Institute for Circulatory Research and Sports Medicine

German Sport University Cologne

Head of Institute: Univ.-Prof. Dr. Wilhelm Bloch

Impact of a German campaign promoting physical activity against cancer on physical activity levels

Doctoral thesis accepted for the degree

Doktorin der Sportwissenschaft

by

Dimitra Theoklitou

from

Limassol, Cyprus

Cologne 2025

First reviewer: Univ.-Prof. Dr. Freerk T. Baumann

Second reviewer: Univ.-Prof. Dr. Wilhelm Bloch

Chair of the doctoral committee: Univ.-Prof. Dr. Mario Thevis

Thesis defended on: 3rd of June 2025

Affidavits following §7 section 2 No. 4 and 5 of the doctoral regulations from the German Sport University Cologne, February 20th 2013:

Hereby I declare:

The work presented in this thesis is the original work of the author except where acknowledged in the text. This material has not been submitted either in whole or in part for a degree at this or any other institution. Those parts or single sentences, which have been taken verbatim from other sources, are identified as citations.

I further declare that I complied with the actual “guidelines of qualified scientific work” of the German Sport University Cologne.

11th of June 2025,

Aus dem Institut für Kreislaufforschung und Sportmedizin

der Deutschen Sporthochschule Köln

Geschäftsführender Leiter: Univ.-Prof. Dr. Wilhelm Bloch

Impact of a German campaign promoting physical activity against cancer on physical activity levels

Von der Deutschen Sporthochschule Köln

zur Erlangung des akademischen Grades

Doktorin der Sportwissenschaft

angenommene Dissertation

vorgelegt von

Dimitra Theoklitou

aus

Limassol, Zypern

Köln 2025

Erster Gutachter:	Univ.-Prof. Dr. Freerk T. Baumann
Zweiter Gutachter:	Univ.-Prof. Dr. Wilhelm Bloch
Vorsitzender des Promotionsausschusses:	Univ.-Prof. Dr. Mario Thevis
Datum der Disputation:	3. Juni 2025

Eidesstattliche Versicherungen gem. § 7 Abs. 2 Nr. 4 und 5 der Promotionsordnung der Deutschen Sporthochschule Köln, 20.02.2013:

Hierdurch versichere ich:
Ich habe diese Arbeit selbständig und nur unter Benutzung der angegebenen Quellen und technischen Hilfen angefertigt; sie hat noch keiner anderen Stelle zur Prüfung vorgelegen. Wörtlich übernommene Textstellen, auch Einzelsätze oder Teile davon, sind als Zitate kenntlich gemacht worden.

Hierdurch erkläre ich, dass ich die „Leitlinien guter wissenschaftlicher Praxis“ der Deutschen Sporthochschule Köln eingehalten habe.

11. Juni 2025,

Dedication

For Anassa, Alkinoos and Andreas.

As well for Fotis, who left us so early…

Ithaka

"As you set out for Ithaka
hope your road is a long one,
full of adventure, full of discovery.
Laistrygonians, Cyclops,
angry Poseidon—don't be afraid of them:
you'll never find things like that on your way
as long as you keep your thoughts raised high,
as long as a rare excitement
stirs your spirit and your body.
Laistrygonians, Cyclops,
wild Poseidon—you won't encounter them
unless you bring them along inside your soul,
unless your soul sets them up in front of you.

Hope your road is a long one.
May there be many summer mornings when,
with what pleasure, what joy,
you enter harbors you're seeing for the first time;
may you stop at Phoenician trading stations
to buy fine things,
mother of pearl and coral, amber and ebony,
sensual perfume of every kind—
as many sensual perfumes as you can;
and may you visit many Egyptian cities
to learn and go on learning from their scholars.

Keep Ithaka always in your mind.
Arriving there is what you're destined for.
But don't hurry the journey at all.
Better if it lasts for years,
so you're old by the time you reach the island,
wealthy with all you've gained on the way,
not expecting Ithaka to make you rich.

Ithaka gave you the marvelous journey.
Without her you wouldn't have set out.
She has nothing left to give you now.

And if you find her poor, Ithaka won't have fooled you.
Wise as you will have become, so full of experience,
you'll have understood by then what these Ithakas mean."

C. P. Cavafy, "The City" from *C.P. Cavafy: Collected Poems.* Translated by Edmund Keeley and Philip Sherrard.

I would like to thank Dr. Freerk Baumann, for being an inspiration and a huge support during all these years. We reached Ithaka but we need to prepare ourselves for the next journey.

Abstract

Justifiably physical activity possesses the leading position under many health indicators and its lack is identified as a risk factor for many diseases. Huge amounts of evidence confirm the power of physical activity in cancer risk reduction for specific cancer types. Additionally physical activity can decrease the recurrence rates and during the last decades constitutes a part of the cancer treatment and rehabilitation. Numerous of health promotion campaigns try to enrich the knowledge and educate the people about the positive influence of physical activity in our health and aim to behavior changes and adoption of a healthier lifestyle.

The goal of the current study was to examine the impact of a German campaign promoting physical activity against cancer on physical activity levels of the participants and to evaluate the success of the campaign "Physical activity against cancer", which was designed to enhance physical activity behavior in Germany. Moreover the study aimed to examine the degree of familiarity of the participants with the relation between physical activity and cancer incidence and whether such knowledge represents a motivating factor to engage in a physically active lifestyle.

The results showed that the exposure to the campaign can have a positive impact on the physical activity levels and movement behavior and can encourage people to engage a healthier and more physically active lifestyle. Gender and age were identified as factors, which were related to the accessibility of the campaign. High physical activity levels were related to a higher motivation level of engaging even more physical activity for health prevention reasons. Impressively, it was stated that cancer patients and non-cancer patients had similar physical activity behavior. Furthermore it was concluded that knowledge and awareness about the fact that physical activity has a positive influence in health prevention can lead to behavioral changes and the adoption of a healthier lifestyle.

Zusammenfassung

Zu Recht nimmt körperliche Aktivität unter vielen Gesundheitsindikatoren die führende Position ein, und ihr Mangel wird als Risikofaktor für viele Krankheiten identifiziert. Riesige Evidenzmengen bestätigen die Kraft der körperlichen Aktivität bei der Reduzierung des Krebsrisikos für bestimmte Krebsarten. Zusätzlich kann körperliche Aktivität die Rezidivrate senken und ist in den letzten Jahrzehnten ein Teil der Krebsbehandlung und -rehabilitation. Zahlreiche Kampagnen zur Gesundheitsförderung versuchen, das Wissen zu bereichern und die Menschen über den positiven Einfluss körperlicher Aktivität auf unsere Gesundheit aufzuklären. Ziel sind Verhaltensänderungen und die Anpassung eines gesünderen Lebensstils.

Ziel der aktuellen Studie war es, die Auswirkungen einer deutschen Kampagne zur Förderung der körperlichen Aktivität gegen Krebs auf das körperliche Aktivitätsniveau der Teilnehmer zu untersuchen und den Erfolg der Kampagne „Körperliche Aktivität gegen Krebs“ zu bewerten, mit der das Verhalten bei körperlicher Aktivität verbessert werden soll in Deutschland. Darüber hinaus zielte die Studie darauf ab, den Grad der Vertrautheit der Teilnehmer mit dem Zusammenhang zwischen körperlicher Aktivität und Krebsinzidenz zu untersuchen und ob dieses Wissen einen motivierenden Faktor für einen körperlich aktiven Lebensstil darstellt.

Die Ergebnisse zeigten, dass sich die Exposition gegenüber der Kampagne positiv auf die körperliche Aktivität und das Bewegungsverhalten auswirken kann und die Menschen zu einem gesünderen und körperlich aktiveren Lebensstil ermutigen kann. Geschlecht und Alter wurden als Faktoren identifiziert, die mit der Zugänglichkeit der Kampagne zusammenhängen. Hohe körperliche Aktivität war assoziiert mit einem höheren Motivationsniveau bei Engagement für mehr körperliche Aktivität zur Gesundheitsprävention. Beeindruckend wurde festgestellt, dass Krebspatienten und Nichtkrebspatienten ein ähnliches körperliches

Aktivitätsverhalten hatten. Darüber hinaus wurde der Schluss gezogen, dass das Wissen und das Bewusstsein darüber, dass körperliche Aktivität einen positiven Einfluss auf die Gesundheitsprävention hat, zu Verhaltensänderungen und zur Anpassung eines gesünderen Lebensstils führen kann.

Aknowledgement

This project was financially supported by the German Cancer Aid (Deutsche Krebshilfe e.V). In addition to that we are grateful to Dr. Christos Kabitsis for his support on the statistical analysis.

TABLE OF CONTENTS

Page

LIST OF APPENTICES

Results:

„Impact of a German campaign promoting physical activity against cancer on physical activity levels"

Introduction

Physical activity has been defined from the World Health Organization (WHO) as any bodily movement produced by skeletal muscles that requires energy expenditure – including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits[1]. Exercise is a subset of physical activity that is planned, structured, and repetitive and has as a final or an intermediate objective the improvement or maintenance of physical fitness[2].

As children, we apply physical activity unconsciously through the play and as we get older, social and physical limitations do not allow us to be that active. It is totally clear that physical activity and exercise benefit our health status and everybody can profit by getting more physically active[3]. Physical activity justifiably occupies a leading position among many health indicators and its absence has been identified as a risk factor for many chronic diseases[4].

Hippocrates spoke about the importance of the natural exercise in ~400 BC, what we nowadays name as physical activity; "eating alone will not keep a man well; he must also take exercise. For food and exercise, while possessing opposite qualities, yet work together to produce health"[5]. Even years before in ~600 BC, moderate exercise considered from Susruta to offer resistance to diseases and against natural wear from aging[6].

A portion reaction connection between physical activity and untimely mortality and the primary and secondary prevention in numerous chronic diseases is being examined by several studies[3]. There are almost no age or health statuses that are not allowing us being physically active.

Nowadays, the development of specific and individual exercise programs from health specialists allowed to the majority of the people to adopt an active lifestyle and apply physical activity. It is also known that even small volumes of physical activity are connected with positive health outcomes[3].

Defining physical activity and physical inactivity

As already mentioned physical activity is defined as bodily movement produced by skeletal muscle contraction that requires energy expenditure above basal levels. It includes activities related to activities of daily life, such as housekeeping, yard work, occupational-related, leisure-related, and transportation (e.g., walking/biking to and from work/school)[1]. Physical inactivity is defined as "physical activity levels less than those required for optimal health and prevention of premature death"[8].

The difference between exercise and physical activity is that the former is scheduled based on a typical, repetitive plan and a structure aiming to the improvement of health and fitness[2]. Physical fitness encompasses a state of good health and strength resulting from physical activity and exercise. It includes at first line the cardiorespiratory fitness (CRF), as well as muscular strength and muscular fitness[2].

Unfortunately remarkable are the current physical activity rates, which are without doubt the lowest they have been in human history[9]. The decrease of these rates during the last decades and in the recent years was expectable, because of the rush mechanical development and the adoption of a sedentary lifestyle. The prognosis for the future indicates further reduction in the physical activity patterns worldwide, which are strongly connected to non-communicable health problems, a scourge for our modern world, and are definitely different than those which individuals were genetically adapted[9].

At present, physical inactivity involves at least 1 of every 5 adults worldwide[10], more often referring to more developed countries, women, the elderly and people with lower socioeconomic status. In addition, approximately 55% of time (7,7 h/day) is occupied by Sedentary Behavior, for example sitting in front of a computer, viewing television etc[11,12]. Physical inactivity is especially prevalent in the United States with an increase of the percentage of Sedentary Behavior from 55% (2003 to 2004) to 58% (2005 to 2006)[13]. A national Health Survey in USA showed that almost 2/3 of the participants did not meet the minimum criteria for physical activity, which according to the Physical Activity Guidelines for Americans included 150 minutes of moderate-intensity Physical Activity or 75 minutes of vigorous physical activity per week[14].

Physical activity recommendations

Based on long-term researches and scientific data, organizations that are relative to health topics, make recommendations about physical activity in different age groups. The World Health Organization (WHO) and the Physical Activity Guidelines Advisory Committee (PAGAC) suggest different forms and intensity of physical activity between the age groups. Generally physical activity sessions with at least 10 minutes of duration need to be performed in order to be beneficial for cardiorespiratory health[7]. Physical activity for preschool-aged children (3 to 5 years) should be engaged throughout the day to enhance growth and development[7]. Sixty minutes of moderate to vigorous-intensity physical activity should take place daily from children and adolescents between 5 to 17 years old, according to the WHO and the PAGAC[1, 7]. Furthermore the WHO suggests activities that strengthen muscle and bone, at least 3 times per week and notice that 60 minutes of daily physical activity can provide additional health benefits in this age-group[1]. The recommendations for adults (18-64 years old)

from both PAGAC and WHO refer to at least 150 to 300 minutes a week of moderate-intensity, or 75 to 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Muscle-strengthening activities should be done on 2 or more days a week[1, 7]. Additional health benefits could be achieved by an increment of the amount of moderate-intensity physical activity to 300 minutes per week[1]. For older adults, aged 65 years old and above, the PAGAC suggests multicomponent physical activity that includes balance training as well as aerobic and muscle-strengthening activities[7] and the WHO specifies with at least 150 minutes of moderate-intensity physical activity per week or at least 75 minutes of vigorous-intensity physical activity per week, or an equivalent combination of the above 2. If a moderate –intensity physical activity is increased to 300 minutes per week, then additional health benefits can be reached. For fall prevention and enhancement of balance for older adults with poor mobility, targeted balance physical activity is been suggested for 3 or more days per week. Moreover, muscle-strengthening activities should be done at least twice a week und should include the major muscle groups[1]. Generally the above recommendations accentuate that more physical activity and the avoidance of a sedentary way of living will profit almost everyone. People performing the least physical activity benefit most by even unobtrusive increases in moderate-to-vigorous physical activity.

Additional benefits could be arised from implementing more physical activity[1]. More specific, in order for Cardiovascular Diseases (CVD) to be avoided, 30 minutes, 5 times a week to reach at least 150 minutes per week of moderate exercise, or 25 minutes, 3 times a week to reach at least 75 minutes per week of vigorous activity were recommended from the American Heart Association. Moderate or vigorous intensity activities can be combined or been used separately. Even small sessions of ten to fifteen minutes each day can be beneficial. Especially for those who are interested to reduce the risk of heart attack and stroke, it is advised to engage in moderate-to-vigorous aerobic exercise for 40 minutes, three or four times a week[15].

Exercise's intensity, method, duration, and frequency can all have a significant impact on the outcome, however even the simplest task, though, is still preferable than doing nothing. Furthermore personalization is in the case of CVD prevention the key that can bring more beneficial effects[16].

The connection between exercise and diabetes 2 prevention is also confirmed. According to the METs concept, 500-1000 MET minutes per week using a mix of high and moderate intensity exercise is recommended for diabetes 2 prevention (500 MET minutes per week is equivalent to 150 minutes of walking 4.8 km/h, or 50 minutes of running 10.5 km/h). Performing resistance exercise twice a week, which includes eight to ten exercises that target the major muscle groups, with eight to twelve repetitions for each group, is been also recommended[17]. A higher fitness of 1 MET was associated with an 8% lower risk of developing diabetes[18].

Health benefits from physical activity

In general some of the benefits of physical activity are the following: helps with weight management[19-21], improves bone health[22-24], muscle strength[25-27], provides rehabilitation for chronic pains[28,29] ,improves the mental health and protects us from mental health related disorders[30-33], improves the quality of sleep[34-36] ,reduces the risk of falls[37-39], supports and protects the cardiovascular system[40-43] and has a risk reducing impact on developing chronic diseases[3,4,8,44]. Furthermore, men and women who reported high levels of physical activity and fitness were found to show reductions in the relative risk of death by about 20% to 35%[45,46].

It is well known, that weight changes are affected by the balance between the measure of energy used and the measure of energy devoured[47]. Weight gain occurs, if the energy

expenditure stays low, yet dietary utilization levels are in abundance. Numerous researches over the last 30+ years have contended that a reduction of physical activity at work[48] and leisure time[49], have a significant role in the increment of the obesity rates. A body weight reduction from 1% to 3% was observed by adoption of physical activity, which was performed for a minimum of 150 minutes per week at a moderate-to-vigorous intensity[19].

Agencies like the International Osteoporosis Foundation, the National Osteoporosis Foundation and the Clinician's Guide to Prevention and Treatment of Osteoporosis recommend resistance training in order to prevent osteoporosis[50-52]. Through the transmitted forces in skeleton during the physical activity, signals related to strain magnitude and rates initiate a cascade of biochemical responses, that locally and systemically support the bone turnover and contribute to bone health by resulting in net bone apposition[22].

Several studies support the notion that regular physical activity, in combination with proper nutritional habits, is the most effective strategy for improving sarcopenia and physical function and preventing disability[53]. Even though the loss of muscle strength is a natural part of the aging process, pieces of evidence showed that physical activity and/or nutritional supplementation have a significant role in muscle strength improvement[27, 54].

The participation in physical activity for most chronic pain patients has as a goal the reduction of pain[28]. Many studies consistently demonstrate physical activity as a beneficial modality for chronic pain[28,55,56] . The abilities and the limitation of chronic pain patients vary to a great extent, nevertheless, daily activity should be encouraged, even if the intensity is low and duration is short[28]. The implementation of physical activity from chronic pain patients can be really challenging and is linked to a behavioral change, which can be difficult to accomplish, notwithstanding, these activities are often the most engaging and yield the biggest improvements in symptoms and overall quality of life[57].

Since a long time it has been known that the regular participation in physical activity can positively affect people in the management of mild-to-moderate mental health illnesses, like depression and anxiety3[2,57-67] . Further data also point out the fact that physical activity may shield our mental health and protect us against the development of depression[61,68-70] and at the same time verify the information that physical inactivity might be a risk factor for depression[58]. Moreover, a review in 2016 established that physical activity can improve physical self-perceptions and enhance self-esteem in young people[33].

A study examining the relationship between physical activity and sleep quality showed that high levels of recreational physical activity are associated with better sleep in midlife women[34]. Lifestyle –or household- related physical activity seemed to have no influence on the sleep quality in midlife women in contrast to higher levels of recreational physical activity which were strongly related to better sleep[34]. Another study showed that physical activity had drastically positive impact on the reduction of sleep dysfunction due to improvement in sleep quality aspects[35]. Even though the number of surveys investigating the association between physical activity and sleep quality is not large, the implementation of physical activity seems to improve sleep quality and protects against the development of sleep disorders[34].

Senility accompanied from a number of reduction in physical and cognitive functions of the human body[71]. Muscle strength reduction and deterioration of the coordination and balance control are the result of a physical wear in an older body[72,73]. Together with decreased cognitive functions, these impairments lead to a higher risk of falling among the elderly[74,75]. Physical inactivity is an accelerating factor of the deterioration of bodily functions[76]. Over 30% of people aged 65 or older, experience on average 1 fall a year[77]. It is proven that physical activity counteracts the aging progress in both physical and cognitive level and prevents falls in elderly people[78]. Furthermore, fall incidences in older adults showed a reduction between 13 to 40% after the adoption of exercise, which included balance and resistance[79].

Physical activity has an essential role in the primary prevention of chronic diseases[4], such as cancer, cardiovascular disease, type-2 diabetes and metabolic syndrome[28]. Additionally, physical activity improves general health, disease risk and progression of chronic illnesses[28]. Physically inactive people have a higher risk for developing several chronic medical illnesses compared to those who are physically active[80].

Cancer is considered as the foremost cause of death in high-income countries[81]. As already mentioned physical inactivity increases the risk of developing cancer and at the same time physical activity is an important allied in the primary prevention of cancer[81]. Evidence that strongly support the fact that physical activity is related to a risk reduction from around 10%-20%, for bladder, breast, colon, endometrial, renal and gastric cancers and esophageal adenocarcinoma was introduced by the US Physical Guidelines Advisory Committee in 2018[82]. A risk reduction in further cancers was also mentioned, but with lower grades of proof[82,83]. Generally, adults who implement and retain physical activity at recommended levels showed to have lower risks on getting sick with multiple cancers[84].

One third of all deaths worldwide are due to cardiovascular diseases[41]. A growing number of surveys have reported that physical activity has an important impact on the support and protection of the cardiovascular system[40]. Increased levels of physical activity improve the cardiorespiratory fitness[80]. Decreased physical activity was arranged by the American Heart Association among the most important cardiovascular risk factors, setting the improvement of exercise capacity and cardiorespiratory fitness (CRF) as an important strategy aiming to the reduction of cardiovascular events[41]. Not only the improved survival and the reduced incidence of coronary artery disease and stroke, but also the decreased incidence of arterial hypertension, diabetes mellitus, heart failure and atrial fibrillation are associated with higher cardiorespiratory fitness[41]. The positive effects of physical activity on the cardiovascular system, including its

significant cardioprotective role, are reflected on the adaptive molecular and cellular reprogramming of the heart muscle[42].

Recent studies established the importance of physical activities in diabetes. Particularly, the participation in regular physical activity improves blood glucose control and prevents or delays type 2 diabetes[85]. Blood glucose management and prevention of type 2 diabetes and gestational diabetes mellitus are some of the benefits of physical training[85]. Probably through reduced adiposity is physical activity inversely associated with the risk reduction of type 2 diabetes. All subtypes of physical activity appear to be beneficial and 5 to 7 hours of leisure-time, vigorous or low intensity physical activity are enough to reduce the risk[86].

Physical activity interventions leading to improved fitness can cause a normalization of insulin resistance, lipid disorders or obesity. The influence on these risk markers proved to have a positive effect on health outcomes related to metabolic syndrome[40]. Physically active people showed to tend to a lower prevalence of metabolic syndrome[40]. It is proven that minimal activity, defined as 150 minutes per week of moderate intensity activity, causes a lower incidence of metabolic syndrome[40,87,88].

Physical inactivity

Justifiably physical activity possesses the leading position under many health indicators and its lack is identified as a risk factor for many diseases[4]. Beside the fact that physical activity can be the best protector of our health, the WHO reported in 2003 that almost two-thirds of people over the age of 18 years are classified as physically inactive on a worldwide level[89]. Since the determining work of Morris and colleagues in the 1950s[90,91] and the work of Paffenbarger and colleagues in the 1970s,[92,93] there have been several long-term prospective

follow-up studies that have assessed the relative risk of death from any cause and from specific diseases associated with physical inactivity[94–101]. The fact that physical inactivity is considered as the fourth leading factor for global mortality should be a strong enough incentive to make people more active[102]. Available data showed that the global prevalence of not meeting the minimum recommendations for physical activity was 31%[103] and, in 2009, the worldwide population, which was mentioned as inactive was 17%[104]. The German Health Insurance Organization (Deutsche Krankenversicherung-DKV) interviewed 3,102 people in 2014, asking them about their health behaviors. Their report "How healthy Germans live" was published in 2015 and it showed that 46% of participants were classified as physically inactive. Impressively, more than 50% of participants were not engaging in any kind of physical activity in their leisure time[105].

Physical inactivity can be identified as a global challenge because of the risk its conveys[106]. Enticing proof, which were presented in 2012 from Lee and colleagues, showed that 6-10% of all deaths from non-communicable diseases in the world can be credited to physical inactivity. This rate is considerably higher for specific diseases like coronary heart disease (30%) [107]. The lifestyle behaviors of individuals with chronic diseases, such as cardiovascular, metabolic and degenerative diseases, verified to be common in lifestyle factors like physical inactivity, poor diet and smoking, which are shown to have an important role to overall mortality[108]. Impressively, about 1 out of 10 deaths reported to be dependable on physical inactivity, which was concluded among the top 10 risk factors for all diseases, with grave health, social, environmental and economic consequences[109]. Undoubtedly health-related issues cause a direct and indirect economic cost for the national health systems[106]. The fact that this cost could have been avoided, if people were physical active, deserves consideration and an intensive planning for promotion of physical activity.

The preventive role of physical activity

The beneficial influence of exercise and physical activity in the improvement of the health condition and the prevention of illnesses is extensively discussed since decades and it is undeniable. Physical activity is described as a key determinant of public health from Desnoyers and his colleagues in 2016[110].

The instrumental role of physical activity for the primary prevention of chronic diseases as well its use for treatment and rehabilitation reasons is revealed from a numerous studies[1]. Both men and women who reported increased levels of physical activity and fitness were found to have reductions in relative risk (by about 20%–35%) of death[111,112]. Recent investigations have revealed even greater reductions in the risk of death from any cause. For instance, being fit or active was associated with a greater than 50% reduction in risk[113]. Moderate increase in physical activity in previously sedentary people has been associated with large improvements in health status[114]. For instance, another study showed, that people who improved their activity level from unfit to fit over a 5-year period had a decrease of 44% in the relative risk of death compared with people with minimal fitness level[115] .Despite the fact that the positive impact of physical activity in our health is extensively documented, the biological mechanisms are not yet 100% clarified[116 – 120]. In 2007, Kruk summarized and quoted in her analysis the following possible mechanisms: decrease of sex hormone production and binding protein levels, the obesity and adiposity, the growth factors level and the DNA damage. An improvement was mentioned for the immune system function, the DNA repair and the antioxidant defence[4]. Additionally, the epigenetic mechanisms, which are associated with a range of human diseases, can be accepting adjustments after physical activity implementation[121-123]. Evidence indicates the fact that physical activity and exercise can modulate gene expression through epigenetic alternations and have an impact in chronic diseases prevention and health benefits, although the type and the duration, which cause these changes still needs to be defined[108].

In general, a physically active lifestyle has a massive importance for the prevention of numerous health problems and its multifactorial dimension can also influences the life of individuals on further levels like the social and the psychological as well the environment and the genetic[80].

Physical activity for cancer prevention

Cancer is a major public health problem and after the cardiovascular diseases the second leading cause of morbidity and mortality worldwide, with 14,1 million new cancer cases been reported in 2012, of which 8 million occurred in economically developing countries[124,125]. Notwithstanding of the early diagnosis and the multidimensional and targeted treatments we have nowadays, the cancer occurrence rates seems to have an increment in the developed countries because of the lifestyle changes, the industrialization, the population growth and the increase of the life expectance[126]. Particularly in the domain of cancer diseases and the primary prevention, the reduction of the risk of someone to develop a specific type of cancer through physical activity is confirmed by a huge number of researches. The risk of being diagnosed with cancer increases substantially with age. The majority of people were diagnosed occur at ages older than 50 years of age[127]. Cancer is caused by internal factors, such as inherited genetic mutations, hormones and immune conditions, and external factors, such as smoking, alcohol consumption, infectious organisms, lack of physical activity and an unhealthy diet, which may act together or in sequence to cause cancer[125]. A considerable extent of malignant neoplasms could be averted. All cancer types caused by smoking or intense alcohol utilization could be totally prevented[128,129]. The rates of the cancers worldwide, which are related to overweight or obesity, physical inactivity and poor nutrition are estimated by the World Cancer Research Fund to be around 20-25% and these could be prevented through behavioral changes[130]. According

to a recent analysis, an increment of the physical activity levels during free time can lead to a cancer risk reduction in 13 out of 26 different types of cancer[131]. The biologic causal pathways and the mechanisms can lead to cancer are numerous. The most well-supported pathways associated with physical activity and cancer prevention are sex hormones, metabolic hormones, inflammation, adiposity and immune function[81].

For the first time in 1922, two groups of researchers, Cherry and Sivertsen & Dahlstrom announced separately that through physical activity there was a reduction on the mortality rates of cancer in Australia, England and the United States of America[132, 133]. According to Courneya and Friedenreich (2011)[134], breast, colon, endometrial and probably prostate and lung cancer are the main cancer types, in which physical activity can have a protective and preventive role. The adoption of an active way of life could decrease all-cause cancer rates by as much as 46%[135] and the optimal reaction of cancer defense mechanisms is preserved from moderate levels of energy expenditure[136]. Lee spoke in 2003 about the association between physical activity and lower risk of developing certain site-specific cancers, in particular colon and breast cancers[137]. Further evidence support the fact that physical activity can reduce cancer risk, with Desnoyers and his colleagues in 2016 to report a breast cancer risk reduction by 15-20% and colorectal cancer risk reduction by 24%[110]. According to latest report of the World Cancer Research Fund (WCRF) moderate and vigorous physical activity decreases the risk of bowel, breast and womb cancer[81]. The US Physical Guidelines Advisory Committee presented in 2018 evidence that strongly support the fact that physical activity is related to a risk reduction from around 10%-20%, for bladder, breast, colon, endometrial, renal and gastric cancers and esophageal adenocarcinoma[82]. The optimal reaction of cancer defense mechanisms is preserved from moderate levels of energy expenditure and the risk of developing cancer is approximately double when passing from a moderate to a low level of physical activity[135]. It is unclear which type, intensity, frequency and duration of exercise across the lifespan is the most optimal in

order to prevent the development of certain types of cancer but it is proven that moderate activity (>4.5 MET) is more beneficial than light activities (<4.5 MET)[138]. This study revealed that the protective effect of the moderate physical activity was much greater than this of low intensity activities[138]. In addition physical activity and site – specific cancer risk was examined for the following cancer types, colorectal, colon, rectal, breast, endometrial, ovarian, prostate, testicular and lung cancer through an identification by using a systematic review of published literature available till August 2000[138].

More specific, for the colorectal, colon and rectal cancer, leisure and occupational physical activity seemed to have a protective effect on their overall risk ranging from 10 to 70%. That may be associated with the reduction of the bowl transit time which at the same time reduces the contact time between the carcinogens and the mucosal cells[138]. Colon cancer risk was found to be 40% lower in both men and women who reported burning more than 1000 kcal/week through vigorous exercise for at least three time periods in their lives[139]. Compared to men who were inactive (1000 kcal/week), men who were highly active (energy expenditure of.2500 kcal/week at two assessments) had a half-risk of colon cancer[139]. A 50% decrease in the risk of colon cancer was linked to 21 MET-hours per week in another study. This indicates that middle-aged American women need to engage in 4 hours of moderate- or 3 hours of high-intensity leisure physical activity per week to lower their risk of colon cancer[140].

