiten (auch Sportunterricht, Kurse usw.). Kreuzen Sie bitte bei jeder Frage nur ein Kästchen an.

Für die folgenden Fragen gilt diese Antwortskala:

0... 0 Stunden 1... 1 Stunde 2... 2 Stunden 3...3 Stunden 4... 4 Stunden oder mehr

BITTE genau durchlesen! Hilfe zur Beantwortung der Fragen:

Sportliche Ausdauerleistungen (z.B.: Laufen, Schwimmen, Radfahren, Langlaufen, Bergwandern, schnelles Gehen etc.)

Mit niedriger Anstrengung: leichte Erhöhung der Atemhäufigkeit; Sprechen möglich

Mit mittlerer Anstrengung: mittelstarke Erhöhung der Atemhäufigkeit; Schwitzen; Sprechen erschwert, aber noch möglich

Mit hoher Anstrengung: starke Erhöhung der Atemhäufigkeit; starkes Schwitzen; Sprechen nicht mehr möglich

Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand:

Manche Sportarten oder Tätigkeiten erfordern sowohl Ausdauer, als auch Kraft und Schnelligkeit (z.B.: Ballspiele, Schifahren etc.). Tragen Sie diese Trainingszeiten nur unter „Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand“ ein.

Wie viele Stunden haben Sie in den **letzten 3 Jahren** durchschnittlich pro Woche

	0	1	2	3	4
sportliche Ausdauerleistungen mit niedriger Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit mittlerer Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit hoher Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand betrieben?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wegstrecken mit dem Fahrrad oder zu Fuß zurückgelegt (einkaufen, Weg zur Arbeit etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Wie viele Stunden haben Sie in den **letzten 3 Wochen** durchschnittlich pro Woche

	0	1	2	3	4
sportliche Ausdauerleistungen mit niedriger Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit mittlerer Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit hoher Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand betrieben?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wegstrecken mit dem Fahrrad oder zu Fuß zurückgelegt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Wie viele Stunden haben Sie **in ihrer Jugend** durchschnittlich pro Woche

	0	1	2	3	4
sportliche Ausdauerleistungen mit niedriger Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit mittlerer Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit hoher Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand betrieben?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wegstrecken mit dem Fahrrad oder zu Fuß zurückgelegt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beantworten Sie von den folgenden Fragen nur jene, die Sie gemäß Ihres Alters beantworten können. Kreuzen Sie das zutreffende Kästchen an:

Bitte beantworten Sie diese Frage nur, wenn Sie über 20 Jahre alt sind:

Wie viele Stunden haben Sie **zwischen dem 20. und 40. Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
sportliche Ausdauerleistungen mit niedriger Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit mittlerer Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit hoher Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand betrieben?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wegstrecken mit dem Fahrrad oder zu Fuß zurückgelegt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beantworten Sie diese Frage nur, wenn Sie über 40 Jahre alt sind:

Wie viele Stunden haben Sie **zwischen dem 40. und 60. Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
sportliche Ausdauerleistungen mit niedriger Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit mittlerer Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit hoher Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand betrieben?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wegstrecken mit dem Fahrrad oder zu Fuß zurückgelegt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beantworten Sie diese Frage nur, wenn Sie über 60 Jahre alt sind:

Wie viele Stunden haben Sie **ab dem 60. Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
sportliche Ausdauerleistungen mit niedriger Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit mittlerer Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
sportliche Ausdauerleistungen mit hoher Anstrengung erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sport mit hohem Schnelligkeitsanteil oder hohem Kraftaufwand betrieben?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wegstrecken mit dem Fahrrad oder zu Fuß zurückgelegt?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Anweisung zu Teil II „Körperliche Arbeit im Beruf, Haushalt, Garten“:

Bitte beantworten Sie die folgenden Fragen mit der folgenden Antwortskala:

0... 0 Stunden **1**... 1-5 Stunden **2**... 6-10 Stunden **3**... 11-15 Stunden **4**... 16 Stunden oder mehr

Wie viele Stunden haben Sie in den **letzten 3 Jahren** durchschnittlich pro Woche

	0	1	2	3	4
mittelschwere körperliche Arbeit (z.B.: Lagerarbeit) im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
schwere körperliche Arbeit (z.B.: Bauarbeit) im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Arbeit im Haushalt erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Gartenarbeit erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Wie viele Stunden haben Sie **zwischen dem 16. und 20 Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
mittelschwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
schwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Arbeit im Haushalt erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Gartenarbeit erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beantworten Sie von den folgenden Fragen nur jene, die Sie gemäß Ihres Alters beantworten können. Kreuzen Sie das zutreffende Kästchen an:

Bitte beantworten Sie diese Frage nur, wenn Sie über 20 Jahre alt sind:

Wie viele Stunden haben Sie **zwischen dem 20. und 40. Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
mittelschwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
schwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Arbeit im Haushalt erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Gartenarbeit erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beantworten Sie diese Frage nur, wenn Sie über 40 Jahre alt sind:

Wie viele Stunden haben Sie **zwischen dem 40. und 60. Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
mittelschwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
schwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Arbeit im Haushalt erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Gartenarbeit erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte beantworten Sie diese Frage nur, wenn Sie über 60 Jahre alt sind:

Wie viele Stunden haben Sie **ab dem 60. Lebensjahr** durchschnittlich pro Woche

	0	1	2	3	4
mittelschwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
schwere körperliche Arbeit im Beruf erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Arbeit im Haushalt erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
mittelschwere oder schwere Gartenarbeit erbracht?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Vielen Dank für Ihre Mitarbeit!

APPENDIX E: FFB-mot

Physical Fitness Questionnaire (Fragebogen zur Erfassung des motorischen Funktionszustandes) (96)

Fragebogen zur Erfassung des motorischen Funktionszustandes

Wie gut können Sie folgende Tätigkeiten bewältigen? Bitte geben Sie zu den nächsten 28 Fragen eine spontane Einschätzung ab.

Neben jeder Frage finden Sie 5 Kästchen:

- 1... *Ich kann diese Tätigkeit nicht*
- 2... *Ich habe große Probleme*
- 3... *Ich habe mäßige Probleme*
- 4... *Ich habe leichte Probleme*
- 5... *Ich habe keine Probleme*

kann ich nicht

keine Probleme

Kreuzen Sie bitte das Kästchen an, das Ihrer Einschätzung am ehesten entspricht. Es kommt nicht darauf an, die Tätigkeit oft durchgeführt zu haben, entscheidend ist, was Sie sich wirklich zutrauen.

Können Sie ...	Bewertungsskala:				
	1	2	3	4	5
... auf einem Stuhl sitzend ohne Hilfe der Arme aufstehen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... einen schweren Einkaufskorb (8kg) über mehrere Etagen tragen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... eine volle Bierkiste in den Keller tragen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... aus der Rückenlage ohne Hilfe der Arme den Oberkörper aufrichten (Situp)....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... einen schweren Koffer über Kopfhöhe heben (z.B.: im Zug auf die Gebäckablage)...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... zwei schwere Koffer über mehrere Etagen tragen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... eine Hantel mit mehr als Ihrem Körpergewicht hochstemmen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... um mehrere Häuserblocks flott gehen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... mehrere Treppen hochgehen ohne sich auszuruhen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... zwei Kilometer schnell gehen („walken“) ohne auszuruhen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... einen Kilometer ohne Pause joggen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... 30 Minuten ohne Pause joggen (ca. 5 km).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... eine Stunde ohne Pause joggen (ca. 10 km).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... einen Marathonlauf (42 km) laufen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... einen engen Pulli und Socken alleine aus- und anziehen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... auf einem Stuhl sitzend mit den Händen den Boden erreichen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... im Stehen Schuhe binden.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... mit der Hand von unten auf dem Rücken ein Schulterblatt berühren.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... aus dem Stand (Knie gestreckt) mit den Händen den Boden erreichen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... im Stehen mit dem Kopf die gestreckten Knie berühren.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... rückwärts bis in die Brücke abbeugen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... eine Treppe hinab gehen, ohne sich festzuhalten.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... auf einem Bein stehen, ohne sich festzuhalten (für mind. 15 Sekunden).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... einen Purzelbaum.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... im schnellen Gehen einen Ball prellen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... mit Abstützen über einen 1 m hohen Zaun springen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... freihändig mit dem Fahrrad um eine Kurve fahren.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
... ein Rad schlagen.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX F: Demographic Questionnaire

Demographical data questionnaire

Anweisung zur Generierung Ihres persönlichen Codes:

- 1. + 2. Stelle = erste zwei Buchstaben des Vornamens der Mutter
- 3. + 4. Stelle = Tag Ihres Geburtsdatums.
- 5. + 6. Stelle = erste zwei Buchstaben ihrer Adresse

Beispiel: Angenommen, Ihre Mutter heißt Anna, Sie sind am 15.3.1980 geboren und ihre Adresse ist Musterweg 75, dann sähe ihre Code wie folgt

aus:

AN15MU

Ihr persönlicher Code lautet: _ _ _ _ _

Bitte den Code selbstständig in die dafür vorgesehenen Felder im Fragebogen eintragen!

