Physical Activity Adherence and Prescription in the Catalan population

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“Si no escalas la montaña jamás podrás disfrutar el paisaje”

-Pablo Neruda-

“Successful people keep moving, they make mistakes, but they don't quit”

-Conrad Hilton-

Alba Pardo Fernández ha estat becària predoctoral del Programa d'Investigaciors Novells de l'Institut Nacional d'Educació Física de Catalunya – INEFC- (Secretaria General de l'Esport) de la Generalitat de Catalunya.

LIST OF PAPERS

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Study III

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CONTENTS

LIST OF ABBREVIATIONS

ACSM	American College of Sports Medicine
BMI	Body Mass Index
CVRF	Cardiovascular Risk Factor
HEPA	Health-Enhancing Physical Activity
HRQL	Health-Related Quality of Life
LTPA	Leisure Time Physical Activity
MPA	Moderate-intensity Physical Activity
NCD	Noncommunicable Diseases
PA	Physical Activity
PARS	Physical Activity Referral Scheme
VPA	Vigorous-intensity Physical Activity
US	United States
WC	Waist Circumference
WHO	World Health Organization

INTRODUCTION

This thesis includes four parts. The first part presents an overall summary of the scientific evidence related to the three studies that compose this thesis. The second part includes three scientific articles published and one being under-review, where the PhD candidate is the first author. The third part summarizes the main results of the three studies. The fourth part is the general discussion for the three scientific articles, with the strength and limitations of the present studies and recommendations for future research.

The present thesis consisted in three studies I, II and III. The study I gives an insight on the prevalence of PA among Catalan population and identify the most physically active and the most sedentary population groups. The study II explores PA level and other lifestyle-related behaviours within Catalan physicians. The study III assesses the recent implantation of Physical Activity Referral Scheme (PARS) in primary health care centres in Catalonia.

The first two studies describe the prevalence of PA among representative samples of Catalan population and Catalan physicians. The study I focused on describing the prevalence of both Health-Enhancing Physical Activity (HEPA) and Leisure-time Physical Activity (LTPA) in the Catalan population. It also identifies associated factors to the most active and the most sedentary population's groups. The results from the Catalan population survey identify those population groups most needed of PA interventions.

Considering PA counselling a powerful strategy to promote PA to general population in primary care (Petrella & Lattanzio, 2002), it was necessary to assess the effectiveness of a PA referral scheme in the Catalan context. According to previous literature, PA counselling is influenced by physicians own habits. PA counselling is more effective when physicians presented positive health behaviours and regularly exercise (Abramson, Stein, Schaufele, Frates, & Rogan, 2000; Lobelo, Duperly, & Frank, 2009; Frank, Segura, Shen, & Oberg, 2010).

Given the importance of physicians own habits on PA counselling and the lack of previous data on PA level of physicians in Catalonia, it was important to explore the PA level and other health-related behaviours of Catalan physicians in the study II. This study gives an insight of the lifestyle-related behaviours of Catalan physicians, particularly PA habits and identify those most physically active and the most sedentary. Exploring the profile of the most physically active physicians is relevant to managers of health care systems to identify those who are more likely to be better PA promoters.

The study III focuses on assessing the recent implantation of a PA referral scheme in Catalan primary care centres by the Plan of Physical Activity, Sport and Health (PAFES). There was a need to test PARS in the Catalan primary are centres to assess its effectiveness and justify its implementation. These results are related to both studies I and II. The study I identifies target groups to increase PA and study II describe the health-related behaviours of physicians that are in part, related to PA counselling.

Findings from the study III extends the knowledge on the impact of PARS on health behaviour change related to PA and health-related quality of life in primary patients with cardiovascular risk factors. Further, it adds findings on PA adherence at long-term.

The present thesis summarizes the main results of three articles that are related to each other on the importance of health behaviour changes related to PA. First, in identifying those populations' groups most needed of PA interventions and secondly, in assessing the effectiveness of a physical activity referral scheme to enhance PA adoption and adherence at long-term.

1. BACKGROUND

1.1. Physical Activity Epidemiology

Physical activity epidemiology has emerged as new field of study in 1940, when it was considered an important influence on public health (U.S. Department of Health and Human Services, 1996).

Previously some of the benefits of physical activity (PA) had been demonstrated, but it was not until the second half of this century that scientific evidence supported the importance of PA on health and the risks of physically inactivity (Dishman, Washburn, & Heath, 2004). Evidence showed the role of PA in reducing cardiovascular diseases and other chronic diseases.

Some of the research areas of physical activity epidemiology focus on the benefits of an increased PA, the association of PA and reduced chronic diseases or the prevalence of physically active population.

To study the effects of PA on health it is important to establish what we mean by PA and its related terms.

1.1.1. Concepts related to Physical Activity, inactivity and sedentary behaviour

Physical activity (PA) and exercise are terms that usually have been used interchangeably. It is therefore fundamental to distinguish between them as they bear different meanings.

Physical activity is classically defined as *"any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level"* (U.S. Department of Health and Human Services (2008). Physical activity has different dimensions, including type, intensity, frequency and duration. PA can be categorised by the domain in which it is performed, occupational, leisure time or recreational, household chores and transportation or commuting activities (U.S. Department of Health and Human Services (2008) (U.S. Department of Health and Human Services, 1996). In addition, PA is a "complex, multi-dimensional and infinitely variable behaviour" (Riddoch C & McKenna J.,

2003). According to the behavioural approach it can be defined from the behavioural approach as the adoption and maintenance of a healthy behaviour (Dishman, 1994).

Exercise *has been recently used to denote a subcategory of PA. Exercise is defined as "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is the objective" (U.S. Department of Health and Human Services, 2008).*

The difficulties in measuring all PA dimensions have produced several terms that refer to different domains or types of physical activity:

Leisure-Time Physical Activity (LTPA), has been defined as *"activities performed by a person that are not required as essential activities of daily living and are performed at the discretion of the person"* (U.S. Department of Health and Human Services, 2008). These activities include sports participation, exercise conditioning or training, and recreational activities such as walking for pleasure, dancing and gardening.

The term **lifestyle activities** describes activities that a person carries out in the course of daily life that can contribute to sizeable energy expenditure, e.g., taking the stairs instead of using the elevator, walking to do errands instead of driving, getting off the bus one stop earlier, or parking further away than usual to walk to a destination (U.S. Department of Health and Human Services, 2008).

Health-Enhancing Physical Activity (HEPA) is a term used particularly among the European health promotion community, and is defined as *"any form of physical activity that benefits health and functional capacity without undue harm or risk"* (Cavill, Foster, Oja, & Martin, 2006) (Hagströmer, 2007).

Physical inactivity and sedentary behaviour

Traditionally, referring to someone as sedentary meant they did not meet PA guidelines. Actually, a sedentary lifestyle is one that is characterized by high levels of sedentary behaviour, independent of an individual's level of moderate or vigorous PA. The new concept recognizes that sedentary behaviour is a risk factor for chronic disease and that it is possible for an individual to accumulate high levels of both PA and sedentary behaviour.

As such physical inactivity is not a synonymous of sedentary behaviour and they have different consequences on health.

A sedentary behaviour is not defined simply as a lack of PA. **Sedentary Behaviour** (SB) refers to activities that do not increase energy expenditure substantially above the resting level, it includes activities like sleeping, sitting, watching TV, etc., that involve energy expenditure at the level of 1.0-1.5 metabolic equivalent units (METs, one MET is the energy cost of resting quietly, equivalent to 3.5 $mL \cdot kg^{-1} \cdot min^{-1}$ of oxygen uptake) (Sedentary Behaviour Research Network, 2012) (Pate, O'Neill, & Lobelo, 2008).

Then **Physical inactivity** involves light activities (1.6-2.9 METs) such as reading, slow walking, cooking, etc. that are not enough to meet current PA guidelines (Ainsworth et al., 2000).

A sedentary individual is different from someone who is considered inactive. Inactive can be used to describe those who are performing insufficient amounts of moderate and vigorous PA, i.e., not meeting the PA guidelines.

An adult who achieves the recommended 150 minutes per week of moderate PA can still be considered sedentary if he/she spends a large amount of time seated, for example, at their desk at work. Recent evidence suggests that having a high level of sedentary behaviour negatively impacts health regardless of other factors including body weight, diet, and PA (Hamilton, Healy, Dunstan, Zderic, & Owen, 2008). Independent of PA level, SB is associated with significant elevated risk of obesity and type 2 diabetes, whereas even light to moderate activity is associated with substantially lower risk (F. B. Hu, T. Y. Li, G. A. Colditz, W. C. Willett, & J. E. Manson, 2003).

Up to now, literature has focused the research on the negative effect of the lack of PA on health, considering that not getting enough PA was equal to physical inactivity. However, recent studies examine the consequences that a sedentary behaviour has on health regardless of PA (Frank B. Hu, Tricia Y. Li, Graham A. Colditz, Walter C. Willett, & JoAnn E. Manson, 2003; F. B. Hu et al., 2003; Katzmarzyk, Church, Craig, & Bouchard, 2009; Owen, Healy, Matthews, & Dunstan, 2010).

Health is defined by the World Health Organization (WHO) as *"a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"* (WHO, 1946). It is also defined as *"a human condition with physical, social and psychological dimensions, each characterized on a continuum with positive and negative poles. Positive health is associated with a capacity to enjoy life and to withstand challenges; it is not merely the absence of disease. Negative health is associated with morbidity, and in the extreme, with premature mortality*"(U.S. Department of Health and Human Services, 2008).

Health-related quality of life (HRQL) is an individual's overall sense of well-being and includes such factors as pain, mood, energy level, family and social interactions, sexual function, ability to work, and ability to keep up with routine daily activities (U.S. Department of Health and Human Services, 1996).

1.1.2. The assessment of Physical Activity

Because PA is an important determinant of health, an accurate assessment of PA is needed to plan new strategies to promote an active lifestyle. In addition, the assessment of PA is an essential part for understanding patterns and influences of behaviour, for designing interventions, and for undertaking population surveillance and monitoring.

However, the measurement of PA is a very difficult task because being as it is a complex, multidimensional and infinitely variable human behaviour and is difficult to quantify it (C. Riddoch, 2005).

PA assessment methods include objective methods (accelerometer, pedometer, etc.) and subjective methods (self-reported methods, etc.) (Haskell, 2012). We will focus on the subjective methods in the present thesis, as the three studies (I, II, II) are based on self-reported questionnaires. Questionnaires have been used for several decades in research settings (Pettee Gabriel, Morrow, & Woolsey, 2012) and have contributed over the past century to the documentation of the benefits attributed to a physically active lifestyle and to the development of PA guidelines (Haskell, 2012).

Questionnaires are the most feasible and practical instrument for measuring PA in large groups or populations. Since the early 1970s, over 30 survey instruments have been developed for PA assessment (Dishman et al., 2004; Haskell, 2012). Traditionally, PA questionnaires assessed a single domain (e.g., work-related PA or leisure-time PA), resulting in a significant gap in obtaining information about frequency, duration and intensity of PA across all domains. Considering that the PA recommendations were based on increasing PA across all domains (e.g., not only engaging in leisure-time PA but also commuting or performing household chores tasks), it was necessary to have a more in-depth knowledge about the PA habits of the general population.

In response to the necessity of having more accurate self-report instruments and to the global demand for comparable and valid measures of PA within and between countries, attempts have been made to develop generalized PA assessment tools worldwide. As an example the International Physical Activity Questionnaire (IPAQ) was developed for surveillance activities and to guide policy development related to HEPA (Craig et al., 2003a). It has proven to be an appropriate self-report instrument for defining patterns of PA across several domains (leisure, work, home and transport) in the general population (Craig et al., 2003a).

The questionnaire is available in both short (IPAQ-short, 7 items) and long form (IPAQ-long, 27 items), respectively, and in versions for use in telephone surveys or on a self-administration basis (www.ipaq.ki.se). The present studies of the thesis are based on the IPAQ short version, more suitable for use in national and regional surveillance systems. Both versions have been piloted and validated in twelve different countries to assess reliability and validity (Craig et al., 2003b). The IPAQ short version in Catalan language was validated by Roman-Viñas et al. (Roman Vinas, Ribas Barba, Ngo, & Serra Majem, 2012).

1.1.3. Physical inactivity and health

There is substantial evidence to show that physical inactivity and sedentary behaviour is a major contributor to death and disability from non-communicable diseases (NCDs) worldwide (WHO, 2009b). Physical inactivity is a significant, independent risk factor for a range of long-term health conditions affecting society nowadays. Besides obesity

problem, physical inactivity is an important public health issue, being the fourth leading risk factor for global mortality (6% of deaths globally). This is followed by high blood pressure (13%), tobacco use (9%) and high blood glucose (6%). Overweight and obesity are responsible for 5% of global mortality (WHO, 2009b). Furthermore, physical inactivity levels are raising in many countries with major implications for the prevalence of NCDs and the general health of the population worldwide (WHO, 2010). Physical inactivity is estimated as being the principal cause for approximately 21–25% of breast and colon cancer burden, 27% of diabetes type 2 and about 30% of ischemic heart disease burden (WHO, 2009b). A recent study has estimated worldwide the negative effect of physical inactivity on health. According to Lee et al., physical inactivity causes 6% of the burden of disease from coronary heart disease, 7% of type 2 diabetes, 10% of breast cancer, and 10% of colon cancer. Inactivity causes 9% of premature mortality (I. M. Lee et al., 2012).

Recent data also showed that both smoking and physical inactivity were the two major risk factors for NCDs around the globe. Of the 36 million deaths each year from NCDs, physical inactivity and smoking each contribute about 5 million (Wen & Wu, 2012).

Strong evidence links high levels of PA to improved health (Pedersen & Saltin, 2006) (Wannamethee & Shaper, 2001). An increase of PA would increase the life expectancy of the world' population by 0.68 years (I. M. Lee et al., 2012). In US, a research study estimated that inactive people would gain 1.3-3.7 years of life by becoming active from age 50. Avoiding a sedentary lifestyle during adulthood not only expands the total life expectancy but also prevents cardiovascular disease independently of other risk factors. This effect is already seen at MPA, and the gains in cardiovascular disease-free life expectancy are twice as large at higher activity levels (Franco, 2005). Therefore, individuals reaching recommended PA levels are more likely to have a better overall HRQL and longer life expectancy than those who are sedentary.

Although the benefits of PA and the harms of inactivity are linked, the benefits message emphasised so far has not worked well for most of the population. According to Wen & Wu, it should be emphasised the harms of inactivity and not merely the benefits of the PA (Wen & Wu, 2012).

Furthermore, previous literature showed that SB is associated with negative effects on health, which differ from those that can be attributed to a lack of moderate to vigorous

PA. The effects of extended periods of SB show metabolic alterations (Hamilton et al., 2008) and are associated to elevated risk of mortality from all causes and from cardiovascular diseases (CVD) (Katzmarzyk et al., 2009). Independent of PA level, SB is associated with significant elevated risk of obesity and type II diabetes (F. B. Hu et al., 2003). SB, reflected by long hours of sitting or standing, was significantly associated with risk of obesity. In contrast, even light activities such as standing or walking around at home (which probably reflects household work) and brisk walking were associated with a significantly lower risk of obesity and type 2 diabetes.

Reducing time spent sitting, regardless of activity, may improve the metabolic consequences of obesity and other chronic diseases. This finding reinforces the potential importance of the deleterious health consequences of prolonged sitting time, which may be independent of the protective effect of regular moderate to vigorous PA (Katzmarzyk et al., 2009; Owen et al., 2010). Hu et al, suggests that 30% of obesity cases and 43% of type II diabetes cases can be potentially prevented by following a relatively active lifestyle (<10 hours/week TV watching and ≥30 minutes/day of brisk walking) (F. B. Hu et al., 2003). For this reason, it is an argument to make specific counselling's messages to reduce the extended sitting periods (Hamilton et al., 2008; Katzmarzyk et al., 2009). Such messages of prevention and health promotion should include increased PA as well as reducing the sitting time (Patel et al., 2010).

1.1.4. Benefits of Physical Activity

A wide range of scientific literature supports the importance of regular PA in the primary and secondary prevention of several chronic conditions. Seven chronic diseases in particular have been associated with a low levels of PA including coronary artery disease, stroke, hypertension, colon cancer, breast cancer, type II diabetes and osteoporosis (Wartburton, 2006; D. Warburton, Katzmarzyk, PT, Rhodes, RE, Shephard, RJ, 2007; D. Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010; WHO, 2010). Moreover, compelling evidence links low levels of PA to the development of obesity, sarcopenia, arthritis, physical disability, and several psychological disorders (D. Warburton, Nicol C, Bredin SS, 2006). Physical activity is thought to benefit over 25 chronic conditions (Bouchard, 1994).

Regular PA is clearly effective in the secondary prevention of CVD and in attenuating the risk of premature death among men and women. PA can reduce the risk of stroke, and be used to treat peripheral vascular disease and to modify cardiovascular disease risk factors (CVRF) such as high blood pressure and adverse lipid profiles (Wartburton, 2006).

Regarding type 2 diabetes, research supports the importance of regular PA for the primary prevention. Regular PA is associated with a lower risk of developing type II diabetes but also it is an effective strategy for a secondary prevention (D. Warburton et al., 2010). Structured interventions combining PA and modest weight loss have been shown to lower type II diabetes risk by up to 58% in high-risk populations (Colberg et al., 2010)

In relation to cancer, Lee (I. Lee, 2003) concluded that there is a likely dose–response relationship for cancers of the colon and breast; 30–60 min/day of moderate-to-vigorous physical activity was associated with a lower risk of both colon and breast cancer in a 30% and 20% of the cases, respectively . There is clear evidence that habitual PA may be also of value against other forms of cancer.

Being physically active reduces the risk of and helps to manage musculoskeletal health conditions, including osteoporosis, back pain and osteoarthritis. In osteoporosis, especially weight bearing exercise (especially resistance exercise) appears to have positive effects on bone mineral density. There is compelling evidence that weight-bearing and impact exercise benefits bone health across the lifespan (D. Warburton et al., 2010).

Several studies have also shown that exercise reduces the risk and (or) the number of falls in comparison with inactive individuals. Exercise programs (involving resistance, aerobic and balance training) are effective in reducing falls and injuries, particularly among elderly people (Nelson et al., 2007). Changes in balance control, muscular strength, mobility, and flexibility also contribute to the reduced risk associated with routine physical activity (D. E. Warburton, Gledhill, & Quinney, 2001; D. E. Warburton, Glendhill, & Quinney, 2001).
For the aging population, PA can help people maintain independent living and enhance their overall quality of life. Research has shown that, even among frail and very old adults, PA can improve mobility and functioning.

Being physically active also reduces the risk of depression and promotes many other positive mental health benefits, including reducing state and trait anxiety; improves physical self-perceptions and self-esteem; and can help reduce physiological reactions to stress. PA has been found to be just as effective in the treatment of mental illness as anti-depressant drugs and psychotherapy (Mutrie, 2001). As evidence has shown, PA may play an important role in the management of mild-to-moderate mental health diseases, especially depression and anxiety (Strohle, 2009; Rimer et al., 2012).

Moreover, PA appears to play an important role in the prevention of obesity and obesity-related co-morbidities. PA is a key determinant of energy expenditure, and thus it is fundamental to energy balance and weight control (WHO, 2010). It can result in modest weight loss of around 0.5–1kg per month (Chief Medical Officer, 2004) (Department of Health/Physical Activity Policy, September 2009). Sustained MPA for approximately 60 minutes per day is needed to maintain normal weight and prevent weight gain (I. M. Lee, Djoussé, Sesso, Wang, & Buring, 2010).

The recommended daily energy expenditure for health is currently 150-400 kcal per day (Wartburton, 2006). It is important to stress that an increase of 1000 kcal per week (150kcal per day) in PA appears to confer a mortality benefit of 20%. This highlights the importance of exercising although at lower level. Significant health benefits can be attained through PA of light to moderate intensity on most days of the week. In fact, many activities of daily living account for achieving health benefits.

The benefits of PA are far-reaching and extend beyond health alone. Being physically active is a major contributor to one's overall physical, social and mental wellbeing. In addition, there are substantial savings to be made in health care costs, and even greater savings on indirect costs such as economic value of lost productivity because of illness, disease-related work disabilities and premature death. Furthermore, promoting active modes of travel, such as walking and cycling, which are good for the environment, in turn also have a positive impact on health.

1.1.5. Current Physical Activity recommendations

PA recommendations have been evolving during the last decades. In 1996, the Centres for Disease Control and Prevention and the American College of Sports Medicine (ACSM) launched a public recommendation on the type and amount of PA needed for health promotion and disease prevention (Pate et al., 1995). This recommendation was based on the growing scientific literature of the health-enhancing effects of PA and exercise. The recommendation for adults was "Every adult should accumulate 30 minutes or more of MPA on most, preferably all days of the week". The recommendation emphasized that PA can be accumulated in relatively short bouts. This recommendation has been updated in 2007 for healthy adults aged 18 to 65 years including also muscular strength training (Haskell et al., 2007): "All healthy adults should engage in moderate-intensity aerobic (endurance) PA at least 30 min on five days each week or vigorous-intensity aerobic PA for a minimum of 20 minutes on three days each week. Combination of moderate- and vigorous-intensity activity can be performed to meet this recommendation. PA amount should at least last for 10 or more minutes. Activities that maintain and increase muscular strength and endurance are recommended for at least 2 days each week".