According to numerous of studies, physical activity could affect the synthesis, metabolism and excretion of progesterone and estrogen, which are strongly linked to the development of endometrial, breast, and possibly even ovarian cancer. In consonance to the above, physical activity could have a protective role against these cancer types[138]. Both occupational and leisure physical activity are linked to a roughly 30% lower risk of breast cancer in pre-, peri-, and postmenopausal women, according to a huge number of breast cancer

cases[138]. According to multiple studies, the actual amount of physical activity required to lower the risk of breast cancer is either continuous vigorous activity (24.5 MET-hours/week)[141] or leisure time physical activity for at least 4 hours/week[142-144] of at least moderate intensity (4–5 MET)[145].

The evidence for the prostate cancer relationship to the amount of physical activity, researches showed that there was a significant 10–70% reduction in the risk of prostate cancer with either leisure or occupational physical activity, or with both actions combined[138]. According to a study, a reduction in the risk of prostate cancer required at least 12 kJ/minute of occupational physical activity. Energy expenditure of at least 1000 kcal/week and up to 3000 kcal/week seemed to reduce the men's risk at most 70%[146].

A reduction of lung cancer risk was associated with a continuous 4 hours/week of hard leisure time physical activity, or an engagement of at least moderate activity (4–5 MET) in combination with adjustments by smoking and other potential risk factors[147].

Several seminal reviews have been published regarding the relation between cancer and regular physical activity[135,137,138]. It appears that habitual physical activity, whether as part of a job or as a leisure activity, is associated with reductions in the incidence of specific cancers and has a strong potential for primary cancer prevention[148 – 152]. Recent recommendations suggest that at least 30 to 60 minutes of moderate to vigorous daily activities can reduce the relative risk of cancer from 10 – 30 %[152] and WHO describes physical activity as a means of primary prevention of cancer in its recommendation on physical activity for health[110].

Physical activity during cancer treatment and among cancer survivors

One of the most frequent chronic diseases which constitute one of the main health issues around the world is cancer. Nonetheless, the rates of cancer survivors are growing because of the multidimensional therapies and the improvement in detection[81].

Regular daily physical activity is not only linked with the reduction of the risk of cancer development but also with the reduction in mortality after the diagnosis of cancer[153-155]. Next to the preventive role, which reaches up to 25% of cancers, improved survival rates and a beneficial impact in the quality of life in patients with cancer adds even more value in physical activity, which has no cost and is accessible to everyone[110]. A better prognosis of the disease, an improvement of the quality of life and the reduction of the side-effects from the treatment are some of the benefits of physical activity during the treatment and that is why it is highly recommended in the majority of cancer patients[156].

The effectiveness and the health benefits of the physical activity are undeniable, so the new improved cancer therapies erect interest of the potential physiological and psychological benefits of physical activity during and after treatment[136]. During a cancer treatment, healthy diet and physical activity can considered as an allied to the therapy process next to the surgery, radiation, chemotherapy, hormone therapy, immune therapy and targeted therapy. The complex nature of cancer and its negative influence in many different levels requires a combination of treatments, which are going to support and promote the physical and as well the mental health status of the patient. Despite the success of recent cancer treatments, patients may experience persistent symptoms and side effects of either cancer or the treatment used[157]. Some of these symptoms and side effects occur immediately after initiating cancer treatment and resolve over days or weeks, or stop when cancer treatment is completed. However, some of these symptoms and side effects may persist beyond completion of treatment or manifest months or years after treatment is completed[158].

It is important to mention that In France, the prescription of physical activity for patient with chronic diseases is legally enshrined since 2016[159]. According to a literature review, which was published from the French National Cancer Institute the beneficial effects from physical activity includes the physical deconditioning, a preservation and/or a normalization of body composition, a reduction of cancer-related fatigue, an overall quality-of-life improvement, the improvement of treatments tolerance and their medium and long-term effects, an increased life expectancy and a lower risk of cancer recurrence[159]. The physiologic and psychosocial responses to exercise rehabilitation during and after cancer treatment are nowadays supported by a huge evidence base that suggests engaging in physical activity. Physical activity is a useful adjunct to improve the deleterious sequelae and side effects experienced during cancer treatment[81], lead to fewer symptoms and retard the rate at which physiologic systems are affected[157]. It can also promote the mental health and prevent from social isolation. More specific, deconditioning of the cardiovascular and pulmonary system[160], cardiac toxicities which affect the cardiac function[161], muscle fatigue and muscle weakness[160,162], cachexia[163], changes in body composition[160] and bone loss[164] belong to the physiologic side effects of a cancer treatment. In regards to the psychosocial side effects, fatigue[165-167], anxiety[81, 160], depression[81, 160, 168], worsening of the quality of life[81,160] and causing bad mood[81,160] are some of them. Beside the numerous positive effects mentioned above, it has been proven that physical activity acts via various mechanisms to slow or diminish tumor growth, including the production and bioavailability of sex hormones, insulin resistance and insulin secretion, and inflammation[110]. The increment of the number and cytotoxicity of monocytes and natural killer cells and cytokines is another immunological anti-cancer mechanism, which is connected to physical activity[169]. Plentiful advantages and outcomes concur from the adoption of physical activity during and after therapy, which are further helpful for the cancer patients in terms of reintegration into daily routine, work and family life[170]. The key factor for having the

advantageous impact from physical activity is to start with it as early as possible and the role of the health professional has an utmost importance for the promotion of physical activity[159].

It is observed by high-grade and fatal prostate cancer patients that diet, physical activity and lifestyle changes, could positively affect the progression and the side-effects of the disease and the mortality[171]. Physical activity constitutes a part of the therapeutic procedure for lung cancer patients and managed to mitigate the disease´s symptoms, to improve the fitness and the quality of life and additionally possibly to diminish the duration of stay of postoperative complications[172]. Major positive effects on the reduction of fatigue and the life quality were often confirmed in patients with cancer who implemented regular physical activity[110, 173-175] as well by cancer patients with depression[110]. The adoption of physical activity by cancer patients from the first stage of the treatment seemed to decrease the fatigue and helped the patients to tolerate and deal with the side effects of the treatment[110]. An 18-week interventional program, which was followed by breast and colon cancer patients, showed that the increase of the physical activity rates helped to the reduction of the fatigue levels in a 4 years' period post-baseline[176]. It was obvious that physical activity during chemotherapy was diminishing the short and the long term treatment-related adverse effects[176]. It´s also been proven that physically active patients with colon, breast, ovaries and prostate cancer had a decrement of mortality risk[177].

Cancer survivors, who were physically active, seemed to have an all-cause mortality reduction by 33%[110]. The positive effects and health benefits from physical activity have an even greater effect in cancer survivors[160]. Post –treatment exercise may converse the negative outcomes of the cancer treatment but also manage the long-term and after treatment effects. A huge amount of evidence showed that physical activity can promote the health and survival of cancer patients after the treatment[81] as also being a possible adjuvant therapy for cancer[178,179].

The valuable effects of physical activity have proven to be even more significant in patients with lower physical activity levels[175]. Nonetheless it is essential for the cancer patient to choose the right levels of physical activity in cooperation with the health professionals in order to have the greatest outcomes and the best possible effectiveness[180]. The estimation of the right physical activity level is certainly of major importance and the individualization is necessary, according to the patient´s condition and personal preferences[181]. Not enough evidence yet exists regarding specific designs and modes of physical activity and exercise programs[170]. For optimizing the outcomes of physical activity during and after the treatment of cancer patients[170,] further attention and focus need to be placed on the exercise modes and dosage-response effects[182].

Physical activity behavior in cancer patients

Most of the cancer patients are vastly engaged to adapt a healthier lifestyle by making better food choices, implementing physical activity, using dietary supplements and complementary nutritional therapies, in order to improve their response to treatment, speed recovery, reduce their risk of recurrence and improve their quality of life[181,183]. But there is still a huge difference between "been engaged" and "engaging" a healthier lifestyle. Studies which examined the behavioral changes and the motivation level of cancer patients showed that less than 10% of cancer patients will be active during their primary treatments and only about 20% to 30% will be active after they recover from treatments[184,185]. The recommended activity level of 15 to 25 MET h/week is been achieved by just 32% of patients, who had breast cancer[186]. Practically, the biggest population of cancer patients will not implement any physical activity and also will not have its beneficial influence, unless behavioral support interventions are provided[181].

If we consider that physical inactivity can be an important cancer risk factor, then we can accept the fact that a big percentage of the cancer patients do not adapt a healthy lifestyle which includes physical activity. Physical inactivity related outcomes like, obesity and overweight seem to be connected with a poor prognostic factor by breast cancer patients and may be related with less favorable lymph node status as well as a range of other adverse outcomes like lymphedema, contralateral disease and recurrence [187-192]. Regarding to the poor prognosis for breast cancer patients, who is associated with the overweight and obesity when diagnosed, it can be concluded that weight management is essential for breast cancer survivors[181]. Another study from Kroenke and his colleagues in 2005 confirmed the above statement by showing that there was a bigger chance of recurrence in cancer patients who gained weight after the diagnosis and during their treatment. More specific patients who had a BMI increment between 0,5 and 2 kg/m^2 had 40% higher recurrence rate. That rate was by 53% for cancer patients, who during the treatment had an increment for more than 2 kg/m^2 compared with those who did not gain more than 0.5 kg/m^2 [193]. Beside the fact that physical activity is approved to have the most powerful effect of all lifestyle factors on breast cancer outcomes[194] and can reduce the breast cancer mortality up to 40%[195] only 13% of breast cancer patients manage to reach the recommended physical activity levels[196].

The treatment and more particular the form of the treatment can influence the physical activity level. A radical reduction of the physical activity levels during therapy was mentioned from Huy and her colleagues in 2012[197]. Specifically, breast cancer patients reduced their physical activities levels from 36 to 14MET h/week. This reduction was more radical in patients their therapy plan included chemo- and/or radiotherapy compared to patients without adjuvant therapy or those treated only with hormones[197].

The evaluation of cancer patients' physical activity levels is not brightly examined. A research published in 2017 from Büntzel and his team showed that 71% of the participants, who

were cancer patients, were physically active before the diagnosis[198]. The percentage of those who reported that they would like to become physically more active was 38%. It seems that factors like gender, the status of the therapy and earlier sport experience are influencing the participation in physical activities. More women than men were engaging physical activity during and after the treatment and were better informed about the local options for physical activities. Male participants reported to be engaged in physical activities in the past. The percentage in physical activity participation was reduced during therapy and only 50% of the participants stated to be engaged in physical activity and just 40% after the treatment. It is logical that former sport experience is connected to physical activity during all stages of lives, so in that case, earlier sport- active - persons were more active during and after their therapy[198]. Generally a reduction of the physical activity level in cancer patients during aftercare is observed[199].

Although cancer patients are likely to proceed with lifestyle changes in order to improve their health and decrease the probability of cancer recurrence and other accompanying diseases[200], it´s been verified that cancer and non-cancer patients revealed no differences in their activity levels but in other improved-health-related factors like smoking and alcohol consumption[201].

It is essential to be mentioned that cancer patients need to be supported by their effort to engage any physical activity and reviewing the benefits is really encouraging for them but also for their health providers and supporters[202]. Recreational physical activity and physical activity for transportation appears to be easier to perform from cancer patients[202]. Personalized structured programs for motivation and empowerment of the cancer patients during their therapy, rehabilitation and aftercare may be the best approach for long lasting improvement of their lifestyle and their quality of life[203]. Recommended physical activity levels (15 to 25 MET h/week) mentioned to be achieved from breast cancer patients during rehabilitation after participating in personalized exercise programs[204]. Individual designed exercise programs

showed to have a stronger and maintainable impact on the physical activity levels in breast cancer patients in rehabilitation[205]. Conversely, less-personalized exercise programs, did not affect the physical activity level in the long term[205,206].

Knowledge as motivator becoming physically active

Knowledge is an important weapon in our lives. Knowledge can raise awareness in matters concerning health and prevention and can support our effort to shield our health by motivating us adapting a healthier lifestyle.

Treatment methods and options against cancer are intensively developed over the last decades and that is for sure optimizing the chances of surviving from cancer. But it is weird that not the same attention was given or effort was made for the development of awareness and knowledge spreading according to the cancer prevention which is related to healthy behavior and lifestyle. The knowledge about cancer prevention and the adoption of a healthier lifestyle is taking place during and after the treatment[207]. It is clear that cancer patients are in a better level of knowledge and information about the disease as healthy individuals and they are more willing in adopting a healthier lifestyle[207.] The level of the knowledge before and after the treatment seems also to be in a different level[207] and this is probably related with the interest erection around the topic when someone is living with it. The availability in physical activity offers for cancer patients is also a factor that affects the participation and the engagement in recreational physical activities[198]. As expected, cancer patients do not think immediately on physical activity options, when they become the diagnosis. It is anticipated from the health care providers to inform the cancer patients about the benefits of physical activity and the physical activity offers existing in the closer area, so a decrease of the physical activity level during the therapy could be avoided. The change on the physical activity curve is possibly connected to

the increment of fatigue levels during the therapy[198], something which can be positively affected after the implementation of any physical activity. That´s why the role of the physicians and other health care providers is essential in promoting physical activity and motivating the cancer patients to follow this path.

Physical activity promotion

The level of evidence and knowledge in the scientific society in topics related to health is excellent. The volume of information connected to this area is incredible but the volume of the information passing to the public still stays in a very low level. There are efforts made to mobilize this kind of information to the public but they are probably not enough or have not been promoted in the right way. On the one hand, there is a huge amount of evidence related to the beneficial role and outcomes of the physical activity, so it has been taken for granted that enough knowledge about this theme already exist. The important role of physical activity in health prevention and in treatment of chronic diseases, raises the necessity for the health care systems to take an action in the promotion of physical activity[208], so more individuals can get informed about these benefits and change their lifestyle behavior either by starting to be physically active or by implementing more physical activity. On the other hand, physical inactivity is being characterized as pandemic and is the fourth leading cause of death worldwide[106]. So, why do people choose to be physically inactive? Is there enough awareness about it?

It has been claimed that physical activity level is influenced by many multifaceted and complex factors[209,210]. Unfortunately, our lives are designed in a way that promotes the sedentary behavior (transport options, workplaces and education settings for young people). Therefore it cannot be only expected from the individuals to bring the change and affect the

physical activity levels[211]. The communication of the physical activity guidelines to the public is provided as a part of this solution[212,213]. The promotion of physical activity nowadays can occur through multiple channels, for example social marketing and mass media campaigns, which could erect awareness and motivate people to become physically active[212, 214-218]. The health benefits from physical activity are unquestionable and have been evidently established. Physical activity habits should be recorded in the medical record and physical activity should be considered as a medication and be prescribed[219]. This can have as a result a drastically decrease of the cost for the health care systems.

Campaigns are often used from health care systems und health organizations for the physical activity promotion in order to reach large populations and promote healthy behaviors[220]. This can significantly influence the health behaviors of populations; however the effects of such campaigns are usually modest[220], because knowledge obtainment and behavioral changes are not inextricably connected. The raise of awareness of the positive effects of physical activity behavior may be more influential than passing the knowledge of guidelines and could increase motivation for engaging more physical activity[221].

Unfortunately the amount of evidence concerning to the effectiveness of mass reach campaigns related to physical activity is low. Nevertheless data optimistically confirmed that even individuals reporting very low physical activity levels may still engage in this kind of campaigns and seem to support others to abandon sedentary lifestyle[222].

Sustainable and comprehensive programs to increase physical activity among all individuals need to be developed and implemented at local, regional, national, and international levels to affect positive changes and improve global health[80]. The effectiveness of physical activity promotion strategies strengthens the fact that these should be considered as a global public health priority, for the avoidance of health, economical and environmental consequences from the lack of physical activity[106].

Formulation of reflection and study´s goals

Despite the extended scientific knowledge about the relation between physical activity and the primary prevention of cancer and other chronic diseases, it is still in question whether the public is aware of this issue. Thus, we sought to examine the extent to which the positive effect of physical activity on the prevention of malignant diseases is known to people and how such knowledge subsequently influences their physical activity levels.

The major aim of the current study was to evaluate the success of the campaign "Physical activity against cancer", which was designed to enhance physical activity behavior in Germany and was initiated by the German Cancer Aid (Deutsche Krebshilfe e.V.), the German Olympic Committee (Deutscher Olympischer Sportbund), the German Sport University in Cologne (Deutsche Sporthochschule Köln) and the Center of Integrated Oncology Köln Bonn (CIO), University Hospital of Cologne. Further main goals were to examine the accessibility of the campaign, to investigate the physical activity levels of the participants and how these were influenced by the campaign, to examine their degree of familiarity with the relation between physical activity and cancer incidence, and whether such knowledge represents a motivating factor to engage in a physically active lifestyle.

In addition, another goal of this study was to examine the physical activity behavior of cancer patients in Germany. Further goals were to investigate the physical activity levels of non-cancer patients and compare them with the physical activity levels of cancer patients and to define a general healthy lifestyle of the two groups. The examination of the knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms and if that constitutes a motivation factor for the adoption of more physical activity between cancer and non cancer patients was another goal of this study.

Methods

The campaign "Physical activity against cancer"

The campaign "Physical activity against cancer" took place in Germany from April to June 2014. The goal of the campaign was to provide simple advice through posters, flyers, videos and a website aimed at helping people to be physically more active every day. Information about a healthy lifestyle and sports offers were available online. The campaign aimed to reach millions of inhabitants in Germany. Three famous German supported the promotion of the campaign, a TV presenter, an Olympic medal winner and an ex-professional football player. Posters on buses as well as at train stations and airports nationwide showed the three personalities playing basketball, cycling or jogging. Short video spots with them could have been seen on Youtube.de and on the website www.bewegung-gegen-krebs.de. The campaign´s website also offers tips on how to get started in everyday life with more exercise. Interested individuals could get help in finding sports in their area. The idea behind the campaign based on the forecast that half of the new cancer incidents could have been prevented, if people were following a healthy lifestyle.

Study design

The study concerns a cross sectional study which was concluded in two surveys and examined the impact of the campaign "Physical activity against cancer". Two surveys were disseminated across Germany by telephone interviews. In total, 2,003 interviews were conducted and the average time needed to complete the computerized telephone interview was 45 minutes. The interviews were carried out by the Forsa Institute of Social Research and Statistical Analysis, an organization specialized in independent private market and opinion

research based in Berlin, Germany. The first survey took place between September 25 and October 4, 2013 just before the launch of the campaign and it involved 1,000 participants across Germany. The second survey included additional questions about the accessibility of the campaign and it was conducted among 1,003 persons from September 15 to 26, 2014 following the end of the campaign. The respondents answered all the questions but not all their answers could be evaluated, so only the data for 922 participants from the first and 919 participants from the second survey were included to the statistical analysis. The main control groups which were compared and examined in the study were the following: a) those who heard about the campaign and their group was named as "2014 exposed to information" and b) those who did not hear about the campaign and their group was named as "2014 not exposed to information" and "2013". For the examination of the physical activity behavior (physical activity levels) of cancer and non-cancer patients, the participants´ population from both surveys was put together and two new groups were created "cancer patients" and "non cancer patients".

Sample

Participants were older than 18 years of age. The selection of interviewees for both surveys in 2013 and 2014 was based on a multi-stage systematic random sample using telephone master samples of the Working Group of German Market and Social Research Institutes (ADM). The participants were homogeneously selected for the 2 surveys according to age, gender, education level, and geographic region.

Questionnaire

The questionnaire was structured according to a standardized and valid instrument, the Global Physical Activity Questionnaire (GPAQ). This questionnaire queries about physical activity behavior during work, transportation and leisure and is developed by the WHO.

Physical activity was classified into levels of "high", "moderate", and "low" intensity according to the GPAQ instrument and the Analysis Guide[223]. The MET-minutes scores were recalculated in MET-hours in the analysis of the results in order to have more understandable values. The physical activity levels were as follow: "high" (3 days of 1 hour and 20 minutes of vigorous intensity physical activity or 7 days of 1 hour and 10 minutes of moderate intensity physical activity), "moderate" (a person not meeting the criteria of "high" or 3 or more days of vigorous intensity physical activity of at least 20 min/day or 5 or more days of moderate-intensity activity or walking of at least 30min/day or 5 or more days of any combination of walking, moderate- or vigorous-intensity activity achieving a minimum of at least 15 min/day), and "low" (a person not meeting any of the above mentioned criteria).

Physical Activity Levels	Criteria
"High"	Three days of 1 hour and 20 minutes of vigorous intensity physical activity or 7 days of 1 hour and 10 minutes of moderate intensity physical activity.
"Moderate"	A person not meeting the criteria of "high" or 3 or more days of at least 20 min/day of vigorous intensity physical activity or 5 or more days of at least 30min/day of moderate-intensity activity or walking, or 5 or more days of any combination of walking, moderate- or vigorous-intensity physical activity achieving a minimum of at least 15 min/day.
"Low"	A person not meeting any of the above mentioned criteria of the categories "high" and "moderate".

In addition, the questionnaire GPAQ was used as well from the German Health Insurance Organization (Deutsche Krankenversicherung–DKV) for the Health Report 2010 that identifies health behavior trends in Germany[101]. Further questions were added and were about:

- Knowledge about the relationship between physical activity and the reduction of the risk in specific cancer types.
- Knowledge about the German health promotion programm "Sport for Health".
- The information pathway through which they were informed about the "Sport for Health" program.
- Participants' health lifestyles (on a five point scale from "strong healthy" to "not healthy at all").

Further questions were integrated in the second telephone questionnaire which was administered in September 2014 and were related to the campaign “Physical activity against cancer”. Specifically, participants were asked about:

- If they heard, read or saw the campaign.
- What was their impression about the campaign in case they were exposed to its information.
- If the campaign was a motivation for them to be more physically active.
- If they were more physically active because of the campaign.
- If they used the website of the campaign
- In case they used the website, how helpful it was for them.

Statistical analysis

Campaign

Descriptive statistics were used for examining frequencies and percentages of the samples. Cross-tabulations utilized χ^2 tests for the analysis of dependent variables (exposed to information, feeling motivated by the campaign, and becoming physically more active as a result of the campaign) and independent variables (gender, age, education level, body mass index (BMI), physical activity level, area of residence, healthy lifestyle, cancer patient, knowledge about the association between physical activity and specific types of cancer, performance of targeted physical activity to reduce the risk of specific cancer types, moving on foot or by bike for at least 10 minutes per day from one place to another, vigorous intensity physical activity for at least 10 minutes per day, moderate intensity physical activity for at least 10 minutes per day). The Mann-Whitney U test was used for comparing physical activity levels between the interviewees from 2013, from 2014 who were exposed to the information of the campaign and from 2014 who did not exposed to the information of the campaign. The Kruskal Wallis Test was used for the statistical analysis of the variables “age” and “healthy lifestyle” and the physical activity levels of the groups “2013” and “2014”. The T-Test was used for the analysis of the MET-hours per week for the categories, “total”, “work”, “transportation”, “free time” and the interviewees from 2013, from 2014 who were exposed to the information of the campaign and from 2014 who did not exposed to the information of the campaign. IBM SPSS Statistics for Windows, Version 26 and Version 27 were used for coding the interviews and analyzing the survey. For all analyses, P values <0.05 were considered statistically significant and 7 tests were concluded.

"Cancer patients" and "non cancer patients" population

Descriptive statistics were used for examining frequencies and percentages of the samples. Cross-tabulations utilized χ^2 tests for the analysis of dependent variables (cancer and non-cancer patients) and independent variables (gender, age, education level, body mass index (BMI), area of residence, educational level, physical activity level and healthy lifestyle). The Mann-Whitney U Test was used for comparing "physical activity levels" between the interviewees of the two main groups ("cancer patients" and "non-cancer patients"), as well for the relationship between the "physical activity levels" and "gender" in all participants and in groups ("cancer patients" and "non-cancer patients") separately. The T-Test was used for the analysis of the "MET scores" and a) "cancer patients" and "non-cancer patients", b) "gender" in all participants and in groups ("cancer patients" and "non-cancer patients") separately. The Kruskal Wallis Test was used for the statistical analysis of the variables "age" and "healthy lifestyle" and the physical activity levels of "cancer patients" and "non cancer patients". The One-Way ANOVA test was implemented for the statistical analysis of the "MET scores" and the variables "age" and "healthy lifestyle". IBM SPSS Statistics for Windows, Version 26 Version 27 were used for coding the interviews and analyzing the survey. For all analyses, P Values <0.05 were considered statistically significant.

Knowledge

Descriptive statistics were used for examining frequencies and percentages of the samples. Cross-tabulations utilized χ^2 tests were used for the analysis of dependent variables ("knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms", "targeted adoption of physical activity for cancer risk reduction in specific cancer forms", "are you aware of the Sport for Health program?", "where did you hear

about the Sport for Health program?", and the independent variables (gender, age, education level, body mass index (BMI), physical activity level, area of residence, healthy lifestyle, cancer patient, moving on foot or by bike for at least 10 minutes per day from one place to another, vigorous intensity physical activity for at least 10 minutes per day, moderate intensity physical activity for at least 10 minutes per day) for all group population in this study ("2013", "2014 exposed to information", "2014 not exposed to information", "cancer patients", "non cancer patients"). Further cross-tabulations utilized χ^2 tests for the analysis of dependent variables: "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms", "targeted adoption of physical activity for cancer risk reduction in specific cancer forms", "are you aware of the Sport for Health program?" and the independent variables: "2013", "2014 exposed to information", "2014 not exposed to information", "cancer patients", "non cancer patients". Further questions about the campaign for the group "2014 exposed to information" were analyzed with the descriptive statistics. IBM SPSS Statistics for Windows, Version 27 was used for coding the interviews and analyzing the survey. For all analyses, P Values <0.05 were considered statistically significant.

Results

Campaign

Anthropometric - Demographic data

The results of the descriptive statistics (frequency, percentage) for the sample concerning gender, area of residence, education level, BMI and age from the interviews that took place in 2013 and 2014 and the group participants "exposed to information" in 2014 are presented in table 1.

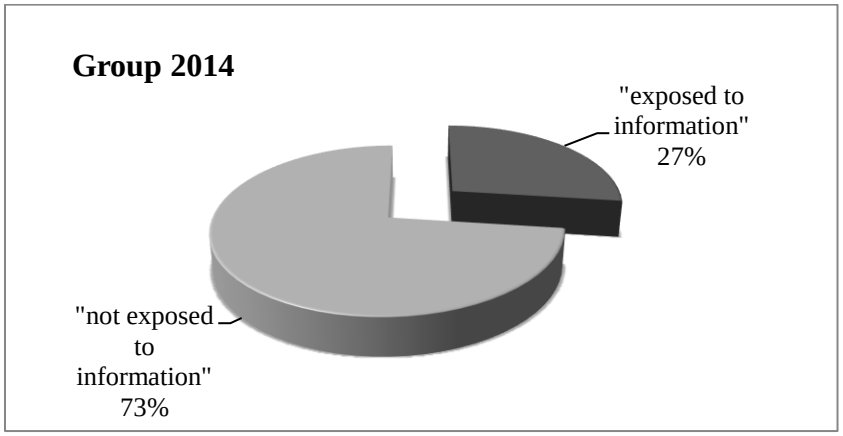
Table 1: Descriptive statistic table for gender, area of living, education level, BMI, and age for 2013 and 2014 interviewees and those who have been exposed to information in 2014.

	Group 2013 (n=922)						**Group 2014** (n=919)						**Exposed to information 2014** (n=247)					
Gender	**Male (n)**			**Female (n)**			**Male (n)**			**Female (n)**			**Male (n)**			**Female (n)**		
Frequency (%)	362 (39%)			560 (61%)			348 (38%)			571 (62)			78 (32%)			169 (68%)		
Area of living	**Rural area (n)**			**City (n)**			**Rural area (n)**			**City (n)**			**Rural area (n)**			**City (n)**		
Frequency (%)	540 (59%)			377 (41%)			523 (57%)			393 (43%)			144 (59%)			101 (41%)		
Education level	**< High school (n)**			**High school (n)**		**> High school (n)**	**< High school (n)**			**High school (n)**		**> High school (n)**	**< High school (n)**			**High school (n)**		**> High school (n)**
Frequency (%)	222 (24%)			303 (33%)		388 (43%)	210 (23%)			310 (34%)		391 (43%)	64 (26%)			84 (34%)		97 (40%)
BMI	**<18.5**		**18.5-25**		**25-30**	**>30**	**<18.5**		**18.5-25**		**25-30**	**>30**	**<18.5**		**18.5-25**		**25-30**	**>30**
Frequency (%)	17 (2%)		455 (51%)		309 (34%)	120 (13%)	25 (3%)		466 (52%)		303 (34%)	100 (11%)	3 (1%)		136 (55%)		85 (35%)	21 (8%)
Age	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**	**18- 20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**
Frequency (%)	38 (4%)	65 (7%)	98 (11%)	211 (23%)	159 (17%)	351 (38%)	25 (3%)	53 (6%)	106 (11%)	196 (21%)	179 (20%)	352 (39%)	9 (4%)	11 (5%)	18 (7%)	40 (16%)	53 (21%)	116 47%)
Cancer	**Cancer patients**			**Non cancer patients**			**Cancer patients**			**Non cancer patients**			**Cancer patients**			**Non cancer patients**		
Frequency (%)	79 (9%)			842 (91%)			74 (8%)			842 (92%)			27 (10%)			237 (90%)		

Campaign accessibility

The percentage of the participants of the second survey who heard about the campaign and belongs to the "exposed to information" group was 27% (chart 1).

Chart 1: Percentages of the participants who were "exposed to information" and "not exposed to information" of the campaign of the "Group 2014".



Information through the campaign

The following descriptive statistics results analyze the additional questions in the questionnaire for those who heard about the campaign ("2014 exposed to information"), regarding to the impact of the campaign on their physical activity behavior and if they were informed about relative topics.

The following table (2) shows the opinion of the participants who were exposed to the information campaign, regarding the aim of the campaign. The interviewees were able to give more than one answer.

Table 2. What was the campaign´s major message to the public? The interviewees' opinion.