Code: _ _ _ _ _

Personendatenblatt

Bitte füllen Sie nun Folgendes aus:

Alter: _____

Körpergröße: _____

Derzeitiges Gewicht: _____

Höchstes Gewicht als Erwachsene(r) (außer Schwangerschaft): _____

Niedrigstes Gewicht als Erwachsene(r): _____

Bitte zutreffendes ankreuzen bzw. ausfüllen:

Geschlecht:

männlich weiblich

Ethnologische Zugehörigkeit:

weiße Hautfarbe (Kaukasier) orientalisches schwarze Hautfarbe
 lateinamerikanisch asiatisch indisch

Staatsangehörigkeit:

Österreich andere

Familienstand:

ledig verheiratet/in Partnerschaft geschieden/ verwitwet

Derzeitige Beschäftigung:

- ArbeiterIn / Angestellte(r) (als _____)
- Selbstständig (als _____)
- StudentIn (Studienrichtung _____)
- andere Ausbildung (als _____)
- Hausfrau/mann
- Arbeitssuchend
- In Pension
- Sonstiges: _____

Berufsalltag:

Beinhaltet Ihre berufliche Vollzeittätigkeit vorwiegend...

- ... sitzende Tätigkeiten (z.B.: StudentIn, Büroangestellte(r) usw.)
- ... mäßige Bewegung (z.B.: HandwerkerIn, VerkäuferIn, Hausfrau/mann usw.)
- ... intensive Bewegung (z.B.: BauarbeiterIn, BergarbeiterIn usw.)

Erfordert Ihr Beruf Nacharbeit?

- ja
- nein

Wenn ja, wie viele Stunden arbeiten Sie im Monat nachts? ____ Stunden

Wie viele Jahre sind Sie zur Schule gegangen? ____ Jahre

Höchste abgeschlossene Ausbildung:

- Hauptschule
- Mittelschule
- Lehre
- Matura
- Abgeschlossenes Studium
- Sonstiges: _____

Wie bewerten Sie Ihren Gesundheitszustand?

Allgemein: sehr gut gut weniger gut schlecht

Psychisch/ seelisch: sehr gut gut weniger gut schlecht

Sportlicher Hintergrund:

Zurzeit würde ich mich einstufen als...

- ... Hobbysportler
- ... Leistungssportler

(Ich übe einen Sport intensiv, planmäßig und regelmäßig mit dem Ziel aus, im Wettkampf eine hohe Leistung zu erzielen)

- ... Hochleistungssportler

(Ich übe einen Sport intensiv, planmäßig und regelmäßig mit dem ausdrücklichen Ziel, aus Spitzenleistungen im internationalen Maßstab zu erzielen)

- ... Ich betreibe derzeit keinen Sport

Wettkämpfe:

- Ich habe nie an sportlichen Wettkämpfen teilgenommen.

Ich nehme derzeit teil an Wettkämpfen in der/ den

Sportarten _____ bei ...

(Mehrfachantworten möglich)

- ... Vereins- bzw. clubinternen Meisterschaften
 ... regionalen Wettkämpfen
 ... landesweiten Wettkämpfen
 ... nationalen Wettkämpfen
 ... internationalen Wettkämpfen
 ... Weltmeisterschaften bzw. Olympischen Spielen

Ich habe in der Vergangenheit teilgenommen an Wettkämpfen in der/ den

Sportarten _____ bei...

(Mehrfachantworten möglich)

- ... Vereins- bzw. clubinternen Meisterschaften
 ... regionalen Wettkämpfen
 ... landesweiten Wettkämpfen
 ... nationalen Wettkämpfen
 ... internationalen Wettkämpfen
 ... Weltmeisterschaften bzw. Olympischen Spielen

Alkohol:

Trinken Sie zurzeit alkoholische Getränke (Bier, Wein, Spirituosen etc.)

- ja nein, nicht mehr, aber früher nein, noch nie (weniger als 10 Gläser Alkohol im Leben)

Wie oft trinken Sie Alkohol oder haben Sie Alkohol getrunken?

- 1 mal pro Tag oder öfter 4- 6 mal pro Woche 1-3 mal pro Woche
 2- 3 mal im Monat einmal pro Monat oder seltener

Rauchen:

Rauchen Sie zurzeit?

- ja gelegentlich (weniger als 5 Zigaretten pro Woche)
 nein, nicht mehr, aber früher nein, noch nie (max. 100 Zigaretten im Leben)

Haben oder hatten Sie eine Krebserkrankung?

- ja nein

Wenn ja, hatten Sie den Primärtumor vor dem 35. Lebensjahr?

- ja nein

Tumorart:

- Brustkrebs Eierstockkrebs Prostatakrebs
 Darmkrebs Gebärmutterkrebs Bauchspeicheldrüsenkrebs
 Nierenkrebs Schilddrüsenkrebs Nebennierenkrebs
 Leberkrebs Andere: _____

Zeitpunkt (Datum) der Diagnose: _____

Familiäre Vorbelastung:

Hatten oder haben ihre Eltern Krebs?