In 2010, the WHO (WHO, 2010) set forth the current guidelines by due to the significance of PA on public health, in relation to promotion of PA and NCDs prevention. The limited existence of national guidelines on PA for health in low- and middle-income countries made evident the need for the development of global recommendations that address the links between the frequency, duration, intensity, type and total amount of PA needed for the prevention of NCDs. The WHO guidelines include recommendations for the different age groups: children of 5–17 years old, adults of 18-64, older adults of 65 years and above and older adults with poor mobility. The present thesis focuses on the recommendations for the sample groups of the studies, adults and older adults. The recommendations are the following:

Adults of 18-64 years old, in order to improve cardiorespiratory and muscular fitness, bone health and reduce the risk of NCDs and depression, should do at least 150 minutes of MPA throughout the week, or do at least 75 minutes of VPA throughout the week, or an equivalent combination of both. Aerobic activity should be performed in bouts of at least 10 minutes duration. PA includes recreational or leisure-time PA, transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or

planned exercise, in the context of daily, family, and community activities. For additional health benefits, adults should increase their MPA to 300 minutes per week, or engage in 150 minutes of VPA per week, or an equivalent combination of both. Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week.

Older adults (65+ years) should engage in the same dosage of PA as recommended for adults, but including balance training. Recreational or leisure-time PA, transportation (e.g. walking or cycling), occupational (if the person is still engaged in work), household chores, play, games, sports or planned exercise, in the context of daily, family and community activities, can improve cardiorespiratory and muscular fitness, improve bone and functional health, and reduce the risk of NCDs, depression and cognitive.

Older adults with poor mobility should perform PA to enhance balance and prevent falls on 3 or more days per week. Muscle-strengthening activities should be done involving major muscle groups, on 2 or more days a week. When adults of this age group cannot do the recommended amounts of PA due to health conditions, they should be as physically active as their abilities and conditions allow (WHO, 2010).

These guidelines emphasize that all adults should avoid physical inactivity and that one activity is better than none. The guidelines also emphasize that additional health benefits can be gained by performing PA in amounts greater than the minimum recommendations. It should also be noted that PA performed in the context of regular occupational, household, and leisure activities can produce benefits similar to those of structured exercise, as long as the frequency, intensity, and duration are sufficient.

New Physical Activity guidelines emerged from Canada

In 2012, the Canadian Society for Exercise Physiology (The Canadian Society for Exercise Physiology, 2012) launched new guidelines including firstly new recommendations on PA especially for infants aged less than 1 year, children aged 5-11 years and adolescents 12-17 years old; and, secondly, special guidelines to reduce sedentary behaviour.

These recent recommendations stem from the alarming trends in childhood obesity even among preschoolers, which have re-focused attention on the importance of PA in this age group and the need to identify the amount and type of PA appropriate for optimal development of preschool children. Canadian guidelines are the first in including recommendations for SB. However, there is little or no justification given in the vast majority of recommendation documents for any time limit concerning sedentary behaviour in adulthood.

1.1.6. Physical Activity levels in populations

Worldwide, overall trends show a declining of total PA level over the last 50-60 years (Brownson, Boehmer, & Luke, 2005). Church et al. estimated that the U.S. daily occupation-related energy expenditure has decreased by more than 100 kilocalories over the last 50 years. This reduction in energy expenditure accounts for a significant portion of the increase in mean US body weights for women and men (Church et al., 2011).

Recent data demonstrates the magnitude of the world's shift toward physical inactivity. The findings are alarming. In just 44 years (approximately 1.5 generations [1 generation = 30 years]), PA in the United States has declined 32% and is on track for a 46% drop by 2030. The United Kingdom became 20% less physically active in the same amount of time and is trending toward a 35% decline by 2030. The research also suggests that the effects of declining PA levels may be felt more acutely in countries with rapidly developing economies (ACSM (American College of Sports Medicine) - ICSSPE - Nike, 2009).

Changes in society such as industrialization and the economic growth have diminished the need of movement of certain daily routines. Worldwide there has been a large shift towards less physically demanding work. This has been accompanied by the increased use of mechanized transportation, a greater prevalence of labour saving technology in the home, and less active recreational pursuits resulting in less energy expenditure in people's lives. The primary opportunity for PA is in leisure and recreation; however data shows that time spent being physically active in leisure time does not come close to compensating for the overall drop in PA in other areas of life. Presently there are many sedentary pursuits in leisure time such as the internet, TV or video games.

Worldwide, at least 31% of the population does not get sufficient exercise (WHO, 2009a). The estimation of PA levels in population varies between studies as several definitions and PA assessment methods have been used. However, studies share similar results in showing a low prevalence of PA worldwide.

The Eurobarometer study showed that two thirds of the adult population in Europe were insufficiently active for optimal health benefits. The prevalence of sufficient PA for health across the EU member countries varied, being the most active Netherlands and Germany (40-45%), and the less active Sweden (23%). Spain was slightly under the middle range, with prevalence estimates close to 25% (Sjöstrom, Oja, Hagströmer, Smith, & Bauman, 2006).

The International Prevalence Study on Physical Activity (IPS) also showed a prevalence of low PA levels from 9% to 43% in nationally representative samples from 20 countries worldwide. The study showed that the most active countries (Australia, Canada, New Zealand and USA) seem to have relatively well developed facilities for recreational activity and a history of long-term promotion of exercise. Otherwise, other countries, such as Spain, had more than 30% of overall PA derived from walking activity, suggesting that countries with an infrastructure or culture that supports walking can achieve high levels of physical activity with lesser contribution from vigorous activity (Bauman A et al., 2009). Although the findings from this study indicate that the majority of the population appeared to undertake at least a moderate amount, it remains insufficient to ensure energy balance and prevent obesity (Bauman A et al., 2009).

Regarding sports participation, the European Commission conducted the *"Sport and Physical Activity"* survey to give strategic orientation on the role of sport in Europe. Out of 27 European Union Member States 34% of respondents say that they seldom or never do PA. Comparing the different countries, the Nordic countries and the Netherlands were the most physically active, while Mediterranean countries and the 12 new Member States of EU used to exercise less than the average (European Commission, 2010).

Physical Activity level in the Spanish population

According to The National Health Survey of Spain 2011-2012, 41.3% of Spanish population reported being sedentary during leisure time (36% of men and 47% of women), while 41% of adults engaged in VPA to MPA (49.4% of men and 32.4% of women) (Instituto Nacional de Estadística, 2011).

Exercising in a park out in the nature or on the way to and from home and school or work or shops was the most popular PA among Spanish population according to the recent report of the European Commission. About 39% of Spanish population exercise or play sport with some regularity. The respondents reported that the main reason to exercise was to improve its health (European Commission, 2010).

Physical Activity level in the Catalan population

In Catalonia, the Health Survey for Catalonia (ESCA) data was collected through cross-sectional surveys conducted periodically by the Health Survey for Catalonia (ESCA) (editions of 1994, 2002 and 2006). As of 2011, the ESCA becomes an ongoing survey providing information about the life conditions and health status of the Catalan population (Generalitat de Catalunya, 2011).

Results from the Health Survey for Catalonia in 2006, (ESCA 2006) showed that almost 40% of the Catalan population were sedentary or minimally active during leisure time (Generalitat de Catalunya, 2006b). In ESCA 2011, 19.1% of the adult population were sedentary (17.2% of men and 21.0% of women). Regarding the assessment of the intensity of PA, 58.0% of the population engaged in MPA and 13.6% engaged in high intensity PA (Generalitat de Catalunya, 2011). On the 2012 edition, 17.8% of the adult population were sedentary (16.4% of men and 19.2% of women). Regarding the assessment of the intensity of PA, 56.4% of the population engaged in MPA and 14% engaged in high intensity PA (Generalitat de Catalunya, 2012). These results have shown a decrease of about 20% in sedentary Catalan population in the last 6 years (2006-2012).

One of the major problems of the surveys is the definition of active PA level and the classification of the individuals. Several definitions are used in different surveys. ESCA survey classifies the population according to the PA intensity or PA descriptive questions, but not according to the PA recommendations based on HEPA level.

1.2. Physical Activity promotion

A broad consensus has emerged in the last years to develop strategies to promote PA in the general population. Different institutional organizations have developed evidence-based documents to address PA promotion in different countries. This section summarizes, in chronological order, the major international developments in the promotion of PA and HEPA.

1.2.1. Strategies to promote Physical Activity

Global framework

In 2004, the WHO urged the governments through "The Global Strategy on Diet, Physical Activity and Health" to develop strategies based on improving the lifestyle of the population to fight the epidemic of chronic diseases. The strategy addressed two of the main risk factors for NCDs, namely, diet and PA (WHO, 2004).

Recently, the WHO endorsed the "Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013–2020 (GAP)" (WHO, 2013). The GAP is an ambitious set of actions whose aim is to lead the political commitments and movements of nations worldwide, reviving NCDs efforts. The main focus of this action plan is on the four types of NCDs – CVD, cancer, chronic respiratory diseases and diabetes – which make the largest contribution to morbidity and mortality due to NCDs, and on the four shared behavioural risk factors – tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol. Within the Plan, one of the objectives is the promotion of PA to achieve a 10% relative reduction in the prevalence of insufficient PA.

The US Department of Health and Human Services also launched The National Prevention Strategy of United States, whose priorities is also to promote an active living through the counselling of PA in health care systems (Tulloch, Fortier, & Hogg, 2006). The strategy suggested that health care professionals should be supported to implement PA assessments, counselling and referrals (e.g. provide training to clinicians, implement clinical reminder systems) (National Prevention Council, 2011).

European framework

In 2005, the European Union commission elaborated the Green Paper *"Promoting healthy diets and PA: a European dimension for the prevention of overweight, obesity and chronic diseases",* to promote initiatives towards preventing obesity (Commission, 2005). The Green Paper invited contributions from interested parties on a wide range of topics related to nutrition and PA. The aim was to gather information with the view of giving a European dimension to the battle against obesity, in terms of support for and coordination of the existing national measures.

Furthermore, the Health-Enhancing Physical Activity (HEPA) was a collaborative project which works to strengthen and support efforts to increase participation and improve the conditions for healthy lifestyles among all European population (Martin et al., 2006).

Spanish framework

In Spain, this action has been translated into the NAOS initiative (Strategy for Nutrition, Physical Activity and the Prevention of Obesity) (NAOS, 2005), which has been set up by the Ministry of Health and Consumer Affairs, through the Spanish Agency for Food Safety and Nutrition (AESAN). NAOS aimed at making the population more aware of the problems that obesity poses to health, and promoting initiatives that help to encourage citizens to adopt healthy lifestyles, mainly through healthy diets and regular PA (NAOS, 2005).

The NAOS Strategy aims to serve as a platform for any actions which that may help meet this objective with the widest possible participation of all components of society, public administrations, experts in the field, private sector businesses, consumers and the whole population. Therefore, the areas of action and influence of the NAOS Strategy are multiple: families, schools, the business world and the health system.

Catalan framework

In Catalonia, the Integral Plan for Health Promotion through Physical Activity and Healthy Eating, also known by its acronym, PAAS was drawn up by the Health Ministry in line with the world strategy established by the WHO and the Spanish strategy NAOS, in response to the observed increase in obesity. The plan proposes activities to promote health through PA and healthy eating. PAAS launch informative and educational initiatives and actions to intervene in the specific environments focussing on lifestyle-related risk factors.

PAAS acts mainly in the education, public health, community and work place field (Government of Catalonia., 2005).

Within the PAAS strategy, a primary care-based intervention to promote PA prescription was developed in 2007: the *"Plan of Health, Physical Activity and Sport"* (Government of Catalonia). PAAS and PAFES plans to incorporate many elements of the WHO recommendations (WHO, 2004), and their task is based in developing, at a national level, both the *"Global Strategy on Diet, Physical Activity and Health"* (WHO, 2004) and the recommended *"Global Action Plan"* (WHO, 2013).

1.2.2. Physical Activity promotion in primary care: Physical Activity prescription

Lifestyle Medicine

Primary care setting is an important place to promote health through lifestyle-related behaviours, such as PA. However, health care system has been more focused in treating disease than in promoting good health. The dominant form of health care is expensive and fails to proactively improve health (Carroll et al., 2013).

In developed countries, lifestyle is one of the major determining factors concerning the health condition of a population (WHO, 2003b). A high percentage of medical consultations in primary healthcare are due to lifestyle-related illness. Actually chronically ill patients account for a large fraction of health expenses (Ma, Urizar Jr, Alehegn, & Stafford, 2004; Fineberg, 2012). Improving lifestyles is thought to be one of the most effective means of reducing mortality and morbidity in the developed world (Lianov L. & Johnson M., 2010).

Furthermore, lifestyle changes are recommended as the first line of treatment in most of chronic diseases, as daily habits profoundly influence both short- and long-term health and quality of life. In the US, three fourths of chronically ill patients had one or more chronic illnesses, that could benefit from lifestyle changes (Fineberg, 2012).

The burden of chronic diseases and its resultant costs could be mitigated through further effort in limiting risk factors, such as increasing PA and decreasing sedentary behaviours, quitting smoking, controlling hypertension, lowering levels of cholesterol or reducing excess of body weight. According to a systematic review (Loef & Walach, 2012), a combination of at least four healthy lifestyle factors (non-smoking, optimal weight, physically active, healthy diet and moderate consumption of alcohol) is associated with a reduction of the all cause mortality risk by 66%. Coronary heart disease, a leading killer, is at least partially based on poor lifestyle choice: high blood pressure, smoking habits, elevated cholesterol, physical inactivity and obesity.

The new 2020 strategic goal for the American Heart Association (AHA) calls for improving the cardiovascular health of all Americans by 20% while continuing to decrease deaths from CVD and stroke by 20%. The AHA has identified *Life's Simple 7* as the key health factors aimed at achieving ideal cardiovascular health: non-smoker, normal weight, physically active, healthy diet, total cholesterol <200 mg/dL, blood pressure <120/80 mm Hg and fasting blood glucose < 100 mg/dL (Lloyd-Jones et al., 2010).

Understanding medicine as a means of promoting good health, leads us to the new concept of the Lifestyle Medicine: the evidence-based practices for helping individuals adopt and sustain healthy behaviours that affect health and quality of life, such as interventions to limit or help patients to quit smoking habits, improving diet, increase PA and moderate alcohol consumption (Lianov L. & Johnson M., 2010).

Unfortunately, clinicians do not typically offer lifestyle interventions as first-line management. During regular check-ups, only 36% of obese patients are advised to lose weight, and among obese patients who already have obesity-related co-morbidities, only 52% of are counselled to lose weight and 32.8% to exercise (Stafford, Farhat, Misra, & Schoenfeld, 2000).

Socially, being inactive is perceived as normal, and in fact doctors order patients to remain on bed rest far most often than they encourage exercise (I. M. Lee et al., 2012). The passive attitude towards physical inactivity made the promotion of PA among

population, and specially patients, difficult. Nevertheless, in the last years, counselling on PA has increased a little bit. In 2010, about one in three US adults (32.4%) who had visited a physician or other health professionals in the past year had been advised to begin or continue to do PA. It represents more than a 40% increase since 2000, where about one in four was counselled (Barnes & Schoenborn, 2012). Moreover, receiving advice to exercise increased for adults with hypertension, CV disease, cancer and diabetes. The most counselled on PA were women, adults and older adults (45 to 74 years), obese patients and adults with type II diabetes (Barnes & Schoenborn, 2012).

The promotion of healthy lifestyles begins with physicians counselling and continues with physicians also leading their own healthy lifestyle. Although motivating someone effectively to change their lifestyle can be highly frustrating and a great challenging, patients report that they would appreciate guidance and assistance from their healthcare providers (Potter, Vu, & Croughan-Minihane, 2001) and would increase their PA level if are so counselled (Petrella & Lattanzio, 2002).

Leaders in Lifestyle Medicine, such as the American College of Preventive Medicine (ACPM) and the American College of Lifestyle Medicine (ACLM) identified and published the core competencies of the Lifestyle Medicine, to describe the key role of healthcare providers in promoting health behaviour as first-line prevention and treatment. The ACSM and its campaign Exercise is Medicine™ (EiM) or the American Medical Association (AMA) are beginning to promote healthy behaviours as first-line prescriptions and offer tools to promote Lifestyle Medicine (Lianov L., 2011).

The enormous potential effects of health behaviour change on mortality, morbidity, and health care costs provide wide motivation for the concept of Lifestyle Medicine (Lianov L. & Johnson M., 2010). Lifestyle Medicine has shown to be a more cost-effective strategy than the approaches currently used in disease prevention and treatment, particularly in chronic pathologies. Lifestyle medicine application should be considered a priority within the changes needed in current health systems and in public health policies (Mora R.R, 2012).

Physical Activity prescription

PA promotion can be delivered in several possible settings, including community settings, worksites or health-care settings. There have been successful models of PA programs in each of these settings; however we will focus our research on interventions delivered in primary-care context. Understanding the importance of Lifestyle Medicine, primary care is recognised as a potentially important setting for the promotion of PA. The evidence suggests that in selected cases exercise therapy is just as effective as medical treatment or adds to the effect (Pedersen & Saltin, 2006).

Primary care setting is an important venue for delivering PA interventions for two main reasons. First, the majority of adults visits their physicians on at least a yearly basis (Centers for Disease Control and Prevention (CDC), 2012) and physicians have the potential to reach a larger number of individuals than other in-person strategies. Second, clinicians' recommendations regarding health behaviours are generally valued and trusted by patients, and research shows that patients want to receive information about PA from their physicians (Godin & Shephard, 1990).

Since primary care settings have been identified as an important setting for the promotion of PA, primary care-based intervention has been developed over the past 20 years. Counselling patients in general practice on exercise is effective in increasing PA and in improving quality of life over 12 months (Elley, Kerse, Arroll, & Robinson, 2003). The evidence suggests that brief advice from a health professional, supported by written materials, is likely to be effective in producing a modest, short-term (6-12 weeks) effect on PA; referral to an exercise specialist, based in the community, can lead to longer-term (>8 months) changes in PA; and short-term effectiveness of primary prevention interventions is associated with single-factor interventions (PA only), which focus on the promotion of MPA (typically walking) in a sedentary population (Hillsdon, Foster, Cavill, Crombie, & Naidoo, 2005). Recent studies showed PA counselling strategies to be cost-effective (Sorensen, Skovgaard, & Puggaard, 2006).

The principal strategies to promote PA in primary care are PA prescription and PA referral schemes (PARS). PA prescription is based on counselling by health care professionals resulting in a written prescription. It includes brief face-to-face communication about the importance and benefits of PA. PARS is a common model in which a general physician (or

other member of primary care team) identifies and refers sedentary individuals to a third service (often a sports facility), offering an assessment, development of a tailored PA programme, monitoring of progress and follow-up. Individuals are supervised by a PA professional within the exercise program. After a defined period of training, the effects are evaluated and a report is sent to the prescribing health professional (NICE, 2006).

The first PARS were first set up in 1990 in the United Kingdom (British Heart Foundation (BHF), 2009) and Scandinavian countries (Sorensen, Kragstrup, Kjaer, & Puggaard, 2007). There has been a proliferation of such schemes involving supervised exercise sessions, which mainly take place in public leisure facilities such as leisure centres or swimming pools, but also involve activities such as cycling, gardening or walking.

Several systematic reviews have examined the evidence base for PARS and concluded that such interventions can increase PA level of sedentary adults in the short term and in certain populations: slightly active patients, older adults and those who are overweight. (Morgan, 2005) (Williams, Hendry, France, Lewis, & Wilkinson, 2007). In 2006, the UK's National Institute for Health and Clinical Excellence (NICE) called for more controlled research on the effectiveness of PARS (NICE, 2006).

Recent systematic reviews showed the effectiveness of primary care-based intervention to promote PA (Grandes, Sanchez, Montoya, Ortega Sanchez-Pinilla, & Torcal, 2011) (T. G. Pavey et al., 2011) (Orrow, Kinmonth, Sanderson, & Sutton, 2012). However, the long-term effectiveness of these interventions is not established as the majority of studies stopped after 12 months (Foster C, 2013).

Several important documents (e.g. from the Centres for Disease Control and Prevention and the ACSM) have identified the importance of PA counselling and exercise prescription in primary care (Pate et al., 1995; WHO, 2004). The U.S. Department of Health and Human Services also encourage PA counselling within its Health People Objectives. In 2010, one of the objectives was to increase the proportion of counselled patients about healthy behaviours, including PA (U.S. Department of Health and Human Services, 2000). Healthy People 2020 proposes to increase the proportion of physician office visits for chronic diseases that include counselling related to exercise (U.S. Department of Health and Human Services, 2010)

It highlights the fact that already powerful institutions have begun to include PA counselling as a health objective in their health policies.

Considering the importance of PA as a preventive and therapeutic tool and the role of physicians in PA counselling, the ACSM and the American Medical Association (AMA) launched in 2007 Exercise is Medicine™ (Exercise is Medicine, 2008). Exercise is Medicine™ calls on doctors to prescribe exercise to their patients and aim to encourage patients to incorporate PA into their daily routine. The overarching goal of the program is that health care providers consider PA a vital sign and would effectively counsel each patient at every visit according to their PA and health needs or refer them for further exercise counselling.

1.2.3. The role of Physicians in Physical Activity prescription

Primary healthcare professionals, especially physicians, play a key role in promoting healthy habits to the population. They have a privileged position to promote health through PA in general population. Physicians come into frequent contact with the general public, about 80% of adults had seen a health professional in the past 12 months during 2010 in the US (Schiller JS, Lucas JW, Ward BW, & Peregoy JA., 2012). In Catalonia, 92.7% of the population visit a health professional once a year (Generalitat de Catalunya, 2011). Moreover, they are often viewed as the most credible and respected source of health-related information (Worsley, 1989) (Lobelo et al., 2009; National Prevention Council, 2011).