Campaign´s major message	Total answers frequency (n=305)	Frequency (%)
People need to be more physically active	130	44%
Children and young people need to be more physically active	6	2%
Physical activity protect our health	38	13%
Physical activity protect us against cancer	25	8%
People need to live health consciously	53	17%
People need to eat healthy	7	2%
Wanted to make the people aware of the topic	10	3%
Other	16	5%
No answer/ don´t know	20	6%

Twenty percent (n=49) of the population of the "2014 exposed to information group" (n=247) mentioned that they were motivated from the campaign to become physically more active, 32% (n=80) reported that the campaign didn´t motivate them to become physically more active and 48% (n=118) mentioned that they were already physically active without the influence of the campaign (table 3).

Table 3. Frequencies about the impact of the campaign

Campaign´s impact	Total answers frequency (n=247)	Frequency (%)
The campaign motivates me to become physically more active	49	20%
No, the campaign doesn´t motivate me	80	32%
I am already physically active without campaign´s impact	118	48%

Thirty five percent (n=17) of the interviewees, who reported that the campaign motivates them to become physically more active, reported that they were implementing more physical activity. The rest 65% did not became physically more active (table 4).

Table 4. Frequencies about changes in physical activity behavior.

Changes in physical activity behavior	Total answers frequency (n=49)	Frequency (%)
I became physically more active because of the campaign	17	35%
I didn´t become physically more active	32	65%

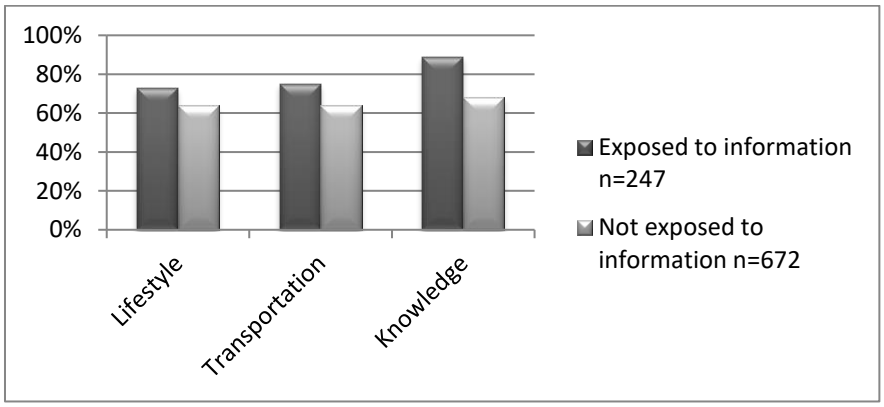
From the interviewees, who were exposed to the information, only 1% (n=3) used the website of the campaign and all of them reported that the website was helpful for them.

Profiling the interviewees "2014 exposed to information"

Of the 247 participants of the "exposed to information" group, 68% were female (n=169) and 32% were male (n=78), 84% were over 41 years old (n=209; over 60 years old: 47%, 51 to 60 years old: 21%, 41 to 50 years old: 16%) and 16% were between 18 and 40 years old (n=38; 31 to 40 years old: 7%, 21 to 30 years old: 5%, 18 to 20 years old: 4%). Among the "2014 exposed to information" group, 59% had a high physical activity level, 27% had a moderate level and 14% had a low level. When asked about their adherence to a healthy lifestyle, the ratings "very strong" and "strong" were used by 73% of those who heard about the campaign. Ten percent of the "2014 exposed to information" group were cancer patients (n=27) and more than half (59%) lived in a rural area. Seventy five percent reported moving on foot or by bike for at least 10 minutes from one place to another for their daily needs (n=184). Among the 247 participants of the "2014 exposed to information" group, 220 (89%) were aware of the role physical activity may play in reducing the risk of specific types of cancer. By comparison, of the "2014 not exposed to information" group (n=672), only 68% were cognizant that physical activity may reduce the risk of certain cancer types. A comparison between the participants of the second survey for the groups "2014 exposed to information" and "2014 not

exposed to information" and their lifestyle (very strong and strong healthy), transportation (moving on foot or by bike for at least 10 minutes per day), and knowledge (regular activity can reduce the risk of specific types of cancer) is shown in Figure 1.

Figure 1: Profiling of interviewees in 2014.



The relation between the variables "age" and "did you hear about the campaign?" was tested with Cross-tabulations utilized χ^2 test and it was statistically significant (χ^2=19.057, p=0.004). Statistically significant results were also noted for the relation between the variables "did you hear about the campaign?" and "transportation activity" (χ^2=9.488, p=0.002), "Sport for health" (χ^2=15.264, p<0.001), BMI (χ^2=10.581 p=0.032).

There were no statistically significant results between the groups "did you hear about the campaign?" and the following variables: "education level" (χ^2=8.668, p=0.371), "area of residence" (χ^2=2.809, p=0.246), "physical activity level" (χ^2=2.416, p= 0.299),"healthy lifestyle" (χ^2=7.348, p=0.196), "cancer patient" (χ^2=3.011, p=0.222), "physical activity aimed at cancer risk reduction for specific cancer types" (χ^2=1.267, p=0.260), "moderate intensity physical activity during leisure time for at least 10 minutes per day" (χ^2=0.000, p=0.991) and "high intensity physical activity during leisure time for at least 10 minutes per day" (χ^2=0.024, p=0.876).

The chi-square test analysis was used in order to examine if there was a relationship between the variables “gender”, “physical activity levels”, “healthy lifestyle” and the variables “the campaign motivate me to engage more physical activity”, “I implement more physical activity because of the campaign”. The results revealed that there was a statistically significant value for the variables “physical activity levels” and “the campaign motivates me to engage more physical activity” (χ^2=23,772, p=0.001), but not for the variables “gender” (χ^2=1.446, p=0.695) and “healthy lifestyle” (χ^2=20470, p=0.059). For the chi-square tests between the variables “I implement more physical activity because of the campaign” and “gender”, “physical activity levels”, “healthy lifestyle”, no statistically significant results were found; “gender” (χ^2=0.985, p=0.321), “physical activity levels” (χ^2=1,462, p=0.481) and “healthy lifestyle” (χ^2=4,241, p=0.374)**.**

Physical activity levels of all participants

The results of the descriptive statistics (frequency, percentage) for the sample concerning the physical activity level from the interviews that took place in 2013 and 2014 and the group participants “exposed to information” in 2014 are presented in table 5.

Table 5: Descriptive statistic table for physical activity level for 2013 and 2014 interviewees, those who have been exposed to information in 2014 and those who were not exposed to information in 2014.

	Physical ativity level		
	High (n)	**Moderate (n)**	**Low (n)**
Group 2013 (n=922)	538	208	176
Frequency (%)	58%	23%	19%
Group 2014 (n=919)	561	218	140
Frequency (%)	61%	24%	15%
Exposed to information 2014 (n=247)	158	50	39
Frequency (%)	64%	20%	16%
Not exposed to information 2014 (n=672)	403	168	101
Frequency (%)	60%	25%	15%

A Mann-Whitney-U-Test was calculated to determine if there were differences between the 3 physical activity levels “high”, “moderate” and “low”, and the groups “2013”, “2014”, “2014 exposed to information” and “2014 not exposed to information”. There was no statistically significant difference in physical activity levels between the participants of all the above groups. More precisely, between all participants of both interviews “2013” and “2014” (U=409908.00, Z= -1.598, p=0.110), the groups “2013” and “2014 exposed to information” (U=107128.00, Z= -1.628, p=0.104), the groups “2013” and “2014 not exposed to information” (U=301435.00, Z= -1.045, p=0.296) and “2014 exposed to information”, and “2014 not exposed to information” (U=80173.00, Z= -0.908, p=0.364).

Table 6: Physical activity levels "high", "moderate" and "low" – Mann Whitney – U Test for the interviewees of the groups (a) "2013" and "2014", (b) "2013" and "2014 exposed to information", (c) "2013" and "2014 not exposed to information", (d) "2014 exposed to information" and "2014 not exposed to information".

	Physical activity levels	U	Z	p
(a)	**2013** (n=922)	**409908.00**	**-1.598**	**0.110**
	2014 (n=919)			
(b)	**2013** (n=922)	**107128.00**	**-1.628**	**0.104**
	2014 Exposed to information (n=247)			
(c)	**2013** (n=922)	**301435.00**	**-1.045**	**0.296**
	2014 Not exposed to information (n=672)			
(d)	**2014 Exposed to information** (n=247)	**80173.00**	**-0.908**	**0.364**
	2014 Not exposed to information (n=672)			

For the participants of the first interview "2013" and the participants of the second interview "2014" further Mann-Whitney-U-Tests analyses were concluded for the examination of the differences between the physical activity levels and the gender. For both groups, no statistically significant results were mentioned. More specific, for the "2013" group and the variables "physical activity levels and "gender" (U=96378.000, Z= -1.426, p=0.154) and for the "2014" group and the variables "physical activity levels" and "gender" (U=98502.000, Z= -0.251, p=0.802).

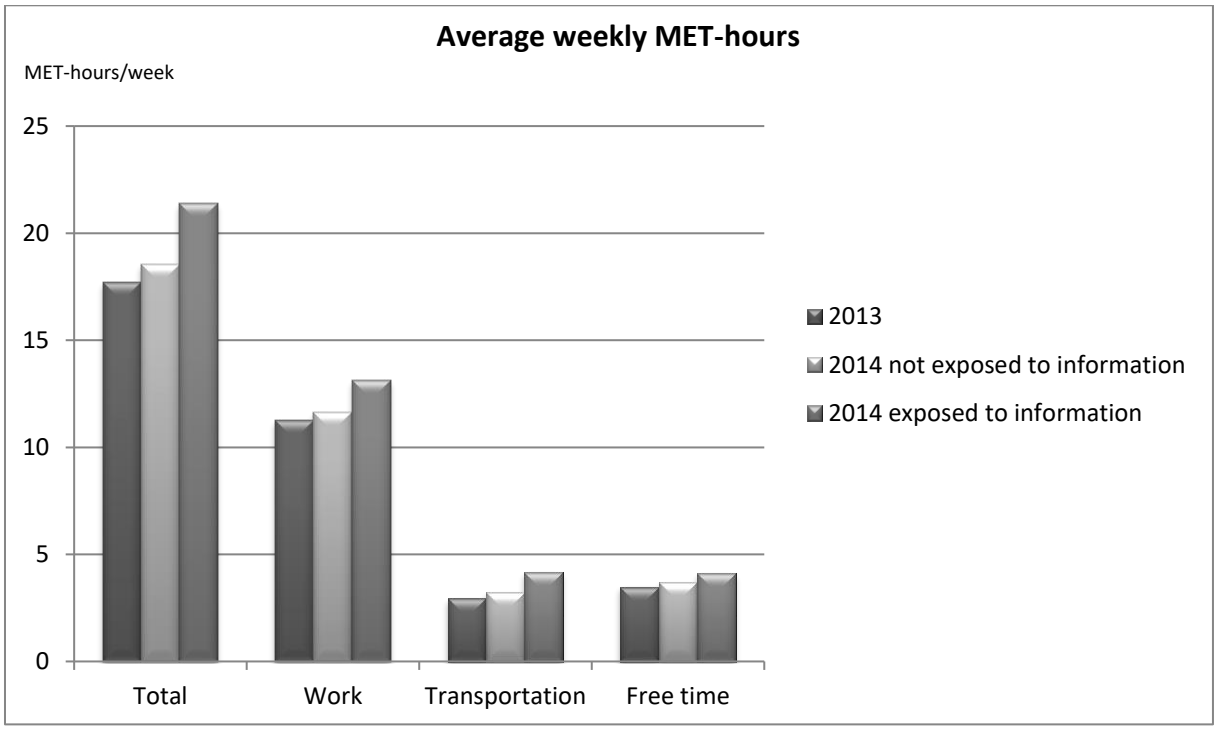
A Kruskal Wallis analysis was concluded to verify the differences between the physical activity levels and the age groups as well the healthy lifestyle categories for the participants of the surveys in "2013" and "2014". The outcomes reveled that no statistical significant results were found for the relationship between physical activity levels and age. More specific, for the "2013" group and the variables "physical activity levels" and "age" (H=5,013, p=0.414), and for the "2014" group the variables "physical activity levels" and "age" (H=9,139, p=0.104). For the variables "physical activity levels" and "healthy lifestyle", a significant result was

mentioned for the “2013” group (H= 23.128, p<0.001), but not for the “2014” group (H= 8.546, p=0.074).

MET-hours per week

The analysis of the average MET-hours per week between the groups “2013”, “2014 exposed to information” and “2014 not exposed to information”, showed that the participants of the second survey in 2014 who were exposed to information had higher weekly average MET-hours in total and the subcategories: physical activity at work, physical activity from transportation and physical activity in free time. The results for the groups “2013” and “2014 not exposed to information” had similar average scores with a small lead from the second group (figure 2).

Figure 2: Average weekly MET-hours for the “2013”, “2014 not exposed to information”, and “2014 exposed to information” groups in total and for the three categories (physical activity: a) at work, b) from transportation and c) during free time).



The T-Test analysis was used for the examination of the homogeneity between the 3 groups, “2013”, “2014 not exposed to information”, “2014 exposed to information”, regarding the total MET-hours per week. The results were associated with statistically significant effects in the following cases: “2013” and “2014 exposed to information”, (a) t= -2.851, p= 0.004, and “2014 exposed to information” and “2014 not exposed to information”, (b) t= 2.089, p= 0.037. No statistically significant was found between the groups “2013” and “2014 not exposed to information”, (c) t= -0.996, p= 0.320) (Table 7).

Table 7: Total MET-hours/week - independent sample t-test results for the interviewees of (a) “2013” and “2014 exposed to information” (b) “2014 exposed to information” and “2014 not exposed to information”, (c) “2013” and “2014 not exposed to information”.

	Total MET-hours/week	**Mean**	**SD**	**t**	**p**
(a)	**2013** (n=922)	**17.68**	**17.07**	**-2.851**	**0.004**
	2014 Exposed to information (n=247)	**21.38**	**21.57**		
(b)	**2014 Exposed to information** (n=247)	**21.38**	**21.57**	**2.089**	**0.037**
	2014 Not exposed to information (n=672)	**18.54**	**18.54**		
(c)	**2013** (n=922)	**17.68**	**17.07**	**-0.996**	**0.320**
	2014 Not exposed to information (n=672)	**18.54**	**18.54**		

For the examination of the homogeneity between the 3 groups, “2013”, “2014 not exposed to information”, “2014 exposed to information”, regarding the MET-hours per week at work further T-Test analysis was adapted. The results for the statistical analysis of the MET-hours from the physical activity at work, between the 3 groups showed no significant values in all three cases (a) t= -1.611, p=0.108, (b) t= 1.240, p=0.215, (c) t= -0.500, p= 0.617 (table 7a).

Table 7a: MET-hours/week at work - independent sample t-test results for the interviewees of (a) "2013" and "2014 exposed to information" (b) "2014 exposed to information" and "2014 not exposed to information", (c) "2013" and "2014 not exposed to information".

	MET-hours/week at work	Mean	SD	t	p
(a)	**2013** (n=922)	**11.25**	**15.24**	**-1.611**	**0.108**
	2014 Exposed to information (n=247)	**13.11**	**19.21**		
(b)	**2014 Exposed to information** (n=247)	**13.11**	**19.21**	**1.240**	**0.215**
	2014 Not exposed to information (n=672)	**11.63**	**14.76**		
(c)	**2013** (n=922)	**11.25**	**15.24**	**-0.500**	**0.617**
	2014 Not exposed to information (n=672)	**11.63**	**14.76**		

A further T-Test analysis was used for the examination of the homogeneity between the 3 groups, "2013", "2014 not exposed to information" and "2014 exposed to information" regarding to the MET-hours per week from transportation. The results were associated with statistically significant effects between the following groups: "2013" and "2014 exposed to information", (a) $t= 3.766$, $p<0.001$ and "2014 exposed to information" and "2014 not exposed to information", (b) $t= 2.593$, $p= 0.010$. No significant results were found for the relationship between the groups "2013" and "2014 not exposed to information", (c) $t= -1.139$, $p= 0.255$ (table 7b).

Table 7b: MET-hours/week from transportation - independent sample t-test results for the interviewees of (a) "2013" and "2014 exposed to information" (b) "2014 exposed to information" and "2014 not exposed to information", (c) "2013" and "2014 not exposed to information".

	MET-hours/week from transportation	Mean	SD	t	p
(a)	**2013** (n=922)	**2.95**	**4.29**	**-3.766**	**0.000**
	2014 Exposed to information (n=247)	**4.15**	**5.03**		
(b)	**2014 Exposed to information** (n=247)	**4.15**	**5.03**	**2.593**	**0.010**
	2014 Not exposed to information (n=672)	**3.21**	**4.82**		
(c)	**2013** (n=922)	**2.95**	**4.29**	**-1.139**	**0.255**
	2014 Not exposed to information (n=672)	**3.21**	**4.82**		

According to the MET-hours per week from physical activity during free time, a T-Test analysis was used for the examination of the homogeneity between the 3 groups, “2013”, “2014 not exposed to information”, “2014 exposed to information”. No statistically significant results were mentioned for all three groups, “2013”, “2014 exposed to information” and “2014 not exposed to information” according the MET-hours from the physical activity during free time, (a) t= -1.799, p= 0.072, (b) t= 1.063, p= 0.288, , (c) t= -0.882, p= 0.378 (Table 7c).

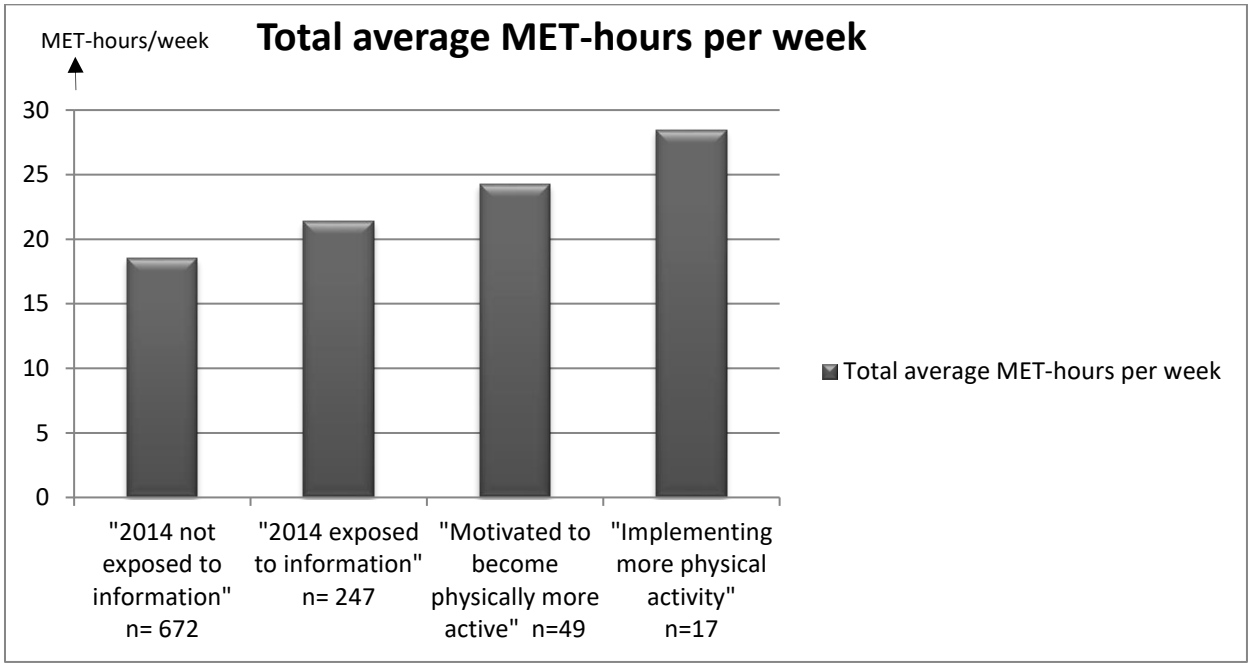
Table 7c: MET-hours/week in free time - independent sample t-test results for the interviewees of (a) “2013” and “2014 exposed to information” (b) “2014 exposed to information” and “2014 not exposed to information”, (c) “2013” and “2014 not exposed to information”.

	MET-hours/week in free time	Mean	SD	t	p
(a)	**2013** (n=922)	**3,48**	**4.655**	**-1.799**	**0.072**
	2014 Exposed to information (n=247)	**4,11**	**5.751**		
(b)	**2014 Exposed to information** (n=247)	**4,11**	**5.751**	**1.063**	**0.288**
	2014 Not exposed to information (n=672)	**3,70**	**5.068**		
(c)	**2013** (n=922)	**3,48**	**4.655**	**-0.882**	**0.378**
	2014 Not exposed to information (n=672)	**3,70**	**5.068**		

Thus, the interviewees from the “exposed to information” group in 2014 showed a larger mean MET-hours per week score than those from the “no exposed to information” group in 2014 and the interviewees from 2013 in all cases (tables 5, 5a, 5b, 5c).

The analysis of the average weekly total MET-hours per week between the following groups: 1) “2014 not exposed to information” 2) “2014 exposed to information”, 3) “2014 exposed to information and motivated to become physically more active” and 4) “2014 exposed to information and implementing more physical activity”, showed that the 4th group had the highest total average weekly MET-hours: 1) 18.54 MET-hours/week, 2) 21.38 MET-hours/week, 3) 24.25 MET-hours/week, 4) 28.46 MET-hours/week (Figure 3).

Figure 3: Total average MET-hours per week for the interviewees in 2014



Cancer and non-cancer patients' population

Anthropometric - Demographic data

For the groups "cancer patients" and "non cancer patients" the results of the descriptive statistics (frequency, percentage) for the sample concerning gender, area of residence, education level, BMI and age are exposed in table 8.

Table 8: Descriptive statistic table for gender, area of living, education level, BMI, and age for the groups "cancer patients" and "non cancer patients".

	Cancer patients (n=153)						**Non cancer patients (n=1688)**					
Gender	**Male (n)**			**Female (n)**			**Male (n)**			**Female (n)**		
Frequency (%)	50 (35%)			103 (65%)			660 (39%)			1028 (61%)		
Area of living	**Rural area (n)**			**City (n)**			**Rural area (n)**			**City (n)**		
Frequency (%)	91 (56%)			62 (44%)			978 (59%)			710 (41%)		
Education level	**< High school (n)**			**High school (n)**			**< High school (n)**			**High school (n)**		
Frequency (%)	11 (10%)			96 (63%)			84 (5%)			1064 (69%)		
BMI	**<18.5**	**18.5-25**		**25-30**		**>30**	**<18.5**	**18.5-25**		**25-30**		**>30**
Frequency (%)	3 (3%)	75 (48%)		48 (26%)		27 (23%)	40 (2%)	869 (51%)		578 (35%)		201 (12%)
Age	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**
Frequency (%)	0 (0%)	2 (1%)	4 (3%)	16 (13%)	27 (15%)	104 (68%)	63 (5%)	106 (8%)	211 (11%)	392 (24%)	313 (18%)	603 (35%)

"Cancer patients" and "non-cancer patients" profile

The largest percentage of the participants in both groups were females ("cancer patients": 67%, n=103 and "non-cancer patients": 61%, n=1026). The males participants were by 33% in the "cancer patients" group (n=50) and by 39% in the "non-cancer patients" group (n=658). Ninety-six percent of the participants which were cancer patients were over 40 years old (n=147) and 4% was younger than 40 years old (n=6). For the "non-cancer patients" group, 77% was above 40 years old (n=1308) and 23% was below 40 (n=380). The percentage of the participants of the "cancer patients" group which reported to follow a very strong healthy lifestyle was 26% (n=40) and from the "non-cancer group" was 15% (n=248). For the category "strong healthy lifestyle" the percentage was similar, with the "cancer patient" group to be on 50% (n=76) and for the "non-cancer" patient on 48% (n=805). Twenty-four percent of the participants of the "cancer patients" group (n=37) identified their lifestyle as "slightly", "poor" and "not at all" healthy, with the percentage of the other group "non-cancer patients" (n=631) to be on 37% (table 9).

Table 9. Frequencies for healthy lifestyle for the groups “cancer patients” and “non cancer patients”

	Healthy lifestyle									
	Cancer patients					Non cancer patients				
	very strong	strong	slightly	poor	not healthy at all	very strong	strong	slightly	poor	not healthy at all
Frequency	**40**	**76**	**33**	**4**	**0**	**248**	**808**	**492**	**95**	**41**
% Percentage	**26%**	**50%**	**21%**	**3%**	**0%**	**15%**	**48%**	**29%**	**6%**	**2%**

A chi-square test was used to examine the relationship between the cancer and non-cancer patients and the variables gender, age, body mass index (BMI), area of residence, educational level, physical activity level and healthy lifestyle. For 2 variables significant results were found. For variable “age” $\chi^2=72.87$, $p<0.001$ (2 cell frequencies were below 5) and for variable “healthy lifestyle” $\chi^2=21.72$, $p=0.001$ (2 cell frequencies were below 5), the results were significant. For the chi-square tests between the cancer and non-cancer patients and the following variables no significant results were mentioned: “gender”: $\chi^2=2.42$, $p=0.120$, “BMI”: $\chi^2=7.13$, $p=0.318$, “area of residence” $\chi^2=0.785$, $p=0.675$, “educational level”, $\chi^2=15.70$, $p=0.073$.

Physical activity levels

In both groups “cancer patients” and “non cancer patients”, 83% reported to exercise in moderate and high level (n=126 and n=1394), with just 17% being on the low level (n=27 and n=290).

A Mann-Whitney-U-Test was calculated to determine if there were differences between the 3 physical activity levels “high”, “moderate” and “low”, for “cancer patients” and “non-cancer patients”. There was no statistically significant difference in physical activity levels between cancer patients and non cancer patients, U=127818.00 Z= -.183, p=0.855. For both

groups “cancer patients” and “non cancer patients” further Mann-Whitney-U-Tests analyses were concluded for the examination of the differences between the physical activity levels and the gender. No statistically significant results were found in all cases. More specific, for the cancer patients and the variables “physical activity levels” and “gender” U=2323.00 Z= -1.111, p=0.266 and for the “non cancer patients” group and the variables “physical activity levels” and “gender” U=332276.50, Z= -0.617, p=0.537.

A Kruskal Wallis analysis was concluded to verify the differences between the physical activity levels and the age groups as well the healthy lifestyle categories in “cancer patients” and “non cancer patients” population. The outcomes reveled that no statistical results were found for the relationship between physical activity levels and age. Precisely, for the cancer patients and the variables “physical activity levels” and age: H=8.518, p=0.074, and for the “non cancer patients” group the variables “physical activity levels” and age: H=7.750, p=0.171”. For the variables “physical activity levels” and “healthy lifestyle”, a significant result was mentioned for the “non-cancer patients” group: H= 26.071, p<0.001, but not for the “cancer patients” group: H= 5.231, p=0.264.

MET-hours per week for “cancer patients” and “non cancer patients”

The T-Test was used for the analysis of the homogeneity between the two groups “cancer patients” and “non cancer patients” regarding the MET-hours per week on the following categories a) total b) work, c) transportation and d) during free time. Statistically significant differences were not reported in all cases. More specific, a) total: t=0.712, p= 0.685. b) work: t=0.165, p=0.603, c) transportation: t= - 0.079, p= 0.702 and d) during free time: t=0.522, p= 0.147.

The differences between female and male participants of the “cancer patients” and the “non cancer patients” groups concerning the MET-hours per week in all 4 categories (a) total b) work, c) transportation and d) during free time) were concluded with the T-Test analysis. For almost all the above cases no statistically significant results were found. More specific, for the “cancer patients” group: a) total: t= -0.874, p= 0.384. b) work: t= -1.431, p=0.155, c) transportation: t= 0.140, p= 0.889 and d) during free time: t=0.124, p= 0.901 and for the “non cancer patients” group: a) total: t= -0.552, p= 0.581. b) work: t= -0.177, p=0.860, c) transportation: t= - 0.668, p= 0.504. There was a statistically significant difference between the MET-hours per week during free time of men and women in “non cancer patients” group: t=2.611, p= 0.009.

The One-Way ANOVA test was implemented for the statistical analysis of the MET-hours and the variables “age” and “healthy lifestyle” in “cancer patients” and “non cancer patients” participants. For the “cancer patients” group and the differences related to age and MET-hours in all 4 categories, the analysis gave us no statistically significant results. MET-hours a) total: F(4, 142) = 1.027, p=0.396, b) work: F(4, 110)=1.313, p=0.270, c) transportation: F(4, 91)=0.189, p= 0.943 and d) during free time: F(4, 109)=0.278, p= 0.892.

For the “non cancer patients” group and the differences related to age and MET-hours in all 4 categories, the analysis gave us the following results. No statistically significant results the MET-hours: a) total: F(6, 1656) = 1.970, p=0.067 and d) during free time: F(6,1233)= 0.737, p= 0.620. The MET-hours per week differed statistically significant for the different age groups at work: F(6, 1240)=3.836, p=0.001 and in transportation: F(6,1064)= 2,161, p= 0.044.