- Mutter Vater nein

Hatte oder haben eines oder mehrere ihrer Geschwister Krebs?

- ja nein Einzelkind

Nur von Frauen zu beantwortende Fragen zu Schwangerschaft, Regelblutung und Wechseljahren:

Wann hatten Sie Ihre erste Regelblutung?

- mit unter 12 Jahren zwischen 12 und 17 Jahren mit über 17 Jahren

Waren Sie jemals schwanger (einschließlich Fehl- und Totgeburten)? ja nein

Anzahl der geborenen Kinder: _____

Haben Sie ihre Kinder gestillt? ja nein

Nehmen Sie oder haben Sie jemals die Antibabypille eingenommen? ja nein

Wenn ja, wie lange nehmen Sie diese bzw. haben Sie die Antibabypille eingenommen? Gesamteinnahmezeit :

- unter 1 Jahr mehr als 1 Jahr mehr als 5 Jahre

Falls Sie die Antibabypille nicht mehr einnehmen, wie lange liegt die letzte Einnahme zurück?

- unter 1 Jahr mehr als 1 Jahr

Haben Ihre natürlichen Regelblutungen bereits dauerhaft aufgehört? ja nein

Wenn ja, in welchem Alter hatten Sie zum letzten Mal natürliche Regelblutungen?

War das vor Ihrem 45. Lebensjahr der Fall? ja nein

War das nach Ihrem 55. Lebensjahr der Fall? ja nein

Warum haben Ihre natürlichen Regelblutungen aufgehört?

Wechseljahre (Menopause) ja nein

Gebärmutterentfernung, Entfernung der Eierstöcke ja nein

Haben Sie zurzeit oder hatten Sie Regelblutungen aufgrund der Einnahme von Hormonersatzpräperaten? ja nein

Wenn ja, wie lange nehmen Sie bzw. haben Sie Hormonersatzpräparate eingenommen?

- unter 1 Jahr mehr als 1 Jahr

APPENDIX G: Subject Information

Subject Information and informed consent

INFORMATIONSBLATT

zur wissenschaftlichen Studie
Erfassung der Bewegungsgewohnheiten

LiebeR TeilnehmerIn,

die Untersuchungen umfassen folgende Teile:

1. Ausfüllen des Fragebogens zu Bewegungsgewohnheiten (ca. 15 Minuten)
2. Spiroergometrie am Fahrradergometer zur Erfassung der Ausdauerleistungsfähigkeit und der damit verbundenen physiologischen Parameter Laktat (LTP1 und LTP2), RQ, Herzfrequenz. (ca. 30 Minuten)
3. Tests zur Beurteilung der Beweglichkeit, Gleichgewichtsfähigkeit, Schnelligkeit und Kraft (ca. 30 Minuten)

Nach 4 Wochen ist noch ein weiterer kurzer Fragenbogen auszufüllen (5-10 Minuten) und zu diesem Zeitpunkt bekommen alle Teilnehmer die Ergebnisse der durchgeführten Tests in schriftlicher und grafischer Form und eine Beurteilung ihres Fitnesszustandes (Ausdauer, Schnelligkeit, Kraft, Beweglichkeit, Balance).

Die Teilnahme an dieser Untersuchung ist freiwillig und kann zu jedem Zeitpunkt ohne Nennung von Gründen und ohne Nachteil für Sie abgebrochen werden. Zu Ihrer Sicherheit wird während des Tests ein Arzt anwesend sein. Ihre Daten werden streng vertraulich behandelt und die Weiterverarbeitung ihrer Angaben und Ergebnisse erfolgt in anonymisierter Form (mittels Code). Die Zuordnung ihres Namens zu dem Code wird in einem Safe aufbewahrt werden und wird nur dem Projektleiter Univ.-Prof. Mag. Dr. Wolfram Müller und der Versuchsleiterin Mag. Sandra Rogen und zugänglich sein. Sie können die Löschung der Daten jederzeit, auch nach Abschluss der Untersuchung, verlangen. Bei Fragen wenden Sie sich bitte an das Testpersonal. Die Untersuchung wird ungefähr 60 bis 90 Minuten in Anspruch nehmen.

Herzlichen Dank für Ihre Mithilfe!



Information und Einwilligungserklärung

zur Studie

„Evaluation des Fragebogens zur Erfassung von Bewegungsgewohnheiten“

Derzeit wird am *Zentrum für Bewegungswissenschaften und sportmedizinische Forschung* in Graz ein Fragebogen entwickelt, der die Bewegungsgewohnheiten verschiedener Personengruppen erfassen soll. Um die Qualität dieses neuen Fragebogens zu überprüfen und den Fragebogen gegebenenfalls zu verbessern, ist es erforderlich, dass eine sehr große Personenanzahl den Fragebogen beantwortet. Ihre Teilnahme an dieser Untersuchung wäre für diese Studie sehr wichtig.