Furthermore, every consultation provides an opportunity to promote PA or to refer people to a PA programme. Physicians see many patients regularly, which enable them to provide continued preventive counselling feedback and follow-up. Continuous feedback and follow-up are important because a long period is needed in order for a person to adopt and maintain a habit such as PA. In addition, patients expect to receive health-related messages and may therefore be more receptive to a brief advice or referral to community-based interventions (Garrett et al., 2011).

Despite the large amount of information about the health benefits of PA, rates of exercise counselling by doctors remain low (Lobelo et al., 2009). Studies show that physicians provide PA counselling infrequently and typically do not spend more than 3-5 minutes

providing this type of counselling (Lewis, Clancy, Leake, & Schwartz, 1991). Other physicians provide exercise counselling but more likely to high-risk patients (64%) than to healthy patients during preventive checkups (29%) (María Giné-Garriga & Martin-Borràs, 2008).

Lack of time, lack of organizational support, lack of materials and standardized protocols and lack of incentives are powerful barriers to provide PA counselling by health care providers (McKenna, Naylor, & McDowell, 1998; Brotons et al., 2005; Ribera, McKenna, & Riddoch, 2005; ACSM, 2009)

Most of physicians reported having limited medical school and residency training education about the benefits of PA, inadequate knowledge of writing an exercise prescription or referral, and poor reimbursement as barriers to counselling regarding exercise. It is for this reason, that some physicians do not counsel because they are not familiar with the current guidelines for exercise prescription or they only encourage their patients to exercise but without a prescription (WHO, 2010) (Pinto, Goldstein, & Marcus, 1998). According to Swinburn, 80% of physicians recommend "walking" to increase PA, because it is easier to prescribe than other fitness-based prescriptions (Swinburn BA, 1997).

Physicians felt that there was a definite need in medical school for a course related to the medical aspects of exercise (Williford, Barfield, Lazenby, & Olson, 1992).

Some other factors can positively encourage physicians to promote PA prescription. Having received PA promotion during medical school, training on PA prescription into the medical curriculum, an updated information on the current PA guidelines and increased self-confidence on PA prescription could improve effectiveness of PA counselling (Frank, Tong, Lobelo, Carrera, & Duperly, 2008).

In addition, one of the most important factors on the effectiveness of PA is physicians' own PA habits. There is a strong association between physicians' personal habits and their related counselling practices (Fie, Norman, & While, 2013). The more physicians practise

positive personal health habits, the more likely they are to counsel their patients on a range of behaviours.

Recent studies showed that PA counselling is related to physicians' own PA level (Abramson et al., 2000; Frank E, 2003; Brotons et al., 2005; Livaudais et al., 2005; Rogers et al., 2006; Frank et al., 2008; Duperly et al., 2009; Lobelo et al., 2009; Frank et al., 2010). Physicians in the action or maintenance stage of changing their own PA (J.O. Prochaska & Velicer, 1997) are three times more likely to regularly promote the same behaviour in their patients than those in the other previous stages (McKenna et al., 1998).

Moreover, patients considered more credible and capable to motivate changes in their diet and PA levels those physicians who follow a healthy and active lifestyle than those with poor habits (Frank, Breyan, & Elon, 2000). Similar trends (healthier doctor habits = better patients counselling attitudes/practices of such habits) were also reported for smoking, nutrition and many other habits in the Women Physicians' Health Study (WPHS) participants (Lobelo et al., 2009). A study among Canadian physicians (Frank et al., 2010), corroborated that there was a clear and consistent relationship between personal and clinical prevention practices: non-smokers, those who drank alcohol less frequently or lower quantities; those exercising more, those eating more fruits and vegetables and those with lower weight, were more likely to counsel about smoking cessation, alcohol consumption, exercise, nutrition and weight, respectively (Frank et al., 2010).

Summarizing, physically active physicians have more positive attitudes toward PA and increased self-confidence to do PA counselling more effective (Abramson et al., 2000; Frank E, 2003). According to Frank, personal characteristics of physicians helped to predict prevention counselling (Frank et al., 2010). It was an argument to realize the study II based on Catalan physicians' health behaviours.

By encouraging physicians to be healthy, one could improve healthy habits among their patients.

1.2.4. Physical Activity prescription in Catalonia: The PAFES program

Within *The Global Strategy on Diet, Physical Activity and Health* and the *Global Action Plan for the prevention and control of non-communicable diseases 2013–2020 of WHO,* PA promotion in primary care setting is a main priority in public health.

In 2005, Ribera et al., (Ribera et al., 2005) explored PA promotion in Catalonia for the first time. The study showed that PA prescription in Catalan primary care centres was limited, basically due to lack of time, unfavourable working conditions in healthcare centres and lack of knowledge by healthcare professionals. PA promotion in Catalonia was not seen as effective and compared with previous research, PA promotion in the primary health-care system was less advanced than in other countries. Ribera et al., suggested that it was important to establish working protocols for primary care professionals to integrate the promotion of PA in their daily work in the clinical practice (Ribera et al., 2005).

Previous local initiatives in Catalonia for PA promotion in primary care settings were developed after the Olympic Games of Barcelona of 1992. Some Catalan primary care centres began to develop exercise programs, exercise workshops for chronically ill patients and walking groups.

In 2006, Giné-Garriga et al., developed the first pilot study assessing a primary care-based PA intervention in Barcelona (M. Giné-Garriga et al., 2009). The study called Programme for the Promotion of Physical Activity (PPAF), offered patients the possibility to participate for a three month period in an exercise programme, carried out in their own healthcare centre. After a three month period, patients increased PA level and this increase persisted one month after the completion of the program compared to the control group (M. Giné-Garriga et al., 2009; Maria Giné-Garriga et al., 2013). Recently, Giné-Garriga presented the results of the PPAF in reducing the total number of visits to the primary care centre among inactive patients, over a 15-month period. The study showed a reduced number of visits during the 12 months after the intervention and an improvement in HRQL (Maria Giné-Garriga et al., 2013).

The Government of Catalonia, in response to *The Global Strategy on Diet, Physical Activity and Health* and the *PAAS* strategy, launched *The Progressive Implementation Plan PIP for the prescription of physical activity in primary health care in Catalonia* through the

Department of Health and the Secretary General for Sport in 2006. The goal of the PIP was to reduce sedentary habits and promote PA in the Catalan population through PA prescription. PIP involved 21 primary care centres of 19 Catalan cities in the pilot program (Lloret Riera, 2006).

In the line with the previous pilot plan PIP, an in accordance with the objectives of the Health Plan for Catalonia 2000-2005, on 28th august 2007 **The Plan of Physical Activity, Sport and Health (PAFES)** (Government of Catalonia) was implemented. It follows the recommendations on prevention of the White Paper (Generalitat de Catalunya, 2006a) and was drawn within the framework of the PAAS (Government of Catalonia., 2005).

The PAFES is a joint programme of the Department of Health and the Secretary General for Sport (Presidential Department) of the Government of Catalonia to establish a health-promotion programme for primary health-care services, aimed at prescribing and advising PA.

PAFES is also supported by the Health Plan for Catalonia 2011-15. One of the objectives of the Health Plan for Catalonia for 2012 was to define and initiate the implementation of regional communitarian programs in the areas of healthy eating and PA. Two examples in Catalonia were the PAFES program and the PAAS strategy (Government of Catalonia., 2005). For 2015 two objectives have been set: to reduce the prevalence of inactivity below the level of 2010 and to increase by 10% the proportion of adults who meet the current recommendations of healthy PA per week.

The final objective of the PAFES programme is to improve health and quality of life of sedentary individuals, by increasing PA levels in adult population. This involves the fact of facilitating skills to health and sport professionals for making the prescription and practise of PA easier for the patients of primary care.

The specific objectives of the PAFES programme are:

- To incorporate prescribing and advising exercise as a therapeutic tool in primary healthcare.
- To update knowledge and skills of professionals involved through training and retraining courses, in coordination with multidisciplinary training teams that can provide the necessary tools for developing their roles.
- To coordinate the health care resources (primary health care and specialist level) with regard to prescribing PA. Sports medicine doctors act as consultants.
- To strengthen the use of existing sports facilities in the community.
- To establish communication channels within multidisciplinary teams.
- To work together with different public organisations and sectors involved.

The professionals involved in the PAFES program are: Primary Healthcare Physician, Referring Nurse, Sports Medicine Physician and Physical Activity professionals. The roles of Primary Healthcare Professionals (physicians and referring nurse) are to advise and prescribe unsupervised PA as a preventive and therapeutic tool, monitor the patients and register their evolution. The roles of Sports Medicine Physicians are to participate in training courses aimed at primary healthcare professionals, act as consultants for the professionals involved and to prescribe supervised PA for patients referred from primary healthcare centre, with an initial evaluation and a further evaluation after 6 months. The roles of the Physical Activity Professionals are to implement the program of supervised exercise in the designated sports facilities, to attend technical conferences of PAFES training and its application, to coordinate with the primary care centres of reference at the beginning and at the end of the program, to counsel and guide patients once the program has ended and to contribute to the outcome of the evaluation program.

Three programs are set forth by the PAFES: a) a general advice of PA, b) an advice and prescription of PA (healthy walking routes) and c) a referral to a supervised exercise program (lead by a PA professional in a sport facility).

a) **The general advice of PA** is addressed to sedentary population with no contraindication for PA. General advice is based on increasing light to moderate PA without supervision. Patients are also offered a healthy PA within the city council area.

b) **Advice and prescription of PA** is aimed at sedentary population with risk factors and some stable chronic illnesses who need periodic follow-up for doing PA. Physicians and nurses can periodically advise on increasing PA with progressive objectives. Patients are offered healthy walking routes to increase their PA level.

c) **Physical Activity Referral Schemes (PARS)** is addressed to sedentary population with chronic conditions that may be controllable through exercise. Patients require supervision when starting the exercise and are evaluated before and after the program by sports medicine physicians.

Physicians and nurses select and refer patients to the supervised exercise program according to the following criteria: sedentary males ≥45 years old, females ≥55 years old with two or more CVRF or type II diabetes in the contemplation or preparation stage of change (James O. Prochaska & Marcus, 1994). Physicians and referring nurses refer those patients that meet inclusion criteria and accept to pay the soft fee of the PARS which varies from 10-25 Euros per month depending of the sport facilities' fee.

PARS consisting of a six-month group-based exercise program of 3 sessions of 60 minutes each weekly in a sport facility, combines MPA, muscular endurance of the major muscle groups with use of equipment (dumbbells and elastic bands) and flexibility. The group-based activities include water aerobics, group gymnastics, healthy walking routes, dancing or interval training. The exercise programs were led and supervised by PA professionals, which were trained to motivate patients to adopt PA behaviour.

The PAFES program designed workshops of 20 hours for primary care and PA professionals. Primary care physicians were trained for PA prescription and instructed to include in their daily task the PAFES protocols. They obtained support material such as the

Exercise Prescription for Health Guide (Generalitat de Catalunya) (Generalitat de Catalunya, 2007) and information on the three types of PA counselling. PA professionals were trained to design and develop exercise sessions for patients with chronic diseases and motivate them for behavioural change.

The PAFES also features a website on the benefits of PA, healthy diet, healthy walking routes and other topics related to health: www.pafes.cat/blog. Health and Sports politicians with all the resources for professionals and patients officially launched the website in December 2009.

Moreover, as from April 2010, PAFES has been the promoter of the organization and yearly celebration of the Physical Activity Day in Catalonia. Results from the current year 2013, showed a participation of 174,771 individuals, 391 entities registered their events on the website and 276 events were held. Since then it has taken place every year with an increase in participation and activities.

From 2007 to 2013, PAFES has been established in 343 of the total Catalan primary care centres, representing the 93% of the total. More than 3,000 professionals (physicians, referring nurses, PA professionals) have been trained in exercise prescription and given tools about how to motivate patients to be active and maintain active lifestyles.
By July 2013, 677 healthy walking routes had been devised in 206 Catalan cities and 65 PARS had been developed. In addition, the PAFES website has received a total of 69,853 visits and 20,000 healthy walking routes have been downloaded.

1.3. Physical Activity Adherence

1.3.1. Adherence

Getting people to adopt and to maintain a regular PA program are two of the biggest challenges of public health in developed countries. The long term adherence is one of the emerging problems of PA interventions. Adherence is an alternative term to compliance and has been offered by some investigators to denote a more active patient-physician treatment collaboration than compliance (Roter et al., 1998).

Adherence to long-term therapy is defined by the WHO as *the extent to which a person's behaviour – taking medication, following a diet, exercise as recommended level and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider* (WHO, 2003a). Adherence implies the active choice of the patients in following medical recommendations, in contrast to other passive compliance.

Adherence to therapies is a primary determinant of treatment success. Poor adherence attenuates optimum clinical benefits and therefore reduces the overall effectiveness of the intervention. Although most research has focused on adherence to medication, adherence also encompasses numerous health-related behaviours that extend beyond taking prescribed pharmaceuticals. The maintenance of an active lifestyle is essential to achieve health benefits and evidence for the long-term effectiveness of PA interventions is urgently required.

Studies suggest that about 50% of adults who start a PA program will drop out within the first six months, with the consequent reduction of the benefits of PA on health (Dishman, 1994). Only 25% of studies include monitoring to determine whether interventions have perdurable effects. More studies that evaluate the adoption and maintenance of PA at long term post-intervention are warranted to investigate PA adherence at long term (Dishman, 1994).

1.3.2. Factors influencing Physical Activity in adults

PA is a complex behaviour that has to be adopted, planned and maintained over time and relapses should be prevented (Dishman, 1994). Models are used to provide a framework to understand those factors and behaviours that enable or act as barriers to PA participation. Ecological models specify that factors at multiple levels, including intrapersonal, interpersonal, organizational, community, and public policy, can influence health behaviours such as PA (Glanz, 2008; J. Sallis, Owen, & Fisher, 2008). Concepts that cut across these levels include socio-cultural factors and physical environments, which may apply to more than one level.

Human behaviour is difficult to change, especially in an environment that does not support change. In order to increase PA, efforts need to focus not only on the behaviour choices of each individual but also on factors that influence those choices. The social-ecological model helps to identify opportunities to promote participation in PA by recognising the multiple factors that influence an individual's behaviour. Efforts to change behaviour are more likely to be successful when the multiple levels of influence are addressed at the same time: individual, social environment, physical environment and policy level.

To understand a PA habit it is necessary to understand the factors that influence PA in every level of the socio-ecological model.

The individual is at the centre of the social-ecological model. This level includes personal factors such as knowledge, attitudes, behaviours, beliefs, perceived barriers, motivation, enjoyment, skills, abilities, disabilities or injuries, age, sex, level of education, socioeconomic status, employment status, self-efficacy, outcome expectancy, stage of change (J. Sallis et al., 2008). Exercise self-efficacy is defined as an individual's belief in his/her capability to be physically active and is found to be the strongest and most consistent psychological predictor of PA behaviour change (Bandura, 1986; Dishman & Sallis, 1994; A. Bauman, Bull F.C., 2007). These factors influence the individual to increase or decrease the likelihood of being physically active. In this level education programs can be used as a strategy to change an individual's knowledge, attitudes, behaviour and skills.

The social environment comprises the relationships, the culture and the society with whom the individual interacts. The social environment has a significant influence on PA behaviour. The social environment includes: family, such as the influence of parental and sibling PA levels and family support in children, spouse or partner, peers, institutions and organisations, such as schools, workplaces and community organisations; influence of health and other professionals such as doctors, teachers and coaches, cultural background or socioeconomic status of the community (J. F. Sallis, Bauman, & Pratt, 1998; J. Sallis et al., 2008). Having someone such as a peer, family member or work colleague to be physically active with, can impact on PA behaviour. At this level, strategies such as

educational programs at community level, supportive groups, peer programs, workplace incentives and social marketing campaigns to raise awareness can change PA behaviour.

Physical environment level includes the natural and the built environment. Physical environments are likely to influence the amount and type of PA, and can be or not supportive for PA practise. Environment that support PA are those that have access to green parks, public sports facilities such as swimming pools and gymnasiums or sports fields, bike or walking paths, community design that promote walking activity such as connectivity of streets, mixed land use, public transport, lower traffic, safe pavements, low perceived crime rates etc. Moreover, some aesthetic factors such as the perception of a friendly, pleasant and attractive neighbourhood are also associated with increased PA. Factors that reduce the likelihood of being active include hills, busy traffic, low density residential regions, no facilities nearby, low walkability and a lack of equipment (A. Bauman, Bull F.C., 2007). The built environment provides opportunities for intervention, such as the inclusion of walking or bicycle tracks and parks and ease of access to them. The natural environment has fewer opportunities for intervention; these tend to focus on overcoming barriers to PA within the natural environment (J. F. Sallis et al., 1998).

Policy level refers to how policies, regulations and procedures carry out actions in different settings such as workplace, school, community, health, urban planning etc. to better support PA. These are often formal legal actions taken by local, state or central governments but also can be informal local policies or rules (J. F. Sallis et al., 1998). Environmental and policy approaches may be especially indicated as a complement to more frequently used individual behaviour and lifestyle modification strategies, because they can benefit all people exposed to the environment rather than focusing on changing the behaviour of one person at a time (J. F. Sallis et al., 1998).

There have been several comprehensive reviews of the correlates and predictors of PA, covering over 380 studies (Trost, Owen, Bauman, Sallis, & Brown, 2002; A. Bauman et al., 2012). It is important to investigate on the determinants of PA and identify these factors that are associated to or predict PA behaviour. Some factors can be modified and others cannot be changed such as age, sex, and race/ethnicity. The modifiable factors in adults'

PA are self-efficacy, expectation of positive outcomes or perceived benefits of PA, social support, exercise enjoyment, previous positive experiences with PA and geographic proximity to home or work (Dishman, Sallis, & Orenstein, 1985).

To understand the factors that influence exercise adherence, theoretical models of exercise adherence and strategies for behaviour change have been used in order to apply this knowledge in future intervention.

1.3.3. Theoretical Models of Physical Activity adherence

Theories and models can help to understand and explain why people do not change their behaviour and suggest ways to achieve behaviour change. There are several models that explain why individuals engage or not in PA, however, no one dominates research on PA.

One of the most commonly adopted theoretical frameworks for PA behaviour change interventions is the Transtheoretical Model (TTM) (J. O. Prochaska & Diclemente, 1983; James O. Prochaska, Diclemente, & Norcross J.C., 1992). The Transtheoretical Model focuses on the idea that adherence is an on-going process. It suggests that the behaviour of people changes in sequences instead of all at once. Individuals vary their levels of motivation to change, from no intention to change to actually making behaviour changes.

This model proposes five stages of readiness for change: pre-contemplation, contemplation, preparation, action and maintenance. Individuals in the pre-contemplation stage are not participating in any PA and have no intention to do so in the future. In the contemplation stage, individuals are not participating in any PA but intend to start doing so in the next six months. In the preparation stage, individuals intend to start participating in regular PA in the next six months and are starting to make small changes in their activity behaviour. In the action stage individuals exercise at the recommended levels but have done so for less than six months. And in the maintenance stage, individuals exercise for more than six months.

The movement through the stages is cyclical rather than lineal. According to this model, it is essential to tailor interventions to match a persons' readiness or stage of change (James O. Prochaska et al., 1992). Therefore it is important to identify the individual's stage of change to apply the most adequate intervention. Cognitive and behavioural techniques are used to progress through the different stages of motivational readiness for change (J. O. Prochaska & Diclemente, 1983). The cognitive processes of change are increasing knowledge, being aware of risks, caring about the consequences to others, comprehending the benefits and increasing healthy opportunities. The behavioural processes of change are substituting alternatives, enlisting social support, rewarding yourself, committing yourself and reminding yourself.

PARS is addressed to patients who already have the intention to be physically active. According to a primary care-based intervention study (PACE: Physician-based Assessment & Counseling for Exercise study) (Calfas et al., 1996) the intervention was most effective in people originally in the contemplation stage of activity change.

In the PAFES program, one inclusion criteria for participating in PARS was to be in the stage of change of contemplation or preparation in order to recruit those patients more interested and motivated to begin and adhered to an exercise program.

1.3.4. Assessment of Physical Activity adherence

Accurate assessment of PA adherence is necessary to plan an effective intervention and for ensuring that changes in health outcomes can be attributed to the recommended prescription of PA (WHO, 2003a).

It is complex to find a single definition for the assessment of PA adherence. Previous literature used different definitions to assess PA adherence, such as attendance to the exercise on prescription program, attendance to follow-up (Marcus et al., 2000) or comparing the number of participants that continue with the prescription to those that enrolled initially.

A recent review detected a diversity of indicators to assess PA adherence used across studies. In order to compare studies this study applied standard definitions of uptake and adherence (Pavey et al., 2012) *Uptake* was defined as the proportion of those individuals offered entry to PARS that attend an initial consultation with an exercise professional or attend the first exercise sessions. *Adherence* was defined as the proportion of individuals undertaking the 75-100% of the program's sessions.

1.3.5. Adherence to Physical Activity Referral Schemes

The promotion of PA to sedentary adults recruited in primary care, such as PA counselling and PARS, significantly increases PA at 12 months (Orrow et al., 2012). However, based on the limited data available, there is no evidence that PARS are more effective than PA counselling. PARS may have more advantages than PA counselling to deal with the initial difficulties of PA adoption. The referral process of the scheme is, in itself, a key motivator and driver for individuals to take up and adhere to exercise interventions (Riddoch C & McKenna J., 2003).

The National Institute for Clinical Excellence (NICE) showed that PARS can have short-term positive effects on PA levels, but they are ineffective in increasing PA in the long term (over 12 weeks) and over the very long term (over one year) (NICE, 2006). Harrison et al., also support that a PARS of 12 weeks had some impact on reducing sedentary behaviour in the short-term, but not at 12 months. (Williams et al., 2007). This review also suggested that 17 sedentary adults would need to be referred for one to become moderately active (Williams et al., 2007). Reasons to poor PA adherence were related to personal barriers such as lack of self-efficacy, poor body image, poor time management or lack of social support and barriers related to the program, such as inadequate supervision and inconvenient opening hours (Williams et al., 2007).