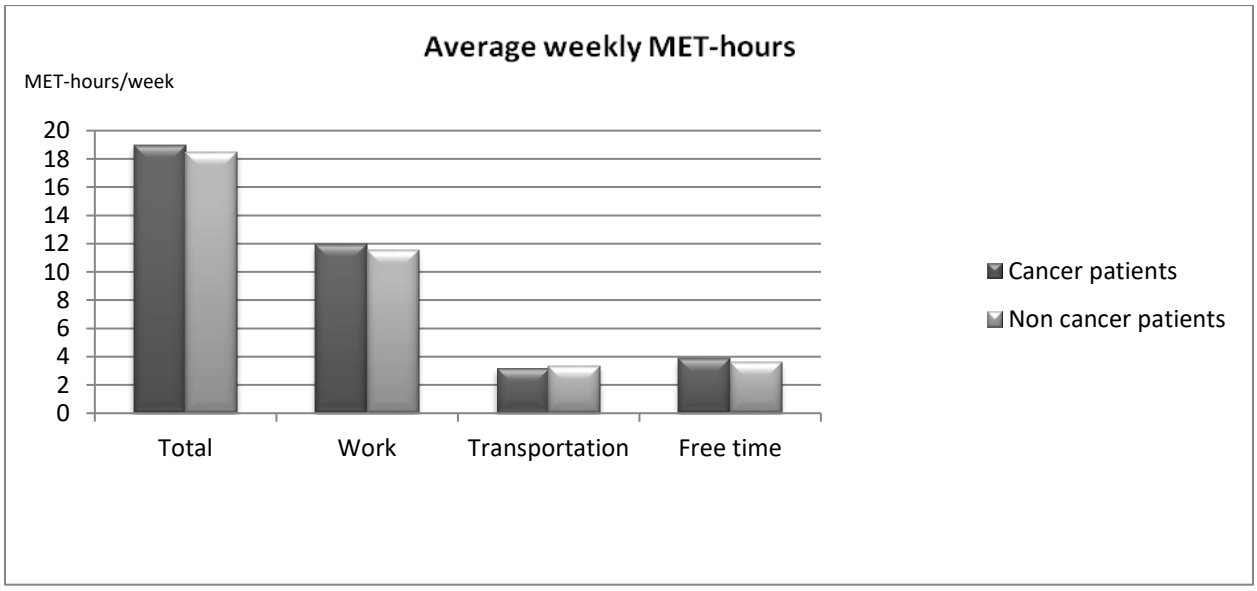
For the identification of differences in the “cancer patients” group, which were related to healthy lifestyle and MET-hours in all 4 categories an One-way Anova analysis was used. Statistically significant results were mention for the category “transportation”: F(3, 92)= 4.301,

p=0.007. The rest categories reviled no statistically significant differences. “Total”: F(3, 143) = 2.362, p=0.074, “work”: F(3, 111) = 1.119, p=0.345 and “during free time”: F(3, 110)= 1.060, p= 0.369.

For the “non cancer patients” group and the differences related to healthy lifestyle and MET-hours in all 4 categories, the analysis gave us statistically significant differences for the categories “work”: F(5, 1241)= 4.436, p=0.001 and “free time”: F(5, 1234)= 5.352, p<0.001. For the MET-hours per week for the different healthy lifestyle categories, no statistically significant results were found for the categories “total”: F(5, 1657)= 1.545, p=0.173 and “transportation”: F(5, 1065)= 2.104, p=0.063.

The average weekly MET-hours for both groups and for all categories are as follow: “cancer patients” a) work: 11.95 MET-hours/week, b) transportation: 3.15 MET-hours/week, c) during free time: 3.85 MET-hours/week, and d) total: 18.95 MET-hours/week and “non-cancer patients” a) work: 11.50 MET-hours/week, b) transportation: 3.35 MET-hours/week, c) during free time: 3.60 MET-hours/week, and d) total: 18.45 MET-hours/week (figure 4)

Figure 4: Average weekly MET-hours for the “cancer patients” and “non cancer patients” groups in total and for the three categories (physical activity: a) at work, b) from transportation and c) during free time).



Knowledge

Campaign

The descriptive statistic (frequency, percentage) results for the question "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" for the groups "2013", "2014 exposed to information" and "2014 not exposed to information" are shown in table 10.

Table 10. Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" for the groups "2013", "2014 exposed to information" and "2014 not exposed to information"

	Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms					
Group	**2013** (n=922)		**2014 exposed to information** (n=247)		**2014 not exposed to information** (n=672)	
	ja	**Nein**	**ja**	**nein**	**ja**	**nein**
Frequency (%)	689 (75%)	232 (25%)	220 (89%)	27 (11%)	452 (67%)	220 (33%)

A chi-square test was used to compare the 3 groups "2013", "2014 exposed to information" and "2014 not exposed to information" and the variable "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms". No expected cell frequencies were below 5. The results showed a significant between the 2 variables, $\chi^2 = 46.306$, $p < 0.001$, $\varphi = 0.000$.

The descriptive statistic (frequency, percentage) results for the statement "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" for the groups "2013", "2014 exposed to information" and "2014 not exposed to information" are shown in table 11. This question was made to the interviewees of the 3 groups who stated that they know about the relationship between physical activity and cancer risk reduction in specific cancer forms.

Table 11. Targeted adoption of physical activity for cancer risk reduction in specific cancer forms for the groups "2013", "2014 exposed to information" and "2014 not exposed to information"

	Targeted adoption of physical activity and cancer risk reduction in specific cancer forms					
Group	**2013** (n=689)		**2014 exposed to information** (n=220)		**2014 not exposed to information** (n=452)	
	ja	**nein**	**ja**	**nein**	**ja**	**nein**
Frequency (%)	152 (22%)	537 (78%)	53 (24%)	167 (76%)	86 (19%)	366 (81%)

A chi-square test was used to compare the 3 groups "2013", "2014 exposed to information" and "2014 not exposed to information" and the variable "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" for the groups "2013". No expected cell frequencies were below 5. The results showed no significant between the 2 variables, $\chi^2 = 2.287$, $p = 0.683$, $\varphi = 0.683$.

The descriptive statistic (frequency, percentage) results for the question "awareness about the program Sport for Health", for the groups "2013", "2014 exposed to information" and "2014 not exposed to information" are shown in table 12.

Table 12. Sport for Health program awareness for the groups "2013", "2014 exposed to information" and "2014 not exposed to information"

	Sport for Health program awareness					
Group	**2013** (n=917)		**2014 exposed to information** (n=246)		**2014 not exposed to information** (n=670)	
	ja	**nein**	**ja**	**nein**	**ja**	**nein**
Frequency (%)	154 (17%)	763 (83%)	59 (24%)	187 (76%)	89 (13%)	581 (87%)

A chi-square test was used to compare the 3 groups "2013", "2014 exposed to information" and "2014 not exposed to information" and the variable "awareness about the

program Sport for Health". No expected cell frequencies were below 5. The results showed a significant between the 2 variables, χ^2= 15.659, *p*= 0.004, φ= 0.004.

The total results for all 3 groups "2013", "2014 exposed to information" and "2014 not exposed to information" regarding the source of the information about the "Sport for Health" program are exposed in table 13.

Table 13. Source of the information about the "Sport for Health" program for all 3 groups.

Information about the "Sport for Health" program							
Source	**Physician**	**TV**	**Press**	**Flyer**	**Internet**	**other**	**no answer**
Frequency (%)	59 (15%)	50 (13%)	111 (28%)	65 (16%)	25 (6%)	67 (17%)	22 (5%)

Further cross-tabulations utilized χ^2 tests were used for the analysis of dependent variables ("knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms", "targeted adoption of physical activity for cancer risk reduction in specific cancer forms", "awareness about the program Sport for Health") and the independent variables (gender, age, education level, body mass index (BMI), physical activity level, area of residence, healthy lifestyle, cancer patient, moving on foot or by bike for at least 10 minutes per day from one place to another, vigorous intensity physical activity for at least 10 minutes per day, moderate intensity physical activity for at least 10 minutes per day) for all group population in this study ("2013", "2014 exposed to information", "2014 not exposed to information". For the "2014 exposed to information" group, there was an additional analysis for the independent variables "motivation from the campaign to engage in physical activity", "implementation of more physical activity because of the campaign" "visited the webpage www.bewegung-gegen-krebs.de". Each group´s results are analyzed below.

"2013": For the variable "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" no significant results were found for all cases:

"gender" χ^2= 1.948, *p*= 0.378, φ= 0.378, "age" χ^2= 16.960, *p*= 0.075, φ= 0.075, "education level" χ^2= 10.728, *p*= 0.906, φ= 0.906, "area of living" χ^2= 2,582, *p*= 0.630, φ= 0.630, "BMI" χ^2= 6.067, *p*= 0.640, φ= 0.640, "physical activity level" χ^2= 2.448, *p*= 0.654, φ= 0.654, "healthy lifestyle" χ^2= 7.658, *p*= 0.662, φ= 0.662, "cancer patients" χ^2= 6.287, *p*= 0.179, φ= 0.179, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.771, *p*= 0.680, φ= 0.680, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 2.101, *p*= 0.350, φ= 0.350, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 3.185, *p*= 0.203, φ= 0.203, "awareness about the program Sport for Health" χ^2= 5.777, *p*= 0.216, φ= 0.216.

Statistically significant results were found between the variables "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" and "gender" χ^2= 8.912, *p*= 0.012, φ= 0.012, "physical activity level" χ^2= 14,986, *p*= 0.005, φ=0.005, "healthy lifestyle" χ^2= 30.750, *p*= 0.001, φ= 0.001, "cancer patients" χ^2= 22.142, p< 0.001, φ< 0.001.

No statistically significant results were found for the variables: "age" χ^2= 14.539, *p*= 0.150, φ= 0.150, "area of living" χ^2= 5.305, *p*= 0.257, φ= 0.257, "BMI" χ^2= 14.346, *p*= 0.073, φ= 0.073, "education level" χ^2= 12.096, *p*= 0.737, φ= 0.737, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.603, *p*= 0.740, φ= 0.740, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 1.603, *p*= 0.449, φ= 0.449, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 3.098, *p*= 0.212, φ= 0.212, "awareness about the program Sport for health" χ^2= 4.548, *p*= 0.337, φ= 0.337.

Statistically significant results we found between the variables "awareness about the program Sport for health" and "gender" χ^2= 10.949, *p*= 0.004, φ= 0.004, "healthy lifestyle" χ^2= 193.839, *p*< 0.001, φ< 0.001, "education level" χ^2= 34.915, *p*= 0.010, φ= 0.010, "area of living" χ^2= 36.098, p< 0.001, φ< 0.001, "cancer patients" χ^2= 186.133, p< 0.001, φ< 0.001,

"moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 7.500, *p*= 0.024, φ= 0.024.

No statistically significant results we were mention between the variables "awareness about the program Sport for health" the variables: "age" χ^2= 5.760, *p*= 0.835, φ= 0.835, "BMI" χ^2= 12.441, *p*= 0.133, φ= 0.133, "physical activity level" χ^2= 2.360, *p*= 0.670, φ= 0.670, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 0.373, *p*= 0.830, φ= 0.830, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 0.486, *p*= 0.784, φ= 0.784.

"2014 exposed to information": The results were significant for the following cases. "Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" and "physical activity level" χ^2= 7.774, *p*= 0.021, φ= 0.021, "BMI" χ^2= 11.067, *p*= 0.026, φ= 0.026, "education level" χ^2= 16.871, *p*= 0.018, φ= 0.018, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 5.424, *p*= 0.020, φ= 0.020, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 11.400, *p*= 0.001, φ= 0.001. No statistically significant results were found for the variables: "gender" χ^2= 2.322, *p*= 0.128, φ= 0.128, "age" χ^2= 9.859, *p*= 0.131, φ= 0.131, "area of living" χ^2= 0,378, *p*= 0.828, φ= 0.828, "healthy lifestyle" χ^2= 3.362, *p*= 0.499, φ= 0.499, "cancer patients" χ^2= 0.734, *p*= 0.392, φ= 0.392, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 1.965, *p*= 0.161, φ= 0.161, "awareness about the program Sport for Health?" χ^2= 0.175, *p*= 0.916, φ= 0.916, "motivation from the campaign to engage in physical activity" χ^2= 1.996, *p*= 0.573, φ= 0.573, "implementation of more physical activity because of the campaign" χ^2= 0.531, *p*= 0.466, φ= 0.466, "visited the webpage www.bewegung-gegen-krebs.de" χ^2= 0.373, *p*= 0.542, φ= 0.542.

Statistically significant results we found between the variables "targeted adoption of

physical activity for cancer risk reduction in specific cancer forms" and "healthy lifestyle" χ^2= 20.808, p< 0.001, φ< 0.001, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 4.940, p= 0.026, φ= 0.026, "motivation from the campaign to engage in physical activity" χ^2= 7.859, p= 0.049, φ= 0.049.

No statistically significant results were found for the variables: "gender" χ^2= 3.128, p= 0.077, φ= 0.077, "age" χ^2= 7.491, p= 0.278, φ= 0.278, "physical activity level" χ^2= 3.728, p= 0.155, φ=0.155, "BMI" χ^2= 1.508, p= 0.680, φ= 0.680, "area of living" χ^2= 0.596, p= 0.742, φ= 0.742, "education level" χ^2= 9.582, p= 0.143, φ= 0.143, "cancer patients" χ^2= 2.959, p= 0.085, φ= 0.085, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 3.327, p= 0.068, φ= 0.068, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 0.019, p= 0.891, φ= 0.891, "awareness about the program Sport for health" χ^2= 3.326, p= 0.190, φ= 0.190, "implementation of more physical activity because of the campaign" χ^2= 0.252, p= 0.616, φ= 0.616, "visited the webpage www.bewegung-gegen-krebs.de" χ^2= 2.994, p= 0.084, φ= 0.084.

Statistically significant results we found between the variables "awareness about the program Sport for health" and "visited the webpage www.bewegung-gegen-krebs.de" χ^2= 9.677, p= 0.008, φ= 0.008.

No statistically significant results we were mention between the variables "awareness about the program Sport for health" the variables: "gender" χ^2= 0.636, p= 0.728, φ= 0.728, "age" χ^2= 5.649, p= 0. 933, φ= 0.933, "BMI" χ^2= 4.070, p= 0.851, φ= 0.851, "education level" χ^2= 10.245, p= 0.744, φ= 0.744, "area of living" χ^2= 2.914, p=0.572, φ=0.572, "physical activity level" χ^2= 2.770, p= 0.597, φ= 0.597, "healthy lifestyle" χ^2= 5.712, p= 0.679, φ=0.679, "cancer patients" χ^2= 2.325, p=0.313, φ=0.313, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.400, p= 0.819, φ= 0.819, "vigorous intensity

physical activity for at least 10 minutes per day" χ^2= 0.900, *p*= 0. 638, φ= 0.638, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 0.060, *p*= 0.641, φ= 0.641, "motivation from the campaign to engage in physical activity" χ^2= 9.146, *p*= 0.166, φ= 0.166, "implementation of more physical activity because of the campaign" χ^2= 2.942, *p*= 0.086, φ= 0.086.

"2014 not exposed to information": The results were significant for the following cases. "Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" and "healthy lifestyle" χ^2= 21.415, *p*= 0.001, φ= 0.001, "BMI" χ^2= 11.024, *p*= 0.026, φ= 0.026, "education level" χ^2= 26.891, *p*= 0.001, φ= 0.001, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 5.231, *p*= 0.022, φ= 0.022.

No significant results were found for the variables: "gender" χ^2= 0.010, *p*= 0.919, φ= 0.919, "age" χ^2= 5.939, *p*= 0.430, φ= 0.430, "area of living" χ^2= 1.250, *p*= 0.535, φ= 0.535, "physical activity level" χ^2= 2.737, *p*= 0.254, φ= 0.254 "cancer patients" χ^2= 4.082, *p*= 0.130, φ= 0.130, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.001, *p*= 0.981, φ= 0.981, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 3.197, *p*= 0.074, φ= 0.074, "awareness about the program Sport for Health?" χ^2= 4.124, *p*= 0.127, φ= 0.127.

Statistically significant results we found between the variables "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" and "healthy lifestyle" χ^2= 29,279, *p*= < 0.001, φ< 0.001.

No statistically significant results were found for the variables: "gender" χ^2= 0.894, *p*= 0.344, φ= 0.344, "age" χ^2= 9.823, *p*= 0.132, φ= 0.132, "education level" χ^2= 6.072, *p*= 0.415, φ= 0.415, "area of living" χ^2= 0.971, *p*= 0.615, φ= 0.615, "physical activity level" χ^2= 1.418, *p*=0.492, φ=0.492, "BMI" χ^2= 2.470, *p*= 0.650, φ= 0.650, "cancer patients" χ^2= 4.387,

p=0.112, φ= 0.112, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 3.181, *p*= 0.075, φ= 0.075, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 2.310, *p*= 0.129, φ= 0.129, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 3.678, *p*= 0.055, φ= 0.055, "awareness about the program Sport for health" χ^2= 3.960, *p*= 0.138, φ= 0.138.

Statistically significant results we found between the variables "awareness about the program Sport for health" and "gender" χ^2= 10.271, *p*= 0.006, φ= 0.006, "healthy lifestyle" χ^2= 27.319, *p*= 0.002, φ= 0.002, "education level" χ^2= 30.695, *p*= 0.015, φ= 0.015.

No statistically significant results we were mention between the variables "awareness about the program Sport for health" the variables: "age" χ^2= 8.139, *p*= 0.774, φ= 0.774, , "area of living" χ^2= 6.822, p= 0.146, φ= 0.146, "BMI" χ^2= 1.581, *p*= 0.991, φ= 0.991, "physical activity level" χ^2= 7.532, *p*= 0.110, φ= 0.110, "cancer patients" χ^2= 2.929, p=0.570, φ= 0.570, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.308, *p*= 0.857, φ= 0.857, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 0.037, *p*= 0.982, φ= 0.982, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 0.204, *p*= 0.903, φ= 0.903.

Cancer patients and non-cancer patients

The descriptive statistic (frequency, percentage) results for the question "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" for the groups "cancer patients" and "non cancer patients" are shown in table 14.

Table 14. Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" for the groups "cancer patients", "non cancer patients"

	Knowledge about the relationship between physical activity and cancer risk reduction			
Group	**Cancer patients (n=153)**		**Non cancer patients (n=1684)**	
	ja	**nein**	**ja**	**nein**
Frequency (%)	127 (83%)	26 (17%)	1230 (73%)	454 (27%)

A chi-square test was used to compare the groups "cancer patients", "non cancer patients" and the variable "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms". No expected cell frequencies were below 5. The results showed a significant between the 2 variables, $\chi^2 = 7.256$, $p = 0.027$, $\varphi = 0.027$.

The descriptive statistic (frequency, percentage) results for the statement "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" for the groups "cancer patients" and "non cancer patients" are shown in table 15. This question was made to the interviewees of the 2 groups who stated that they know about the relationship between physical activity and cancer risk reduction in specific cancer forms.

Table 15. Targeted adoption of physical activity for cancer risk reduction in specific cancer forms for the groups "cancer patients", "non cancer patients"

	Targeted adoption of physical activity and cancer risk reduction in specific cancer forms			
Group	**Cancer patients (n=127)**		**Non cancer patients (n=1230)**	
	ja	**nein**	**ja**	**nein**
Frequency (%)	58 (38%)	95 (62%)	246 (20%)	984 (80%)

A chi-square test was used to compare the groups "cancer patients", "non cancer patients" and the variable "targeted adoption of physical activity for cancer risk reduction in

specific cancer forms" for the groups "2013". No expected cell frequencies were below 5. The results showed no significant between the 2 variables, $\chi^2 = 25.426$, $p < 0.001$, φ $p < 0.001$.

The descriptive statistic (frequency, percentage) results for the question "are you aware of the Sport for Health program?", for the groups "2013", "2014 exposed to information" and "2014 not exposed to information" are shown in table 16.

Table 16. Sport for Health program awareness for the groups "cancer patients", "non cancer patients".

	Sport for Health program awareness			
Group	**Cancer patients (n=153)**		**Non cancer patients (n=1677)**	
	ja	**nein**	**ja**	**nein**
Frequency (%)	37 (24%)	116 (76%)	265 (16%)	1412 (84%)

A chi-square test was used to the groups "cancer patients", "non cancer patients" and the variable "awareness about the program Sport for Health". No expected cell frequencies were below 5. The results showed a significant between the 2 variables, $\chi^2 = 7.810$, $p = 0.020$, $\varphi = 0.020$.

Further cross-tabulations utilized χ^2 tests for the analysis of dependent variables: "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms", "targeted adoption of physical activity for cancer risk reduction in specific cancer forms", "awareness about the program Sport for health" and the independent variables (gender, age, education level, body mass index (BMI), physical activity level, area of residence, healthy lifestyle, cancer patient, moving on foot or by bike for at least 10 minutes per day from one place to another, vigorous intensity physical activity for at least 10 minutes per day, moderate intensity physical activity for at least 10 minutes per day, are you aware of the program Sport for Health?) for the group population "cancer patients", "non cancer patients". Each group´s results are analyzed below.

"Cancer patients": There were no statistically significant results for all following cases: "Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" and "gender" χ^2= 1,320, p= 0.251, φ= 0.251, "age" χ^2= 86.419, p= 0.170, φ= 0.170, "healthy lifestyle" χ^2= 0.437, p= 0.979, φ= 0.979, "physical activity level" χ^2= 1.157, p= 0.561, φ= 0.561, "area of living" χ^2= 2.674, p= 0.263, φ= 0.263, "BMI" χ^2= 2.015, p= 0.733, φ= 0.733, "education level" χ^2= 4.510, p= 0.608, φ= 0.608, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.342, p= 0.559, φ= 0.559, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 0.207, p= 0.649, φ= 0.649, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 3.088, p= 0.079, φ= 0.079, "awareness about the program Sport for health" χ^2= 2.731, p= 0.098, φ= 0.098.

Statistically significant results were found between the variables "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" and "physical activity level" χ^2= 23,881, p< 0.001, φ< 0.001, "healthy lifestyle" χ^2= 23.288, p= 0.001, φ= 0.001, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 12.672, p= 0.002, φ= 0.002.

No statistically significant results were found for the variables: "gender" χ^2= 1,389, p= 0.499, φ= 0.499, "age" χ^2= 8.877, p= 0.353, φ= 0.353, "area of living" χ^2= 1.900, p= 0.387, φ= 0.387, "BMI" χ^2= 9.762, p= 0.282, φ= 0.282, "education level" χ^2= 9.033, p= 0.700, φ= 0.700, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 5.424, p= 0.522, φ= 0.522, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 1.083, p= 0.582, φ= 0.582, "awareness about the program Sport for health" χ^2= 0.670, p= 0.715, φ= 0.715.

Statistically significant results we found between the variables "awareness about the program Sport for health" and "healthy lifestyle" χ^2= 12.038, p= 0.017, φ= 0.017.

No statistically significant results we were mention between the variables "awareness about the program Sport for health" the variables: "gender" χ^2= 0.590, p= 0.442, φ= 0.442, "age" χ^2= 0.740, p= 0.946, φ= 0.946, "education level" χ^2= 6.550, p= 0.365, φ= 0.365, "area of living" χ^2= 0.324, p= 0.850, φ= 0.850, "BMI" χ^2= 3.151, p= 0.533, φ= 0.533, "physical activity level" χ^2= 0.099, p= 0.473, φ= 0.473, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 1.182, p= 0.277, φ= 0.277, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 0.520, p= 0.471, φ= 0.471, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 1.607, p= 0.205, φ= 0.205.

"Non cancer patients": There were statistically significant results for the variables "Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" and "healthy lifestyle" χ^2= 24.373, p= 0.007, φ= 0.007, "BMI" χ^2= 21.874, p= 0.005, φ= 0.005, "education level" χ^2= 31.944, p= 0.022, φ= 0.022, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 10.447, p= 0.005, φ= 0.005

No statistically significant results were mentioned for the following cases: "gender" χ^2= 2.405, p= 0.300, φ= 0.300, "age" χ^2= 13.931, p= 0.305, φ= 0.305, "physical activity level" χ^2= 7.290, p= 0.121, φ= 0.121, "area of living" χ^2= 2.596, p= 0.628, φ= 0.628, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 1.878, p= 0.391, φ= 0.391, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 5.238, p= 0.073, φ= 0.073, "awareness about the program Sport for health" χ^2= 9.291, p= 0.054, φ= 0.054.

Statistically significant results we found between the variables "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" and "gender" χ^2= 9,352, p= 0.002, φ= 0.002, "awareness about the program Sport for health" χ^2= 7.254, p= 0.027, φ= 0.027, "healthy lifestyle" χ^2= 44.120, p< 0.001, φ< 0.001. No statistically significant results were found for the variables: "age" χ^2= 11.398, p= 0.077, φ= 0.077, "physical activity level" χ^2= 4.717, p=0.095, φ=0.095, "BMI" χ^2= 5.156, p= 0.272, φ= 0.272, "area of living" χ^2= 0.368,

p= 0.832, φ= 0.832, "education level" χ^2= 5.808, p= 0.669, φ= 0.669, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 0.578, p= 0.447, φ= 0.447, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 1.671, p= 0.196, φ= 0.196, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 2.731, p= 0.098, φ= 0.098.

Statistically significant results we found between the variables "awareness about the program Sport for health" and "gender" χ^2= 23.759, p< 0.001, φ< 0.001, "physical activity level" χ^2= 9.760, p= 0.045, φ= 0.045, "healthy lifestyle" χ^2= 11.603, p< 0.001, φ< 0.001, "education level" χ^2= 31.506, p= 0.025, φ= 0.025,

No statistically significant results we were mention between the variables "awareness about the program Sport for health" the variables: "age" χ^2= 10.458, p= 0.576, φ= 0.576, "area of living" χ^2= 3.867, p= 0.424, φ= 0.424, "BMI" χ^2= 3.355, p= 0.910, φ= 0.910, "moving on foot or by bike for at least 10 minutes per day from one place to another" χ^2= 4.713, p= 0.095, φ= 0.095, "vigorous intensity physical activity for at least 10 minutes per day" χ^2= 0.021, p= 0.683, φ= 0.683, "moderate intensity physical activity for at least 10 minutes per day" χ^2= 0.045, p= 0.978, φ= 0.978.

Discussion

Campaign

The current study aimed to evaluate the success of the campaign "Physical activity against cancer" to increase physical activity behavior in Germany. Further goals were to examine the accessibility of the campaign, to assess whether physical activity levels of participants were influenced by the campaign, to evaluate the knowledge of the interviewees about the potential that physical activity can reduce specific cancer types and to determine whether the campaign served as a motivator for people to become physically more active. The results showed that 27% of participants of the second survey had heard about the "Physical activity against cancer" campaign, which took place from April to June 2014. The campaign aimed to be a motivator for people to become more physically active and this goal was achieved, because 44% of the answers were given from those who were exposed to the information, mentioned that the campaign´s message to the people was to become physically more active. This kind of campaigns, were characterized as one population approach, which aim to the increment of the physical activity levels[209], but according to the American Heart Association their effectiveness is not proved in details and how these can be considered useful in health behavior changes[224]. The exact impact of a campaign and how it affects the lifestyle behavior of the public still remains unclear, but that does not degrade the importance of such campaigns. Even the behavioral change of a single individual is definitely worth the effort. The fact that 20% of the participants who were exposed to the information were motivated to become physically more active and from this group 35% adapted more physical activity because of the campaign, give a further value to this kind of attempts. It needs to be noted that almost half of the participants, who were exposed to the information, were already physically active. That strengthens the relationship between healthy lifestyle behavior and knowledge[225]. Strategies

designed in order to promote nutrition and physical activity seemed to help with the implementation of actions for better nutrition and more physical activity[226]. A variety of complementary strategies are needed for cancer prevention initiatives. Many effective public health campaigns are guided by a multitude of health promotion models and theories, and risk factor awareness is well-known to play a significant role in influencing attitudes and intentions[227,228]. Social media campaigns are a useful tool for dispelling myths and filling in information gaps regarding cancer risk factors[229]. While social media marketing has the power to reshape social norms and alter perceptions and attitudes, it is not always effective in changing lifestyle behavior on its own[230].

The campaign reached more female than male participants and the majority of them were older than 41 years old. The fact that the campaign reached more females could be related to the fact that women are generally more interested in health and medical topics, while males more likely read something about science and technology[231]. The older the people are, the bigger is their relationship to health issues but also their interest in health and medical subjects, with the younger people being more interested in science and technology[231]. The greatest part of them, mentioned that they have a "very strong" and "strong" healthy lifestyle and their physical activity level was classified as "high" and "moderate". It seems that people who have an active and healthy lifestyle are also more aware of the benefits of their actions and they are better informed about topics that are relevant to physical activity and health prevention. The majority of the "2014 exposed to information" group was going on foot or was using their bikes for their daily transportation for at least 10 minutes. If we consider that the campaign was released and promoted in public places and public transportation, then it was more visible to people who were moving on the streets. More than half of the interviewed people of the "2014 exposed to information" group were living in a rural area. The area of residence did not influence the accessibility of the campaign.

The high physical activity level seemed to be related to the motivation of the participants of the "2014 exposed to information" group to become more physically active. Gender wasn´t related with the motivation to become physically more active through the campaign, as men and women revealed no differences between them. According to the results from both surveys, there is an excess of knowledge among the respondents that regular physical activity can have an impact on the cancer risk reduction[232-234]. The fact that almost all participants from the "2014 exposed to information" group were aware of this, revealed that awareness and knowledge are strongly connected. The awareness level, which in that case is mentioned as high, plays an important role in cancer prevention because it can contribute to the promotion of physical activity levels[235] which is considered one of the leading health indicators[4]. At the same time that means that physical inactivity can be a main risk factor and that is mentioned by the WHO in 2002 and 2003[89].

Between the participants of both surveys "2013" and "2014" as well the groups "2014 exposed to information", "2014 not exposed to information" no differences were indicated according to the physical activity levels. That was an important reason to examine the physical levels in more detail by converting the levels into MET-scores, in order to be able to identify any differences between the groups. Physical activity levels were not related to the gender or age in both "2013" and "2014" groups, which means that the physical activity status is not affected by the gender or the age of the individuals. According to a survey of Amin et al, gender seemed not to be related to physical activity levels during free time but there was an age-related decline in leisure-related physical activity[235]. Differences between males and females, which were mentioned in the bibliography, are related to the type of the physical activity, for example male participants are interested on mastery and competition physical activities, where females are choosing physical activities related to appearance and fitness[237]. The physical activity levels

were related to the healthy lifestyle status. That was expected, because physical activity is one of the most important components of healthy lifestyle.