Die Teilnahme an dieser Untersuchung ist freiwillig und kann zu jedem Zeitpunkt ohne Nennung von Gründen und ohne Nachteil für Sie abgebrochen werden. Ihre Daten werden streng vertraulich behandelt und die Weiterverarbeitung ihrer Angaben und Ergebnisse erfolgt in anonymisierter Form. Sie können die Löschung der Daten jederzeit, auch nach Abschluss der Untersuchung, verlangen.

Ich erkläre hiermit, dass ich freiwillig an dieser Fragebogenuntersuchung teilnehme und die hier angeführten Daten in anonymisierter Form für wissenschaftliche Zwecke verwendet werden dürfen.

Ort, Datum

Unterschrift Proband/in

APPENDIX H: Record Sheets- Exercise Tests

Record sheet exercise tests



Datenblatt Testbatterie

Datum: _____

Uhrzeit: _____

Code: _____

Sitzgröße: _____ cm Gewicht: _____ kg Körpergröße: _____ cm

BEWEGLICHKEIT

1. M. Iliopsoas
2. M. Pectoralis Major
3. M. Rectus Femoris
4. Ischiocrurale Muskulatur
5. M. Adductores
6. M. Triceps surae
7. M. Tibialis Anterior
8. M. Erector Spinae

Rechts

1	2	3
1	2	3
1	2	3
1	2	3
1	2	3
1	2	3
1	2	3
1	2	3

Links

1	2	3
1	2	3
1	2	3
1	2	3
1	2	3
1	2	3
1	2	3
1	2	3

1... unterhalb des Normbereichs 2... innerhalb des Normbereichs 3... oberhalb des Normbereichs

Anmerkung:

KOORDINATION

1. Stand, offene Augen
2. Stand, Augen geschlossen
3. Zehenstand, offene Augen
4. Zehenstand, geschl. Augen

Rechts	
Ja	Nein
Ja	Nein
Ja	Nein
Ja	Nein

Links	
Ja	Nein
Ja	Nein
Ja	Nein
Ja	Nein

Beidbeinig	
Ja	Nein
Ja	Nein
Ja	Nein
Ja	Nein

Dauer : 10 sec.

Anmerkung:

SCHNELLIGKEIT

F_R [% G]	Last [kg]	v_{max} [m/s]	$P_{r,max}$ [W]	SP [W]	SP_{rel} [W/kg]
4					
10					

Anmerkung:

KRAFT

1. Handkraft

Rechts: F_{max} : _____ N F_{max} / m : _____ N/kg

Links: F_{max} : _____ N F_{max} / m : _____ N/kg

2. Klimmzüge

	F_{min} (Anzeige)	F_{max}	F_{max} / m
Rechts			
Links			

3. Sprungkraft (Quattro Jump)

F_{max}	F_{max} / m	PJP	JP	Höhe

Anmerkung:

APPENDIX I: Feedback Folder

Example of the feedback folder the participants received (sample A)



Studie zur Erfassung der Bewegungsgewohnheiten und der aktuellen Leistungsfähigkeit

Untersuchungsleiterin: Mag. Sandra Rogen

FEEDBACK

Zentrum für Bewegungswissenschaften
und sportmedizinische Forschung
Max-Mell-Allee 11
A- 8010 Graz
Austria

Zentrumsleitung: Univ.-Prof. Dr. Mag. Wolfram Müller

Studie zur Erfassung der Bewegungsgewohnheiten und der aktuellen Leistungsfähigkeit

Personendaten

Testdatum: 12.5.2009


- Name: X. Y.
- Geburtsdatum: TT.MM.1989
- Alter: 20 Jahre
- Geschlecht: weiblich










Medizinische Daten




- Blutdruck
 - Blutdruck bei Testbeginn: 130/70 mmHg (*normal*)
 - Blutdruckanstieg unter Belastung bis max. 219/82 mmHg (*normal*)
- EKG
 - Ruhe- und Belastungs-EKG: keine Auffälligkeiten (*SR, unauffällige Endstrecken*)


Testdaten

- Anthropometrie (*Messung der Körpermaße*)
 - Größe: 1,65 m
 - Gewicht: 68,0 kg
 - BMI: 25,3
 - MI: 24,6
- Spiroergometrie* (*Ausdauerleistungstest*)
 - Maximale Leistung: 140 W
 - Maximale relative Leistung: 2,1 W/kg 😊😊😊😊😊
 - Dauerleistungsgrenze (*Leistung am LTP2*): 91 W
 - Körpergewichtsbezogene Dauerleistungsgrenze: 1,3 W/kg 😊😊😊😊😊
 - Maximale Sauerstoffaufnahme: 1,97 l/min
 - Maximale relative Sauerstoffaufnahme: 30,3 ml/min/kg 😊😊😊😊😊
 - Maximale Herzfrequenz: 191 1/min