PARS appear to increase PA levels in certain populations, namely individuals who are not sedentary but already slightly active, older adults and those who are overweight (but not obese), but these increases may not be sustained over time (Morgan, 2005). Further studies are required to assess effectiveness in a range of populations and for different activities.

The weaker evidence for longer term PA maintenance could be related to the short duration of PARS programmes in several studies (typically a 10-12 weeks to 4 months leisure centre based programme) that could be insufficient to maintain PA adherence at long term (Harrison, Roberts, & Elton, 2005).

According to the NICE, longer-term increases in PA were more likely to occur if the duration of the PARS was not limited by time and if written information which included a personal PA plan and strategies to overcome barriers was given to the patients (National Institute for Clinical Excellence (NICE), 2010).

A recent systematic review (Pavey et al., 2012) quantified the levels of uptake and adherence of PARS and was the first to identify predictive factors of uptake and adherence. Overall uptake and adherence rates to PARS were relatively low but also highly variable across different programmes. Pavey et al. found uptake rates of 66-81% and adherence rates of 43-45% (Pavey et al., 2012). Predictors for PARS uptake were being female and older age. Predictors of higher levels of adherence to PARS were only being male and increasing age (Pavey et al., 2012).

Conclusions of several systematic reviews that have examined the evidence-based for PARS reported that these schemes can increase PA level of sedentary adults in the short term (Morgan, 2005; Williams et al., 2007; T. Pavey et al., 2011; T. G. Pavey et al., 2011). Most of the research surrounding PARS has predominantly focused on assessing the effectiveness of schemes in increasing PA levels, with little attention being paid to the scheme characteristics and how these relate to access, uptake and adherence. For this reason there is a lack of evidence on the medium to long term effectiveness of PARS rendering it made difficult to explore the effectiveness of PARS on PA adherence at long term (Orrow et al., 2012).

Further trials of PARS are needed, with longer follow-up, objective outcome measures and with the use of quantitative and qualitative methods in order to improve a better understanding of PA adherence at long term after PARS intervention (Orrow et al., 2012).

2. AIMS OF THE THESIS

The general aim of this thesis is to assess the adherence to the current PA guidelines in two different but related samples: a representative sample of the Catalan population and a representative sample of Catalan physicians. The second main aim is to assess the impact of a physical activity referral scheme promoted by *the Plan of Physical Activity, Sport and Health* on both PA adherence and health-related quality of life in primary care patients with cardiovascular risk factors.

These objectives are reflected individually in the following studies:

Study I

The study I has two aims: (i) to describe the prevalence of both Health-Enhancing Physical Activity level and Leisure-time physical activity of a representative sample of Catalan population (ii) and identify those factors characterizing physically active and inactive groups of population.

Study II

The study II has three aims: (i) to assess physical activity level and other health-related behaviours from a sample of physicians from the Catalan Medical Association, (ii) to identify factors characterizing physically active and inactive physicians and (iii) to identify combinations of lifestyle-related risk factors among Catalan physicians.

Study III

The study III has three aims: (i) to assess physical activity adherence after a physical activity referral scheme (at 6-month) (ii) to asses PA adherence at long-term (at 12-month follow-up), (iii) to assess the impact of the physical activity referral scheme on health-related quality of life in primary care patients with cardiovascular risk factors.

3. PAPERS

Study I

Health-enhancing physical activity and associated factors in a Spanish population

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The Journal of Science and Medicine in Sport

Abstract

Introduction

Physical activity is a key determinant of health. Understanding PA level of population and those factors associated to higher and lower levels of PA help to target sedentary population and implement PA interventions to increase PA among the most sedentary groups.

Aim

To assess Health-Enhancing Physical Activity (HEPA) level and Leisure-time physical activity (LTPA) level in a representative sample of Catalan population and identify those factors associated with the most active and the most inactive population groups.

Material and methods

Data of the present study was obtained from the second ENCAT Survey 2003-03 (Evaluation of Nutritional Status in Catalonia), an epidemiological observational study with a transversal design, in a representative sample of the Catalan population between 18-70 years, which enable to identify trends of obesity, nutrition patterns and physical activity habits.

Total Physical activity was assessed with the International Physical Activity Questionnaire (IPAQ-short version) classifying individuals according to meeting the current PA guidelines (HEPA level) or being physically inactive (low level). Physical activity during leisure time was assessed by a question adapted from the WHO Countywide integrated Non-communicable Diseases Intervention (CIND) physical activity questionnaire.

The variables used in this study were the socio-demographic: gender, age, education level, working class, marital status, family life, community size; and health-related variables were: obesity by body mass index (BMI) and waist circumference index and smoking status.

Chi-square tests and binomial and multiple logistic regressions analysis were conducted to indentify differences between PA levels and the socio-demographic and health-related variables.

Results

76.7% of Catalan population were physically active and 23.3% were classified as inactive. There were differences between gender in terms of PA intensity, being females more active at moderate levels and males at higher levels.

The most physically active groups were younger age group (18-34 years old), blue-collar workers, single marital status, living with a partner as a family life, living in small towns and having a normal-weight.

During leisure time 55.6% of Catalan population were sedentary and only 16.1% were highly active. The most physically active during leisure time were males, younger age group, higher education levels, unemployed, single individuals, those living with a partner, those having normal weight and occasional smokers.

Overall low levels of PA and sedentary behaviour during leisure time were associated with middle-aged groups (35-54 years old), housewives, those who were married, those living with children and obese individuals (BMI ≥30 kg/m^2).

Discussion

Most of Catalan population are physically active but not during their leisure time. According to previous studies, regular walking for active commuting may be the most prevalent PA domain within Catalan population.

The most active groups were young adults and those with normal weight. The most inactive groups were middle-aged group, housewives, those who were married and obese individuals.

Thus, a target group to promote PA activity are middle-aged adults, because their low PA levels and their high prevalence rates of overweight and obesity. New strategies to promote easy ways to integrate PA such as non-structured PA and light activities should be promoted specially into obese individuals' life.

Males and females are active at the same level but, while males are more likely to engage in high intensity PA and during leisure time, females are more likely to engage in moderate intensity PA and may be active in other domains such as active commuting and domestic activities.

Individuals with higher educational level are more likely to be physically active during leisure time than those with lower educational level, which may be more active during occupational activities.

To plan new strategies to increase PA level in the Catalan population is important to take into account that different population groups may be active at different intensities and in different domains. Addressing different types of strategies to meet interest groups may be primordial to change health behaviours related to PA.

Paper-study I

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Original research

Health-enhancing physical activity and associated factors in a Spanish population

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ABSTRACT

Objective: This study describes the prevalence of health-enhancing physical activity and leisure-time physical activity in a Spanish sample and identifies the characteristics of the physically active and inactive populations.
Design: A cross-sectional study.
Methods: A random sample of 1595 adults (18–70 years old) living in Catalonia, Spain were assessed using the International Physical Activity Questionnaire (short version) and categorised according to their physical activity levels. The independent associations between physical activity levels and socio-demographic and health-related variables were investigated.
Results: Seventy-seven percent of the population engaged in health-enhancing physical activity. Being a young adult (odds ratio = 2.0; 95% confidence interval = 1.25–3.21) and having a normal weight (odds ratio = 1.46; 95% confidence interval = 1.04–2.03) were positively associated with a high health-enhancing physical activity level. Living in a medium-sized town (odds ratio = 1.60; 95% confidence interval = 1.09–2.35) was positively associated with a moderate health-enhancing physical activity level, whereas being male (odds ratio = 0.72; 95% confidence interval = 0.53–0.96) odds ratio a middle-aged adult (odds ratio = 0.67; 95% confidence interval = 0.46–0.97) was negatively associated with a moderate health-enhancing physical activity level. Regarding leisure-time physical activity, 16.1% of the participants were active, 28.3% were lightly active and 55.6% were sedentary. Being male, being a non-smoker, having a normal weight and living with a partner increased the odds of engaging in leisure-time physical activity.
Conclusions: Engaging in health-enhancing physical activity is common but not during leisure time, as concluded based on a representative sample of adults from Catalonia, Spain. Being a young adult, having a normal weight odds ratio living in a medium-sized town was positively associated with a high health-enhancing physical activity level, whereas being male odds ratio a middle-aged adult was negatively associated with a moderate health-enhancing physical activity level.

1. Introduction

Physical inactivity is the fourth leading global risk factor for mortality in the world.[1] A recent study estimated that physical inactivity causes 6% of the worldwide burden of disease from coronary heart disease, 7% from type 2 diabetes, 10% from breast cancer, and 10% from colon cancer. Inactivity accounts for 9% of premature mortality.[2]

For this reason, several international organisations have developed physical activity (PA) guidelines: the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), the American College of Sports Medicine (ACSM),

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the American Heart Association (AHA) and the US Department of Health and Human Services (USDHHS). The current guidelines (WHO, 2010)[3] state that adults should engage in at least 150 min of moderate-intensity aerobic PA throughout the week or at least 75 min of vigorous-intensity aerobic PA throughout the week or an equivalent combination of moderate- and vigorous-intensity activity. These PA doses can be accumulated throughout the week by performing activities in multiple short bouts of at least 10 min each (e.g., 30 min of moderate-intensity activity 5 times per week).[3]

Because PA is an important determinant of health, an accurate assessment of PA is needed to plan new strategies to promote an active lifestyle. PA assessment methods include objective methods (accelerometer, pedometer, etc.) and subjective methods (self-reported methods, etc.).[4] Over the past century, self-reports of PA have contributed to the documentation of the benefits attributed to a physically active lifestyle and to the development of PA guidelines.[4] Traditionally, PA questionnaires have assessed a single domain (e.g., work-related PA or leisure-time PA). As a consequence, there has been a significant gap in obtaining information about frequency, duration and intensity of PA across all domains, including leisure, work, home and transport. Because PA recommendations are based on increasing PA across all domains (e.g., not only engaging in leisure-time PA but also commuting or performing household tasks), more in-depth knowledge about the PA habits of population is needed. The International Physical Activity Questionnaire (IPAQ)[5] has been proven to be an appropriate self-report instrument for defining patterns of PA across several domains (leisure, work, home and transport) in the general population.[6]

Moreover, it is important to assess leisure-time physical activity (LTPA) because it is the most prevalent type of PA in Western countries.

Health-enhancing physical activity (HEPA) is a new term that encompasses all physical activities that produce health benefits. Thus, identifying the prevalence of HEPA in the population and the characteristics of the most physically active and inactive individuals will enable us to plan and develop strategy for increasing the PA level of the most inactive groups in the population.

In Spain, there are no data on the prevalence of HEPA. For this reason, this study has two aims: (i) to assess the prevalence of both HEPA and LTPA in a Spanish population (ii) and to identify the characteristics of physically active and inactive individuals.

2. Methods

The assessment of PA levels in Catalonia, Spain was conducted as part of the Catalan Nutrition Survey (ENCAT 2002-03),[7] a cross-sectional survey used to assess nutritional status, eating habits and PA prevalence in a representative sample of the Catalan population. The total sample included 2060 participants aged 10–75 years old. Because the IPAQ format used in this study has been validated for individuals aged 18–70 years old, the analysis was limited to this age range (1760 individuals). The Ethical Committee of the Department of Health of the Catalan Government approved the survey, and all of the participants gave fully informed written consent. The participants answered a general questionnaire containing PA and socio-demographic data. A detailed description of the survey methodology has been published elsewhere.[7,8]

Body weight and height were measured under standardised conditions: all of the participants wore underwear and no shoes, and a portable spring scale and a metric tape (Kawe© model) were used for the measurements. Body mass index (BMI) (kg/m^2) was classified as underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25 $kg/m^2 \geq$ BMI < 30 kg/m^2) or obese (≥30 kg/m^2).[7] Central obesity was assessed by measuring waist circumference with a non-elastic metric tape halfway between the lower border of the ribs and the iliac crest on a horizontal plane. Central obesity was defined as a waist circumference ≥102.0 cm in men and ≥88.0 cm in women.[9]

Table 1
Description of the socio-demographic variables.

Variables	Categories
Age	Young adults (18–34 years) Middle-aged adults (35–54 years) Older adults (55–70 years)
Education level	<6 years (illiterate or pre-school) 6–12 years (primary school) >12 years (high school, college or university)
Working class	White-collar worker Blue-collar worker Service sector worker Housewife Unemployed
Marital status	Single (unmarried, separated, divorced, widow/widower) Married
Family life	Living alone Living with a partner Living with children (including living alone or with partner)
Residential community size	Large-sized town (>500,000 inhabitants) Medium-sized town (500,00–500,000 inhabitants) Small-sized town (10,000–50,000 inhabitants) Village (<10,000 inhabitants)
Smoking status	Non-smoker (0 cigarette/day) Occasional smoker (<1 cigarette/day) Current smoker (≥1 cigarette/day)

Table 1 shows the details about the socio-demographic variables used for the analysis.[8]

Total PA was assessed using the short, self-administered version of the IPAQ.[5] The IPAQ was translated into Catalan and translated back into English, following the recommendations of the IPAQ committee. The validity and reliability of the IPAQ in a Catalan population can be found elsewhere.[10] The IPAQ was designed to measure PA in the domains of leisure time, work, transportation and household tasks during the last 7 days. The respondents are asked to report the frequency and duration of vigorous-intensity activities, moderate-intensity activities and walking that were performed for at least 10 min. Vigorous-intensity activities are defined as activities that make breathing much harder than normal, and moderate intensity activities make breathing somewhat harder than normal. To guarantee the quality of the data, the IPAQ data were entered twice and were subsequently scored according to the IPAQ scoring protocol (http://www.ipaq.ki.es).[5] For the data analysis, vigorous-intensity PA was assigned a value of 8.0 METs (metabolic equivalent task), moderate PA was assigned 4.0 METs and walking was assigned 3.3 METs. Total PA (MET-minutes/week) was calculated as the product of the time dedicated to each activity multiplied by the specific MET for that activity.[5]

To identify those who reached the recommended HEPA level, the IPAQ data were scored according to the IPAQ scoring criteria. The cut-off limits for PA are based on the current PA guidelines.[3] The HEPA data were recoded into categories based on the level of PA achieved. Those categorised into the moderate level were the individuals who met the minimum recommended level of PA for health, while those at the high PA level achieved more than the minimum recommended level. The individuals who did not meet the minimum recommended PA for health were categorised into the low level (Table 2).

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Table 2
Physical activity categories and cut-off levels based on the IPAQ scoring protocol (http://www.ipaq.ki.es).

Physical activity category	Cut-off levels
Low level	No activity reported, or some activity is reported but not enough to qualify as HEPA.
HEPA-moderate level	3 or more days of vigorous-intensity activity for at least 20 min per day or 5 or more days of moderate-intensity activity or walking for at least 30 min per day or 5 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of 600 MET-minutes/week.
HEPA-high level	3 or more days of vigorous-intensity activity accumulating at least 1500 MET-minutes/week or 7 days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum of 3000 MET-minutes/week.

LTPA was assessed using a question adapted from the WHO Countrywide Integrated Non-communicable Diseases Intervention (CINDI) physical activity questionnaire.[11] LTPA data were obtained from the answers to the following question: How much PA do you have during your leisure time? The responses were as follows: (1) in my leisure time, I read, watch television and do things that do not require physical activity; (2) in my leisure time, I walk, ride a bicycle or move in other ways requiring physical activity for at least 4 h a week, including walking, fishing and hunting, light garden work and so on, but not including going to and coming from work; (3) in my leisure time, I do physical activities to maintain fitness, such as running, skiing, gymnastics, swimming, ball games, or I do heavy garden work or its equivalent; (4) in my leisure time, I train regularly, several days a week, for competitions in running, orienteering, ball games or other physically demanding sports. LTPA was recoded based on its intensity as sedentary (TV, reading), lightly active (walking, cycling, gardening, fishing) or highly active (sports or vigorous-intensity activity several days a week).

The bivariate relationships between the HEPA categories and socio-demographic variables, central obesity and BMI were tested using chi-square tests. The same analysis was conducted with the categories of LTPA (sedentary, lightly active, highly active). Multinomial logistic regression was performed to obtain adjusted odds ratios (OR) and 95% confidence intervals (CI) to determine the associations of other variables (gender, age, working class, marital status, family life, residential community size, central obesity, smoking) with HEPA and highly active LTPA. Binomial logistic regression was performed to determine the association between socio-demographic variables and highly active LTPA by gender. The reference categories for the ORs were women, older adults (55–70 years), central obesity, housewife, married, living in a small village and current smoker.

Not all of the PA variables were normally distributed according to the Kolmogorov–Smirnov test, and thus, a multiple regression was conducted using Spearman's rank correlation coefficients.

The level of significance for all analyses was set at 0.05. The analyses were conducted using SPSS Statistics for Windows, Version 15.0. Chicago: SPSS Inc.

3. Results

The PA levels for the sample, as measured by the IPAQ and the LTPA question, are presented in Table 3. The final sample included 1595 participants (85.4% response rate; 718 males and 877 females). Following the IPAQ protocol, 165 participants were excluded from the analysis because they were missing data.

The mean age was 41.1 ± 15.1 years. The median total MET-minutes/week was 2085.

A total of 76.7% of the study population reported engaging in HEPA. Of these individuals, 37.9% and 38.8% reported that they engage in high and moderate levels of PA, respectively, and 23.3% were categorised in the low-level category. Although the HEPA levels (high and moderate levels) were similar for both genders, males were more likely to engage in a high level of HEPA and females were more likely to engage in a moderate level. Table 3 shows that the groups engaging in the most HEPA (high- and moderate-level PA) were young adults, unemployed people, single people, those living with a partner, those living in a large-sized town and those with a normal weight. In contrast, middle-aged adults, obese individuals, white-collar workers, housewives, married people, those living with children and those living in villages had the highest proportions of individuals not reaching HEPA levels (low-level PA).

There were significant differences in PA levels associated with gender, age, BMI, central obesity, working class, marital status, family life and residential community size, but there were no differences associated with education level or smoking status.

As Table 4 shows, after adjusting for all of the socio-demographic variables, young adults (OR = 2.00; 95% CI: 1.25–3.21) and those with a normal waist circumference (OR = 1.46; 95% CI = 1.04–2.03) had higher odds of reaching the highest PA category than middle-aged and older adults and those with central obesity. Males (OR = 0.72; 95% CI = 0.53–0.96) and middle-aged adults (OR = 0.67; 95% CI = 0.46–0.97) had lower odds of achieving a moderate HEPA level. Those living in a medium-sized community (OR = 1.66; 95% CI = 1.09–2.35) had a higher OR of achieving a moderate HEPA level.

More than half (55.6%) of the participants were sedentary during leisure time, 28.3% were lightly active and 16.1% were highly active (Table 3). The individuals who were most physically active during leisure time were males, young adults, those with a normal weight, individuals with a high education level, unemployed individuals, white-collar workers, single people and those living with a partner. The groups of people who were most sedentary during leisure time were females, middle-aged adults, those classified as underweight, those classified as obese, current smokers, individuals with a low educational level, housewives, married people and those living with children (Table 3).

As Table 5 shows, after adjusting for all of the socio-demographic variables, males (OR = 2.15; 95% CI = 1.70–2.72), individuals with a normal waist circumference (OR = 1.54; 95% CI = 1.18–2.02), non-smokers (OR = 1.42; 95% CI = 1.11–1.82) and those living with a partner (OR = 1.59; 95% CI = 1.16–2.06) had higher odds of being highly physically active during their leisure time.

With regard to obesity (data not shown), higher levels of HEPA were associated with lower BMI values (up to 0.93 kg/m^2) and lower central obesity (3.36 cm in women and 4.3 cm in men). This pattern was also observed in relation to PA during leisure time: the active group had lower BMI values (up to 1.9 kg/m^2) and lower central obesity (up to 8.72 cm in men and 7.42 cm in women) compared with the sedentary group.

4. Discussion

This study presents, for the first time, the prevalence of HEPA and associated factors in a large representative sample of adults from Catalonia, Spain.

The study produced three main findings: (i) a large proportion of adults engage in HEPA (77%) in a representative sample of adults from Catalonia, Spain; (ii) the prevalence of active LTPA is low (16.1%); and (iii) certain factors are associated with different levels of PA.

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Table 3
The sample characteristics and distribution of physical activity by the IPAQ[a] categories and by leisure-time physical.