The relationship between healthy lifestyle behavior and interest on health related topic is verified once more from the fact that the participants of the "2014 exposed to information" had higher average MET-hours per week in all 4 categories (total, work, transportation, free time) than the participants of the other two groups, "2013" and "2014 not exposed to information". The fact that the members of the "exposed to information" group had the highest MET-hours per week supports the hypothesis that the campaign had a positive influence on the activity levels of the participants. The fact that the interviewees, who were "exposed to information", had the highest MET-hours per week can also be associated to their interest in topics, which are health related. Furthermore, the effect of the campaign on the physical activity levels of the participants can be verified from the results of the statistical analysis of the MET-hours per week in total and for the subcategory "physical activity from transportation" which were statistically significant in both examined cases 1) the MET-hours per week between the groups "2013" and "2014 exposed to information", 2) the MET-hours per week between the groups "2014 exposed to information" and "2014 not exposed to information". The tendency of the results in the subcategories "physical activity at work" and "physical activity in free time" shows that the "2014 exposed to information" group had an impact on the p values even if those were not statistically significant. In all cases no significant p values were found for the groups "2013" and "2014 not exposed to information", which means that these groups were homogeneous. That strengthens the fact that the campaign had an impact on the physical activity behavior of the participants who were exposed to the information of the campaign, which was promoting physical activity against cancer. If we consider that physical activity at work is not something it can be easily changed and the recreational physical activity (during

free time) was already in high level, then the only behavioral change according to the physical activity could only be occurred in the category of physical activity from transportation.

The MET-hours per week for the groups, “2014 not exposed to information”, “2014 exposed to information”, “2014 exposed to information and motivated to become physically more active” and “2014 exposed to information and implementing more physical activity”, showed that the 4th group had the highest total average weekly MET-hours, which means that the campaign had probably an influence on the health behavior related to physical activity of those who were exposed to it.

The campaign seemed to be well understood by everyone and a high education level was not required. A well-designed campaign needs to be understandable by anyone and that was the result in this case. The campaign also managed to reach people from all areas of living, physical activity levels, sport habits for leisure, BMI, and cancer patients and this can also be recognized as a success of the designers of the campaign.

Cancer and non-cancer patients

The examination of the physical activity behavior of cancer patients in Germany and the comparison with the physical activity behavior of non-cancer patients was another major aim of the current study. Furthermore the evaluation of the physical activity levels of both “cancer patients” and “non-cancer patients” was one of the tasks. Another goal was the definition of how healthy the lifestyle of the participants in these two groups was. The results showed that no differences were indicated between the cancer patients and the non-cancer patients according to the amount of the physical activity (MET scores) in all categories (total, work, transportation and during free time) but also in all three physical activity levels (high, moderate and low).

From those results can be concluded that the physical activity constitutes a part of the therapy of cancer patients and it is well promoted from the health care system in Germany. The fact that the non-cancer patients were physically active let us concluded that the physical activity is part of peoples life in Germany, which are probably recognizing the positive effects of it and they keep implementing physical activity in all stages of their lives unexceptionally. The "cancer patient" population seemed to adopt a healthier lifestyle that the "non-cancer" population. The health status of individuals surely affects their lifestyle and it seems that they are more willing to live more health conscious,[110,177] something has been verified from the significant results, which were examining the differences between cancer and non-cancer patients regarding their lifestyle and revealed that more cancer patients than non-cancer patients reported to follow a very strong and strong healthy lifestyle. The majority of the "cancer patients" group was over 40 years old, which was expected because cancer incident is more usual in older ages[238], so the significant results confirmed the **hypothesis.** For the gender, BMI, education level and area of living, no significant results were mentioned, which means that no differences were found between the two groups in the above categories. It has been determined that there were no differences between the two groups "cancer patients", non-cancer patients" according to their physical activity levels. As already mentioned, no differences were noticed on a further detailed analysis between the MET scores in both groups, which confirms the fact that the physical activity behavior in cancer patients and non-cancer patients in Germany is similar, something which comes to conflict with other evidence, which support that only 10% of cancer patients will be active during their primary treatments and only about 20% to 30% will be active after they recover from treatments[184,185]. The fact that Germany was among the top 5 countries, between Finland, Denmark, Sweden and Austria, where people spent at least two and a half hours per week of free time on physical activities (2014)[239], support the above statement about the physical activity behavior in German people. Also because of the development of institutes

and centers during the last decades, which are responsible for the promotion and implementation of exercise for cancer patients, it can be assumed that these are the reasons why physical activity behavior by cancer patients in Germany is not different from physical activity behavior by non-cancer patients.

Physical activity levels were also alike between male and female participants, as well as between the age categories in both groups. By the analysis of the MET scores in all categories, a statistical significant result was mentioned between male and female participants of the "non cancer patients" group only for the category "during free time". The results showed that gender was not related to the physical activity levels and the MET scores in almost all cases. The only case, in which a relationship was mentioned, was for the "cancer patients" group and the MET scores at work. For the same case (MET scores at work) of the "non-cancer patients" group the p value was not significant but the lowest in all four groups. That might be related with the fact, that females in their majority do not practice occupations with vigorous physical activity. Generally men and women seem to have no differences in their health behavior trends and age seems not to affect the physical activity behavior of the individuals. According to Speakman and Westerterp (2010), physical activity levels decrease with age by people aged ≥52 years, a statement that comes to conflict with the above results[240]. Statistical significant differences were mentioned for the "non-cancer patients" group, between the variables "physical activity level" and "healthy lifestyle", which indicates differences between the mean values of the physical activity levels in all 5 healthy lifestyle categories. For the "cancer patients" group, no differences were pointed out by all 5 healthy lifestyle categories. A high or moderate physical activity level can identify a healthy lifestyle or be a part of it. In the case of cancer patients it can be assumed that there were no differences in all three physical activity level categories according to how healthy their lifestyle was. The definition of a "healthy lifestyle" does not only include the physical activity behavior but also other components like healthy nutrition, no

smoking and avoiding uncontrolled and long exposure to the UV-radiation. Beside the fact that the majority of the "non-cancer patients" group stated to espouse a "very strong" and a "strong" healthy lifestyle, a big part of them affirmed to have a "slightly", "poor" and "not at all" healthy lifestyle. The fact that the percentage of the "cancer patients" group was higher in the categories "very strong" and "strong" healthy lifestyle and lower in the other categories ("slightly", "poor" and "not at all") can lead us to the conclusion that people with health problems may be more aware of the importance of the implementation of a healthy lifestyle and the avoidance of any unhealthy habits, which can aggravate their health condition. Schermer et al., tried to report the population trends in healthy lifestyle through a period of 30 years. Of all participants, 17% reported to have a healthy lifestyle (physical activity, weight, smoking, sleep, and alcohol consumption), which was reduced by 10.8% within 30 years[241]. For cancer patients the adherence a healthy lifestyle is strongly connected to the quality of life, which is the reason why cancer patients develop a healthy lifestyle conscious[242]. Beside the numerous benefits of a healthy lifestyle during the cancer treatment, Cao reported in 2021, that a healthy lifestyle among cancer patients is connected to lower risk for cardiovascular diseases and type 2 diabetes[243].

The examination of the factor, "age" and the relationship to the MET scores in both participant groups ("cancer patients" and "non-cancer patients"), allowed us to come into some further conclusions. The "age" showed to be irrelevant to the physical activity levels in all participants. That can be supported from the fact, that adopting an active lifestyle is something we learn from our childhood and it is part of our lifestyle and mentality, which stays unchanged through the years. Furthermore, life expectancy has been changed the last decades and people that were considered old in the past are nowadays having an active lifestyle. The results showed that the MET scores were different between the age groups for the categories "work" and "transportation" for the non-cancer patients. The mean scores for the age groups "18-20" and

"over 60" in the category "work" were the lowest and that can be considered as normal because none of these two age groups is common to be related with vigorous physical activity at work. For the category "transportation", the age groups "21-30" and "over 60" had the highest mean scores, which can mean that people in these two age groups used less means of transport, because they had more free time. It can be assumed that for the ages between 21-30, most of them were students with probably no children and for the agers over 60, it can be said that they did not working and had more time to walk or use a bike for their transportation. According to the results, no relationship was indicated between the "age" and the "MET scores" in the categories "work", "transportation", "during the free time" and "total" for the cancer patients. This strengthens the fact that all cancer patients understand the importance of exercise and are physically active beside their age.

Differences between the MET scores and healthy lifestyle for the "cancer patients" group were only mentioned for the category "transportation". For all other three categories, the MET-scores did not differ between the healthy lifestyle levels. The above significant result might be related to the MET scores of the participants, who characterized their lifestyle as "not healthy" but had high MET scores. It can be concluded that these participants considered their healthy lifestyle behavior as not healthy because they were not having a healthy diet or because they believed that their physical activity behavior was not healthy enough. The reflection of this significant result might also be generally connected to the physical activity level, because the fact that they were physically active is more important than the kind of the activity (occupational, transportation, free time). For the "non cancer patients" group, differences were stated between the MET score und the healthy lifestyle levels for the categories "work" and "free time". The same conclusions as above can be noted for these cases too. The interpretations of questions, which are related to behavior, are often misunderstood from the interviewees. It

also has to be mentioned that the evaluation of a behavior from any individual is subjective and not objective.

Knowledge

Campaign

The assumption that knowledge is strongly connected to our interests has been confirmed from the results of the study. The more an individual is interested in a topic the more he/she is willing to enrich his/her knowledge[244]. Furthermore, health campaigns showed to have significant effects on knowledge intention and behavior of the receivers[245]. Through this study it can be verified that an informational campaign can have an impact on the knowledge level of the individuals it has reached. The participants, who heard about the campaign and have been exposed to its information, showed to be better knowledgeable about the relationship between physical activity and cancer risk reduction in specific cancer forms, compared to the participants who were not exposed to information. Cancer forms were not analyzed or mentioned separately in that case. There was only a general statement. On account of the results, in which almost 90% of those who were exposed to the information reported to be aware of the statement that physical activity is connected to the cancer risk reduction in specific cancer forms, strengthens the value of the campaign. The value of the implementation of the certain campaign could be enchased by the fact, that by another survey, where only the acknowledgement about the preventive role of the physical activity was examined, the results showed that participants correctly identified the function of physical activity in preventing chronic conditions such as hypertension and coronary heart disease, but they were unable to identify the same function of PA in preventing cancer[236]. The examination of the differences between the groups "2013", "2014 exposed to information" and "2014 not exposed to information" according to the

knowledge about the relationship between physical activity and cancer risk reduction, showed a significant p value, which supports the impact of the campaign on the knowledge level of the participants. The previous survey just mentioned, examined also the participant's knowledge about the preventive role of the physical activity by specific types of the cancer. From the male participants, a percentage of 29.1% mentioned that they did not know, while 18.6% mentioned colon cancer, 21.7% brain cancer and 30.6% bone cancer. The female interviewees were more aware and better informed about the preventive role of physical activity and specific types of cancer in comparison to the male interviewees. One third of the female participants reported breast cancer (32,2%), 18,2 thyroid cancer, 22.7 bone cancer and 26,9 did not know[236].

There is no doubt that such campaigns can motivate the public to adapt a healthier lifestyle[245]. But there is a huge difference between feeling motivated to change a health behavior and actually doing it. Motivational differences and differences in prior knowledge and education of the receivers will always influence the efficacy of a campaign[246]. In the case of this informational campaign, one of the goals of which was to motivate people to become physically more active, we checked how many of the participants really proceeded with that change. One fourth of the participants of the "2014 exposed to information" group who knew about the relationship between physical activity and cancer risk reduction in specific cancer forms, reported to adapt physical activity, which has as a goal the cancer risk reduction. No significant p values reveal that the impact of such campaigns on health related behavioral changes might not be that extent. The percentages of the interviewees from the other two groups "2013" and "2014 not exposed to information", who reported that they adapted physical activity in order to reduce the cancer risk was quit close to those from the "2014 exposed to information" group. The connection between knowledge and health behavior changes remains in a low level. Consequently the need for design of further health promoting strategies has to be integrated with that kind of campaigns. For example the campaign had an informational role but at the

same time tried to promote and inform the people about physical activity programs. If we consider that the receivers of that campaign, who saw or heard about the campaign, should have been passing through different stages (saw the poster or heard about it, then visited the website, tried to be informed about physical activity programs´ offers) in order to adapt more physical activity, which was actually the goal of the campaign, makes the whole procedure a little complicated and time consuming. On one hand, individuals have under those circumstances the chance to attempt a program and proceed with that behavioral change. On the other hand, when following a complicated "campaign journey" the chances, that an information campaign will lead to a behavioral change are reduced. It might be more efficient, if such campaigns had as main goal the direct promotion of physical activity programs. As a result of that, people who hear or see a campaign get directly the information they need, in order to proceed with that behavioral change in case they are interested and convinced.

The awareness of the participants of both surveys (2013 and 2014) about the "Sport for Health" program was also proved. This program wasn´t designed for the purposes of the campaign, it already existed and was just connected with it because it was relevant to the topic of the campaign. The results showed that there was a significant p value for the variables "group" ("2013", "2014 exposed to information", "2014 not exposed to information") and "awareness about the program Sport for Health. More individuals from the "2014 exposed to information" group knew about that program than from the other 2 groups. It can be concluded that the campaign arose the interest of the participants to find relevant physical activity programs in order to join them. The relationship between knowledge, motivation and interest for further education about a topic[244] is defined once again. To the question how they got informed about that program, "press" had the leading position. It is important to note that physicians were also promoting that program and were on the same level with "TV" and "Flyers", with "internet" to be on the last place. Bearing in mind that the promoting channels

are numerous and all of them can access the public, then it is intelligent to use all of them, so that as many individuals as possible will get inform. It might be interesting and probably more effective, if people could get informed about the campaign and the physical activity program through the health insurance companies. The information could have probably reached more individuals and it would have been personalized and put together in one letter or flyer.

There was an effort to identify the variables, which can be related with the variable "knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms". Physical activity level, BMI, education level, moving on foot or by bike for at least 10 minutes per day from one place to another and vigorous intensity physical activity for at least 10 minutes per day were the variables, which were related to the knowledge for the "2014 exposed to information" group. Healthy lifestyle, BMI, education level and vigorous intensity physical activity for at least 10 minutes per day were the variables who revealed a relationship with knowledge for the "2014 not exposed to information" group. It can be concluded that educational level was related to the knowledge status of the participants of the second survey, as well as BMI and vigorous physical activity. Healthy lifestyle and physical activity levels seemed to be also connected with it. It can be said that there is a bidirectional relationship between healthy lifestyle behavior and knowledge. Gender, area of living, health status and moderate physical activity seemed not to be associated with the status of knowledge of the participants. For the "2013" group no significant results were found in all cases.

The relationship between "targeted adoption of physical activity for cancer risk reduction in specific cancer forms" and any other independent variable was proved for all three groups "2013", "2014 exposed to information" and "2014 not exposed to information". The variable "healthy lifestyle" revealed significant results in all three groups, something it confirms the relationship between healthy lifestyle and readiness to proceed with a health behavioral

change in order to improve the health status. The variables “gender” and “physical activity level” seemed to be related with the depended variable “targeted adoption of physical activity for cancer risk reduction in specific cancer forms” only for the “2013” group and “vigorous intensity physical activity for at least 10 minutes per day” and “motivation from the campaign to engage in physical activity” were connected with the targeted adoption of physical activity for cancer risk reduction in specific cancer forms for those who were exposed to the information in 2014.

More women than men were aware of the program “Sport for health” for the “2013” and “2014 not exposed to information” groups. For those, who were exposed to the information of the campaign, gender seemed not to be related. “Healthy lifestyle” and “educational level” were two further variables with significant p values for their relationship to the dependent variable “awareness about the program Sport for health” for the participants in “2013” and “2014 not exposed to information”. The participants of the first survey (2013) who were living in a city were more aware of the “Sport for Health” program compared to those, who were living in a rural area. Sport offers are for sure more frequent in cities than in rural areas and also the possibility to be reached from such information is bigger. People who were moving on foot or by bike for at least 10 minutes per day from one place to another from the group “2013” seemed to be more aware about the “Sport for health” program. There are two explanations about this. Firstly, people who are moving on the streets is easier to see a poster or an advert and secondly people who are physically active in the category “transportation” are generally supporting an active and healthy lifestyle, so they also more interested on health related topic and get informed about them.

Cancer and non-cancer patients

The statistical analysis revealed that there was an association between the health status, i.e. “cancer patients” and “non cancer patients” and the following dependent variables, “knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms”, “targeted adoption of physical activity for cancer risk reduction in specific cancer forms” and “awareness about the program Sport for Health”. The percentage of cancer patients who knew about the relationship between physical activity and cancer risk reduction in specific cancer forms, were aware of the “Sport for Health” program and implemented physical activity in order to reduce the cancer risk (which in that case was probably related to the recurrence of the illnesses) was higher than that those of who did not reported to be cancer patients. The relationship between “healthy lifestyle” and the three dependent variables just mentioned above has been almost verified for all cases and for both groups (“cancer patients” and “non cancer patients”). The only case a relationship was not confirmed was for the variable “knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms” by cancer patients. It seems that healthy lifestyle, knowledge, awareness and behavioral change related to health topics are strongly connected. The knowledge of non-cancer patients about the relationship between physical activity and cancer risk reduction in specific cancer forms appears to be related to the educational level, the BMI and the implementation or not of vigorous intensity physical activity for at least 10 minutes per day. It can be concluded that better educated people, people with normal BMI rates, and those who were implementing vigorous intensity physical activity for at least 10 minutes per day, were better informed about this relationship.

Cancer patients with high and moderate physical activity levels and those who were implementing vigorous intensity physical activity for at least 10 minutes per day, were adapting

targeted physical activity for cancer risk reduction. It was expected to have these results, because cancer patients, who were physically active, of course targeted to have an influence on their recurrence rates. For the “non cancer patients” group more females than males were adapting targeted physical activity for cancer risk reduction and were aware about the “Sport for Health” program. The physical activity and educational level were also related to the awareness of the non-cancer patients about the program “Sport for Health”.

Strengths and limitations

Campaign

Strengths of this study include the homogeneous data choice for the two interviews, the timing of the two interviews and the use of a worldwide recognized questionnaire for the identification of the activity level of the participants. One limitation is the lack of test-retest because not the same participants were used for both interviews and the campaign could not be considered as an intervention. Because of the size of the sample and the time the two interviews took place (1 year difference), that would have been extremely difficult and might have caused even more limitations (reduction on the participant number for the retest). The absence of a question for the identification of the reason why the campaign had no motivational role could be mentioned as a limitation.

Campaigns which aim to increase the awareness and the knowledge about a healthy lifestyle can be considered helpful and important for everyone. In the case of this study, the representative and homogeneous sample design through Germany could reject the declaration that if interviewees for both surveys were the same (test – retest) and the campaign was used as an interventional program, could lead to more objective results about the effects of the

campaign. The fact that the participants who heard about the campaign had better activity levels than the other participants strengthens the value of this campaign. If the time design of the two interviews was shorter, we might have been able to have a test and retest group or to have stronger and even different results about the interventional role of the campaign. If considered that the MET-hours scores were high then it needs to be taken into account the fact that people overestimate their selves and in many cases exaggerate, when they are asked about their performances.

It needs to be mentioned that more valid results regarding the motivational role of the campaign could have been achieved if the group of interviewees had been identical in both surveys (test – retest). The activity levels of the participants of the second survey before the campaign are unknown and they were not asked, so any impact from the campaign in their activity levels cannot be identified. Therefore it can be concluded that any differences in physical activity levels between the first and the second survey occurred through participants from the group "exposed to information" and in that case the campaign might influence the activity level of the participants.

Cancer and non-cancer patients

The homogeneous data choice was confirmed by the two subgroups "cancer patients" and "non cancer patients" too; something that strengthens the design of this study. The lack of information around the cancer type and stage of the therapy can be considered as a limitation. Additional data about them could allow us to come with some further conclusions and be more specific about the physical activity levels in different cancer types and therapy stages. The complex nature of cancer demands a unique therapy for each patient and any collected

information and conclusions about physical activity, could have an important role for its treatment.

Conclusions

Information campaigns and education can have an influence on changing people's movement behavior. A health communication campaign is a series of targeted messages that are disseminated through a coordinated media platform with the goal of influencing health behavior determinants in order to promote positive behavior modification or maintenance of healthy behavior[247]. Health communication campaigns can take the form of large-scale, neighborhood-wide initiatives to promote physical activity through highly visible, multicomponent strategies (risk factor screening, social support, health education, etc.) or they can be tailored to the needs of specific individuals and delivered through individualized media (computer, tablet, and smartphone devices). Effective health communication campaigns, regardless of their size or format, should be based on behavior change theory, which has been demonstrated to be successful in raising levels of physical activity[248]. Through the analysis of the results could be noticed that the exposure to a health promoting campaign can have a positive impact on the physical activity behavior and can encourage people to engage a healthier and more physically active lifestyle. Interestingly, gender and age identified as two factors, which influenced the accessibility of the campaign, as the campaign accessed more females and participants older than 41 years old. Impressively it was stated that cancer patients were similarly physically active as non-cancer patients. High physical activity levels are related with a higher motivation level to engage even more physical activity for health prevention reasons. Knowledge and awareness about the fact that physical activity has a positive influence in health prevention emboldened the promotion of such information campaigns. It´s important to be

mentioned that most of people may have the knowledge about the importance of a healthy lifestyle behavior such as physical activity, but they may not exactly understand the real connection and the benefits of physical activity on their health status. The conversion of the knowledge into a behavior change is the success key into this situation. That can be only achieved if health and fitness professionals have the requisite knowledge, attitudes, skills, experience, credentials, and evidence-based physical activity programs, they can become essential partners in a range of sectors to design, implement, and assess health communication campaigns in community, clinical, or school-based settings[249,250].

References

1. Physical Activity Key Facts [Internet]. 2015 [cited 2016 Jul 11]; Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity.
2. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep*. 1985; 100(2): 126–131.
3. Warburton DE , Bredin SS. Health benefits of physical activity: a systematic review of current systematic reviews. *Curr Opin Cardiol.* 2017 Sep; 32(5):541-556.
4. Kruk J. Physical activity in the prevention of the most frequent chronic diseases: an analysis of the recent evidence. Review. *Asian Pac J Cancer Prev.* 2007;8(3):325-38.
5. Berryman JW. The tradition of the "six things non-natural": exercise and medicine from Hippocrates through ante-bellum America. *Exerc Sport Sci Rev.* 1989; 515–559.
6. Tipton CM. Susruta of India, an unrecognized contributor to the history of exercise physiology. *J Appl Physiol.* 1985; 1553–1556.
7. Piercy KL, Troiano RP, Ballard RM, Carlson SA, Fulton JE, Galuska DA, George SM, Olson RD.The Physical Activity Guidelines for Americans. *JAMA.* 2018; 320(19):2020-2028.
8. Booth FW, Roberts CK, Laye JM. Lack of exercise is a major cause of chronic diseases. *Compr Physiol.* 2012; 2(2): 1143–1211.
9. Myers J, McAuley P, Lavie CJ, Despres JP, Arena R, Kokkinos P. Physical activity and cardiorespiratory fitness as major markers of cardiovascular risk: their independent and interwoven importance to health status. *Prog Cardiovasc Dis.* 2015: 306–314.

10. Dumith SC, Hallal PC, Reis RS, Kohl HW 3rd.Worldwide prevalence of physical inactivity and its association with human development index in 76 countries. *Prev Med*. 2011; 53:24–8.
11. Owen N, Sparling PB, Healy GN, Dunstan DW, Matthews CE. Sedentary behavior: emerging evidence for a new health risk. *Mayo Clin Proc*. 2010; 85:1138–41.
12. Rey-Lopez JP, Vicente-Rodriguez G, Ortega FB, Ruiz JR, Martinez-Gómez D, De Henauw S, et al. Sedentary patterns and media availability in European adolescents: the HELENA study. *Prev Med*. 2010; 51:50–5.
13. Centers for Disease Control and Prevention, National Health and Nutrition Examination Survey Data, 2005-2006. [Internet] 2006. [cited 2018 Aug 1]; Available from: http://www.cdc.gov/nchs/nhanes.htm
14. Carlson SA, Fulton JE, Schoenborn CA, Loustalot F. Trend and prevalence estimates based on the 2008 Physical Activity Guidelines for Americans. *Am J Prev Med.* 2010; 39:305.
15. Lobelo F, Young D, Sallis R. Garber M, Billinger S, Duperly J, et al. Routine assessment and promotion of physical activity in healthcare settings: a scientific statement from the American Heart Association. *Circulation*. 2018; 137(18), e495–e522.
16. Tian D & Meng J. Exercise for Prevention and Relief of Cardiovascular Disease: Prognoses, Mechanisms, and Approaches. *Oxidative Medicine and Cellular Longevity*, 2019, 3756750.
17. Duclos M, Oppert J-M, Verges B, Coliche V, Gautier J-F, Guezennec Y, Reach G, Strauch G, & for the SFD Diabetes and Physical Activity Working Group. Physical activity and type 2 diabetes. Recommendations of the SFD (Francophone Diabetes Society) diabetes and physical activity working group. *Diabetes & Metabolism*. 2013; 39, 205–216.

18. Juraschek S, Blaha M, Blumenthal R, Brawner C, Qureshi W, Keteyian S, et al. Cardiorespiratory fitness and incident diabetes: the FIT (Henry Ford ExercIse Testing) project. *Diabetes Care*. 2015; 38(6), 1075–1081.
19. Jakicic JM, Davis KK. Obesity and physical activity. *Psychiatr Clin North Am.* 2011; 34(4):829-40.
20. Swift DL, Johannsen NM, Lavie CJ , Earnest CP, Church CT. The role of exercise and physical activity in weight loss and maintenance. *Prog Cardiovasc Dis.* 2014; 56 (4):441-7.
21. Jakicic JM, Rogers RJ, Davis KK, Collins KA. Role of Physical Activity and Exercise in Treating Patients with Overweight and Obesity. *Clin Chem.* 2018; 64(1):99-107.
22. Troy KL, Mancuso ME, Butler TA, Johnson JE. Exercise Early and Often: Effects of Physical Activity and Exercise on Women's Bone Health. *Int J Environ Res Public Health.* 2018; 15(5):878.
23. Landry BW, Driscoll SW. Physical activity in children and adolescents. *PM R.* 2012; 4(11):826-32.
24. Gómez-Bruton A, Matute-Llorente Á , González-Agüero A, Casajús JA, Vicente-Rodríguez G. Plyometric exercise and bone health in children and adolescents: a systematic review. *World J Pediatr.* 2017; 13(2):112-121.
25. Piastra G, Perasso L , Lucarini S, Monacelli F, Bisio A, Ferrando V, et al. Effects of Two Types of 9-Month Adapted Physical Activity Program on Muscle Mass, Muscle Strength, and Balance in Moderate Sarcopenic Older Women. *Biomed Res Int.* 2018; 2018:5095673.
26. Liberman K, Forti LN, Beyer I, Bautmans I. The effects of exercise on muscle strength, body composition, physical functioning and the inflammatory profile of older adults: a systematic review. *Curr Opin Clin Nutr Metab Care.* 2017; 20(1):30-53.

27. Beaudart C, Dawson A, Shaw SC, Harvey NC, Kanis JA, Binkley N, et al. Nutrition and physical activity in the prevention and treatment of sarcopenia: systematic review. *Osteoporos Int.* 2017; 28(6):1817-1833.
28. KR, Golightly YM. Physical exercise as non-pharmacological treatment of chronic pain: Why and when. *Best Pract Res Clin Rheumatol.* 2015; 29(1):120-30.
29. Suh JH, Kim H, Jung GP, Ko JY, Ryu JS. The effect of lumbar stabilization and walking exercises on chronic low back pain: A randomized controlled trial. *Medicine (Baltimore).* 2019; 98(26):e16173.
30. Peluso MA, Guerra de Andrade LH. Physical activity and mental health: the association between exercise and mood. *Clinics (Sao Paulo).* 2005; 60(1):61-70.
31. White RL, Babic MJ, Parker PD, Lubans DR, Astell-Burt T, Lonsdale C. Domain-Specific Physical Activity and Mental Health: A Meta-analysis. *Am J Prev Med.* 2017; 52(5):653-666.
32. Paluska SA, Schwenk TL. Physical activity and mental health: current concepts. *Sports Med.* 2000; 29(3):167-80.
33. Lubans D, Richards J, Hillman C, Faulkner G, Beauchamp M, Nilsson M, et al. Physical Activity for Cognitive and Mental Health in Youth: A Systematic Review of Mechanisms. *Pediatrics.* 2016; 138(3):e20161642.
34. Kline CE, Irish LA, Krafty RT, Sternfeld B, Kravitz HM, Buysse DJ, et al. Consistently High Sports/Exercise Activity Is Associated with Better Sleep Quality, Continuity and Depth in Midlife Women: The SWAN Sleep Study. *Sleep.* 2013; 36(9): 1279–1288.
35. Rogers LQ , Courneya KS, Oster RA, Anton PM, Robbs RS, Forero A, et al. Physical Activity and Sleep Quality in Breast Cancer Survivors: A Randomized Trial. *Med Sci Sports Exerc.* 2017; 49(10):2009-2015

36. Hartescu I, Morgan K, Stevinson CD. Increased physical activity improves sleep and mood outcomes in inactive people with insomnia: a randomized controlled trial. *J Sleep Res.* 2015; 24(5):526-34.

37. Thomas E, Battaglia G, Patti A, Brusa J, Leonardi V, Palma A, et al. Physical activity programs for balance and fall prevention in elderly: A systematic review. *Medicine (Baltimore).* 2019; 98(27):e16218.

38. De Labra C, Guimaraes-Pinheiro C, Maseda A, Lorenzo T, Millán-Calenti JC. Effects of physical exercise interventions in frail older adults: a systematic review of randomized controlled trials. *BMC Geriatr.* 2015; 15:154.

39. Lopez P, Pinto RS, Radaelli R, Rech A, Grazioli R, Izquierdo M, et al. Benefits of resistance training in physically frail elderly: a systematic review. *Aging Clin Exp Res.* 2018; 30(8):889-899.

40. Myers J, Kokkinos P, Nyelin E. Physical Activity, Cardiorespiratory Fitness, and the Metabolic Syndrome. *Nutrients.* 2019; 11(7):1652.