- Ergometrie (*Schnelligkeit bei 4% vom Körpergewicht*)
 - Last: 2,8 kg
 - Geschwindigkeit: 130,7 U/min 

- Kraft
 - Absolute Handkraft
 - Rechts: 314 N 
 - Links: 284,5 N 
 - Relative Handkraft
 - Rechts: 4,56 N/kg 
 - Links: 4,13 N/kg 
 - Absolute Armkraft (*Klimmzug*)
 - Rechts: 187 N 
 - Links: 192 N 
 - Relative Armkraft (*Klimmzug*)
 - Rechts: 2,71 N/kg 
 - Links: 2,79 N/kg 
 - Schnellkraft
 - Sprunghöhe: 21,1 cm 

- Balance
 - Rechts: 5/8 Punkte 
 - Links: 3/8 Punkte 
 - Beidbeinig: 8/8 Punkte 

- Beweglichkeit 32 Punkte 

	Rechts:	Links:
○ Hüftbeuger (<i>M. iliopsoas</i>)	leicht verkürzt	leicht verkürzt
○ Großer Brustmuskel (<i>M. pectoralis major</i>)	gut	gut
○ Gerader Schenkelmuskel (<i>M. rectus femoris</i>)	leicht verkürzt	leicht verkürzt
○ Oberschenkelrückseite (<i>Mm. ischiocrurales</i>)	leicht verkürzt	leicht verkürzt
○ Schenkelanzieher (<i>Mm. adductores</i>)	gut	gut
○ Dreiköpfiger Wadenmuskel (<i>M. triceps surae</i>)	stark verkürzt	stark verkürzt
○ Vorderer Schienbeinmuskel (<i>M. tibialis anterior</i>)	stark verkürzt	stark verkürzt
○ Rückenstrecker (<i>M. erector spinae</i>)	leicht verkürzt	leicht verkürzt

Studie zur Erfassung der Bewegungsgewohnheiten und der aktuellen Leistungsfähigkeit

Legende

BMI (Body Mass Index) und MI (Mass Index):

Der BMI ist ein Index zur Beurteilung des Körpergewichts. Der MI ist ein Index, der zur Beurteilung des Körpergewichts auch die Beinlänge berücksichtigt. Bei mittlerer Beinlänge sind BMI und MI gleich.

unter 18,5

zwischen 18,5 und 24,9

zwischen 25,0 und 29,9

über 30,0

Untergewicht

Normalgewicht

Übergewicht

Fettleibigkeit (Adipositas)

Beurteilung der Leistungsfähigkeit:

Die Beurteilung erfolgt auf Basis von alters- und geschlechtsspezifischen Normen.



hervorragend

sehr gut

gut

normal

könnte besser sein

* durchgeführtes Protokoll bei der Spiroergometrie:

Stufentest mit 10 Watt Steigerung pro Minute, Startbelastung 20 Watt, Abbruch: bei Ausbelastung

ANHANG I

Auswertung der Spiroergometrie

Ausdauer

Diss Rogen 12.05.2009 (e:\datens~1\testun~1\kw20~1\fertig~1\e_s2)

PERSONENDATEN

Name
 Adresse
 Adresse
 Geb.Datum
 Größe 165 cm
 Gewicht 68 kg
 Training Stunden/Woche
 Ruhepuls 1/min
 Bemerkung

UNTERSUCHUNGSDATEN

Test Diss Rogen
 Datum 12.05.2009
 Startzeit 22:55:33
 Bemerkung
 Bemerkung

BERECHNETE WERTE

PWC 170 87,5 Watt
 PWC 150 55,6 Watt
 PWC 130 00,0 Watt
 P max 140,0 Watt
 P max/kg 02,1 Watt/kg
 HRschwelle/HRmax 90 %
 Pschwelle/Pmax 65 %
 Schwelle = LTP 2

SCHWELLEN UND MAXIMALWERTE

	HR 1/min	P Watt	P/kg	Laktat mmol/l	V'E [l/min]	sV'O2 [l/min]	sV'CO2 [l/min]	Eq. O2 []	Eq. CO2 []
Maximum	191	140	2.1	12.4	90.79	1.97	2.13	42.78	39.59
HRT	173	94	1.4	4.8	44.81	1.52	1.5	27.19	27.6
LTP 1	145	49	.7	2.1	26.55	1.19	1	20.47	24.44
LTP 2	172	91	1.3	4.6	42.63	1.5	1.44	26.24	27.22
TP V'E	171	91	1.3	4.5	42.12	1.49	1.43	26.02	27.13