	N	%	Physical activity level (%)			p	Leisure-time physical activity (%)			p
			Low	HEPA level			Sedentary	Lightly active	Highly active	
				Mod.	High					
Gender						<0.01				<0.01
Men	718	44.9	23.0	32.9	44.2		46.4	32.3	21.4	
Women	877	55.0	23.6	43.7	32.7		63.1	25.1	11.9	
Age (years)						<0.01				<0.01
18–34	628	39.4	17.4	35.8	46.8		50.6	18.4	31.0	
35–54	607	38.1	28.3	36.7	34.9		60.5	31.3	8.2	
55–70	360	22.6	25.3	47.5	27.2		55.8	40.6	3.6	
Education level						n.s.				<0.01
<6 years	446	28.1	25.6	37.0	37.4		59.9	33.4	6.7	
6–12 years	426	26.8	21.4	38.5	40.1		59.8	23.3	16.9	
>12 years	716	45.1	23.0	40.2	36.7		50.3	28.1	21.6	
Working class						<0.01				0.01
White-collar	563	36.5	28.1	41.2	30.7		51.7	30.4	17.9	
Service sector	310	20.1	20.3	38.1	41.6		56.1	27.4	16.5	
Blue-collar	369	23.9	20.9	30.1	49.1		57.6	29.1	13.3	
Unemployed	210	13.6	17.6	43.8	38.6		55.2	23.3	21.4	
Housewife	89	5.8	27.0	50.6	22.5		68.5	25.8	5.6	
Marital status						<0.01				<0.01
Single	727	45.7	20.1	37.6	42.4		51.8	22.2	26.0	
Married	863	54.3	26.1	39.7	34.2		58.5	33.6	7.9	
Family life						<0.01			<0.01	
Living alone	122	7.6	24.6	43.4	32.0		52.5	32.0	15.6	
Living with a partner	806	50.5	20.2	37.1	42.7		50.1	25.5	24.4	
Living with children	667	41.8	26.8	40.0	33.1		62.7	31.0	6.3	
Community size						<0.01				n.s.
Village	334	20.9	26.9	30.5	42.5		55.0	30.4	14.5	
Small-sized town	358	22.4	22.9	33.8	43.3		53.6	30.0	16.3	
Medium-sized town	516	32.4	22.9	43.2	33.9		58.5	24.3	17.0	
Large-sized town	387	24.3	21.2	44.7	34.1		58.4	28.0	13.5	
Body mass index						<0.01				<0.01
<18.5 kg/m^2	31	2.1	16.1	61.3	22.6		69.7	15.2	15.2	
18.5–24.9 kg/m^2	704	47.7	20.7	38.9	40.3		54.2	24.7	21.1	
25–29.9 kg/m^2	522	35.4	23.4	38.7	37.9		55.2	32	12.9	
≥30 kg/m^2	219	14.8	32.0	36.1	32.0		64.9	31.8	3.3	
Waist circumference						<0.01				<0.01
Normal	1075	72.7	21.4	37.9	40.7		52.0	26.9	21.1	
Central obesity[c]	403	27.3	28.5	41.4	30.0		64.3	33.0	2.7	
Smoking status					n.s.			<0.01		
Non-smoker	1061	66.7	23.8	40.2	36.0		53.9	30.9	15.2	
Occasional smoker	47	3.0	21.3	29.8	48.9		46.8	29.8	23.4	
Current smoker	482	30.3		22.4	36.5	41.1		60.0	22.4	17.6
Total	1595[b]	100[b]	23.3	38.8	37.9		55.6	28.3	16.1	

[a] International Physical Activity Questionnaire.
[b] Total numbers may be not equal to 1595 and 100% due to missing data in a few variables.
[c] Men ≥102 cm and women ≥88 cm. n.s.=not significant.

Similar data on the prevalence of PA have been found in other studies. The Eurobarometer Study indicated that 68.8% of the Spanish population adhered to PA guidelines, and regular walking was the most prevalent type of PA.[12] These results were consistent with a previous study by Bauman et al.[13] and a recent report from the European Commission (2010).[14] According to these publications, the Spanish population tends to exercise more in outdoor spaces and on the way to and from work, school or shops. These results align with other countries that have infrastructure and a culture that support walking and where the population achieves higher levels of PA with relatively low levels of vigorous activity.[13] However, the World Health Survey data on PA presented Spain as one of the countries with an unfavourably high prevalence of physical inactivity (27.4% for men and 33.1% for women) within the European region.[15] With regard to the prevalence of LTPA, similar findings were found in the Eurobarometer 2010[14]: 42% of the Spanish population did not participate in any sport, and only 12% engaged in sports regularly. These inconsistencies highlight the differences in prevalence rates that occur when different measurement instruments or questionnaires are used to evaluate PA in the population. Even using the same instrument (e.g., the IPAQ), it is difficult to make comparisons at the country level because there may be modifications to the wording of the questions or differences in the administration of the interview or the survey administration. In an effort to reduce self-report error, Ainsworth et al.[16] provide a 6-step process to help researchers and practitioners improve the accuracy of self-reported PA data.

Within the Catalan population, the individuals who were most likely to reach recommended HEPA levels were young adults, those with normal weight or those living in medium-sized towns. The results we found were consistent with previous studies,[13,15,17] in terms of showing an inverse relationship between age and HEPA

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Table 4
Odds ratios and 95% confidence intervals from a multinomial logistic regression model predicting moderate and high PA levels.

	N	HEPA level							
		Moderate				High			
		Crude analysis		Adjusted analysis		Crude analysis		Adjusted analysis	
		OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Gender									
Men	718	0.77	0.59–1.00	0.72	0.53–0.96	1.38	1.06–1.79	1.08	0.80–1.46
Women	877	1.00		1.00		1.00		1.00	
Age (years)									
18–34	628	1.09	0.78–1.54	0.98	0.62–1.55	2.50	1.74–3.59	2.00	1.25–3.21
35–54	607	0.69	0.50–0.95	0.67	0.46–0.97	1.14	0.80–1.62	1.03	0.69–1.74
55–70	360	1.00		1.00		1.00		1.00	
Waist circumference									
Normal	1075	1.21	0.91–1.62	1.18	0.86–1.63	1.81	1.33–2.44	1.46	1.04–2.03
Central obesity[a]	403	1.00		1.00		1.00		1.00	
Working class									
White-collar worker	563	0.78	0.45–1.33	0.86	0.47–1.54	1.31	0.69–2.47	0.91	0.45–1.83
Service sector worker	310	0.99	0.55–1.78	1.14	0.61–2.14	2.45	1.26–4.78	1.79	0.87–3.69
Blue-collar worker	369	0.76	0.43–1.36	0.89	0.47–1.67	2.82	1.47–5.40	2.04	0.99–4.18
Unemployed	210	1.32	0.71–2.47	1.28	0.65–2.51	2.62	1.29–5.34	1.51	0.70–3.29
Housewife	89	1.00				1.00		1.00	
Marital status									
Single	727	1.22	0.94–1.59	1.00	0.70–1.43	1.60	1.23–2.09	1.02	0.71–1.47
Married	863	1.00		1.00		1.00		1.00	
Family life									
Living alone	122	1.18	0.72–1.92	0.98	0.54–1.76	1.05	0.62–1.76	1.07	0.58–1.98
Living with a partner	806	1.23	0.94–1.60	0.98	0.69–1.40	1.70	1.30–2.24	1.09	0.75–1.57
Living with children	667	1.00		1.00		1.00		1.00	
Resid. comm. size									
Large-sized town	387	1.86	1.26–2.74	1.49	0.98–2.26	1.00	0.69–1.49	0.99	0.65–1.50
Medium-sized town	516	1.66	1.16–2.39	1.66	1.09–2.35	0.94	0.66–1.33	0.95	0.64–1.39
Small-sized town	358	1.30	0.87–1.94	1.37	0.89–2.10	1.19	0.82–1.74	1.20	0.79–1.81
Village	334	1.00		1.00		1.00		1.00	

[a] Men ≥102 cm and women ≥88 cm.

level. However, in our study, middle-aged adults had a higher prevalence of low PA compared with young and older adults. Because middle-aged adults have the highest prevalence rates of overweight/obesity in Spain,[18] they have become a target group for increasing PA. Because the LTPA analysis indicated that they were mostly sedentary, perhaps they should be encouraged to modify their habits by incorporating non-structured PA into their daily lives.

With regard to gender, males tended to engage more in high PA level, while moderate PA level were more prevalent among women. Another study has found that all domains of PA must be considered when evaluating adherence to PA recommendations among females because they engage in substantial amounts of physical activity while performing occupational and household tasks.[19] According to a study by Dong et al.[20] using a 24-h recall method for assessing PA, household activities accounted for 20.1% and 33.3% of the energy expenditure for males and females, respectively. Furthermore, Jacobi et al.[21] found similar data in a study using accelerometers: for women, non-occupational, non-leisure PA contributed more to the total PA energy expenditure than occupational PA or LTPA. In fact, reviewing these results, women were mostly sedentary during their leisure time, but according to the HEPA analysis, most women reached a moderate level of PA. The differences in the PA patterns of men and women (i.e., that women are more physically active while performing the activities of daily life, such as household chores) may explain this result.

The literature has produced mixed results about the relationship between education level and PA.[22] In the present study, education level was associated with LTPA but not with HEPA. It is likely that participants with a higher education level might engage in more LTPA, but they may have less physically demanding occupations, resulting in a lower overall HEPA level compared with the participants who have a lower education level and more physically demanding jobs. This pattern is also evident with respect to the working class variable: blue-collar workers were more physically active than white-collar workers, but white-collar workers exercise more during leisure time compared with blue-collar workers.

The present results support previous data on the association between active LTPA and normal weight in males.[23,24] Obese individuals were more sedentary (both in terms of overall PA level and LTPA) compared with individuals of normal weight. A high proportion of overweight/obese individuals engage mostly in moderate PA. Moderate-intensity and lifestyle PA can be adopted and maintained more easily than higher intensity activities or structured exercise programs, which might explain this result.[25] These results stress the importance of promoting daily life PA among overweight/obese participants, particularly if we consider that people with higher BMIs tend to have more obesity-related barriers to performing PA, especially women.[26,27] In addition, the time pressure associated with combining a career and family responsibilities may influence PA levels. Life events (getting married, having children and starting work) are associated with decreased levels of PA,[28] which could explain the low rates of participation in LTPA among women.

The large differences found in the PA levels obtained from the IPAQ and from the LTPA may be attributable to the type of questions used. The short IPAQ is a recall questionnaire that contains four open-ended questions about the time spent performing vigorous and moderate physical activities and walking, and the participant must remember and sum all of the activities conducted in

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Table 5
Distribution of leisure-time physical activity odds ratios and 95% confidence intervals from a binomial logistic regression.

	Active LTPA[a]			
	Crude analysis		Adjusted analysis	
	OR	95% CI	OR	95% CI
Gender				
Men	1.97	1.61–2.42	2.15	1.70–2.72
Women	1.00		1.00	
Age (years)				
18–34	1.23	0.95–1.60	0.99	0.68–1.46
35–54	0.82	0.63–1.07	0.92	0.67–1.27
55–70	1.00		1.00	
Waist circumference				
Normal	1.66	1.31–2.10	1.54	1.18–2.02
Central obesity[b]	1.00		1.00	
Education level				
>12 years	1.47	1.16–1.87	1.16	0.84–1.60
6–12 years	1.01	0.77–1.32	0.88	0.63–1.22
<6 years	1.00		1.00	
Working class				
White-collar worker	2.03	1.26–3.28	1.16	0.67–2.00
Service sector worker	1.70	1.03–2.80	1.00	0.57–1.74
Blue-collar worker	1.61	0.98–2.64	0.83	0.48–1.45
Unemployed	1.76	1.04–2.98	1.05	0.59–1.89
Housewife	1.00		1.00	
Marital status				
Single	1.31	1.07–1.60	0.95	0.71–1.27
Married	1.00		1.00	
Family life				
Living alone	1.52	1.03–2.24	1.61	0.99–2.59
Living with a partner	1.67	1.35–2.06	1.59	1.16–2.06
Living with children	1.00		1.00	
Smoking status				
Non-smoker	1.28	1.02–1.59	1.42	1.11–1.82
Occasional smoker	1.70	0.93–3.10	1.54	0.80–2.96
Current smoker			1.00	

[a] Leisure-time physical activity.
[b] Men ≥102 cm and women ≥88 cm.

all of the physical activity domains (leisure time, work, home and transportation). The question about LTPA was closed-ended and descriptive, and it only referred to leisure time. Activities conducted regularly in a structured way are easier to recall than those conducted irregularly.[29]

Some limitations of the current study should be considered. Some respondents had difficulty distinguishing between moderate and vigorous activities on the IPAQ. In addition, it is well recognised that self-reported measures can be overestimated, and some data may be missed.[30] Finally, the time elapsed since data collection might be another limitation. However, the data used for the present study (based on the ENCAT 2002-03 survey) were obtained in the last survey performed in a representative sample of the population of Catalonia, Spain.

The strengths of this study are the size of the sample and the fact that the sample is representative of the Catalan population.

5. Conclusion

The majority of the Catalan population reaches the recommended level of HEPA, but few are physically active during their leisure time. The groups that should be targeted with efforts to encourage more PA are middle-aged adults, overweight/obese individuals, housewives, married people and those who are sedentary during leisure time.

This study provides useful descriptive data on the prevalence of HEPA and LTPA and associated factors in a Catalan population. These data are helpful for identifying the most sedentary groups and for planning future interventions.

Practical implications

- Three-quarters of the Catalan population reached the recommended HEPA level, but only one in six participants was active during leisure time.
- The most physically active groups were young adults, those with a normal weight and those living in a medium-size town.
- Middle-aged adults, obese individuals, and housewives were the groups that should be targeted to increase their PA levels.

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Study II

Physical activity level and lifestyle-related risk factors from Catalan Physicians

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Journal of Physical Activity and Health

Abstract

Introduction

Sedentary lifestyles are rising in many countries which have implications for global health. Health professionals are well placed to promote increased physical activity levels to their patients. Moreover, it has been established that health professionals' smoking and physical activity influence their related health-promoting behaviours (Lobelo et al., 2009). Although patients would increase their levels of PA when so counselled by their physicians (Petrella & Lattanzio, 2002), systematic PA counselling is still low.

Aim

To identify PA level among a representative sample of Catalan physicians and explore other lifestyle-related risk factors.

Material and methods

A self-administered questionnaire was sent to 2,400 Catalan physicians, aged 30 to 55 years old and whose professional activity involved patient care. PA level and other health-related behaviours such as body mass index and smoking habits were assessed.

Total PA level was the sum of the total minutes of walking, sports and other PA and classified according to the current PA guidelines into sedentary, under-exercising (exercising but not enough to meet current PA guidelines) and exercising (achieving 150+ minutes a week of moderate PA or 75+ minutes of weekly vigorous PA).

Results

A majority (80.5%) of Catalan physicians reported being non-smokers and in good health (94.8%), while half did not meet current PA recommendations. 36.5% reported overweight/obesity, being males six times more likely to be overweight/obese tan females. Females reported the most optimal lifestyles, yet almost one of four physicians presented one or more life-style risk factors; under-exercising and/or overweight/obesity were the most prevalent of the factors we measured.

The most active physicians were those in the age group of 45-55 years old, primary care or medical-surgical specialization, those without children, those working in private sector, those with a normal weight, and those with self-reported positive general and mental health. The most sedentary physicians were those who were obese, smokers and reported a poor general health.

Discussion

The low compliance with PA recommendations could adversely influence PA promotion, which in turn, may influence patients' health. Furthermore, the high prevalence of overweight/obesity may also undermine the credibility of lifestyle messages that under-active and apparently unhealthy physicians deliver. However, this may not be a uniquely Catalan concern; similar levels of overweight/obesity were found in EU physicians, including notably high levels among males (Ajani et al., 2004).

It is important to implement programs aimed at engaging physicians in healthy and active lifestyle as strategy firstly to improve physicians' own health and secondly to increase PA level among general population.

Paper-study II

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Letter to the Editor

Physical activity level and lifestyle-related risk factors from Catalan physicians

Keywords:
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Physician health

Unhealthy behaviors, such as lack of physical activity, are largely responsible for the global epidemic of obesity and chronic disease. Improved health-related behaviors contributes about four times as much to health outcomes as medically-based secondary prevention efforts (Hotchkiss et al., 2011), making this an important feature determining the effectiveness of any medical service. Since primary prevention interventions can facilitate health behavior improvement (Orrow et al., 2012), it makes sense that all physicians promote physical activity (PA) to their patients.

Patients increase their levels of PA when so counseled by their physicians (Petrella and Lattanzio, 2002) or when their physicians are regular exercisers (Lobelo et al., 2009). Despite these strong influences, systematic PA counseling is still low (Lobelo et al., 2009). Further and notwithstanding concerns about avoidable ill-health among doctors, unhealthy and overweight physicians are also less likely to counsel patient about healthy lifestyle (Reilly, 2007). Thus, it is important to explore physicians' PA behavior and their other health-related behaviors.

A self-administered questionnaire was sent to 2400 Catalan physicians to explore their PA level and other lifestyle-related behaviors. PA, self-rated health, body mass index (BMI) and smoking habits were all analyzed. From a response rate of 31.5% (n = 762, 52% female) a majority (80.5%) reported being non-smokers and in good health (94.8%), while half did not meet current PA recommendations; 36.5% reported overweight/obesity. Females reported the most optimal lifestyles, yet almost one of four physicians presented one or more lifestyle risk factors; under-exercising and/or overweight/obesity were the most prevalent of the factors we measured. Compared to females, males were six times more likely to be overweight and three times more likely to combine under-exercising with overweight (Table 1).

The low compliance with PA recommendations could adversely influence PA promotion, which in turn, may influence patients' health. Furthermore, the high prevalence of overweight/obesity may also undermine the credibility of lifestyle messages that under-active and apparently unhealthy physicians deliver. However, this may not be a uniquely Catalan concern; similar levels of overweight/obesity were found in US physicians, including notably high levels among males (Ajani et al., 2004). The most unhappy of US physicians also combined poor self-rated health, little exercise and obesity (Peckham, 2012).

Previous data show that exercising physicians are more likely to counsel patients to exercise. The current data confirm that a more active approach is needed to promote PA and healthy body weight among physicians, especially males.

Table 1
Odds ratio (95% CI) associated to Lifestyle Risk Factors (LRF) of a sample of physicians from Catalonia, Spain, during 2005–2006.

		Lifestyle risk factors		
		Under-exercising (≤150 min PA/week) (n = 182)	BMI (≥25 kg/m^2) (n = 88)	Under-exercising plus BMI (n = 132)
	Predictor variables	Adjusted odds ratio (95% CI)		
Demographic/work-related data	Gender			
	Male vs. female	n.s.	6.47 (4.56–5.75)**	3.38 (2.31–4.95)**
	Age			
	45–56 years vs. 30–44 years	0.62 (0.46–0.84)*	1.79 (1.26–2.55)*	n.s.
	Work sector			
	Public vs. private	1.63 (1.11–2.41)*	n.s.	n.s.
Lifestyle/health related data	BMI			
	≥25 kg/m^2 vs. ≤25 kg/m^2	1.76 (1.29–2.41)**	n.e.	n.e.
	Under-exercising			
	≤150 vs. ≥ 150 min PA/week	n.e.	1.85 (1.31–2.60)**	n.e.
	Smoking habit			
	Smoker vs. non-smoker	n.s.	n.s.	n.s.
	Chronic diseases			
	≥1 vs. none	n.s.	1.52 (1.07–2.15)*	n.s.
	Health status			
	Poor vs. positive	n.s.	2.83 (1.39–5.75)*	3.61 (1.88–6.94)**
	Mental health status			
	Poor vs. positive	1.67 (1.14–2.44)*	n.s.	n.s.

Note: CI = Confidence interval, ns = Not significant at p = 0.05; *significant at p ≤ 0.05 **significant at p ≤ 0.01; n.e. = variable not in the equation.

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Conflict of interest statement

None.

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Physical activity level and lifestyle-related risk factors from Catalan Physicians

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Abstract

Background: Physicians' own Physical Activity (PA) and other health-related habits influence PA promotion. The present study identifies the PA level, according to the current PA recommendations and other health-related habits of physicians from the Catalan Medical Council. **Methods:** 2,400 physicians (30 to 55 years) were randomly selected; each received a self-administered mailed questionnaire identifying medical specialization, work setting, health self-perception, body mass index (BMI), PA and smoking habits. **Results:** 762 physicians responded (52% female). Almost one in two (49.3%) exercised sufficiently, nearly all self-perceived good health, while 80.5% were non-smokers. Almost 6 in 10 males reported overweight or obesity (56.9%) versus 18.2% of females. Active physicians dominated specific groups; (i) aged 45-55 years, (ii) specializing either in primary care or surgery, (iii) working in the private sector, (iv) BMI <25kg/m^2, (v) perceiving themselves in good health, or (vi) having free leisure time. **Conclusions:** Only half of Catalan physicians met current PA recommendations; male physicians were particularly at risk of overweight/obesity. Overweight and under-exercise were associated with private workplaces and positive health perceptions, meaning that it is it is now possible to target inactive and/or overweight Catalan physicians in future interventions.

Keywords: physical activity, prescription, habits, obesity.

Introduction

Physical inactivity, overweight/obesity and smoking are the most important worldwide behavioral risk factors, raising the risk of chronic diseases and premature death.[1] Addressing the ill-health associated with physical inactivity that is then imposed on health-care systems worldwide requires consideration not only of patient lifestyles but also of staff delivering this care. Approximately, 60% of adults are physically inactive and overweight/obesity is a modern day pandemic; these issues also play out among physicians' groups.[2,3]

Given that secondary and tertiary prevention has been largely unsuccessful for reversing the negative societal trends toward physical inactivity, more emphasis should be placed on primary prevention.[4] There is a compelling case here; one analysis from Scotland has suggested that primary prevention, including modification of health-related behaviors, contributes about four times as much to health outcomes as medically-based secondary prevention efforts.[5] Given their wide access within the population, physicians can have a unique and strong influence on patients' health.[6] As the single most universally important area for improved health behaviour[7], it makes sense that all physicians promote physical activity (PA) among their patients.

Importantly, Petrella and Lattanzio[8] found that patients increased their levels of PA when their primary care physicians counsel them. In general practice, this increase also improved quality of life over 12-months.[9] However, systematic PA counseling is still relatively uncommon.[6] In Catalonia, 88% of physicians and nurses promoted PA infrequently.[10] Lack of time, training or effective protocols are each regarded as powerful barriers to more systematic PA promotion.[11]

While a number of factors can positively increase PA promotion, including physicians' self-confidence, knowledge, appearance and/or professional motivation[10,12,13], several studies highlight the importance of physicians' personal health-related behaviours.[14] The effectiveness of PA promotion is influenced by physicians' own PA level[6,15,16], perhaps because exercising physicians are more confident about helping patients to handle the specific issues around becoming more physically active. Thus, it is important to explore the health-related habits of physicians and identify those groups presenting some lifestyle risk factor.