41. Al-Mallah MH, Sakr S, Al-Qunaibet A. Cardiorespiratory Fitness and Cardiovascular Disease Prevention: an Update. *Curr Atheroscler Rep*. 2018; 16; 20(1):1.

42. Makar O, Siabrenko G. Influence of Physical Activity on cardiovascular system and prevention of cardiovascular diseases (Review). *Georgian Med News.* 2018; (285):69-74.

43. Lavie CJ, Ozemek C, Carbone S, Katzmarzyk PT, Blair SN. Sedentary Behavior, Exercise and Cardiovascular Health. *Circ Res.* 2019; 124(5):799-815.

44. Piercy KL, Troiano, PR, Ballard RM, Carlson SA, Fulton JE, Galuska DA, et al. The Physical Activity Guidelines for Americans. *JAMA.* 2018; 320(19):2020-2028.

45. Macera CA, Hootman JM, Sniezek JE. Major public health benefits of physical activity. *Arthritis Rheum.* 2003;49:122-8.

46. Macera CA, Powell KE. Population attributable risk: implications of physical activity dose. *Med Sci Sports Exerc* 2001;33:S635-9.
47. Thomas DM, Bouchard C, Church T, Slentz C, Kraus WE, Redman LM, et al. Why do individuals not lose more weight from an exercise intervention at a defined dose? An energy balance analysis. *Obes Rev.* 2012; 13:835–47.
48. Church TS, Thomas DM, Tudor-Locke C, Katzmarzyk PT, Earnest CP, Rodarte RQ, et al. Trends over 5 decades in U.S. Occupation-related physical activity and their associations with obesity. *PLoS ONE.* 2011; 6:e19657.
49. Fogelholm M, Kukkonen-Harjula K. Does physical activity prevent weight gain- a systematic review. *Obes Rev.* 2000; 1:95–111
50. Cosman F, Lindsay R, Le Boff MS, Jan de Beur S, Tanner B. Clinician's Guide to Prevention and Treatment of Osteoporosis. *Natl. Osteoporos.* 2014; 1:55.
51. National Osteoporosis Foundation Osteoporosis Exercise for Strong Bones. [Internet] 2018. [cited 2018 Mar. 3]; Available from: https://www.nof.org/patients/fracturesfall-prevention/exercisesafe-movement/osteoporosis-exercise-for-strong-bones/
52. Pfeifer M, Minne H. International Osteoporosis Foundation Bone Loading Exercise Recommendations for Prevention and Treatment of Osteoporosis. [Internet] 2015. [cited 2018 Mar. 4]; Available from: https://www.iofbonehealth.org/exercise-recommendations.
53. Calvani R, Joseph AM, Adhihetty PJ, Miccheli A, Bossola M, Leeuwenburgh C, et al. Mitochondrial pathways in sarcopenia of aging and disuse muscle atrophy. *Biol Chem*. 2013; 394(3):393–414.
54. Cruz-Jentoft AJ, Landi F, Schneider SM, Zúñiga C, Arai H, Boirie Y, et al. Prevalence of and interventions for sarcopenia in ageing adults: a systematic review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). *Age Ageing.* 2014; 43(6): 748-59.

55. Busch AJ, Webber SC, Richards RS, Bidonde J, Schachter CL, Schafer LA, et al. Resistance exercise training for fibromyalgia. *The Cochrane database of systematic reviews.* 2013; 12:Cd010884.

56. Jones KD, Sherman CA, Mist SD, Carson JW, Bennett RM, Li F. A randomized controlled trial of 8-form Tai chi improves symptoms and functional mobility in fibromyalgia patients. *Clin Rheumatol.* 2012; 31:1205–14.

57. Mannerkorpi K, Henriksson C. Non-pharmacological treatment of chronic widespread musculoskeletal pain. *Best Pract Res Clin Rheumatol.* 2007; 21:513–34.

58. Farmer ME, Locke BZ, Moscicki EK, Dannenberg AL, Larson DB, Radloff LS. Physical activity and depressive symptoms: the NHANES I epidemiologic follow-up study. *Am J Epidemiol*. 1988; 128:1340-51.

59. Martinsen EW, Hoffart A, Solberg O. Aerobic and non-aerobic forms of exercise in the treatment of anxiety disorders. *Stress Med.* 1989; 5:115-20.

60. Martinsen EW, Hoffart A, Solberg O. Comparing aerobic with non-aerobic forms of exercise in the treatment of clinical depression: a randomized trial. *Compr Psychiatry.* 1989; 30(4):324-31.

61. Raglin JS. Exercise and mental health. Beneficial and detrimental effects. *Sports Med.* 1990; 9(6):323-9.

62. North TC, McCullagh P, Tran ZV. Effect of exercise on depression. *Exerc Sport Sci Rev.* 1990; 18:379-415.

63. Petruzzello SJ, Landers DM, Hatfield BD, Kubitz KA, Salazar W. A meta-analysis of the anxiety-reducing effects of acute and chronic exercise. Outcomes and mechanisms. *Sports Med.* 1991; 11(3):143-82.

64. Martinsen EW. Physical activity and depression: clinical experience. *Acta Psychiatr Scand.* 1994; 377 Suppl: 23-7.

65. Dimeo F, Bauer M, Varahram I, Proest G, Halter U. Benefits from aerobic exercise in patients with major depression: a pilot study. *Br J Sports Med*. 2001; 35(2):114-7.
66. Dunn AL, Trivedi MH, O'Neal HA. Physical activity dose-response effects on outcomes of depression and anxiety. *Med Sci Sports Exerc.* 2001; 33(6 Suppl):587-97.
67. Leppamaki SJ, Partonen TT, Hurme J, Haukka JK, Lonnqvist JK. Randomized trial of the efficacy of bright-light exposure and aerobic exercise on depressive symptoms and serum lipids. *J Clin Psychiatry.* 2002; 63(4):316-21.
68. Pate RR, Pratt M, Blair SN, Haskell WL, Macera CA, Bouchard C, et al. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 1995; 273(5):402-7.
69. Camacho TC, Roberts RE, Lazarus NB, Kaplan GA, Cohen RD. Physical activity and depression: evidence from the Alameda County study. *Am J Epidemiol.* 1991; 134:220-31.
70. Paffenbarger RS, Lee IM, Leung R. Physical activity and personal characteristics associated with depression and suicide in American college men. *Acta Psychiatr Scand Suppl.* 1994; 377:16-22.
71. Fernandez-Arguelles EL, Rodriguez-Mansilla J, Antunez LE, Garrido-Ardila EM, Muñoz RP. Effects of dancing on the risk of falling related factors of healthy older adults: a systematic review. *Arch Gerontol Geriatr*. 2015; 60:1–8.
72. Owino V, Yang SY, Goldspink G. Age-related loss of skeletal muscle function and the inability to express the autocrine form of insulin-like growth factor-1 (MGF) in response to mechanical overload. *FEBS Lett*. 2001; 505:259–63.
73. Daley MJ, Spinks WL. Exercise, mobility and aging. *Sports medicine.* 2000; 29:1–2.
74. Zecevic AA, Salmoni AW, Speechley M, Vandervoort AA. Defining a fall and reasons for falling: comparisons among the views of seniors, health care providers, and the research literature. *Gerontologist.* 2006; 46:367–76.

75. Kendrick D, Kumar A, Carpenter H, Rixt Zijlstra GA, Skelton DA, Cook JR, et al. Exercise for reducing fear of falling in older people living in the community. *Cochrane Database Syst Rev*. 2014; 11: CD009848.

76. Inouye SK, Studenski S, Tinetti ME, Kuchel GA. Geriatric syndromes: clinical, research, and policy implications of a core geriatric concept. *J Am Geriatr Soc.* 2007; 55:780–91.

77. Gillespie LD, Gillespie WJ, Robertson MC, Lamb SE, Cumming RG, Rowe BH. Interventions for preventing falls in elderly people. *Cochrane Database Syst Rev.* 2003; 4:CD000340.

78. Sherrington C, Whitney JC, Lord SR, Herbert RD, Cumming RG, Close JC. Effective exercise for the prevention of falls: a systematic review and meta-analysis. *J Am Geriatr Soc.* 2008; 56:2234–43.

79. Panel on Prevention of Falls in Older Persons. Summary of the updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for prevention of falls in older persons. *Journal of the American Geriatrics Society*. 2011; 59(1):148–157.

80. Fletcher GF, Landolfo C, Niebauer J, Ozemek C, Arena R, Lavie CJ. Reprint of: Promoting Physical Activity and Exercise. *J Am Coll Cardiol*. 2018; 72:3053–70.

81. Brown JC, Winters-Stone K, Lee A, Schmitz KH. Cancer, Physical Activity and Exercise. *Compr Physiol.* 2012; 2 (4): 2775-2809.

82. 177. McTiernan A, Friedenreich CM, Katzmarzyk PT, Powell KE, Macko R, Buchner D, et al: Physical activity in cancer prevention and survival: A systematic review. *Med Sci Sports Exerc.* 2019; 51: 1252-1261.

83. Office of Disease Prevention and Health Promotion: 2018 Physical Activity Guidelines Advisory Committee Scientific Report. [Internet] 2018. [cited 2020 Oct 17]; Available from: https://health.gov/paguidelines/second-edition/report/

84. Matthews CE, Moore SC, Arem H, Cook MB, Trabert B, Håkansson N, et al. Amount and intensity of leisure-time physical activity and lower cancer risk. *J Clin Oncol*. 2020; 38:686-697.

85. 182. Colberg SR, Sigal RJ, Fernhall B, Regensteiner JG, Blissmer BJ, Rubin RR, et al. Exercise and type 2 diabetes: the American College of Sports Medicine and the American Diabetes Association: joint position statement. *Diabetes Care.* 2010; 33(12):e147-67.

86. Aune D, Norat T, Leitzmann M, Tonstad S, Vatten LJ. Physical activity and the risk of type 2 diabetes: a systematic review and dose-response meta-analysis. *Eur J Epidemiol.* 2015; 30(7):529-42.

87. Thune I., Njølstad I., Løchen M.L., Førde O.H. Physical activity improves the metabolic risk profiles in men and women: The Tromsø Study. *Arch. Intern. Med.* 1998; 158:1633–1640.

88. Ekelund U, Griffin SJ, Wareham NJ. Physical activity and metabolic risk in individuals with a family history of type 2 diabetes. *Diabetes Care.* 2007; 30:337–342.

89. World Health Organization. Health and Development Through Physical Activity and Sport [Internet]. 2003 [cited 2016 Feb 01]; Available from: http://www.who.int/whr/2003/en/index.html

90. Morris JN, Heady JA, Raffle PA, Roberts CG, Parks JW. Coronary heart-disease and physical activity of work. *Lancet,* 1953; 265:1111-20.

91. Morris JN, Heady JA. Mortality in relation to the physical activity of work: a preliminary note on experience in middle age. *Br J Ind Med,* 1953; 10:245-54.

92. Paffenbarger RS Jr, Brand RJ, Sholtz RI, Jung DL. Energy expenditure, cigarette smoking, and blood pressure level as related to death from specific diseases. *A m J Epidemiol.* 1978; 108:12-8.

93. Paffenbarger RS, Hale WE. Work activity and coronary heart mortality. *N Engl J Med.* 1975; 292:545-50.

94. Blair SN, Cheng Y, Holder JS. Is physical activity or physical fitness more important in defining health benefits? *Med Sci Sports Exerc.* 2001; 33:S379-99.

95. Kohl HW III. Physical activity and cardiovascular disease: evidence for a dose response. *Med Sci Sports Exerc.* 2001; 33:S472-83. 21.

96. Berlin JA, Colditz GA. A meta-analysis of physical activity in the prevention of coronary heart disease. *A m J Epidemiol.* 1990; 132:612-28.

97. Powell KE, Thompson PD, Caspersen CJ, Kendrick JS. Physical activity and the incidence of coronary heart disease. *Annu Rev Public Health*. 1987; 8:253-87.

98. Lee IM, Hsieh CC, Paffenbarger RS Jr. Exercise intensity and longevity in men. The Harvard Alumni Health Study. *JAMA.* 1995; 273:1179-84.

99. Wannamethee SG, Shaper AG, Walker M. Changes in physical activity, mortality, and incidence of coronary heart disease in older men. *Lancet.* 1998; 351:1603-8.

100. Lee IM, Paffenbarger RS Jr. Associations of light, moderate, and vigorous intensity physical activity with longevity. The Harvard Alumni Health Study. *A m J Epidemiol.* 2000; 151:293-9.

101. Oguma Y, Sesso HD, Paffenbarger RS Jr, Lee IM. Physical activity and all cause mortality in women: a review of the evidence. *Br J Sports Med.* 2002; 36:162-72.

102. Nunan D, Mahtani KR, Roberts N, Heneghan C. Physical activity for the prevention and treatment of major chronic disease: an overview of systematic reviews. *Systematic Reviews Journal.* 2013; 2:56

103. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. *Lancet.* 2012; 380(9838):247-57.

104. WHO. Global health risks. Mortality and burden of disease attributable to selected major risks. [Internet]. 2009. [cited 2012 Jan 15]; Available from: http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf.

105. Froböse I, Wallmann-Sperlich B. Der DKV-Report „Wie gesund lebt Deutschland?“ [Internet]. 2015 [cited 2016 Jul 11]; Available from: https://www.dkv.com/downloads/20150126-DKV-Report-2015-Wie-gesund-lebt-Deutschland.pdf

106. Kohl HW, Craig CL, Lambert EV, Inoue S, Alkandari JR, Leetongin G, Kahlmeier S. The pandemic of physical inactivity: global action for public health. *Lancet.* 2012; 380(9838):294-305.

107. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet.* 2012; 380(9838):219-29.

108. Grazioli E, Dimaura I, Mercatelli N, Wang G, Pitsiladis Y, Di Luigi L, et al. Physical activity in the prevention of human diseases: role of epigenetic modifications. *BMC Genomics*. 2017; 18(Suppl 8):802

109. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet.* 2012; 380:219–29.

110. Desnoyers A, Riesco E, Fülöp T, Pavic M. Physical activity and cancer: Update and literature review. *Rev Med Interne.* 2016. S0248-8663(15)01136-4.

111. Macera CA, Hootman JM, Sniezek JE. Major public health benefits of physical activity. *Arthritis Rheum*. 2003; 49:122-8.

112. Macera CA, Powell KE. Population attributable risk: implications of physical activity dose. [discussion 640-1]. *Med Sci Sports Exerc.* 2001; 33:S635-9. 29.

113. Myers J, Kaykha A, George S, Abella J, Zaheer N, Lear S, Yakazaki T, Froelicher V. Fitness versus physical activity patterns in predicting mortality in men. *Am J Med.* 2004; 117:912-8.

114. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. *N Engl J Med.* 2002; 346:793-801.

115. Blair SN, Kohl HW III, Barlow CE, Paffenbarger Jr RS, Gibbons LW, Macera CA. Changes in physical fitness and all-cause mortality. A prospective study of healthy and unhealthy men. *JAMA.* 1995; 273:1093-8.

116. Friedenreich CM, Orenstein MR. Physical activity and cancer prevention: etiologic evidence and biological mechanisms. *J Nutr.* 2002; 132, 5456-64

117. IARC. Weight Control and Physical Activity. IARC Handbooks of Cancer Prevention Volume 6. Press Lyon, France. *IARC*. 2002. [Internet]. 2002 [cited 2018 Nov 11]; Available from: https://publications.iarc.fr/Book-And-Report-Series/Iarc-Handbooks-Of-Cancer-Prevention/Weight-Control-And-Physical-Activity-2002

118. Taylor RS, Brown A, Ebrahim S, Jolliffe J, Noorani H, Rees K, Skidmore B, Stone JA, Thompson DR, Oldridge N. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. *Am J Med*. 2004; 116, 682 – 692.

119. Rundle A. Molecular epidemiology of physical activity and cancer. *Cancer Epidemiol Biomarkers Prev.* 2005; 14, 227 – 36.

120. McTiernan, Wu LL, Chen C, Chlebowski R, Mossavar-Rahmani Y, Modugno F, et al. Relation of BMI and physical activity to sex hormones in postmenopausal women. *Obesity.* 2006; 14, 1662-77.

121. Sanchis-Gomar F, Garcia-Gimenez JL, Perez-Quilis C, Gomez-Cabrera MC, Pallardo FV, Lippi G. Physical exercise as an epigenetic modulator: eustress, the

"positive stress" as an effector of gene expression. *J Strength Cond Res*. 2012; 26:3469–72.

122. Santos-Reboucas CM, Pimentel MM. Implication of abnormal epigenetic patterns for human diseases. *Eur J Hum Genet.* 2006;15:10–7.

123. Pareja-Galeano H, Sanchis-Gomar F, García-Giménez JL. Physical exercise and epigenetic modulation: elucidating intricate mechanisms. *Sports Med.* 2014; 44:429–36.

124. National Cancer Institute. 2017. Cancer statistics. [Internet]. 2017 [cited 2020 Jul 11]; Available from: https://www.cancer.gov/about-cancer/understanding/statistics.

125. American Cancer Society. Global cancer facts & figures, 3rd ed. American Cancer Society, Inc., Atlanta, GA. 2015.

126. Kruk J, Aboul-Enein HY. Physical activity in the prevention of cancer. *Asian Pac J Cancer Prev.* 2006; 7, 11 – 21.

127. Siegel RL, Miller KD, Jemal A. Cancer statistics. *CA Cancer J Clin.* 2018; 68(1):7-30.

128. Institute of Health Metrics and Evaluation (IHME). GBD Cause Patterns. Seattle, WA: IHME, University of Washington, 2017. [Internet]. 2017 [cited 2018 Nov 13]; Available from: http://vizhub.healthdata.org/gbd-cause-patterns/.

129. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al**.** Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet.* 2012; 380(9859):2095-2128.

130. World Cancer Research Fund International. Cancer preventability estimates for food, nutrition, body fatness and physical activity. [Internet]. 2014 [cited 2018 Dec 20]; Available from: http://www.werf.org/int/cancer-facts-figures/preventability-estimates/cancer-preventability-estimates-food-nutrition

131. Moore SC, Lee IM, Weiderpass E, Campbell PT, Sampson JN, Kitahara CM, et al. Association of leisure-time physical activity with risk of 26 types of cancer in 1.44 million adults. *JAMA Intern Med*. 2016; 176: 816–825.

132. Cherry TA. A theory of cancer. *Med J Aust*. 1922; 1, 425 – 438.

133. Sivertsen I, Dahlstrom AW. The relation of muscular activity to carcinoma. Apreliminary report. *J Cancer Res*. 1922; 6, 365 – 378.

134. Courneya KS, Friedenreich CM. Physical activity and cancer: an introduction. *Recent Results Cancer Res.* 2011; 186:1-10.

135. Shephard RJ, Futcher R. Physical activity and cancer: How may protection be maximized? *Crit Rev Oncog.* 1997; 8:219-72.

136. Schrack JA, Gresham G, Wanigatunga AA. Understanding physical activity in cancer patients and survivors: new methodology, new challenges, and new opportunities. *Cold Spring Harb Mol Case Stud.* 2017; 3(4).

137. Lee IM. Physical activity and cancer prevention — data from epidemiologic studies. *Med Sci Sports Exerc.* 2003;35:1823-7.

138. Thune I, Furberg AS. Physical activity and cancer risk: dose-response and cancer, all sites and site-specific. [discussion S609-10]. *Med Sci Sports Exerc.* 2001; 33:S530-50.

139. Slattery ML, Potter J, Caan B, Edwards S, Coates A, Ma KN, Berry TD. Energy balance and colon cancer—beyond physical activity. *Cancer Research*. 1997; 57, 75–80.

140. Martinez ME, Giovannucci E, Spiegelman D, Hunter DJ, Willett W, Colditz GA. Leisure-time physical activity, body size, and colon cancer in women. Nurses' Health Study Research Group. *Journal of the National Cancer Institute*,1997; 89, 948–955.

141. Carpenter CL, Ross RK, Paganini-Hill A, Bernstein L. Lifetime exercise activity and breast cancer risk among post-menopausal women. *British Journal of Cancer*. 1999; 80, 1852–1858.

142. Bernstein L, Henderson BE, Hanisch R, Sullivan-Halley J, Ross RK. Physical exercise and reduced risk of breast cancer in young women. *Journal of the National Cancer Institute*. 1994; 86, 1403–1408.

143. Rockhill B, Willett WC, Hunter DJ, Manson JE, Hankinson SE, Colditz GA. A prospective study of recreational physical activity and breast cancer risk. *Archives of Internal Medicine*. 1999; 159, 2290–2296.

144. Thune I, Brenn T, Lund E, Gaard M. Physical activity and the risk of breast cancer. *New England Journal of Medicine*. 1997; 336, 1269–1275.

145. Verloop J, Rookus MA, van der Kooy K, Leeuwen FE. Physical activity and breast cancer risk in women. *Journal of the National Cancer Institute*. 2000; 92, 128–135.

146. Hsing AW, McLaughlin JK, Zheng W, Gao YT, Blot M. Occupation, physical activity, and risk of prostate cancer in Shanghai, People's Republic of China. *Cancer Causes & Control*. 1994; 5, 136–140.

147. Lee I-M, Sesso HD, Paffenbarger Jr RS. Physical activity and risk of lung cancer. *International Journal of Epidemiology*.1999; 28, 620–625.

148. Paffenbarger RS Jr, Lee IM, Wing AL. The influence of physical activity on the incidence of site-specific cancers in college alumni. *Adv Exp Med Biol.* 1992; 322:7-15.

149. Wannamethee G, Shaper AG, Macfarlane PW. Heart rate, physical activity, and mortality from cancer and other noncardiovascular diseases. *Am J Epidemiol.* 1993; 137:735-48.

150. Kampert JB, Blair SN, Barlow CE, Kohl 3rd HW. Physical activity, physical fitness, and allcause and cancer mortality: a prospective study of men and women. *Ann Epidemiol*. 1996; 6:452-7. 35.

151. Sesso HD, Paffenbarger RS Jr, Lee IM. Physical activity and breast cancer risk in the College Alumni Health Study (United States). *Cancer Causes Control.* 1998; 9:433-9.

152. Steindorf K, Schmidt M, Ulrich C. Effects of physical activity on cancer risk and disease progression after cancer diagnosis. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz.* 2012 Jan;55(1)

153. Ballard-Barbash R, Friedenreich CM, Courneya KS, Siddiqi SM, McTiernanA, Alfano CM. Physical activity, biomarkers, and disease outcomes in cancer survivors: a systematic review. *J Natl Cancer Inst.* 2012; 104(11):815–840

154. Betof AS, Dewhirst MW, Jones LW. Effects and potential mechanisms of exercise training on cancer progression: a translational perspective. *Brain Behav Immun*. 2013; 30(Suppl):S75–S87.

155. Je Y, Jeon JY, Giovannucci EL,Meyerhardt JA. Association between physical activity and mortality in colorectal cancer: a meta-analysis of prospective cohort studies. *Int J Cancer*. 2013; 133(8):1905–1913.

156. Ramírez K, Acevedo F, Herrera ME, Ibáñez C, Sánchez C. Physical activity and breast cancer. *Rev Med Chil*. 2017; 145(1):75-84.

157. Lindsay N. Kohler1, David O. Garcia1, Robin B. Harris1, Eyal Oren1, Denise J. Roe1,2, and Elizabeth T. Jacobs1,2,3. Adherence to Diet and Physical Activity Cancer Prevention Guidelines and Cancer Outcomes: A Systematic Review. *Cancer Epidemiol Biomarkers Prev.* 2016; 25(7): 1018–1028.

158. Schmitz KH, Courneya KS, Matthews C, Demark-Wahnefried W, Galvão DA, Pinto BM, et al. American College of Sports Medicine roundtable on exercise guidelines for cancer survivors. *Med Sci Sports Exerc.* 2010; 42(7):1409-26.

159. Ancellin R. Benefits of physical activity for cancer patients. *Rev Prat.* 2019; 69(4):438-443.

160. Speck RM, Courneya KS, Mâsse LC, Duval S, Schmitz KH. An update of controlled physical activity trials in cancer survivors: a systematic review and meta-analysis. *J Cancer Surviv.* 2010; 4(2):87-100.

161. Scott JM, Khakoo A, Mackey JR, Haykowsky MJ, Douglas PS, Jones LW. Modulation of anthracycline-induced cardiotoxicity by aerobic exercise in breast cancer: current evidence and underlying mechanisms. *Circulation.* 2011; 124(5):642-50.

162. Segal RJ, Reid RD, Courneya KS, Sigal RJ, Kenny GP, Prud'Homme DG, et al. Randomized controlled trial of resistance or aerobic exercise in men receiving radiation therapy for prostate cancer. *J Clin Oncol*. 2009; 27(3):344-51.

163. Bossola M, Pacelli F, Tortorelli A, Doglietto GB. Cancer cachexia: it's time for more clinical trials. *Ann Surg Oncol.* 2007; 14(2):276-85.

164. Schwarz AL, Winters-Stone K. Effects of a 12-month randomized controlled trial of aerobic or resistance exercise during and following cancer treatment in women. *Phys Sportsmed.* 2009; 37(3):62-7.

165. Blaney J, Lowe-Strong A, Rankin J, Campbell A, Allen J, Gracey J. The cancer rehabilitation journey: barriers to and facilitators of exercise among patients with cancer-related fatigue. *Phys Ther.* 2010; 90(8):1135-47.

166. Velthuis MJ, Agasi-Idenburg SC, Aufdemkampe G, Wittink HM. The effect of physical exercise on cancer-related fatigue during cancer treatment: a meta-analysis of randomised controlled trials. *Clin Oncol (R Coll Radiol).* 2010; 22(3):208-21.

167. Swen M, Mann A, Paxton RJ, Dean L. Do Cancer-related fatigue and physical activity vary by age for black women with a history of breast cancer? *Prev Chronic Dis.* 2017; 14: E122.

168. Carter SJ, Hunter GR, Norian LA, Turan B, Rogers LQ. Ease of walking associates with greater free-living physical activity and reduced depressive symptomology in breast cancer survivors: pilot randomized trial. *Support Care Cancer.* 2018; 26(5): 1675-1683.

169. Schmidt T, van Mackelenbergh M, Wesch D, Mundhenke C. Physical activity influences the immune system of breast cancer patients. *J Cancer Res Ther.* 2017; 13(3):392-398.

170. Baumann FT, Bloch W, Weissen A, Brockhaus M, Beulertz J, Zimmer P, et al. Physical Activity in Breast Cancer Patients during Medical Treatment and in the Aftercare - a Review. *Breast Care (Basel).* 2013; 8(5):330-4.

171. Ballon-Landa E , Kellogg Parsons J . Nutrition, physical activity, and lifestyle factors in prostate cancer prevention. *Curr Opin Urol.* 2018 Jan; 28(1):55-61.

172. Bade BC, Thomas DD, Scott JAB, Silvestri GA . Increasing physical activity and exercise in lung cancer: reviewing safety, benefits, and application. *J Thorac Oncol.* 2015; 10(6):861-71.

173. Otto SJ, Korfage IJ, Polinder S, van der Heide A, de Vries E, Rietjens JA, et al. Association of change in physical activity and body weight with quality of life and mortality in colorectal cancer: a systematic review and meta-analysis. *Support Care Cancer.* 2015; 23(5): 1237–1250.

174. Sweegers MG, Altenburg TM, Chinapaw MJ, Kalter J, Verdonckde Leeuw IM, Courneya KS, et al. Which exercise prescriptions improve quality of life and physical function in patients with cancer during and following treatment? A systematic review

and metaanalysis of randomised controlled trials. *Br J Sports Med.* 2018; 52(8): 505–513.

175. Buffart LM, Sweegers MG, May AM, Chinapaw MJ, van Vulpen JK, Newton RU, et al. Targeting exercise interventions to patients with cancer in need: an individual patient data meta-analysis. *J Natl Cancer Inst*. 2018; 1190–1200

176. Witlox L, Hiensch AE, Velthuis MJ, Steins Bisschop CN, Los M, Erdkamp FLG, et al. Four-year effects of exercise on fatigue and physical activity in patients with cancer. *BMC Med.* 2018; 8; 16(1):86.

177. Steindorf K, Schmidt ME, Zimmer P. Exercise and Physical Activity During and after Cancer - Who benefits most. What is proven? *Dtsch Med Wochenschr*. 2018; 143(5):309-315.

178. Friedenreich CM. The role of exercise in cancer progression and mortality: observational and molecular epidemiologic evidence. *Cancer Res.* 2016; 76:SY22-01.

179. Buffart LM, Galvao DA, Brug J, Chinapaw MJ, Newton RU. Evidence-based physical activity guidelines for cancer survivors: current guidelines, knowledge gaps and future research directions. *Cancer Treat Rev.* 2014; 40: 327–340.

180. Douma JAJ, de Beaufort MB, Kampshoff CS, Persoon S, Vermaire JA, Chinapaw MJ, et al. Physical activity in patients with cancer: self-report versus accelerometer assessments. *Support Care Cancer*. 2020; 28(8):3701-3709.

181. Rock CL, Doyle C, Demark-Wahnefried W, Meyerhardt J, Courneya KS, Schwartz AL, et al. Nutrition and physical activity guidelines for cancer survivors. *CA Cancer J Clin.* 2012; 62(4):243-74.

182. Baumann FT. Physical exercise programs following cancer treatment. *Eur Rev Aging Phys Act.* 2013; 10:57–59

183. Jones LW, Demark-Wahnefried W. Diet, exercise, and complementary therapies after primary treatment for cancer. *Lancet Oncol.* 2006; 7:1017-1026.

184. Courneya K, Karvinen K, Vallance JK. Exercise motivation and behavior change. In: Feuerstein M, ed. Handbook of Cancer Survivorship. New York: *Springer Science- Business Media LLC*; 2007:113-132.

185. Pinto BM, Ciccolo JT. Physical activity motivation and cancer survivorship. *Recent Results Cancer Res.* 2011; 186:367-387.