TRAININGSTABELLE

Intensität %	HR 1/min	P Watt	Laktat mmol/l	
60 - 70	149 - 156	55 - 64	2.4 - 2.7	Regeneration
70 - 80	156 - 161	64 - 73	2.7 - 3.2	low pace endurance
80 - 90	161 - 168	73 - 82	3.2 - 3.9	medium pace endurance
90 - 97	168 - 170	82 - 89	3.9 - 4.3	fast pace endurance
97 - 105	170 - 175	89 - 96	4.3 - 5	ext. intervals
100 % = LTP 2				

Diss Rogen 12.05.2009 (e:\datens~1\testun~1\kw20~1\fertig~1\e_s2)

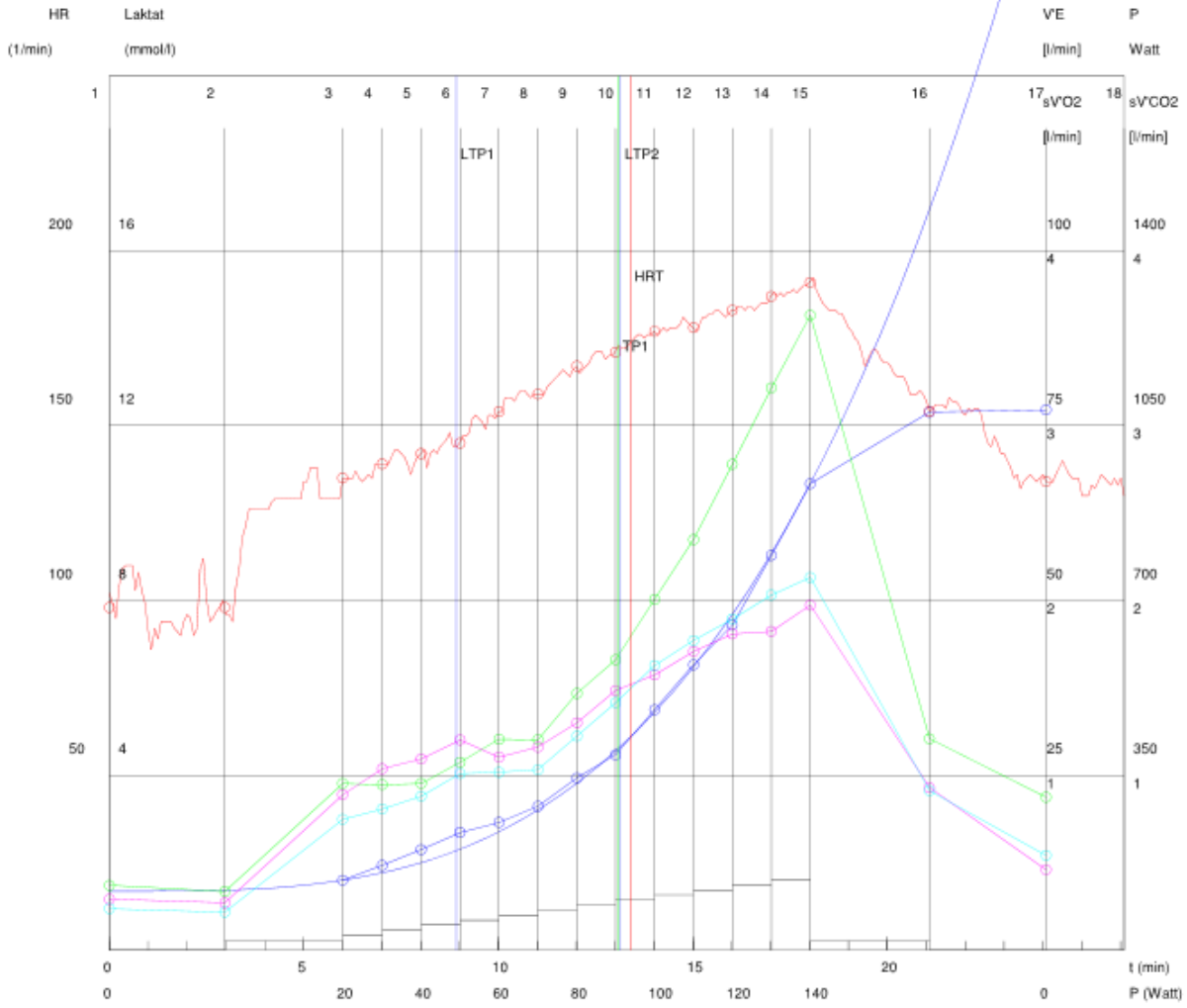
ZWISCHENZEITWERTE

Zeit	P	HR	Laktat	V'E	sV'O2	sV'CO2
hh:mm:ss	Watt	1/min	mmol/l	[l/min]	[l/min]	[l/min]
00:00:00	0	98	0	9,25	,291	,237
00:02:58	0	98	0	8,374	,27	,217
00:06:00	20	135	1,6	23,826	,889	,748
00:07:01	30	139	1,94	23,651	1,037	,807
00:08:01	40	142	2,3	23,82	1,093	,88
00:09:01	50	145	2,69	26,856	1,202	1,01
00:10:01	60	154	2,92	30,139	1,104	1,018
00:11:01	70	159	3,29	30,097	1,162	1,032
00:12:01	80	167	3,94	36,69	1,3	1,224
00:13:01	90	171	4,47	41,53	1,485	1,415
00:14:01	100	177	5,5	50,147	1,574	1,628
00:15:01	110	178	6,53	58,697	1,708	1,772
00:16:01	120	183	7,44	69,475	1,808	1,893
00:17:01	130	187	9,03	80,392	1,823	2,031
00:18:01	140	191	10,67	90,79	1,973	2,132
00:21:05	20	154	12,31	30,221	,929	,912
00:24:05	0	134	12,36	21,849	,459	,541
00:26:05	0	0	0	0	0	0

HR WERTE

102	99	95	104	109	110	110	110	103	108	103	99
91	86	92	89	94	94	94	94	92	91	90	94
96	95	90	92	109	112	100	94	95	97	98	100
96	96	94	104	109	118	121	126	126	126	126	126
126	126	128	129	129	129	129	129	129	129	129	129
134	134	138	138	138	129	129	129	129	129	129	129
135	135	135	135	137	135	134	135	136	135	139	139
139	139	139	141	143	143	142	141	139	136	139	141
142	143	138	142	143	142	144	145	146	148	144	144
145	147	147	148	152	153	152	151	149	153	153	152
154	154	158	158	158	157	159	160	160	159	158	159
159	159	159	161	162	163	164	165	166	165	164	166
167	165	166	167	168	170	171	171	171	169	170	170
171	173	172	172	173	174	175	176	176	175	176	176
177	176	177	178	177	178	178	178	179	181	180	179
178	177	179	181	181	182	182	183	183	182	181	182
183	183	184	184	183	184	184	183	184	185	185	185
187	188	187	188	187	188	188	189	188	189	190	190
191	192	189	187	185	184	183	183	183	182	182	180