The present study has three aims, (i) to assess PA level and other health-related habits from a sample of physicians from the Catalan Medical Association, (ii) to identify factors characterizing physically active physicians and (iii) to identify combinations of lifestyle risk factors (LRFs) among physicians.

Methods

Context

In Catalonia, a Spanish region of around 7.5 million inhabitants, 40% of the population is sedentary and around 50% are either overweight or obese.[17] For PA prescription to be effective and to be cost-effective, the role of physicians' own behaviors, PA level and health-related habits should be explored. At the time of undertaking this work, no existing data were available regarding the promotion or adoption of the current PA recommendations by Catalan physicians.

Sample and design

The data of the present study was part of the survey "Health, lifestyle and work conditions of physicians from Catalonia".[18] It was targeted on all physicians registered in the Catalan Medical Council, aged 30 to 55 years, and whose professional activity involved patient care. Physicians were selected randomly from blind lists provided by the local medical colleges. Physicians on special leave or who worked exclusively in management, training, or research were excluded. The internal distribution of selected participants was proportional to the known characteristics of gender, age, area and medical specialty. Care was taken to adhere to all ethical research standards, as prescribed by Spanish law, to prevent linking the identities of study participants to their responses (Spanish Organic Law 15/1999 of 13 December on the Protection of Personal Data).

The mailed questionnaire was based on self-reported responses to 86 pre-coded items. The field work, mailing and completion of the questionnaire spanned December 2005 to April 2006. The sample was designed to be representative of physicians aged 30-55 years involved in patient care and registered in the Catalan Medical Council. Questionnaires were posted to 2,400 registered physicians (13% of the total registered) in Catalonia. An intensive telephone follow-up process was established to obtain the required response rate. Replacements for non-responders were identified by matching for age, gender, medical specialization and postal district.

The present study focuses on data related to PA, health-related habits and socio-demographic variables that could influence PA level. To assess PA level, a 2-week PA recall test was used. Walking, sports and other form of PA were assessed. The frequency (days/week), duration (time/day), and type were also identified.

Outcome measures

Total PA was calculated by summing the weekly minutes devoted to walking, sports or PA. These same data were also converted to Metabolic Equivalents (METs): the energy cost of PA as multiples of resting metabolic rate, which is defined as the ratio of metabolic rate during a specific PA to a reference rate of metabolic rate at rest (3.5 ml $O_2 \cdot kg^{-1} \cdot min^{-1}$). Weekly PA was reclassified according to the current PA recommendations into (i) sedentary, (ii) under-exercising and (iii) exercising (achieving 150+ minutes a week of moderate PA or 75+ minutes of weekly vigorous PA or an equivalent combination of moderate- and vigorous-intensity aerobic activity).[19] Body Mass Index (BMI) was calculated from height and weight (kg/m^2). Health status was reported through a self-perception rating[20], while mental health was obtained from the General Health Questionnaire 12 (GHQ-12). Scores of >2 were considered to indicate poor mental health.[21]

Analysis

Double data entry helped to ensure data entry quality. The normality of distribution for numerical variables was tested using the Kolmogorov-Smirnov test. Categorical variables were described by frequencies and percentages. Differences between categorical variables (demographic-, work- and lifestyle/health-related data) were analyzed by chi-square test. Binary logistic regressions with Wald selection were used to predict the likelihood of reporting lifestyle risk factors. The binary dependent variables were under-exercising (≤150 minutes PA/week, including sedentary), BMI ≥25kg/m^2 or having both lifestyle risk factors (LRFs). Odds ratio (OR) and 95% confidence intervals (CI) were calculated as a measure of strength of association for each variable. The model was adjusted by demographic (gender, age group, work sector) and health-related variables (BMI, PA level, smoking habit, having chronic disease, health status and mental health status). Data were analyzed using SPSS version 18.0.

Results

From 2,400 sent questionnaires, 762 physician response sets (31.8%; 403 women aged 43.5 ±6.8 years; 359 men aged 46.2 ±6.3 years old) were analyzed. This sample is representative of all of the male and female doctors in Catalonia (according to previously stated criteria in the methods: aged 30-55 years, involved in patient care and registered in the Catalan Medical Council) and achieves a margin of error of ±3.55% of the total.

Sample characteristics are described in Table 1. Almost all physicians reported a positive perception of health and were non-smokers. While 63.6% reported a normal weight, 31.7% of physicians were overweight and 4.8% obese. Males (56.9%) presented higher prevalence of a BMI ≥25kg/m^2 over females (18.2%), ($p < .01$).

In the previous two weeks, 79.8% of respondents reported walking as a leisure time exercise and 54.9% reported engaging in sports or some other type of PA. The average weekly minutes (±SD) for walking were 122.5 (±154.5) and 446.1 (±981.1) minutes/week for sports and PA. Average MET min/week (±SD) were (i) walking, 416.8 (±612.9); (ii) PA, 2525.2 (±5832.8); (iii), overall PA (including walking and sports) 2942.0 (±5930.9). The most common types of PA were walking for exercise (n=608; 79.8%), exercising in a fitness centre (n=148; 19.4%), cycling (n=86; 11.2%), swimming (n=75; 9.8%) and running (n=50; 6.6%).

Almost half of respondents (49.3%) met current PA recommendations, 38.5% were under-exercisers and 12.2% were sedentary. Significant differences were found

between PA levels and these following demographic, health and workplace variables; exercising physicians were proportionately most common among (i) 45 to 55 year olds (53.3%), (ii) those without children (56.7%) (table 2), (iii) those specializing in primary care (55.8%) or (iv) in medical-surgical (54.1%); (v) those working in the private sector (59.3%) (table 2), (vi) those reporting a healthy BMI (53.6%), (vii) those with a positive self-perceived general health (56.7%), (viii) a positive mental health (51.6%) or (ix) those who reported 'always' having leisure time (84.0%) (table 3). The most sedentary physicians were those who reported 'poor' self-perceived general health (25.0%), obesity (27.8%) or current smokers (19.1%) (table 3).

No significant differences were found between PA levels for gender, family structure (living alone, as a couple or with children), and number of acknowledged health problems (having one or two+ chronic conditions).

While 27.4% of physicians did not present any LRFs, 72.6% presented one or more from under-exercising, BMI ≥25kg/m^2 and a current smoking habit. Physical inactivity was the commonest of the LRFs (24.1%), while the most common combination paired under-exercising with BMI ≥25kg/m^2 (17.5%).

Table 4 shows the predictors for (i) under-exercising, (ii) a BMI ≥25kg/m^2 or (iii) both. After controlling for demographic (gender, age, work sector) and health-related data (BMI, PA, smoking habit, having chronic disease, health status and mental health status), under-exercising was best predicted by being aged 30 to 44, working in the public sector, having a BMI ≥25kg/m^2 and poor mental health. For BMI ≥25kg/m^2 the best predictors were being male, aged 45 to 56, under-exercising, having one or more chronic diseases and self-reporting 'poor' health status. Males were three times more likely than females to present the combination of under-exercising and a BMI ≥25kg/m^2 (OR=3.38; 95% CI=2.31-4.95, p <.01). Furthermore, those who perceived 'Poor' health

197 status were three times more likely to report both LRFs (OR=3.61; 95% CI=1.88-6.94)
198 than those who perceived positive health status (p <.01).
199
200 **Discussion**
201
202 Physicians represent the core of the Catalan health care system and their well-being
203 reflects not only its processes but also its outcomes. Collectively, this underlines the
204 importance of the current study.
205
206 In relation to the response rate of 31.8%, we must take into account that the survey
207 was sent by mail, the questionnaire was relatively long and it was addressed to a group
208 with little spare time during their working hours. Other studies have also shown that
209 initial response rates among physicians population are often problematic[22-24] and
210 exhaustive follow-ups are needed. The current sample size of 762 compares with
211 similar studies based on 298 in the US[15], 735 in the UK [25] and 496 in Switzerland.[26]
212
213 There are three main findings from this study. First, many Catalan physicians did not
214 meet the recommendations for PA. Second, while normal weight was higher among
215 physicians than the Catalan general population and very few were obese, there were
216 still many physicians in the overweight category, especially among males. Third, the
217 most physically active physicians were characterized by being aged 45-55 years,
218 having a primary care or surgery medical specialty, working in the private work sector,
219 reporting a BMI <25kg/m^2 along with positive self-perceived health, having free leisure
220 time. In contrast, the less physically active physicians were characterized by poor self-
221 perceived general health, BMI ≥30kg/m^2 and smoking habit.
222
223 Most Catalan physicians presented themselves as having positive health and not
224 smoking. Yet, 70% presented at least one modifiable LRF. Compared to non-smoking,

which is supported by smoking cessation counseling, the current data confirm that a more positive approach is needed to promote physical activity and healthy weight among Catalan physicians, especially males. Although PA prescription was implanted in Catalan primary health care by the "Plan of Physical Activity, Sport and Health" (PAFES) [27] in 2008, the impact on physicians should be explored.

These findings are relevant to managers of health care systems for at least three main reasons; healthy staff attend work more regularly[28], they counsel more regularly on healthy lifestyle habits and they do it more effectively.[6,15,16] The findings can help managers to target the groups of physicians who themselves are most in need of PA and health-related promotion. The current study also extends previous work by showing the most common LRFs, their combinations and what predicts them. Unsurprisingly, table 4 shows that overweight and under-exercising were linked; multiple unhealthy behaviors were also commonly combined. While older physicians were more likely to present overweight/obesity, younger physicians under-exercised. Further, physicians working in the public sector were more likely to under-exercise although they were not overweight. Table 4 identifies that being male and having poor health were the strongest predictors for both under-exercise and obesity. Low compliance with PA recommendations could also adversely influence the PA promotion that, in turn, influences patients' health. Physicians who do not exercise sufficiently may not present positive role modeling of behavior, self-discipline or commitment that supports regular PA.[29]

Previous literature, based on US and EU physician samples, has shown similar (49%)[30] or slightly higher (54-59%)[25,31,32] PA levels than in these Catalan physicians. Two other studies, using questionnaires similar to those in the present study (two-week and 7 days-recall), reported lower PA levels than was found in Catalan physicians. One Canadian study reported that only 30% of physicians were physically active[33], while

253 another study of US resident physicians showed that only 41% met current PA
254 recommendations[34]. In contrast, higher levels of compliance with PA guidelines (92%)
255 were found among a sample of female Estonian physicians.[35] Although these
256 differences may reflect genuine gender differences, i.e., women physicians tend to
257 have better healthy habits than men, the use of different questionnaires or differences
258 in the Health care systems make it difficult to compare between studies. These data
259 confirm that, like physicians from other countries, Catalan physicians comply with the
260 general PA recommendations. Comparing the results with the Catalan General Health
261 Survey, physicians are doing less than the general population, where around 60%
262 exercise regularly.[17]
263
264 Beyond the immediate health concern for individual physicians, the high prevalence of
265 overweight among Catalan males' physicians may also undermine the credibility of
266 lifestyle messages they deliver. However, this may not be a uniquely Catalan concern;
267 these levels of overweight were similar to those found in US physicians, where
268 overweight prevalence among males' physicians was also high.[36,37] Previous literature
269 has shown that physicians with overweight or poor personal habits such as physical
270 inactivity, are less likely to counsel patient about healthy lifestyle.[16,38] Moreover,
271 patients are less confidence in their advice than in that from normal weight
272 physicians.[15,38,39] Patients may also perceive overweight/obesity as being less
273 unhealthy when they see it in their own physician or in large groups of physicians.
274 Given the high prevalence of physical inactivity (40%) and overweight/obesity (50%) in
275 Catalonia[17], many Catalan patients have considerable potential to improve lifestyle,
276 potentially facilitated by the help of their physician.
277
278 Previous literature[29] has shown that physicians with positive health behaviors tend to
279 deliver more effective counseling. Our findings suggest that females support the most
280 optimal lifestyles, yet almost one of four physicians in the current study presented one

or more LRFs, with under-exercising or/and overweight/obesity being the most prevalent. Compared to females, males were six times more likely to be overweight and were three times more likely to present the combination of under-exercising and overweight. With every Catalan physician handling around 1500 patients, these 370 under-exercising and sedentary physicians may be offering a less than optimal service regarding lifestyle counseling for more than 555,000 patients.[40] Furthermore, this number will expand by including physicians who exercise, but who do not currently promote PA because of the range of barriers that limit delivery and impact in most health care systems.

Although these data relate to the Catalan system, they align with results from studies in other countries. This confirms that the value of such case studies; the specific often illustrates the general. Further, these are all issues that influence current moves toward global management of non-communicable disease.

There are two main implications of the present study. Firstly, the evidence provides a better understanding of the health status of physicians aged 30-55 years in Catalonia and their exposure to different risk factors, especially physical inactivity. Secondly, the support, together with the Galatea Foundation[18], the promotion and development of activities focusing on improving healthy habits and lifestyle amongst this professional collective. Gender is one of the principle variables that should be taken into account. Future interventions should focus on improving prevention and early detection of health-related problems, and promotion of healthy habits among male physicians. Future studies should investigate the impact of the Plan of Physical Activity, Sport and Health (PAFES)[27] on PA level and PA counseling by Catalan physicians.

The study strengths included its size, reaching almost all the expected sample, its thoroughness and originality; it is the first study in Catalonia assessing PA level among

physicians, reflecting current PA recommendations. The main study limitation is the reliance on self-reported data, which can be influenced by under- and/or overestimation of responses. Another limitation was the lack of information from non-responders, meaning that the representativeness of the sample is uncertain. Finally, the questionnaire was focused on leisure time PA. Validated questionnaires such as the International Physical Activity Questionnaire (IPAQ)[41] that assess all PA domains could be used in future studies among physicians' populations.

In conclusion, the low compliance with the PA recommendations and the higher rate of overweight and obesity among males' physicians may each negatively impact on the Catalan health care system. Beyond concerns for the lifestyles and well-being of physicians, there are concerns about the spill-over of personal behavioral profiles into counseling of Catalan patients about viable and effective lifestyle options. Our data underline the importance of implementing programs aimed at engaging physicians in healthy and active lifestyle as a strategy to improve physicians' own health and increase PA level in the general population. Previous literature concluded that this type of interventions should be implemented in the process of the medical education, because it will affect the future advice and prescription by physicians.[6,42] In US, only 13% of 102 medical schools in 2002 included PA and health in their curricula.[6] In Catalan Universities, PA promotion has not been on the medical curriculum since 2010. It is important that medical schools promote healthy lifestyle among students. Combining this with training on PA prescription through the PAFES program may offer a powerful approach for improving both physicians' own health and physicians' future attitudes towards positive preventive counseling.

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Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

Founding source

The authors declare no founding source.

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Table 1 Sample distribution according to the current Physical Activity (PA) recommendations† (demographic data). Groups differences according X^2 test.

			PA recommendations†				
	n	%	Sedentary % (n)	Under-exercising % (n)	Exercising % (n)	Sig (p)	X^2
Gender						0.111	2.541
Males	359	47.1	11.2 (40)	38.5 (138)	50.3 (180)		
Females	403	52.9	13.2 (53)	38.3 (154)	48.5 (195)		
Total	760	100	12.2 (93)	38.4 (292)	49.3 (375)		
Age (years)						0.002	12.494
30-44	330	43.4	16.7 (55)	39.1 (129)	44.2 (146)		
45-55	430	56.6	8.8 (38)	37.9 (163)	53.3 (229)		
Total	760	100	12.2 (93)	38.4 (292)	49.3 (375)		
Are you a parent?						0.027	7.198
Yes	525	69.3	13.0 (68)	41.0 (215)	46.1 (242)		
No	233	30.7	10.3 (24)	33.0 (77)	56.7 (132)		
Total	758	100	12.1 (92)	38.5 (292)	49.3 (374)		

† Physical Activity (PA) recommendations of the World Health Organization: 150+ minutes a week of moderate PA or 75+ minutes of weekly vigorous PA or an equivalent combination of moderate- and vigorous-intensity aerobic activity; p= significant level; X^2=chi squared.

Table 2 Sample distribution according to the current Physical Activity (PA) recommendations† (work-related data). Groups differences according X^2 test.

			PA recommendations†				
	n	%	Sedentary % (n)	Under-exercising % (n)	Exercising % (n)	Sig (p)	X^2
Medical speciality group						0.008	20.730
Generalist	89	11.7	19.1 (17)	36.0 (32)	44.9 (40)		
Primary care	249	32.8	8.8 (22)	35.3 (88)	55.8 (139)		
Biomedical	203	26.7	16.3 (33)	40.4 (82)	43.3 (88)		
Medical-surgical	133	17.5	9.8 (13)	36.1 (48)	54.1 (72)		
Surgical	73	9.6	8.2 (6)	52.1 (38)	39.7 (29)		
Total	747	100	12.2 (91)	38.6 (288)	49.3 (368)		
Work sector						0.017	12.034
Private	167	22.0	11.4 (19)	29.3 (49)	59.3 (99)		
Public	329	43.3	10.3 (34)	42.9 (141)	46.8 (154)		
Public and private	263	34.7	14.8 (39)	38.8 (102)	46.4 (122)		
Total	759	100	12.1 (92)	38.5 (292)	49.4 (375)		
Main work setting						0.001	25.413
Primary care center	251	33.0	10.4 (26)	40.2 (101)	49.4 (124)		
Hospital-surgical services	126	16.6	10.3 (13)	47.6 (60)	42.1 (53)		
Hospital-medical services	155	20.4	18.1 (28)	38.7 (60)	43.2 (67)		
Private clinic	117	15.4	9.4 (11)	23.9 (28)	66.7 (78)		
Others	111	14.6	13.5 (15)	38.7 (43)	47.7 (53)		
Total	760	100	12.2	38.4	49.3		

† Physical Activity (PA) recommendations of the World Health Organization: 150+ minutes a week of moderate PA or 75+ minutes of weekly vigorous PA or an equivalent combination of moderate- and vigorous-intensity aerobic activity; p= significant level; X^2=chi squared.

Table 3 Sample distribution according to the current Physical Activity (PA) recommendations† (lifestyle/health-related data). Groups differences according X^2 test.

			PA recommendations†				
	n	%	Sedentary % (n)	Under-exercising % (n)	Exercising % (n)	Sig (p)	X^2
Self-perceived health						0.043	6.290
Positive	712	94.1	11.9 (85)	37.8 (269)	50.3 (358)		
Poor	45	5.9	17.8 (8)	51.1 (23)	31.1 (14)		
Total	757	100	12.3 (93)	38.6 (292)	49.1 (372)		
Mental health						0.023	7.573
Positive	618	81.3	12.1 (75)	36.2 (224)	51.6 (319)		
Poor	142	18.7	12.7 (18)	47.9 (68)	39.4 (56)		
Total	760	100	12.2 (93)	38.4 (292)	49.3 (375)		
Body mass index (BMI; Kg/m^2)						0.000	21.534
Normal-weight (<25)	481	63.5	12.3 (59)	34.1 (164)	53.6 (258)		
Overweight (≥25 - <30)	240	31.7	9.6 (23)	46.3 (111)	44.2 (106)		
Obesity (≥30)	36	4.8	27.8 (10)	44.4 (16)	27.8 (10)		
Total	757	100	12.2 (92)	38.4 (291)	49.4 (374)		
Smoking habits						0.047	9.186
Non-smoker	612	80.5	11.6 (71)	40.0 (245)	48.4 (296)		
Ocasional smoker	58	7.6	6.9 (4)	39.7 (23)	53.4 (31)		
Current smoker	89	11.7	19.1 (17)	27.0 (24)	53.9 (48)		
Total	759	100	12.1 (92)	38.5 (292)	49.4 (375)		
Having leisure time						0.000	74.249
Always	50	6.6	0.0 (0)	16.0 (8)	84.0 (42)		
Almost always	160	21.2	7.5 (12)	29.4 (47)	63.1 (101)		
Sometimes	357	47.3	10.4 (37)	42.0 (150)	47.6 (170)		
Never	187	24.8	23.0 (43)	46.5 (87)	30.5 (57)		
Total	754	100	12.2 (92)	38.7 (292)	49.1 (370)		

† Physical Activity (PA) recommendations of the World Health Organization: 150+ minutes a week of moderate PA or 75+ minutes of weekly vigorous PA or an equivalent combination of moderate- and vigorous-intensity aerobic activity; p= significant level; X^2=chi squared.

Table 4 Adjusted Odds ratio (95% CI) associated to Lifestyle Risk Factors (LRF).

		Lifestyle Risk Factors					
		Under-exercising (≤150 minutes PA/week)		BMI (≥25 kg/m^2)		Under-exercising plus BMI	
Demographic / work-related data	Predictor Variables	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)
Gender	Male vs. Female	0.393	1.20 (0.79-1.82)	0.000**	6.47 (4.56-5.75)	0.000**	3.38 (2.31-4.95)
Age	45-56 years vs. 30-44 years	0.002**	0.62 (0.46-0.84)	0.001*	1.79 (1.26-2.55)	0.161	1.43 (0.87-2.37)
Work sector	Public vs. private	0.013*	1.63 (1.11-2.41)	0.954	0.99 (0.62-1.57)	0.425	0.81 (0.48-1.37)
Lifestyle / health related data							
BMI	≥25 kg/m^2 vs. ≤25 kg/m^2	<0.001**	1.76 (1.29-2.41)	n.e.	n.e.	n.e.	n.e.
Under-exercising	≤150 vs. ≥ 150 min. PA/week	n.e.	n.e.	<0.001**	1.85 (1.31-2.60)	n.e.	n.e.
Smoking habit	Smoker vs. Non-smoker	0.305	0.78 (0.49-1.25)	0.929	1.03 (0.59-1.80)	0.288	0.69 (0.35-1.37)
Chronic Diseases	≥1 vs. None	0.413	1.17 (0.80-1.70)	0.019*	1.52 (1.07-2.15)	0.520	1.18 (0.71-1.97)
Health status	Poor vs. Positive	0.396	1.44 (0.62-3.34)	0.004**	2.83 (1.39-5.75)	0.000**	3.61 (1.88-6.94)
Mental health status	Poor vs. Positive	0.009**	1.67 (1.14-2.44)	0.788	1.08 (0.62-1.89)	0.301	1.37 (0.75-2.50)

Note: OR=Odds ratio, CI= Confidence interval, ns=Not significant at p=0.05; *significant at p ≤0.05 **significant at p ≤0.01; n.e.=variable not in the equation. This study included physicians from the Catalonia, Spain, during 2005-2006.