186. Irwin ML, McTiernan A, Bernstein L, Gilliland FD, Baumgartner R, Baumgartner K, et al. Physical activity levels among breast cancer survivors. *Med Sci Sports Exerc.* 2004; 36:1484-1491.

187. Chlebowski RT, Aiello E, McTiernan A. Weight loss in breast cancer patient management. *J Clin Oncol.* 2002; 20:1128-1143.

188. Protani M, Coory M, Martin JH. Effect of obesity on survival of women with breast cancer: systematic review and meta-analysis. *Breast Cancer Res Treat.* 2010; 123:627-635.

189. Enger SM, Bernstein L. Exercise activity, body size and premenopausal breast cancer survival. *Br J Cancer*. 2004; 90:2138-2141.

190. Healy LA, Ryan AM, Carroll P, Crowley V, Boyle T, Kennedy MJ, et al. Metabolic syndrome, central obesity and insulin resistance are associated with adverse pathological features in postmenopausal breast cancer. *Clin Oncol (R Coll Radiol).* 2010; 22:281-288.

191. Caan BJ, Kwan ML, Hartzell G, Castillo A, Slattery ML, Sternfeld B, et al. Prediagnosis body mass index, post-diagnosis weight change, and prognosis among women with early stage breast cancer. *Cancer Causes Control.* 2008; 19:1319-1328.

192. Paskett ED. Breast cancer-related lymphedema: attention to a significant problem resulting from cancer diagnosis. *J Clin Oncol.* 2008; 26:5666-5667.

193. Kroenke CH, Chen WY, Rosner B, Holmes MD. Weight, weight gain, and survival after breast cancer diagnosis. *J Clin Oncol.* 2005; 23:1370-1378.

194. Dieli-Conwright CM, Orozco BZ. Exercise after breast cancer treatment: current perspectives. *Breast Cancer (Dove Med Press).* 2015; 7:353-62.

195. Lahart IM, Metsios GS, Nevill AM, Carmichael AR. Physical activity, risk of death and recurrence in breast cancer survivors: a systematic review and meta-analysis of epidemiological studies. *Acta Oncol.* 2015; 54:635-54.

196. Irwin ML, Crumley D, McTiernan A, Bernstein L, Baumgartner R, Gilliland FD, et al. Physical activity levels before and after a diagnosis of breast carcinoma: the Health, Eating, Activity, and Lifestyle (HEAL) study. *Cancer.* 2003; 97: 1746-57.

197. Huy C, Schmidt ME, Vrieling A, Chang-Claude J, Steindorf K. Physical activity in a German breast cancer patient cohort: one-year trends and characteristics associated with change in activity level. *Eur J Cancer*. 2012; 48: 297–304.

198. Büntzel J, Kusterer I, Rudolph Y, Kubin T, Micke O, Hübner J. Cancer Patients' Knowledge and Acceptance of Physical Activities for Rehabilitation . *In Vivo.* 2017; 31(6):1187-1192.

199. Lucas AR, Levine BJ, Avis NE. Post-treatment trajectories of physical activity in breast cancer survivors. *Cancer.* 2017; 123: 2773–2780.

200. Low CA, Beckjord E, Bovbjerg DH, Dew MA, Posluszny DM, Schmidt JE, et al. Correlates of positive health behaviors in cancer survivors: results from the 2010 LIVESTRONG survey. *J Psychosoc Oncol.* 2014; 32(6):678-695.

201. De Silva GA, de Rezende LFM, da Silva Gomes F, de Souza Júnior BRB, Szwarcwald CL, Neto JL. Lifestyle among former cancer patients in Brazil in 2013. *Cien Saude Colet*. 2016; 21(2):379-88.

202. Ichijo Y, Takeda Y, Oguma Y, Kitagawa Y, Takeuchi H, Doorenbos AZ. Physical Activity Among Postoperative Esophageal Cancer Patients. *Cancer Nurs.* 2019; 42(6):501-508.

203. Wirtz P, Baumann FT. Physical Activity, Exercise and Breast Cancer - What Is the Evidence for Rehabilitation, Aftercare, and Survival? A Review. *Breast Care (Basel).* 2018; 13(2):93-101.

204. Zimmer P, Baumann FT, Oberste M, Schmitt J, Joisten N, Hartig P, et al. Influence of Personalized Exercise Recommendations During Rehabilitation on the Sustainability of Objectively Measured Physical Activity Levels, Fatigue, and Fatigue-Related Biomarkers in Patients With Breast Cancer. *Integr Cancer Ther.* 2018; 17(2):306-311.

205. Baumann FT, Bieck O, Oberste M, Kuhn R, Schmitt J, Wentrock S, et al. Sustainable impact of an individualized exercise program on physical activity level and fatigue syndrome on breast cancer patients in two German rehabilitation centers. *Support Care Cancer.* 2017; 25(4):1047-1054.

206. Cereda E, Turrini M, Ciapanna D, Marbello L, Pietrobelli A, Corradi E. Assessing energy expenditure in cancer patients: a pilot validation of a new wearable device. *JPEN J Parenter Enteral Nutr.* 2007; 31:502-507.

207. Adamowicz K, Zaucha R. Evaluation of the Impact of Cancer Treatment on the Adoption and Consolidation of Pro-Health Attitudes in the Field of Cancer in Treated Patients with Colon Cancer. *J Cancer Educ*. 2018; 33(2):309-316.

208. Sallis R, Franklin B, Joy J, Ross R, Sabgir D, Stone J. Strategies for promoting physical activity in clinical practice. *Prog Cardiovasc Dis.* 2015; 57(4):375-86.

209. World Health Organization. Global Action Plan on Physical Activity 2018–2030; Geneva, Switzerland, [Internet] 2018. [cited 2020 Nov 4]; Available from: https://www.who.int/ncds/prevention/physical-activity/global-action-plan-2018-2030/en/

210. Rutter H, Cavill N, Bauman A, Bull F. Systems approaches to global and national physical activity plans. Bull. *World Health Organ.* 2019; 97, 162–165.

211. Trinder-Widdess Z, Speed C, Gibson A, Davies R, Farr M, Jago R, et al. "Let's Talk about Physical Activity": Understanding the Preferences of Under-Served Communities when Messaging Physical Activity Guidelines to the Public. *Int J Environ Res Public Health*. 2020; 17(8):2782.

212. Brennan M, Foster CE, Timpson CM, Clarke N, Sunyer E, Amlani A, et al. Active 10–A new approach to increase physical activity in inactive people in England. *Prog. Cardiovasc. Dis.* 2019; 62, 135–139.

213. Williamson C, Baker G, Mutrie N, Niven A, Kelly P. Get the message? A scoping review of physical activity messaging. *Int J Behav Nutr Phys Act.* 2020; 17(1):51

214. Bauman A, Smith BJ, Maibach EW, Reger-Nash R. Evaluation of mass media campaigns for physical activity. *Eval Progr Plan.* 2006; 29, 312–322.

215. Foster C, Kelly P, Reid HAB, Roberts N, Murtagh EM, Humphreys DK, et al. What works to promote walking at the population level? A systematic review. *Br J Sports Med.* 2018; 12, 807–812.

216. Gordon R, McDermott L, Stead M, Angus K, Hastings G. A Review of the Effectiveness of Social Marketing Physical Activity Interventions; National Social Marketing Centre: Sterling, UK, 2006. [Internet]. 2006 [cited 2020 Oct 23]; Available from:
https://www.researchgate.net/publication/238798609_A_Review_of_the_Effectiveness_of_Social_Marketing_Physical_Activity_Interventions

217. Kubacki K, Rundle-Thiele S, Lahtinen V, Parkinson J. A systematic review assessing the extent of social marketing principle use in interventions targeting children (2000–2014). *Young Consum.* 2015, 16, 141–158.

218. Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behavior. *Lancet.* 2010; 376, 1261–1271.

219. Sallis R, Franklin B, Joy J, Ross R, Sabgir D, Stone J. Strategies for promoting physical activity in clinical practice. *Prog Cardiovasc Dis.* 2015; 57(4):375-86.

220. Lankford T, Wallace J, Brown D, Soares J, Epping JN, Fridinger F. Analysis of physical activity mass media campaign design. *J Phys Act Health.* 2014; 11(6):1065-9.

221. Knox ECL, Taylor IM, Biddle SJH, Sherar LB. Awareness of moderate-to-vigorous physical activity: can information on guidelines prevent overestimation? *BMC Public Health.* 2015; 15: 392.

222. Berry TR, Rhodes RE, Ori EM, McFadden K, Faulkner G, Latimer-Cheung AE, et al. The short-term effects of a mass reach physical activity campaign: an evaluation using hierarchy of effects model and intention profiles. *BMC Public Health.* 2018; 18: 1300.

223. Global Physical Activity Questionnaire (GPAQ), Analysis guide [Internet]. 2015 [cited 2015 Nov 15]; Available from: http://www.who.int/chp/steps/resources/GPAQ_Analysis_Guide.pdf

224. Mozaffarian D, Afshin A, Benowitz NL, Bittner V, Daniles SR, Franch HA, et al. Population approaches to improve diet, physical activity, and smoking habits: a scientific statement from the American Heart Association. *Circulation*. 2012; 126(12):1514–63.

225. Stonerock GL, Blumenthal JA. Role of Counseling to Promote Adherence in Healthy Lifestyle Medicine: Strategies to Improve Exercise Adherence and Enhance Physical Activity. *Prog Cardiovasc Dis.* Mar-Apr 2017;59(5):455-462.

226. Puckett M, Neri A, Underwood JM, Stewart SL. Nutrition and Physical Activity Strategies for Cancer Prevention in Current National Comprehensive Cancer Control Program Plans. 2016; 41:1013–1020.

227. Hill D, Wakefield M. Designing and evaluating population-wide campaigns. In:

Stewart BW, Wild CP, editors. World cancer report 201. Geneva: International Agency for Research on Cancer, *World Health Organization;* 2014. [Internet].2015 [cited 2024 Jan 2]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4785485/pdf/an012211.pdf

228. Fabrigar LR, Petty RE, Smith SM, Crites SL Jr. Understanding knowledge effects on attitude–behaviour consistency: the role of relevance, complexity, and amount of knowledge. *J Pers Soc Psychol.* 2009; 90:556–77.

229. Evans WD. How social marketing works in health care. *BMJ*. 2006; 332:1207–10.

230. Kippen R, James E, Ward B, Buykx P, Shamsullah A, Watson W, Chapman K. Identification of cancer risk and associated behaviour: implications for social marketing campaigns for cancer prevention. *BMC Cancer*. 2017; 17:550.

231. Pew Research Center. Public Interest in Science and Health Linked to Gender, Age and Personality [Internet]. 2015 [cited 2016 Feb 15]; Available from: http://www.pewinternet.org/files/2015/12/PI_2015-12-11_Science-and-Health_FINAL.pdf

232. Kenfield SA, Stampfer MJ, Giovannucci E, Chan JM. Physical activity and survival after prostate cancer diagnosis in the health professionals follow-up study. *J Clin Oncol.* 2011: 20(29): 726-32.

233. Eliassen AH, Hankinson SE, Rosner B, Holmes MD, Willett WC. Physical activity and risk of breast cancer among postmenopausal women. *Arch Intern Med.* 2010: 170: 1758-64.

234. Steindorf K, Schmidt M, Ulrich C. Effects of physical activity on cancer risk and disease progression after cancer diagnosis. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz*. 2012;55(1).

235. Anker A, Hugh Feeley T, McCracken B, Lagoe C. Measuring the Effectiveness of Mass-Mediated Health Campaigns Through Meta-Analysis**.** J Health Commun. 2016; 21(4):439-56.

236. Amin TT, Al-Hammam AM, Al-Mulhim NA, Al-Hayan MI, Al-Mulhim MM, Al-Mosabeh MJ, et al. Physical Activity and Cancer Prevention: Awareness and Meeting the Recommendations among Adult Saudis. *Asian Pacific Journal of Cancer Prevention*. 2014;15: 2597-2606.

237. Molanorouzi K, Khoo S, Morris T. Motives for adult participation in physical activity: type of activity, age, and gender. *BMC Public Health.* 2015; 15:66.

238. Roser M, Ritschie Hannah. Our world in Data: Cancer. [Internet]. 2019 [cited 2020 Nov 23]; Available from: https://ourworldindata.org/cancer

239. How much do Europeans exercise? [Internet].2017 [cited 2024 Jan 2]; Available from: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20170302-1

240. Speakman JR, Westerterp KR. Associations between energy demands, physical activity, and body composition in adult humans between 18 and 96 y of age. *Am J Clin Nutr*. 2010; 92(4):826-34.

241. Schermer EE, Engelfriet PM, Blokstra A, Verschuren WMM, Picavet HSJ. Healthy lifestyle over the life course: Population trends and individual changes over 30 years of the Doetinchem Cohort Study. *Sec. Life-Course Epidemiology and Social Inequalities in Health*. 2022. Volume 10.

242. Higashiyama N, Yamaguchi K, Yamamoto Y, Ueda A, Inayama Y, Egawa M, et al. Development of healthy lifestyle consciousness index for gynecological cancer patients. *Supportive Care in Cancer.* 2022; 30(9), 7569–7574.

243. Cao Z, Xu C, Yang H, Li S, Wang Y. The Role of Healthy Lifestyle in Cancer Incidence and Temporal Transitions to Cardiometabolic Disease. *JACC Cardio Oncol.* 2021; 3(5), 663-674.

244. Rotgans JI, Schmidt HG. The relation between individual interest and knowledge acquisition. *BERJ*. 2017; 43(2): 350-371.

245. Jeong M, Tan AS, Brennan E, Gibson L, Hornik RC. Talking about quitting: Interpersonal communication as a mediator of campaign effects on smokers' quit behaviors. *Journal of Health Communication.* 2015; 20(10): 1196–1205.

246. Weenig MWH, Midden CJH. Mass-media information campaigns and knowledge-gap effects. *Journal of Applied Social Psychology.* 1997; 27(11), 945–958.

247. King KM, Della LJ, Eckler ST, Mullis LM. Promoting Physical Activity through Health Communications Campaigns. *ACSM's Health & Fitness Journal.* 2021; 25(4), 45-50.

248. Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines Advisory Committee Scientific Report. Washington (DC): U.S. Department of Health and Human Services [Internet] 2018. Cited 2024 Jan 3]; Available from: https://health.gov/sites/default/files/2019-09/PAG_Advisory_Committee_Report.pdf

249. King KM, Jaggers JR, Wintergerst K. Strategies for partnering with health care settings to increase physical activity promotion. *ACSMs Health Fit J*. 2019; 23(4):40–3.

250. King KM, Terson de Paleville D. Partnering with schools to implement physical activity interventions. *ACSMs Health Fit J.* 2018; 22(2):38–41.

Tables

Table 1: Descriptive statistic table for gender, area of living, education level, BMI, and age for 2013 and 2014 interviewees and those who have been exposed to information in 2014.

	Group 2013 (n=922)						**Group 2014** (n=919)						**Exposed to information 2014** (n=247)					
Gender	**Male (n)**			**Female (n)**			**Male (n)**			**Female (n)**			**Male (n)**			**Female (n)**		
Frequency (%)	362 (39%)			560 (61%)			348 (38%)			571 (62)			78 (32%)			169 (68%)		
Area of living	**Rural area (n)**			**City (n)**			**Rural area (n)**			**City (n)**			**Rural area (n)**			**City (n)**		
Frequency (%)	540 (59%)			377 (41%)			523 (57%)			393 (43%)			144 (59%)			101 (41%)		
Education level	**< High school (n)**			**High school (n)**		**> High school (n)**	**< High school (n)**			**High school (n)**		**> High school (n)**	**< High school (n)**			**High school (n)**		**> High school (n)**
Frequency (%)	222 (24%)			303 (33%)		388 (43%)	210 (23%)			310 (34%)		391 (43%)	64 (26%)			84 (34%)		97 (40%)
BMI	**<18.5**	**18.5-25**		**25-30**		**>30**	**<18.5**	**18.5-25**		**25-30**		**>30**	**<18.5**	**18.5-25**		**25-30**		**>30**
Frequency (%)	17 (2%)	455 (51%)		309 (34%)		120 (13%)	25 (3%)	466 (52%)		303 (34%)		100 (11%)	3 (1%)	136 (55%)		85 (35%)		21 (8%)
Age	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**	**18- 20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**
Frequency (%)	38 (4%)	65 (7%)	98 (11%)	211 (23%)	159 (17%)	351 (38%)	25 (3%)	53 (6%)	106 (11%)	196 (21%)	179 (20%)	352 (39%)	9 (4%)	11 (5%)	18 (7%)	40 (16%)	53 (21%)	116 47%)
Cancer	**Cancer patients**			**Non cancer patients**			**Cancer patients**			**Non cancer patients**			**Cancer patients**			**Non cancer patients**		
Frequency (%)	79 (9%)			842 (91%)			74 (8%)			842 (92%)			27 (10%)			237 (90%)		

Table 2. Campaign´s message to the public, interviewees' opinion.

Campaign´s message	**Total answers frequency (n=305)**	**Frequency (%)**
People need to be more physically active	130	44%
Children and young people need to be more physically active	6	2%
Physical activity protect our health	38	13%
Physical activity protect us against cancer	25	8%
People need to live health consciously	53	17%
People need to eat healthy	7	2%
Wanted to make the people aware of the topic	10	3%
Other	16	5%
No answer/ don´t know	20	6%

Table 3. Frequencies about the impact of the campaign

Campaign´s impact	Total answers frequency (n=247)	Frequency (%)
The campaign motivates me to become physically more active	49	20%
No, the campaign doesn´t motivate me	80	32%
I am already physically active without campaign´s impact	118	48%

Table 4. Frequencies about changes in physical activity behavior.

Changes in physical activity behavior	Total answers frequency (n=247)	Frequency (%)
I became physically more active because of the campaign	17	35%
I didn´t become physically more active	32	65%

Table 5: Descriptive statistic table for physical activity level for 2013 and 2014 interviewees, those who have been exposed to information in 2014 and those who were not exposed to information in 2014.

	Physical ativity level		
	High (n)	Moderate (n)	Low (n)
Group 2013 (n=922)	538	208	176
Frequency (%)	58%	23%	19%
Group 2014 (n=919)	561	218	140
Frequency (%)	61%	24%	15%
Exposed to information 2014 (n=247)	158	50	39
Frequency (%)	64%	20%	16%
Not exposed to information 2014 (n=672)	403	168	101
Frequency (%)	60%	25%	15%

Table 6: Physical activity levels "high", "moderate" and "low" – Mann Whitney – U Test for the interviewees of the groups (a) "2013" and "2014", (b) "2013" and "2014 exposed to information", (c) "2013" and "2014 not exposed to information", (d) "2014 exposed to information" and "2014 not exposed to information",

	Physical activity levels	U	Z	p
(a)	**2013** (n=922)	**409908.00**	**-1.598**	**0.110**
	2014 (n=919)			
(b)	**2013** (n=922)	**107128.00**	**-1.628**	**0.104**
	2014 Exposed to information (n=247)			
(c)	**2013** (n=922)	**301435.00**	**-1.045**	**0.296**
	2014 Not exposed to information (n=672)			
(d)	**2014 Exposed to information** (n=247)	**80173.00**	**-0.908**	**0.364**
	2014 Not exposed to information (n=672)			

Table 7: Total MET-hours/week - independent sample t-test results for the interviewees of (a) "2013" and "2014 exposed to information" (b) "2014 exposed to information" and "2014 not exposed to information", (c) "2013" and "2014 not exposed to information".

	Total MET-hours/week	Mean	SD	t	p
(a)	**2013** (n=922)	**17.68**	**17.07**	**-2.851**	**0.004**
	2014 Exposed to information (n=247)	**21.38**	**21.57**		
(b)	**2014 Exposed to information** (n=247)	**21.38**	**21.57**	**2.089**	**0.037**
	2014 Not exposed to information (n=672)	**18.54**	**18.54**		
(c)	**2013** (n=922)	**17.68**	**17.07**	**-0.996**	**0.320**
	2014 Not exposed to information (n=672)	**18.54**	**18.54**		

Table 7a: MET-hours/week at work - independent sample t-test results for the interviewees of (a) "2013" and "2014 exposed to information" (b) "2014 exposed to information" and "2014 not exposed to information", (c) "2013" and "2014 not exposed to information".

	MET-hours/week at work	Mean	SD	t	p
(a)	**2013** (n=922)	**11.25**	**15.24**	**-1.611**	**0.108**
	2014 Exposed to information (n=247)	**13.11**	**19.21**		
(b)	**2014 Exposed to information** (n=247)	**13.11**	**19.21**	**1.240**	**0.215**
	2014 Not exposed to information (n=672)	**11.63**	**14.76**		
(c)	**2013** (n=922)	**11.25**	**15.24**	**-0.500**	**0.617**
	2014 Not exposed to information (n=672)	**11.63**	**14.76**		

Table 7b: MET-hours/week from transportation - independent sample t-test results for the interviewees of (a) "2013" and "2014 exposed to information" (b) "2014 exposed to information" and "2014 not exposed to information", (c) "2013" and "2014 not exposed to information".

	MET-hours/week from transportation	Mean	SD	t	p
(a)	**2013** (n=922)	**2.95**	**4.29**	**-3.766**	**0.000**
	2014 Exposed to information (n=247)	**4.15**	**5.03**		
(b)	**2014 Exposed to information** (n=247)	**4.15**	**5.03**	**2.593**	**0.010**
	2014 Not exposed to information (n=672)	**3.21**	**4.82**		
(c)	**2013** (n=922)	**2.95**	**4.29**	**-1.139**	**0.255**
	2014 Not exposed to information (n=672)	**3.21**	**4.82**		

Table 7c: MET-hours/week in free time - independent sample t-test results for the interviewees of (a) "2013" and "2014 exposed to information" (b) "2014 exposed to information" and "2014 not exposed to information", (c) "2013" and "2014 not exposed to information".

	MET-hours/week in free time	Mean	SD	t	p
(a)	**2013** (n=922)	**3,48**	**4.655**	**-1.799**	**0.072**
	2014 Exposed to information (n=247)	**4,11**	**5.751**		
(b)	**2014 Exposed to information** (n=247)	**4,11**	**5.751**	**1.063**	**0.288**
	2014 Not exposed to information (n=672)	**3,70**	**5.068**		
(c)	**2013** (n=922)	**3,48**	**4.655**	**-0.882**	**0.378**
	2014 Not exposed to information (n=672)	**3,70**	**5.068**		

Table 8. Descriptive statistic table for gender, area of living, education level, BMI, and age for the groups "cancer patients" and "non cancer patients".

	Cancer patients (n=153)						Non cancer patients (n=1688)					
Gender	**Male (n)**			**Female (n)**			**Male (n)**			**Female (n)**		
Frequency (%)	50 (35%)			103 (65%)			660 (39%)			1028 (61%)		
Area of living	**Rural area (n)**			**City (n)**			**Rural area (n)**			**City (n)**		
Frequency (%)	91 (56%)			62 (44%)			978 (59%)			710 (41%)		
Education level	**< High school (n)**			**High school (n)**		**> High school (n)**	**< High school (n)**			**High school (n)**		**> High school (n)**
Frequency (%)	11 (10%)			96 (63%)		46 (27%)	84 (5%)			1064 (69%)		540 (26%)
BMI	**<18.5**	**18.5-25**		**25-30**		**>30**	**<18.5**	**18.5-25**		**25-30**		**>30**
Frequency (%)	3 (3%)	75 (48%)		48 (26%)		27 (23%)	40 (2%)	869 (51%)		578 (35%)		201 (12%)
Age	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**	**18-20**	**21-30**	**31-40**	**41-50**	**51-60**	**>61**
Frequency (%)	0 (0%)	2 (1%)	4 (3%)	16 (13%)	27 (15%)	104 (68%)	63 (5%)	106 (8%)	211 (11%)	392 (24%)	313 (18%)	603 (35%)

Table 9. Frequencies for healthy lifestyle for the groups “cancer patients” and “non cancer patients”

	Healthy lifestyle									
	Cancer patients					Non cancer patients				
	very strong	strong	slightly	poor	not healthy at all	very strong	strong	slightly	poor	not healthy at all
Frequency	**40**	**76**	**33**	**4**	**0**	**248**	**808**	**492**	**95**	**41**
% Percentage	**26%**	**50%**	**21%**	**3%**	**0%**	**15%**	**48%**	**29%**	**6%**	**2%**

Table 10. Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms” for the groups “2013”, “2014 exposed to information” and “2014 not exposed to information”

	Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms					
Group	**2013** (n=922)		**2014 exposed to information** (n=247)		**2014 not exposed to information** (n=672)	
	ja	**nein**	**ja**	**nein**	**ja**	**nein**
Frequency (%)	689 (75%)	232 (25%)	220 (89%)	27 (11%)	452 (67%)	220 (33%)

Table 11. Targeted adoption of physical activity for cancer risk reduction in specific cancer forms for the groups “2013”, “2014 exposed to information” and “2014 not exposed to information”

	Targeted adoption of physical activity and cancer risk reduction in specific cancer forms					
Group	**2013** (n=689)		**2014 exposed to information** (n=220)		**2014 not exposed to information** (n=452)	
	ja	**nein**	**ja**	**nein**	**ja**	**nein**
Frequency (%)	152 (22%)	537 (78%)	53 (24%)	167 (76%)	86 (19%)	366 (81%)

Table 12. Sport for Health program awareness for the groups "2013", "2014 exposed to information" and "2014 not exposed to information"

	Sport for Health program awareness					
Group	**2013** (n=917)		**2014 exposed to information** (n=246)		**2014 not exposed to information** (n=670)	
	ja	**nein**	**ja**	**nein**	**ja**	**nein**
Frequency (%)	154 (17%)	763 (83%)	59 (24%)	187 (76%)	89 (13%)	581 (87%)

Table 13. Source of the information about the "Sport for Health" program for all 3 groups.

Information about the "Sport for Health" program							
Source	**Physician**	**TV**	**Press**	**Flyer**	**Internet**	**other**	**no answer**
Frequency (%)	59 (15%)	50 (13%)	111 (28%)	65 (16%)	25 (6%)	67 (17%)	22 (5%)

Table 14. Knowledge about the relationship between physical activity and cancer risk reduction in specific cancer forms" for the groups "cancer patients", "non cancer patients"

	Knowledge about the relationship between physical activity and cancer risk reduction			
Group	**Cancer patients (n=153)**		**Non cancer patients (n=1684)**	
	ja	**nein**	**ja**	**nein**
Frequency (%)	127 (83%)	26 (17%)	1230 (73%)	454 (27%)

Table 15. Targeted adoption of physical activity for cancer risk reduction in specific cancer forms for the groups "cancer patients", "non cancer patients"

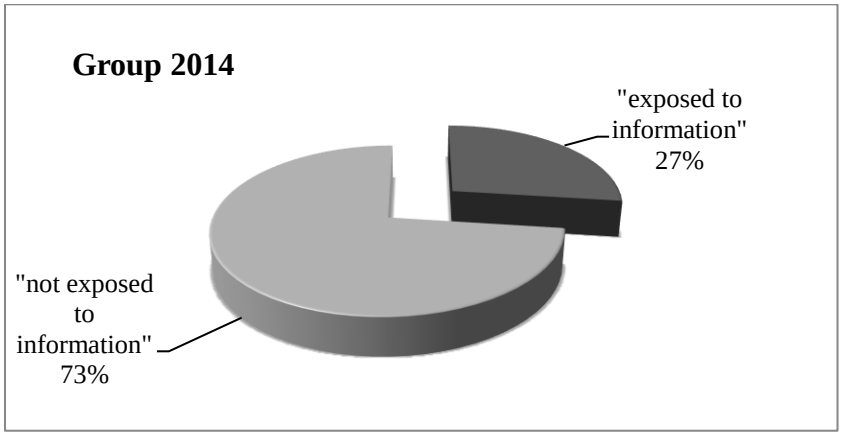
	Targeted adpption of physical activity and cancer risk reduction in specific cancer forms			
Group	**Cancer patients (n=127)**		**Non cancer patients (n=1230)**	
	ja	**nein**	**ja**	**nein**
Frequency (%)	58 (38%)	95 (62%)	246 (20%)	984 (80%)

Table 16. Sport for Health program awareness for the groups “cancer patients”, “non cancer patients”.

	Sport for Health program awareness			
Group	**Cancer patients (n=153)**		**Non cancer patients (n=1677)**	
	ja	**nein**	**ja**	**nein**
Frequency (%)	37 (24%)	116 (76%)	265 (16%)	1412 (84%)

Chart

Chart 1: Percentages of the participants who “exposed to information” and “not exposed to information” of the campaign of the “Group 2014”.



Figures

Figure 1: Profiling of interviewees in 2014.

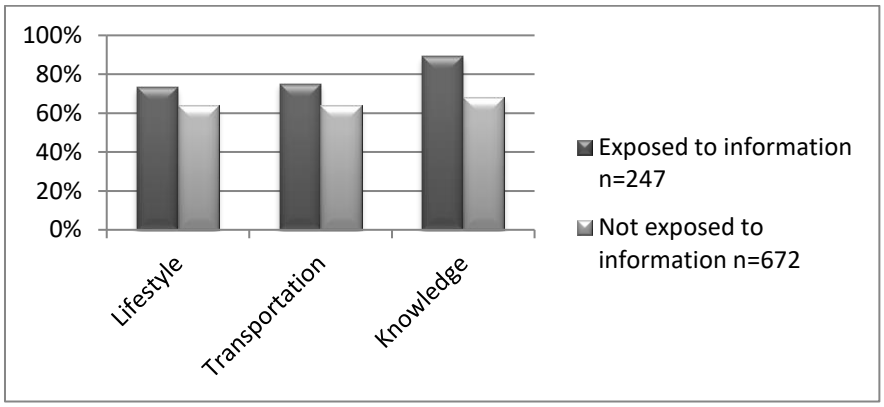


Figure 2: Average weekly MET-hours for the "2013", "2014 not exposed to information", and "2014 exposed to information" groups in total and for the three categories (physical activity: a) at work, b) from transportation and c) during free time).