178	177	175	174	171	167	169	171	172	171	169	168
168	167	165	164	164	164	162	159	159	159	160	159
157	154	155	156	156	156	155	158	157	157	156	154
153	155	154	155	155	153	148	145	144	147	145	142
142	140	138	135	136	132	134	135	136	135	134	135
136	134	134	134	136	138	140	138	136	135	135	135
130	130	130	133	132	134	136	135	134	133	135	133
135	130	0	0	0	0	0	0	0	0	0	0

Diss Rogen 12.05.2009



ANHANG II

Auswertung der Testbatterie

Schnelligkeit
Kraft
Gleichgewicht
Beweglichkeit

Nummer: 2

Datum: 12.05.2009

Name: X.Y.

Körpergröße: 1,650 m

Geburtsdatum: XXXXXXXXXX

Sitzhöhe: 0,885 m

Gewicht: 68,9 kg

Schnelligkeit:

F_R [%]	F_R [kg]	V_{max} [ms ⁻¹]	$P_{r,max}$ [W]	P_{max} [W]	$P_{max,rel}$ [Wkg ⁻¹]
4	2,8	13,07	0	359	5,21
10	6,9	6,06	-4	406	5,90

Kraft:

	Rechts:		Links:	
	F_{max} [N]	F_{max}/m [N/kg]	F_{max} [N]	F_{max}/m [N/kg]
1. Handkraft	314,00	4,56	284,50	4,13
2. Klimmzüge	187,00	2,71	192,00	2,79

	F_{max} [N]	F_{max}/m [N/kg]	PJP [W/kg]	JP [W/kg]	Höhe [cm]
3. Sprungkraft	1150	16,69	27,4	10,4	21,1

Beweglichkeit:

	Rechts:			Links:		
	1	2	3	1	2	3
1. M. Iliopsoas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2. M. Pectoralis Major	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. M. Rectus Femoris	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4. Ischiocrurale Muskulatur	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5. M. Adductores	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. M. Gastrocnemius	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
7. M. Tibialis Anterior	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8. M. Erector Spinae	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

1. gute Beweglichkeit, 2. leicht verkürzt, 3. stark verkürzt

Koordination:

	Rechts:	Links:	Beidbeinig:
1. Stand, Augen geöffnet	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2. Stand, Augen geschlossen	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
3. Zehenstand, Augen geöffnet	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4. Zehenstand, Augen geschlossen	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>