Study III

Effectiveness of a Physical activity referral scheme on physical activity adherence in patients with cardiovascular risk factors

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Apunts de Medicina de l'Esport

Abstract

Introduction

Physical activity referrals schemes (PARS) in primary care centres increase PA level among general population. However, few studies assess the effect if PARS on PA adherence and health-related quality of life (HRQL) after interventions.

Aim

This study aimed i) to assess PA adherence at 6-month of PARS and at 12 month (after six months of follow-up after the completion of the scheme) ii) and to assess the impact of PARS on health-related quality of life (HRQL) of patients with CVRF.

Material and methods

323 patients with two or more CVRF, in contemplative stage of change from 27 Catalan primary care centres, were referred to a six-month PARS (3 sessions/week of 60 minutes of moderate-intensity PA (MPA) during 2010-11. PA level and HRQL were analysed pre- and post-intervention and at the six months of follow-up after the intervention, with the International Physical Activity Questionnaire (short version) and the SF-12, respectively.

Results

75% of patients (n=242; 62.6±8.5 years; 75% women) completed the PARS, with a mean attendance of 84.1%. The 6-month PARS increased PA level, especially MPA and improved HRQL ($p<0.01$). At 12-month, the number of physically inactive patients remains lower than baseline, MPA level decreased and the positive effects on HRQL were retained, especially on the perception of physical functioning, mental health and social functioning ($p<0.01$).

Discussion

A six-month PARS decreases the number of sedentary patients and improves HRQL, especially on emotional components, up to one year. PARS may be an effective strategy to reach those groups of populations more difficult to be motivated to adopt PA and is effective in improving the quality of life of patients with chronic conditions.

Papers-study III

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Abstract: Introducción: programas de prescripción de actividad física supervisada (PPAFS) aumentan el nivel de actividad física (AF) en la población general. Sin embargo, pocos estudios evalúan la adherencia a la AF después de las intervenciones. Este estudio i) evalúa la adherencia a la AF después de PPAFS y al 12-mes ii) y el impacto de PPAFS sobre la calidad de vida (CVRS) en pacientes con factores de riesgo cardiovascular (FRCV).
Material y métodos: Diseño longitudinal. 323 pacientes con ≥ dos FRCV, en la etapa contemplativa de cambio, se derivan desde centros de atención primaria de Cataluña, en 2010-11 a PPAFS de seis meses (3 sesiones / semana de 60 minutos de AF intensidad moderada). Nivel de AF y la CVRS fueron analizados al inicio, a los seis meses y al 12-mes de seguimiento, con el Cuestionario Internacional de Actividad Física (versión corta) y el SF- 12, respectivamente.
Resultados: El 75 % de los pacientes (n = 242; 62,6 ± 8,5 años, 75 % mujeres) completaron el PPAFS (asistencia media del 84,1%.). PPAFS aumentan el nivel de AF y mejoran la CVRS ($p < 0,01$). A los 12 meses, el número de pacientes físicamente inactivos sigue siendo inferior a los datos basales, el nivel de AF disminuye pero se mantienen los efectos positivos en la CVRS, especialmente en la funcionalidad física, social y componente emocional ($p < 0,01$).
Conclusiones: Los PPAFS aumentan el nivel de AF y mejoran la CVRS. PPAFS parece ser un tratamiento adecuado para mejorar la salud de los pacientes con FRCV.

Introduction: Physical activity referral schemes (PARS) in primary care centres increase PA level among general population. However, few studies assess PA adherence after interventions. This study aimed i) to assess PA adherence after a six-month PARS and at 12-months (after six months of a follow-up period without intervention) ii) and to assess the impact of PARS on health-related quality of life (HRQL) in patients with cardiovascular risk factors (CVRF).
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Conclusions: A six-month PARS decrease the number of inactive patients and improves PA level and HRQL. Improvements in physical functioning, social functioning and emotional component were retained up to one year. PARS seems to be an adequate treatment to improve the health of patients with CVRF.

Eficacia de un programa de actividad física supervisado en la adherencia a la actividad física en pacientes con factores de riesgo cardiovascular.

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Eficacia de un programa de actividad física supervisado en la adherencia a la actividad física en pacientes con factores de riesgo cardiovascular.

Effectiveness of a Physical activity referral scheme on physical activity adherence in patients with cardiovascular risk factors.

Resumen

Introducción: programas de prescripción de actividad física supervisada (PPAFS) aumentan el nivel de actividad física (AF) en la población general. Sin embargo, pocos estudios evalúan la adherencia a la AF después de las intervenciones. Este estudio i) evalúa la adherencia a la AF después de PPAFS y al 12-mes ii) y el impacto de PPAFS sobre la calidad de vida (CVRS) en pacientes con factores de riesgo cardiovascular (FRCV).

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Resultados: El 75 % de los pacientes (n = 242; 62,6 ± 8,5 años, 75 % mujeres) completaron el PPAFS (asistencia media del 84,1%.). PPAFS aumentan el nivel de AF y mejoran la CVRS ($p<0,01$). A los 12 meses, el número de pacientes físicamente inactivos sigue siendo inferior a los datos basales, el nivel de AF disminuye pero se mantienen los efectos positivos en la CVRS, especialmente en la funcionalidad física, social y componente emocional ($p<0,01$).

Conclusiones: Los PPAFS aumentan el nivel de AF y mejoran la CVRS mostrando ser un tratamiento adecuado para mejorar la salud de los pacientes con FRCV.

Palabras clave: actividad física, programa de prescripción de actividad física supervisada, prescripción, adherencia; atención primaria, la calidad de vida.

Abstract

Introduction: Physical activity referral schemes (PARS) in primary care centres increase PA level among general population. However, few studies assess PA adherence after interventions. This study aimed i) to assess PA adherence after a six-month PARS and at 12-months (after six

months of a follow-up period without intervention) ii) and to assess the impact of PARS on health-related quality of life (HRQL) in patients with cardiovascular risk factors (CVRF).

Materials and method: Longitudinal design. A total of 323 patients with ≥ two CVRF, in contemplative stage of change, from 27 Catalan primary care centres, were referred during 2010-11 to a six-month PARS (3 sessions/week of 60 minutes of moderate-intensity PA (MPA)). PA level and HRQL were analysed at baseline, at six-month and 12-months follow-up measurement, with the International Physical Activity Questionnaire (short version) and the SF-12, respectively.

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Conclusions: A six-month PARS decrease the number of inactive patients and improves PA level and HRQL. Improvements in physical functioning, social functioning and emotional component were retained up to one year. PARS seems to be an adequate treatment to improve the health of patients with CVRF.

Keywords: physical activity; physical activity referral scheme; prescription; adherence; primary care; quality of life.

Introduction

Physical activity (PA) is a therapeutic and preventive tool for numerous chronic diseases. Globally, physical inactivity causes 6% of cardiovascular disease, 7% of type II diabetes, 10% breast cancer, 10% for colon cancer and 9% of premature mortality (1). The burden of chronic diseases and its resultant cost could be mitigated through a lifestyle medicine, based on including lifestyle behaviour changes.

PA prescription and physical activity referral schemes (PARS) in primary care have been shown to be effective in increasing PA level among general population (2, 3). In Catalonia a pilot study showed that a three-month PARS based on primary care was sufficient to cause changes in lifestyle from an increased level of PA (4). Moreover, Garcia et al. have shown that PA prescription was effective in improving control of risk factors and decreasing cardiovascular risk (5).

Furthermore, health care providers are in good position to promote an increase in PA among general population. First because many individuals have contact with their physicians each year, in Catalonia, 92.7% of the population visit a health professional once a year (6); and second because health care providers are the preferred source of health information among general population (7) and patients trust them.

The Department of Sports and the Department of Health of the Government of Catalonia established in 2007 the Plan of Physical Activity, Sport and Health (PAFES) (8). The PAFES is a strategy created by the Catalan Government, whose objectives are to fight against the high levels of sedentary behaviours among the population and to promote an active and healthy lifestyle through the PA prescription from primary care professionals. The PAFES developed three programs: a) PA general counselling, b) PA prescription (healthy walking routes) and c) PARS (six-month of an exercise program, lead and supervised by a PA professional in a sport facility).

PARS was designed especially for inactive patients presenting cardiovascular risk factors (CVRF). The main objective of PARS was to get the most inactive patients to adhere to the current PA recommendations: accumulate a minimum of 150 minutes/week of moderate-intensity PA (MPA) (9).

Although several studies has shown the effectiveness of a PA intervention based on primary care, there is a lack of evidence regarding their long-term effectiveness in maintaining PA adherence after the finalization of the intervention (3, 10, 11).

This study has two aims: (i) to assess PA adherence at six-month of PARS and at 12-month follow-up (after six-months of follow-up after the completion of the scheme) and (ii) to assess the impact of PARS on health-related quality of life (HRQL) in patients with CVRF.

Material and methods

Longitudinal descriptive study based on a sample of patients from 27 Catalan primary care centres, which have been referred by their primary care physician to a PARS during 2010-11.

Participants

The inclusion criteria for PARS were inactive adults ≥ 45 years old in the contemplative stage of change (12) and with two or more CVRF: diagnosed with hypertension, type II diabetes, with a body mass index (BMI) ≥ 25 kg/m^2 and/or dyslipidemia. We excluded anyone with a medical condition that contraindicates exercise. Physicians recruited patients who met any of these criteria during their routine visits consultation.

A total of 32 groups of maximum 15 participants (N=323) of 45-80 years were referred by physicians to PARS. The participants gave informed consent to participate in the study, and both the Department of Sports and the Department of Health of the Catalan Government approved the project. This study was approved by the Clinical Research Ethics Committee of Sports Administration of the Catalan Government.

Intervention

PARS consisted in a supervised exercise program of 3 sessions of 60 minutes each weekly, combining moderate intensity aerobic activity (MPA), muscular endurance of the major muscle groups with use of equipment (dumbbells and elastic bands) and flexibility. The supervised exercise program was lead by a PA professional previously trained. Patients must pay a soft fee to participate in the program.

Measurements and follow-up

Participants were assessed at baseline, at six-months after PARS and at 12-months follow-up assessment. At baseline and at six-month of PARS, the questionnaires were self-administered and at 12-month of follow-up patients were interviewed by telephone.

The first outcome measure was the change in self-reported PA level using the International Physical Activity Questionnaire (IPAQ) in its short version and validated into the Catalan language (13, 14). The questionnaire consists of five questions on the frequency and duration of vigorous-intensity PA (one that requires hard physical effort and make you breathe much harder than normal) and moderate-intensity PA (one that requires moderate physical effort and breathe a little stronger than normal) and walking time. It allows to classify individuals according to their level of adherence to current PA recommendations: (1) do not engage in MPA, (2) <150 minutes/week of MPA or (3) ≥150 minutes/week of MPA.

Two variables were created for PA level. The first, classified subjects according to the minutes that they engage in MPA: (1) do not engage in MPA, (2) <150 minutes/week of MPA or (3) ≥150 minutes/week of MPA. A second variable was created by counting the MPA time plus the time spent walking: (1) do not engage in MPA and walking (2) performed <150 minutes/week, or (3) ≥150 minutes/week.

The second outcome measure was the assessment of the self-perceived HRQL by the SF-12 (15). It includes 12 questions and generates a health profile of eight dimensions: physical functioning, physical role limitation, bodily pain, general health, vitality, social function, emotional role limitation and mental health. It can be summarized into two summary components, physical and mental. The number of response options range from three to six and

each question is given a value which is then transformed into a scale from 0 (worst score) to 100 (best). Scores have a mean of 50 with a standard deviation of 10, so values above or below 50 indicates a better or worse health, respectively, than the general population.

Adherence to PARS was assessed using attendance list at the exercise sessions and was translated into average percentage of attendance in the program.

Data analysis

A descriptive analysis of the baseline characteristics of PA level and HRQL was run. The mean and the standard deviation were calculated in quantitative variables and percentages for qualitative variables. The normal distribution of numerical variables was analyzed using the Kolmogorov-Smirnov test. The Student t test was used for paired data in order to assess the evolution of intra-group dependent variables before and after the program, when the distribution of the variables was not normal Wilcoxon test was used. Changes in the different variables between pre-, post- and at 12 months follow-up assessment, was analysed with the Friedman test.

Statistical significance was set at $p < 0.05$. Statistical analysis was performed using SPSS version 18.0 (SPSS Inc. Released 2009. PASW Statistics for Windows Version 18.0. Chicago: SPSS Inc.).

Results

Baseline data

The level of uptake to the intervention was of 75%. Of 323 participants, 242 completed the PARS. The mean age of the sample was 62.6 ± 8.5 years (from 45 to 80 years) and females were more prevalent among the sample (74%).

Baseline data showed that some participants already reported some type of PA: 41.6% of the sample engaged in walking activity for ≥150 minutes weekly and 30.6% accumulated ≥150 minutes/week of MPA. Significant differences were found at baseline in gender and age variables. Males engaged in more MPA than females ($p=0.039$) and adults (45-64 years) were more likely to engage in MPA than older adults (65-80 years) ($p=0.038$).

Post-intervention data

Mean attendance to PARS sessions was of 84.1%. Table 1 shows pre- and post-intervention values of the variables related to PA level and HRQL. PARS increased by 39.6% the proportion

of patients who engaged in ≥150 minutes/week (p<0.001), mainly due to an increase of MPA, since no significant differences were found in walking or VPA time. At the end of the program, males were more active at MPA (86% versus 65%) than females (p=0.005). No significant differences were found between PA levels with gender, age or attendance to PARS.

HRQL increased in all dimensions, both physical and emotional summary components (p<0.01), especially in social functioning, physical functioning and in the emotional component (p<0.01) (Table 1).

Regarding dropouts, 16.5% of drop out during PARS and 7.9% were missed due to changes in contact address or non-responders (Figure 1). The main reasons for dropout were the worsening of a disease and the perception of more pain. Droppers were predominantly female, slightly younger than the average (58.9 ± 1.3years vs. 62.6 ± 8.5 years), more likely to perceive poor health (72.7% versus 60.0%) and were slightly more active than the rest of the sample (average total PA min. / week: 576.8 ± 612.1 versus 473 ± 493.6).

Follow-up data

PA adherence at 12-months was assessed in a subsample of 101 patients. After six months of follow-up without intervention, MPA decreased and no changes were observed in walking time. The number of physically inactive patients remains lower than the baseline (34.3% vs. 50%), showing a decrease of 15.7% (Table 2).

The positive effects on HRQL were retained up to six months after the finalization of the intervention, especially in social functioning, emotional component and physical functioning (p<0.05) (Table 2).

Discusion

The present study shows the first results of one of the PA prescription programs of PAFES. This study extends the knowledge on PA adherence at long-term (six months after the completion of the intervention) and the impact of a PARS on quality of life in patients with CVRF. It is important to assess PA programs based on health promotion to understand its success or failure and justify its implementation.

The three major findings of this study were that (i) a six-month PARS significantly increases PA level in patients with CVRF, (ii) adherence to PA decreases at 12-month assessment and (iii) a six-month PARS improves HRQL up to one year, especially on emotional component, social and physical functioning.

Most of the participants of the present study were females and adults > 60 years old. Those who dropped out during the intervention were predominantly females. This is in line with a systematic review showing that being female and increasing age were found to be consistent predictors of higher levels of uptake of PARS (16) and being male and increasing age were found to be consistent predictors of higher levels of adherence to PARS (16, 17).
The presence of barriers to PA practice could explain some of the reason of dropouts (18, 19). Studies showed that older adults and patients with chronic disease, the onset or worsening of a disease is a major reason for leaving and not continue with a PA intervention (17, 20) together with the feeling of not being identified with the group, feeling of being intimidated or isolated (19). The present sample may have fewer long-term adherences to PA due to their condition as patients with CVRF and their older age. Moreover, females' reasons of non-adherence were predominantly family responsibilities and lack of spousal support. It is then necessary to address barriers such as pain or the lack of motivation or social support.

The adherence to PARS (mean attendance: 84.1%) was higher than the results of a systematic review which show that 45% of participants attended at least 75% of the program sessions (16). The six-month PARS increased up to 40% the proportion of patients who accumulated 150 minutes/week of MPA. A total of 70.2% achieved the active level (≥150 minutes/week of MPA) after the completion of the intervention. No changes were found in walking time or VPA variables. These results may be explained by the high prevalence of walking habit already at the baseline assessment and the lack of including VPA in PARS' sessions because it was addressed to patients with CVRF.

Results of PA adherence at 12-month were consistent with previous random control trials and systematic reviews (3, 10, 21, 22) in showing a decrease of changes attained during the intervention. Grandes et al. also showed that physicians were effective in increasing PA level among inactive patients during the initial six-months of an intervention but its effect decline at 12 and 24 months (11).
Although PA level decreased at 12-month follow-up assessment, the percentage of inactive patients was lower than baseline (Table 2). The decrease of PA adherence at long-term may be explained by the lack of an ongoing intervention. Despite all participants were offered access to the most appropriate PA sessions within the sport facility at the end of the intervention, most of them reported willing to continue exercising only with the same group and the same PA leader. It may suggest that a six-month PARS may be not enough to maintain PA adherence at long-term if there is not continuity in the exercise groups but is effective in decreasing the number of inactive patients up to one year.
Behavioural programs tailored to specific PA barriers and motivational factors together with receiving repeated PA prescription are warranted to maintain PA adherence after PA intervention (11). More randomised control trials are needed in assessing PA adherence at long-term after a PARS in sedentary patients with chronic conditions.

Aside from health benefits from increased physical activity, PARS provide positive effects on quality of life, similar to results of previous studies (23-25). Interestingly was the retention of the positive effects on perceived physical functioning, social functioning and on the emotional component up to one year. These improvements are especially significant among elderly people. Firstly, because an improved physical functioning allows independence and autonomy in the elderly avoiding the risk of falling, considered as one of the leading causes of hospitalization and responsible for high healthcare costs (26, 27). Secondly, improvements in social functioning and in mental health may prevent elderly from the negative effects of increased risk of social exclusion and isolation (28). Taking into account that mental and social well-being is an integral and essential component of health (29) PARS may have a greater impact in chronic ill patients.

Consistent with our findings, the last results from the overall implantation of the PAFES showed a decrease of sedentary behaviour in Catalan population from 2006 to 2013, especially in the target group of PARS, females (a decrease of 20%) and adults aged 56-74 years old (a decrease of 34%) (30).

Primary care interventions based on PA are equally cost-effective than drug interventions (31) and most of the cases, could yield to more profound and sustainable gains in health than drugs (32). In addition, existing randomised trial suggests that exercise and many drug interventions are often potentially similar in terms of their mortality benefits in the secondary prevention of cardiovascular diseases and prevention of diabetes (33).

This research provides new information about PARS effectiveness in the Catalan primary care setting and it is important to consider that it was performed under real conditions with the consequent advantages and handicaps. The strengths of this study are based on the intervention itself, as it is part of a community program lead by the Department of Sports and the Department of Health of the Government of Catalonia. Furthermore, it is one of the first primary care-based PA program in Catalonia extending the knowledge of PA benefits in general population with chronic conditions.

We point out some limitations of the study. First, the use of subjective assessments may over/under-estimated results. Secondly, the use of two types of administering the questionnaires, by telephone interviews and self-administered may have influenced the validity of the response. The limited sample size and the sampling can introduce a number of biases and the results can only be extrapolated as normative to the population under study.

In conclusion, our results showed that PARS are effective and easily practicable method for increased PA and quality of life in routine primary care patients. In addition, PARS promote

increased PA in a wide part of the population who otherwise are hard to reach or have a low motivation for lifestyle changes. Future research should investigate the impact of the PAFES program on PA level from primary care providers and on patients' counselling and recruitment rates.

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Table 1 Changes in Physical activity (PA) level and Health-related quality of life, pre- and post-intervention (n=242).