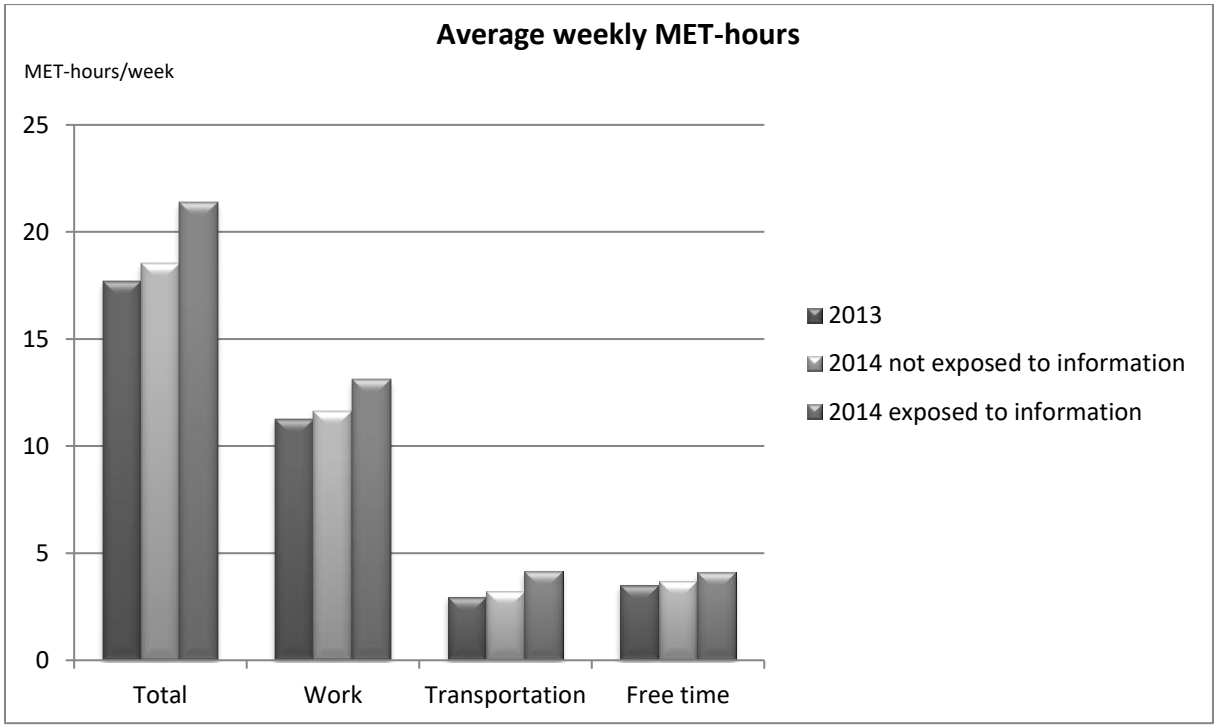


Figure 3: Total average MET-hours per week for the interviewees in 2014

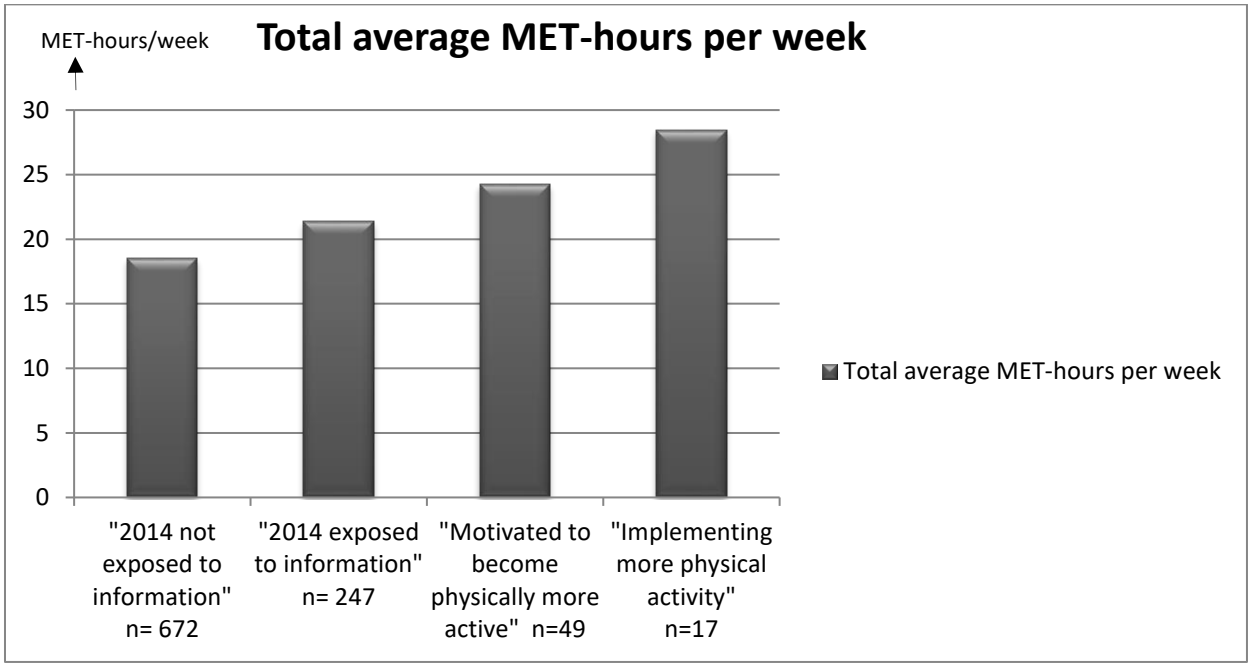
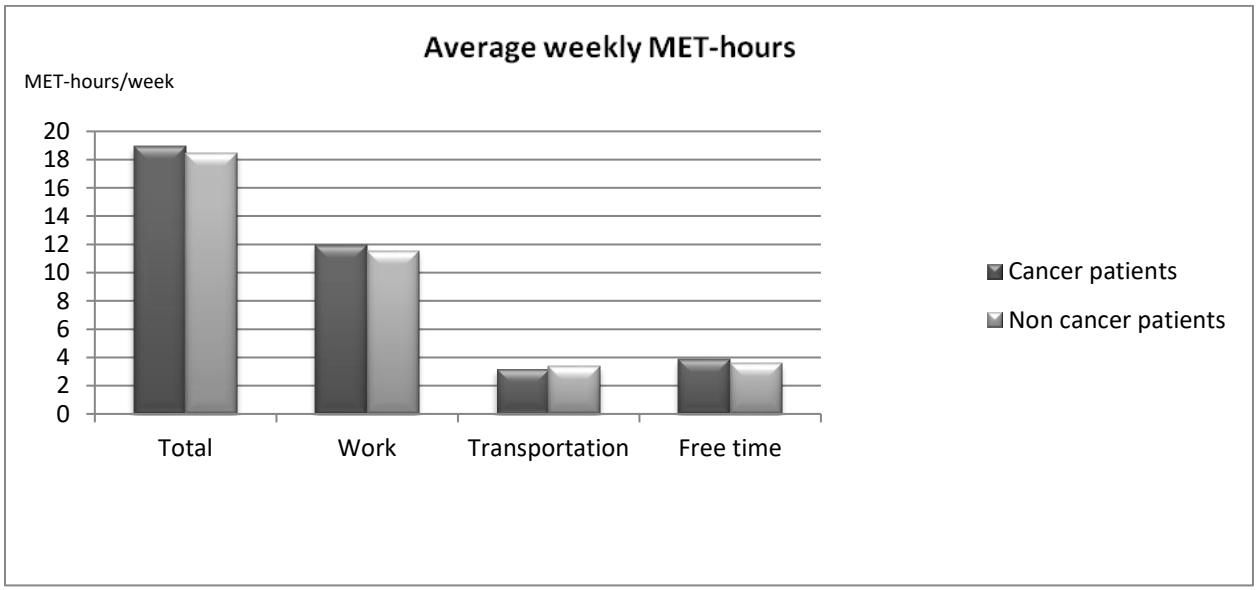


Figure 4: Average weekly MET-hours for the "cancer patients" and "non cancer patients" groups in total and for the three categories (physical activity: a) at work, b) from transportation and c) during free time).



Posters

Deutsche Krebshilfe
HELFEN. FORSCHEN. INFORMIEREN.

DOSB

Deutsche Sporthochschule Köln
German Sport University Cologne

Deutsche Krebshilfe
HELFEN. FORSCHEN. INFORMIEREN.

DOSB

Deutsche Sporthochschule Köln

Deutsche Krebshilfe
HELFEN. FORSCHEN. INFORMIEREN.

DOSB

Deutsche
Sporthochschule Köln
German Sport University Cologne

Questionnaire for the 1st Survey 2013

Evaluation der Informationskampagne „Bewegung gegen Krebs“ der Deutschen Krebshilfe, des Deutschen Olympischen Sportbundes und der Deutschen Sporthochschule Köln

- 1. Befragungswelle (2. Welle folgt im September 2014) -

Projektnummer:	**q3565**
Fallzahl:	**1.000 Befragte ab 18 Jahre**
Erhebungszeitraum:	**September 2013**
Auswertung:	**Datensatz, Tabellen, Bericht**

Einleitung:

Guten Tag/Guten Abend. Ich heiße (Vorname, Nachname) und ich rufe vom Sozialforschungsinstitut forsa in Berlin/Dortmund an. Wir führen zur Zeit eine bundesweite Repräsentativ-Umfrage zum Thema Gesundheit durch.

Zunächst geht es darum, wie viel Sie sich in einer gewöhnlichen Woche bewegen. Wir unterscheiden dabei zwischen intensiven körperlichen Aktivitäten und moderaten körperlichen Aktivitäten. Mit intensiven körperlichen Aktivitäten meinen wir körperlich anstrengende Tätigkeiten, bei denen Sie stark ins Schwitzen oder außer Atem kommen. Moderate körperliche Aktivitäten sind mäßig anstrengende körperliche Tätigkeiten, bei denen Sie nur leicht ins Schwitzen kommen oder die Sie etwas schneller atmen lassen. Es geht dabei nicht nur um Sport, sondern um alle körperlichen Aktivitäten, also bei der Arbeit, bei der Fortbewegung im Alltag oder in der Freizeit.

Beginnen wir mit den körperlichen Aktivitäten bei der Arbeit. Gemeint ist nicht nur die Erwerbsarbeit, sondern jede Arbeit, die Sie erledigen müssen, bezahlt oder unbezahlt, Studium/Ausbildung, Arbeiten im Haushalt, Landwirtschaft, Arbeitssuche u.s.w.

P1 Gehören zu Ihrer Arbeit auch intensive körperliche Aktivitäten, bei denen Sie stark ins Schwitzen oder stark außer Atem kommen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. körperlich anstrengendes Tragen oder Heben von schweren Lasten, schwere Lager- oder Bauarbeiten

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P1 = „JA“

P2 An wie vielen Tagen einer gewöhnlichen Woche verrichten Sie normalerweise solche intensiven körperlichen Arbeitsaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

Anm: Wenn der Befragte einmal im Monat o.ä. angibt, also seltener als einmal in der Woche, dann soll 0 notiert werden.

FALLS P1 = „JA“

P3 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit intensiven körperlichen Arbeitsaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

P4 Gehören zu Ihrer Arbeit auch moderate körperliche Aktivitäten, bei denen Sie etwas ins Schwitzen kommen oder die Sie etwas schneller atmen lassen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. zügiges Gehen oder Tragen von leichten Lasten

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P4 = „JA“

P5 An wie vielen Tagen einer gewöhnlichen Woche verrichten Sie normalerweise solche moderaten körperlichen Arbeitsaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P4 = „JA“

P6 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit moderaten körperlichen Arbeitsaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

Im Folgenden möchte ich Ihnen ein paar Fragen zur Fortbewegung im Alltag stellen. Sie werden nun gefragt, wie Sie gewöhnlich zu den Orten Ihres regelmäßigen Bedarfs gelangen, wie z.B. zur Arbeit, zum Einkaufen, zu Freunden, zu Freizeitstätten etc. Die Fragen schließen körperliche Aktivitäten bei der Arbeit, die Sie bereits erwähnt haben, aus.

P7 Gehen Sie zu Fuß oder fahren Sie Fahrrad mit einer Mindestdauer von 10 Minuten, um Orte Ihres regelmäßigen Bedarfs zu erreichen?

Int: Beispiele nur bei Bedarf vorlesen!
Mit Orten des regelmäßigen Bedarfs meinen wir z.B. die Arbeitsstätte, Einkaufsmöglichkeiten, Freizeitstätten, die Wohnung von Freunden etc.

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P7 = „JA“

P8 An wie vielen Tagen einer gewöhnlichen Woche gehen Sie zu Fuß oder fahren Sie Fahrrad mit einer Mindestdauer von 10 Minuten, um Orte Ihres regelmäßigen Bedarfs zu erreichen?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P7 = „JA“

P9 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit zu Fuß gehen oder Fahrradfahren, um Orte Ihres regelmäßigen Bedarfs zu erreichen?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

Kommen wir nun auf Ihr Freizeitverhalten zu sprechen. Dabei geht es zuerst um intensive, dann um moderate Sport-, Fitness- und Freizeitaktivitäten. Die folgenden Fragen schließen körperliche Aktivitäten bei der Arbeit und bei der Fortbewegung aus, die Sie bereits erwähnt haben.

P10 Betreiben Sie intensive Sport-, Fitness- oder Freizeitaktivitäten, bei denen Sie stark ins Schwitzen oder stark außer Atem kommen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. Jogging, sportliches Schwimmen oder Radfahren

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P10 = „JA“

P11 An wie vielen Tagen einer gewöhnlichen Woche betreiben Sie normalerweise solche intensiven Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P10 = „JA“

P12 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit intensiven Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

P13 Betreiben Sie moderate Sport-, Fitness- oder Freizeitaktivitäten, bei denen Sie etwas ins Schwitzen kommen oder die Sie etwas schneller atmen lassen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. Walken, Golfen, Wandern, Gymnastik

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P13 = „JA“

P14 An wie vielen Tagen einer gewöhnlichen Woche betreiben Sie normalerweise solche moderaten Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P13 = „JA“

P15 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit moderaten Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

P16 Wissen Sie, dass regelmäßige Bewegung das persönliche Risiko, an bestimmten Krebsarten zu erkranken reduzieren kann oder war Ihnen das bisher nicht bekannt?

- ja
- nein, war mir nicht bekannt

- weiß nicht
- keine Angabe

FALLS P16 = „JA“ UND P10 UND/ODER P13 = „JA“ *(also Befragter weiß, dass regelmäßige Bewegung das Krebsrisiko senken kann und betreibt selbst intensiven und/oder moderaten Sport)*

P17 Betreiben Sie regelmäßige Sport-, Fitness oder Freizeitaktivitäten bewusst auch mit dem Ziel Ihr Krebsrisiko zu reduzieren oder spielt das für Ihre Motivation, Sport zu treiben keine Rolle?

- ja, betreibe es bewusst auch mit dem Ziel, mein Krebsrisiko zu reduzieren
- nein, spielt für meine Motivation keine Rolle

- weiß nicht
- keine Angabe

P18 Kennen Sie das Qualitätssiegel SPORT PRO GESUNDHEIT?

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P18=“JA“

P19 Woher kennen Sie das Siegel? Wo haben Sie das Siegel schon einmal gesehen?

KATEGORIEN VORLESEN; RANDOMISIEREN; MEHRFACHNENNUNG MÖGLICH

- beim Arzt/ in einer Arztpraxis
- im Fernsehen
- in einer Zeitung oder Zeitschrift
- in einer Broschüre oder einem Flyer
- im Internet

NICHT VORLESEN

- sonstiges
- weiß nicht
- keine Angabe

P20 Wenn Sie einmal an die allgemeinen Empfehlungen für eine gesunde Lebensweise denken, also z.B. „Nichtrauchen“, ausgewogene Ernährung, vernünftiger Umgang mit der Sonne, geringer Alkoholkonsum, ausreichend Bewegung u.s.w., wie würden Sie sich selbst dann einstufen? Würden Sie sagen, Sie achten insgesamt betrachtet sehr stark, stark, etwas, weniger oder überhaupt nicht auf eine gesunde Lebensweise?

- sehr stark
- stark
- etwas
- weniger
- überhaupt nicht

- weiß nicht
- keine Angabe

S1 Nun geht es um Ihre derzeitige körperliche Verfassung. Wie groß sind Sie? Bitte geben Sie Ihre Körpergröße in cm an.

Int: Notfalls reicht auch eine Schätzung aus!

- ____ (KÖRPERGRÖßE IN CM ERFASSEN)

- weiß nicht
- keine Angabe

S2 Wie viel wiegen Sie zur Zeit? Bitte geben Sie Ihr Gewicht in kg an.

Int: Notfalls reicht auch eine Schätzung aus!

- ____ (KÖRPERGEWICHT IN KG ERFASSEN)

- weiß nicht
- keine Angabe

S3 Waren oder sind Sie selbst von einem Krebsleiden betroffen?

- ja
- nein
- keine Angabe

S4 Geschlecht

- männlich
- weiblich

S5 In welchem Jahr sind Sie geboren?

- ____ (JAHRGANG ERFASSEN)
- keine Angabe

S6 Welchen höchsten allgemein bildenden Schulabschluss haben Sie?

- ohne Schulabschluss
- Haupt-/ Volksschulabschluss
- Mittlere Reife, Realschulabschluss, Fachschulreife
- Abschluss der Polytechnischen Oberschule (8./10. Klasse)
- Fachhochschulreife, Abschluss einer Fachoberschule
- Abitur, allgemeine oder fachgebundene Hochschulreife
- Fach-/ Hochschulstudium
- einen anderen Schulabschluss
- noch keinen Schulabschluss, da noch Schüler

- keine Angabe

S7 Wie würden Sie Ihre eigene Wohnumgebung am ehesten beschreiben: Wohnen Sie in einer eher ländlichen Gegend oder in einer eher städtischen Gegend?

- eher ländlich
- eher städtisch

- weiß nicht
- keine Angabe

Zusätzliche Sampleinformationen:

- GKZ
- Einwohnerzahl
- BIK-Regionen

Questionnaire for the 2nd Survey 2014

Evaluation der Informationskampagne „Bewegung gegen Krebs“ der Deutschen Krebshilfe, des Deutschen Olympischen Sportbundes und der Deutschen Sporthochschule Köln

- 2. Befragungswelle (Wiederholung von q3565 plus Zusatzfragen) -

Projektnummer:	**q4591**
Fallzahl:	**1.000 Befragte ab 18 Jahre**
Erhebungszeitraum:	**September 2014**
Auswertung:	**Datensatz, Tabellen, Bericht**

Einleitung:

Guten Tag/Guten Abend. Ich heiße (Vorname, Nachname) und ich rufe vom Sozialforschungsinstitut forsa in Berlin/Dortmund an. Wir führen zur Zeit eine bundesweite Repräsentativ-Umfrage zum Thema Gesundheit durch.

Zunächst geht es darum, wie viel Sie sich in einer gewöhnlichen Woche bewegen. Wir unterscheiden dabei zwischen intensiven körperlichen Aktivitäten und moderaten körperlichen Aktivitäten. Mit intensiven körperlichen Aktivitäten meinen wir körperlich anstrengende Tätigkeiten, bei denen Sie stark ins Schwitzen oder außer Atem kommen. Moderate körperliche Aktivitäten sind mäßig anstrengende körperliche Tätigkeiten, bei denen Sie nur leicht ins Schwitzen kommen oder die Sie etwas schneller atmen lassen. Es geht dabei nicht nur um Sport, sondern um alle körperlichen Aktivitäten, also bei der Arbeit, bei der Fortbewegung im Alltag oder in der Freizeit.

Beginnen wir mit den körperlichen Aktivitäten bei der Arbeit. Gemeint ist nicht nur die Erwerbsarbeit, sondern jede Arbeit, die Sie erledigen müssen, bezahlt oder unbezahlt, Studium/Ausbildung, Arbeiten im Haushalt, Landwirtschaft, Arbeitssuche u.s.w.

P1 Gehören zu Ihrer Arbeit auch intensive körperliche Aktivitäten, bei denen Sie stark ins Schwitzen oder stark außer Atem kommen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. körperlich anstrengendes Tragen oder Heben von schweren Lasten, schwere Lager- oder Bauarbeiten

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P1 = „JA“

P2 An wie vielen Tagen einer gewöhnlichen Woche verrichten Sie normalerweise solche intensiven körperlichen Arbeitsaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

Anm: Wenn der Befragte einmal im Monat o.ä. angibt, also seltener als einmal in der Woche, dann soll 0 notiert werden.

FALLS P1 = „JA“

P3 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit intensiven körperlichen Arbeitsaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

P4 Gehören zu Ihrer Arbeit auch moderate körperliche Aktivitäten, bei denen Sie etwas ins Schwitzen kommen oder die Sie etwas schneller atmen lassen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. zügiges Gehen oder Tragen von leichten Lasten

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P4 = „JA“

P5 An wie vielen Tagen einer gewöhnlichen Woche verrichten Sie normalerweise solche moderaten körperlichen Arbeitsaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P4 = „JA“

P6 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit moderaten körperlichen Arbeitsaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

Im Folgenden möchte ich Ihnen ein paar Fragen zur Fortbewegung im Alltag stellen. Sie werden nun gefragt, wie Sie gewöhnlich zu den Orten Ihres regelmäßigen Bedarfs gelangen, wie z.B. zur Arbeit, zum Einkaufen, zu Freunden, zu Freizeitstätten etc. Die Fragen schließen körperliche Aktivitäten bei der Arbeit, die Sie bereits erwähnt haben, aus.

P7 Gehen Sie zu Fuß oder fahren Sie Fahrrad mit einer Mindestdauer von 10 Minuten, um Orte Ihres regelmäßigen Bedarfs zu erreichen?

Int: Beispiele nur bei Bedarf vorlesen!
Mit Orten des regelmäßigen Bedarfs meinen wir z.B. die Arbeitsstätte, Einkaufsmöglichkeiten, Freizeitstätten, die Wohnung von Freunden etc.

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P7 = „JA“

P8 An wie vielen Tagen einer gewöhnlichen Woche gehen Sie zu Fuß oder fahren Sie Fahrrad mit einer Mindestdauer von 10 Minuten, um Orte Ihres regelmäßigen Bedarfs zu erreichen?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P7 = „JA“

P9 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit zu Fuß gehen oder Fahrradfahren, um Orte Ihres regelmäßigen Bedarfs zu erreichen?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

Kommen wir nun auf Ihr Freizeitverhalten zu sprechen. Dabei geht es zuerst um intensive, dann um moderate Sport-, Fitness- und Freizeitaktivitäten. Die folgenden Fragen schließen körperliche Aktivitäten bei der Arbeit und bei der Fortbewegung aus, die Sie bereits erwähnt haben.

P10 Betreiben Sie intensive Sport-, Fitness- oder Freizeitaktivitäten, bei denen Sie stark ins Schwitzen oder stark außer Atem kommen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. Jogging, sportliches Schwimmen oder Radfahren

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P10 = „JA“

P11 An wie vielen Tagen einer gewöhnlichen Woche betreiben Sie normalerweise solche intensiven Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P10 = „JA“

P12 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit intensiven Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

P13 Betreiben Sie moderate Sport-, Fitness- oder Freizeitaktivitäten, bei denen Sie etwas ins Schwitzen kommen oder die Sie etwas schneller atmen lassen und die mindestens 10 Minuten andauern?

Int: Beispiele nur bei Bedarf vorlesen!
z.B. Walken, Golfen, Wandern, Gymnastik

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P13 = „JA“

P14 An wie vielen Tagen einer gewöhnlichen Woche betreiben Sie normalerweise solche moderaten Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (ANZAHL TAGE ERFASSEN)

- weiß nicht
- keine Angabe

FALLS P13 = „JA“

P15 Und was schätzen Sie: Wie viel Zeit verbringen Sie im Durchschnitt an einem solchen Tag mit moderaten Sport-, Fitness- oder Freizeitaktivitäten?

- ____ (STUNDEN (a) UND MINUTEN (b) ERFASSEN)

- weiß nicht
- keine Angabe

P16 Wissen Sie, dass regelmäßige Bewegung das persönliche Risiko, an bestimmten Krebsarten zu erkranken reduzieren kann oder war Ihnen das bisher nicht bekannt?

- ja
- nein, war mir nicht bekannt

- weiß nicht
- keine Angabe

FALLS P16 = „JA“ UND P10 UND/ODER P13 = „JA“ *(also Befragter weiß, dass regelmäßige Bewegung das Krebsrisiko senken kann und betreibt selbst intensiven und/oder moderaten Sport)*

P17 Betreiben Sie regelmäßige Sport-, Fitness oder Freizeitaktivitäten bewusst auch mit dem Ziel Ihr Krebsrisiko zu reduzieren oder spielt das für Ihre Motivation, Sport zu treiben keine Rolle?

- ja, betreibe es bewusst auch mit dem Ziel, mein Krebsrisiko zu reduzieren
- nein, spielt für meine Motivation keine Rolle

- weiß nicht
- keine Angabe

P18 Kennen Sie das Qualitätssiegel SPORT PRO GESUNDHEIT?

- ja
- nein

- weiß nicht
- keine Angabe

FALLS P18=“JA“

P19 Woher kennen Sie das Siegel? Wo haben Sie das Siegel schon einmal gesehen?

KATEGORIEN VORLESEN; RANDOMISIEREN; MEHRFACHNENNUNG MÖGLICH

- beim Arzt/ in einer Arztpraxis
- im Fernsehen
- in einer Zeitung oder Zeitschrift
- in einer Broschüre oder einem Flyer
- im Internet

NICHT VORLESEN

- sonstiges
- weiß nicht
- keine Angabe

P21 Haben Sie schon von der Informationskampagne „Bewegung gegen Krebs“ der Deutschen Krebshilfe, des Deutschen Olympischen Sportbundes und der Deutschen Sporthochschule Köln etwas gehört, gelesen oder gesehen oder ist Ihnen diese Kampagne nicht bekannt?

- ja, schon davon gehört oder gelesen
- nein, nicht bekannt
- weiß nicht
- k.A.

FALLS P21=“JA“

P22 Wie ist Ihr Eindruck? Was möchte diese Informationskampagne bewirken? Wozu möchte diese Kampagne die Bevölkerung aufrufen? Bitte sagen Sie mir das ganz genau.

GENAU NOTIEREN

- weiß nicht

- k.A.

FALLS P21="JA"
P23 Motiviert Sie persönlich diese Informationskampagne, mehr Bewegung in Ihren Alltag zu bringen oder gelingt das der Kampagne eher nicht?

- ja, motiviert mich
- nein, gelingt der Kampagne eher nicht
- ich bewege mich ohnehin genug
- weiß nicht
- k.A.

FALLS P23="JA, MOTIVIERT MICH"
P24 Und haben Sie das auch schon in Ihrem Alltag umgesetzt? D.h. bewegen Sie sich, angeregt durch diese Kampagne, mehr als vorher oder ist das bisher eher nicht der Fall?

- ja, bewege mich mehr
- nein, eher nicht der Fall
- weiß nicht
- k.A.

FALLS P21="JA"
P25 Waren Sie schon einmal auf der Webseite www.bewegung-gegen-krebs.de?

- ja
- nein
- weiß nicht
- k.A.

FALLS P25="JA"

P26 Wie hilfreich finden Sie persönlich die Seite www.bewegung-gegen-krebs.de: sehr hilfreich, hilfreich, weniger hilfreich oder gar nicht hilfreich?

- sehr hilfreich
- hilfreich
- weniger hilfreich
- gar nicht hilfreich
- weiß nicht
- k.A.

P20 Wenn Sie einmal an die allgemeinen Empfehlungen für eine gesunde Lebensweise denken, also z.B. „Nichtrauchen", ausgewogene Ernährung, vernünftiger Umgang mit der Sonne, geringer Alkoholkonsum, ausreichend Bewegung u.s.w., wie würden Sie sich selbst dann einstufen? Würden Sie sagen, Sie achten insgesamt betrachtet sehr stark, stark, etwas, weniger oder überhaupt nicht auf eine gesunde Lebensweise?

- sehr stark
- stark
- etwas
- weniger
- überhaupt nicht

- weiß nicht
- keine Angabe

S1 Nun geht es um Ihre derzeitige körperliche Verfassung. Wie groß sind Sie? Bitte geben Sie Ihre Körpergröße in cm an.

Int: Notfalls reicht auch eine Schätzung aus!

- ____ (KÖRPERGRÖßE IN CM ERFASSEN)

- weiß nicht
- keine Angabe

S2 Wie viel wiegen Sie zur Zeit? Bitte geben Sie Ihr Gewicht in kg an.

Int: Notfalls reicht auch eine Schätzung aus!

- ____ (KÖRPERGEWICHT IN KG ERFASSEN)

- weiß nicht
- keine Angabe

S3 Waren oder sind Sie selbst von einem Krebsleiden betroffen?

- ja
- nein
- keine Angabe

S4 Geschlecht

- männlich
- weiblich

S5 In welchem Jahr sind Sie geboren?

- ____ (JAHRGANG ERFASSEN)

- keine Angabe

S6 Welchen höchsten allgemein bildenden Schulabschluss haben Sie?

- ohne Schulabschluss
- Haupt-/ Volksschulabschluss
- Mittlere Reife, Realschulabschluss, Fachschulreife
- Abschluss der Polytechnischen Oberschule (8./10. Klasse)
- Fachhochschulreife, Abschluss einer Fachoberschule
- Abitur, allgemeine oder fachgebundene Hochschulreife
- Fach-/ Hochschulstudium
- einen anderen Schulabschluss
- noch keinen Schulabschluss, da noch Schüler

- keine Angabe

S7 Wie würden Sie Ihre eigene Wohnumgebung am ehesten beschreiben: Wohnen Sie in einer eher ländlichen Gegend oder in einer eher städtischen Gegend?

- eher ländlich
- eher städtisch

- weiß nicht
- keine Angabe

Zusätzliche Sampleinformationen:

- GKZ
- Einwohnerzahl
- BIK-Regionen