Variables[a]	Pre	Post	Differences Wilcoxon Test	p[b]
Physical activity (min./week)				
Total PA	496.5 ± 491.8	519.6 ± 412.9	-2.2	0.027
Vigorous PA	41.2 ± 159.6	28.2 ± 131.4	ns	ns
Moderate PA (MPA)	154.7 ± 277.9	229.9 ± 202.5	-5.8	< 0.001
Walking	299.9 ± 324.5	261.4 ± 253.9	ns	ns
Physical activity (days/week)				
MPA	1.6 ± 2.2	3.0 ± 1.8	-7.7	< 0.001
Walking	4.1 ± 2.7	4.3 ± 2.5	ns	ns
MPA and Walking (n (%))			-5.5	< 0.001
Physically inactive[c]	40 (16.6)	9 (4.0)		
Insufficiently active[d]	27 (11.2)	12 (5.0)		
Active[e]	175 (72.2)	219 (90.9)		
MPA (n (%))			-9.7	< 0.001
Physically inactive[c]	134 (55.4)	28 (11,6)		
Insufficiently active[d]	34 (14.0)	44 (18.2)		
Active[e]	74 (30.6)	170 (70.2)		
Health-related quality of life (0-100)				
General health	47.3 ± 15.9	50.8 ± 17.1	-3.1	0.002
Physical functioning	74.0 ± 21.3	82.6 ± 22.1	-6.7	< 0.001
Role limitations, physical	73.0 ± 24.9	82.0 ± 23.4	-5.1	< 0.001
Bodily pain	68.1 ± 27.3	75.0 ± 27.6	-3.6	< 0.001
Vitality	71.7 ± 23.5	63.5 ± 22.3	-4.5	< 0.001
Role limitations, emotional	76.0 ± 23.1	83.2 ± 21.7	-4.7	< 0.001
Mental health	62.5 ± 12.7	76.6 ± 19.2	-8.2	< 0.001
Social functioning	80.6 ± 24.0	90.4 ± 20.8	-5.9	< 0.001
Physical component	68.7 ± 18.1	75.8 ± 18.2	-6.6	< 0.001
Emotional component	70.6 ± 13.3	80.3 ± 16.4	-8.9	< 0.001

[a]Data are presented as mean ± standard deviation or as numbers and percentages, [b]$p < 0.05$ [c]do not engange in PA, [d]<150 min./week of PA, [e]≥150 min./week of PA, ns: not significant.

Table 2 Changes in Physical activity level and Health-related quality of life, pre- and post-intervention and at 12-month of follow-up assessment (n=101).

Variables[a]		Pre	Post	12-month follow-up assessment	Differences x^2	p[b]
Physical activity (min./week)						
	Total PA	473 ± 493.6	533.5 ± 377.7	387.9 ± 345.5	11.3	0.003
	Vigorous PA	54.8 ± 201.3	36.0 ± 156	19.6 ± 113	8.6	0.013
	Moderate PA (MPA)	170 ± 294.3	233.1 ± 213	146.7 ± 203.3	20.0	< 0.001
	Walking	247.8 ± 235.3	243.7 ± 212.7	217.5 ± 200.2	ns	ns
Physical activity (days/week)						
	MPA	1.9 ± 2.4	3.2 ± 2.0	1.9 ± 1.8	23.2	< 0.001
	Walking	4.2 ± 2.6	4.7 ± 2.5	3.9 ± 2.6	ns	ns
MPA and Walking (n (%))					28.7	< 0.001
	Physically inactive[c]	14 (14.0)	4 (4.3)	12 (11.7)		
	Insufficiently active[d]	9 (9.0)	7 (6.5)	17 (16.5)		
	Active[e]	78 (77.0)	90 (89.1)	72 (71.8)		
MPA (n (%))					30.3	< 0.001
	Physically inactive[c]	51 (50.0)	19 (18.5)	35 (34.3)		
	Insufficiently active[d]	19 (19.0)	14 (14.1)	28 (28.2)		
	Active[e]	31 (31.0)	68 (67.4)	38 (37.9)		
Health-related quality of life (0-100)						
	General health	48.8 ± 18.0	48.6 ± 15.7	48.8 ± 16.2	ns	ns
	Physical functioning	73.0 ± 20.8	78.5 ± 23.4	82.8 ± 21.0	18.2	< 0.001
	Role limitations, physical	75.6 ± 23.7	76.6 ± 24.8	80.5 ± 25.5	ns	ns
	Bodily pain	67.0 ± 27.4	70.4 ± 27.4	70.4 ± 29.3	ns	ns
	Vitality	65.3 ± 23.0	67.6 ± 23.1	68.0 ± 24.5	ns	ns
	Role limitations, emotional	76.5 ± 24.5	80.0 ± 22.2	84.2 ± 23.0	7.5	0.024
	Mental health	69.3 ± 22.2	76.4 ± 19.0	76.0 ± 21.0	14.3	< 0.001
	Social functioning	80.6 ± 24.0	91.0 ± 20.2	90.4 ± 20.0	26.4	< 0.001
	Physical component	48.7 ± 13.8	50.1 ± 14.3	52.0 ± 14.0	ns	ns
	Emotional component	55.3 ± 13.0	60.0 ± 12.0	59.0 ± 13.0	18.3	< 0.001

[a]Data are presented as mean ± standard deviation or as numbers and percentages, [b]p <0.05, [c]do not engange in PA, [d]<150 min./week of PA, [e]≥150 min./week of PA, ns: not significant

4. MAIN RESULTS

This section presents the main results of the three studies, starting with the results of the population surveys of the Catalan population (paper I) and the Catalan physicians sample (paper II), followed by the results from the paper III, which assess different outcomes of the PA referral scheme in the Catalan context.

Catalan Population survey (study I)

Sample description

The study population consisted of 1595 individuals aged 18-70 years old. The mean age of the subjects was 41.1 years (SD 15.1) in ENCAT 2002-03.

In ENCAT 2002–03, the theoretical sample size was set at 3300 individuals, taking into account an anticipated 70% participation rate, which would result in a sample of approximately 2310 individuals. Finally, 2160 individuals (participation rate 65%) aged 10 to 80 years participated in the ENCAT 2002–03 study (Ribas-Barba et al., 2007). For this study only was used the sample between 18-70 years old (n= 2060).

Health-Enhancing Physical Activity Level (HEPA)

According to the HEPA level, 76.7% of Catalan population were physically active, 37.9% and 38.8% reported that they engage in high and moderate levels of PA respectively. From the sample 23.3% were classified as inactive. Although the HEPA level was similar for both genders, there were differences in terms of PA intensity, being females more active at moderate levels and males at higher levels.

The HEPA level were associated to young adults (18-34 years old), unemployed, single marital status, living with a partner as a family life, living in small-sized town and having a normal-weight. After adjusting for all socio-demographic variables, being young (odds ratio = 2.0; 95% confidence interval = 1.25–3.21) and having a normal waist circumference weight (odds ratio = 1.46; 95% confidence interval = 1.04–2.03) predicted high HEPA level.

Those not reaching the HEPA level were found among middle-aged adults, obese individuals, white-collar workers, housewives, married individuals, those with children and those living in villages.

Leisure Time Physical Activity (LTPA)

Regarding LTPA, 55.6% were sedentary during leisure time and 16.1% were highly active. Highly active LTPA were associated with males, young adults, high education level, unemployed, single individuals, those living with a partner, those having normal weight and occasional smokers. After adjusting for all socio-demographic variables, being male (odds ratio = 2.15; 95% confidence interval = 1.70–2.72), individuals with a normal waist circumference (odds ratio = 1.54; 95% confidence interval = 1.18–2.02), living with a partner (odds ratio = 1.59; 95% confidence interval = 1.16–2.06) and being non-smoke (odds ratio = 1.42; 95% confidence interval = 1.11–1.82) predicted highly active LTPA.

The most sedentary groups during leisure time were females, especially housewives, middle-aged adults (35-54 years old), those with low education level, married individuals, those having children, underweighted and obese individuals, and current smokers.

Some groups of Catalan population showed both overall physically inactivity and during leisure time sedentary behaviour. These groups, most needed of PA interventions, were middle-aged adults, housewives, obese individuals, married individuals and those having children.

Other groups presented differences in both PA variables. While females and males were overall physically active at the same level, significant differences were found in LTPA variable: 63.1% of females presented sedentary behaviour during leisure time vs. 46.4% of males. In education level variable existed also this difference. There was no significant difference between categories within education level in HEPA variable but in LTPA variable. Those individuals reporting high education level were most active during leisure time than those with low level of education (21.6% vs. 6.7%).

Physical Activity and Obesity index

Regarding obesity (data not shown), higher levels of HEPA were related to lower BMI (up to 0.93 kg/m^2) and lower central obesity (3.36 cm in females and 4.3 cm in males). This tendency was also found when evaluating PA during leisure time: the active group had lower BMI (up to 1.9 Kg/m^2) and lower central obesity (up to 8.72 cm in males and 7.42 cm in females) compared to the sedentary group.

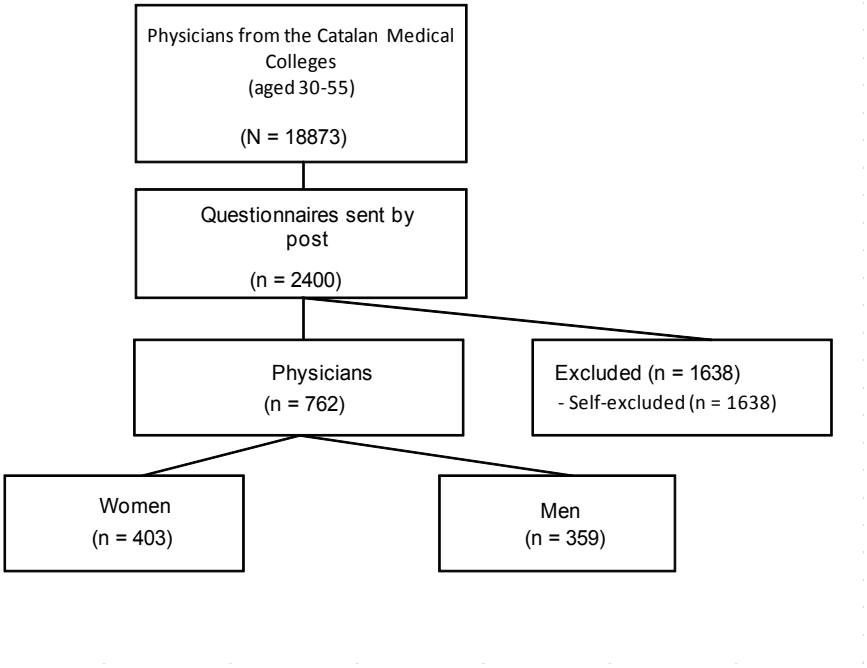
High BMI was most prevalent among males, those with low education level, housewives, blue-collar workers and older adults (55-70 years old).

Individuals with low education level and housewives were two target groups to address PA intervention considering at cardiovascular risk at presenting high prevalence of sedentary behaviour and overweight and obesity.

Catalan Physicians' survey (study II)

Of the 800 expected returns, 95.5%, n=762 responded (403 women aged 43.5 ± 6.8 years old; 359 men aged 46.2 ± 6.3 years old) and were analysed (Figure 1). The response rate was about 31.5%, only one out of three of those who received the questionnaire returned it completed. It should pointed out that the response rate can be considered high for a survey sent by mail, even more if one keeps in mind that the questionnaire was relatively long and addressed to a group with very little time to spare.

Figure 1. General scheme. Flow of the selection process of participants.



Sample description

88.3% of surveyed physicians reported having a medical specialty. The most prevalent specialties were those related to primary care (32.8%), medical-biomedical (26.7%), medical-surgical (17.5%) and surgical (9.6%). 43.3% reported working in the public sector, 22.1% in the private sector and 34.6% in both sectors.

Almost all physicians reported a positive perception of general health and have a positive mental health (Figure 2). However, 36.4% reported a BMI ≥25kg/m^2; 31.6% overweight and 4.7% obese, with a higher percentage of overweight and obesity among males (56.9%) over females (18.2%) ($p < 0.01$), (Figure 3). In relation to smoking habits, almost all physicians (80.5%) reported not smoking habits (Figure 2).

Figure 2. Health status and health-related behaviours within Catalan physicians.

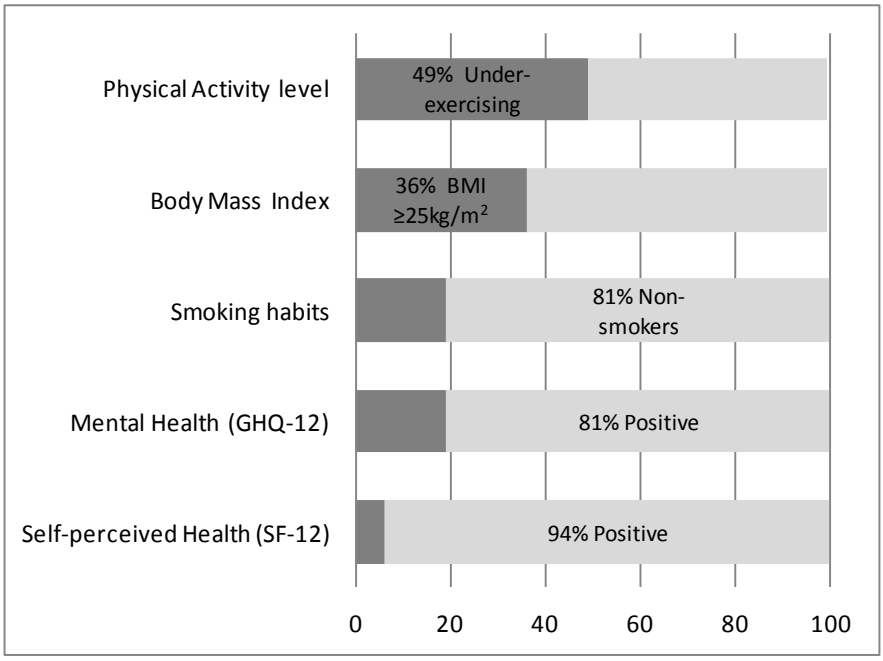
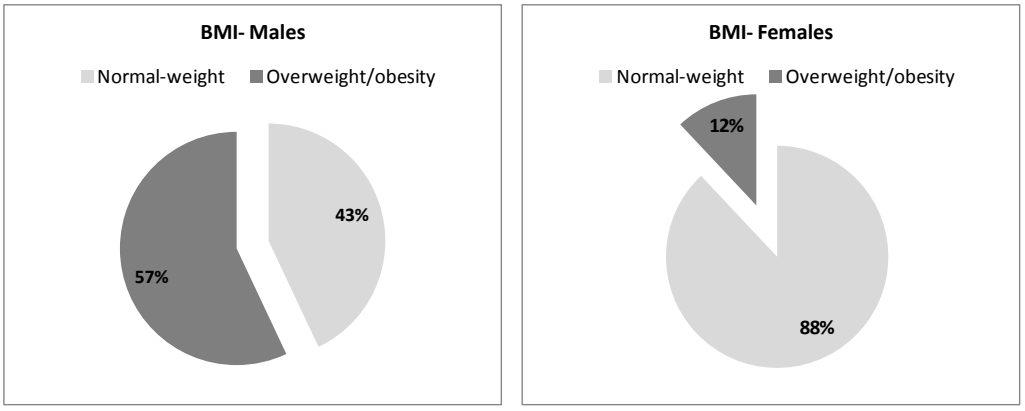


Figure 3. Body mass index (BMI) in relation to gender.



Physical Activity level

In relation to PA level, 79.8% of respondents reported walking and 54.9% reported performing some type of PA in the previous two weeks. The average weekly minutes for walking were 122.5 ± 154.5 and of PA were 446.1 ± 981.1 minutes/week. Average MET min/week were (i) walking, 416.8 ±612.9; (ii) PA, 2525.2 ±5832.8; (iii), overall PA (including walking and sports) 2942.0 ±5930.9.

Beyond walking, the most common types of PA were PA in a fitness centre, cycling, swimming and running (Table 1).

Table 1. Participation in Physical Activity[a]

Physical activity (PA)	n	%
Walking	608	79.8
PA in Fitness center	148	19.4
Cycling	86	11.2
Swimming	75	9.8
Running	50	6.6
Gardening	40	5.2
Tennis	39	5.1
Yoga, tai chi	26	3.4
Skiing	35	4.6
Dancing	27	3.5
Hiking	17	2.2
Others[b]	99	13.0
Total	762	100

[a] Participation in the last 15 days. [b]Lower rates of types of physical activity have been grouped.

When we examine the most prevalent PA type among women and men physicians beyond walking activity, we found the follows. The most prevalent PA type among women was PA in Fitness centre, swimming and dancing. Within men, the most prevalent were exercising in Fitness centre, cycling and running. Differences in participation due to gender were found. While yoga and tai chi was more practised by women, football and tennis were more frequent within men (Table 2).

Table 2. Participation in Physical Activity according to gender[a]

	Men		Women	
Physical activity (PA)[a]	n	%	n	%
Cycling	45	5.9	17	2.2
Dancing	0	0	25	3.2
Football	14	1.8	1	0.1
Gardening	22	2.9	18	2.3
Hiking	9	1.1	8	1.0
PA in Fitness center	55	7.2	95	12.4
Running	37	4.8	13	1.7
Skiing	24	3.1	15	1.9
Swimming	30	3.9	45	5.9
Tennis	30	3.9	9	1.1
Walking	285	37.4	323	42.3
Yoga,Tai chi	3	0.4	23	3.0
Others[b]	207	27.1	187	24.5
Total	762	100	762	100

[a] Participation in the last 15 days. [b] Lower rates of types of physical activity have been grouped.

Almost half of respondents (49.3%) met the PA recommendations, 38.5% were under-exercisers and 12.2% were sedentary. No significant differences were found between PA levels for gender, medical speciality, family structure, number of acknowledged health problems. Physicians reaching PA recommendations were those aged between 45-55 years, those with a primary care or medical-surgical medical specialty and those who work in the private sector.

The most physically active physicians

The proportion of more physically active physicians were found among those who work in private sector in compared with those working in public or both sectors and those who work in private practices, in compared to physicians who work in primary health care centres or hospitals (Figure 5). Physicians who reported no having children were more active than those who had children (Figure 4). PA level were influenced by health-related variables. There was greater compliance with PA recommendations for physicians who reported a healthy weight, a positive general health self-perception and mental health. Smokers were slightly more active than non-smokers (Figure 6). Physicians who reported having leisure time reached in a greater proportion the recommendations than those who reported having never leisure time (Figure 7).

The most sedentary physicians

The most sedentary physicians were those who reported a poor self-perceived general health (25.0%), obesity (27.8%) or smoking habits (19.1%) (Figure 6).

Figure 4. Physical activity level in relation to demographic-related variables.

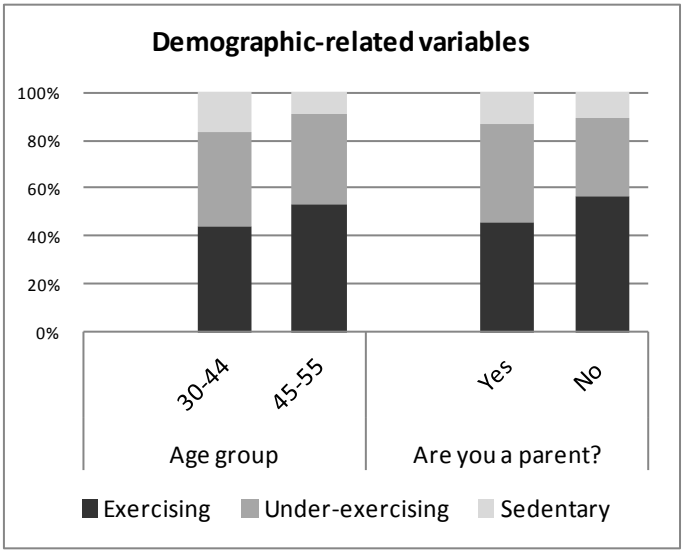


Figure 5. Physical activity level in relation to work-related variables.

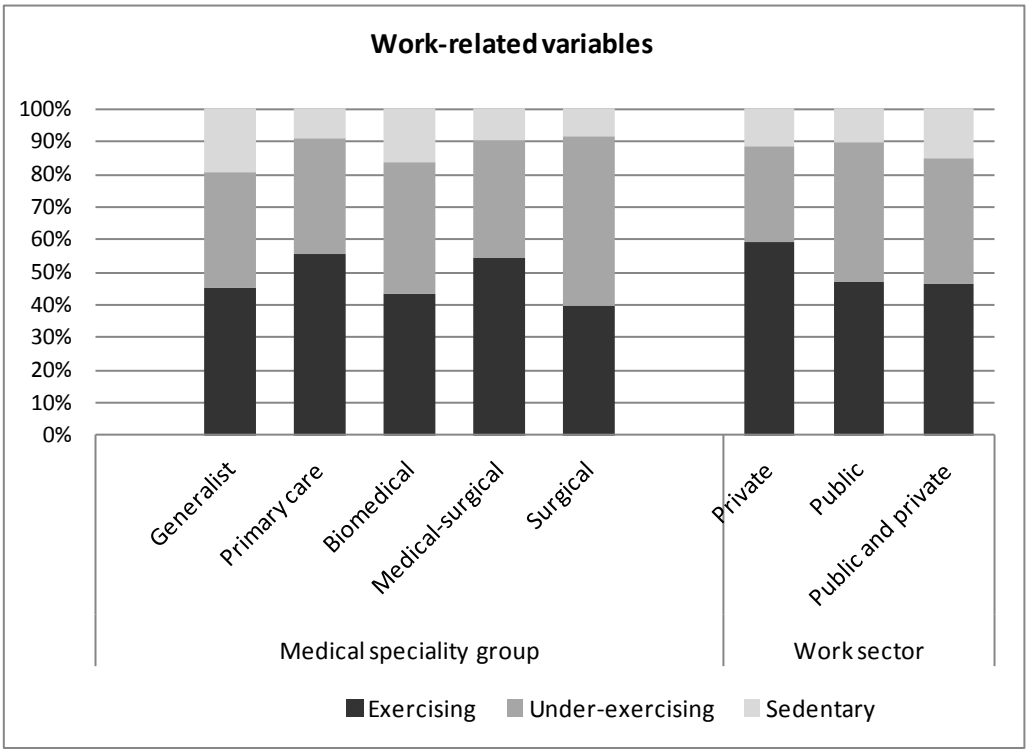


Figure 6. Physical activity level in relation to Lifestyle/health-related variables.

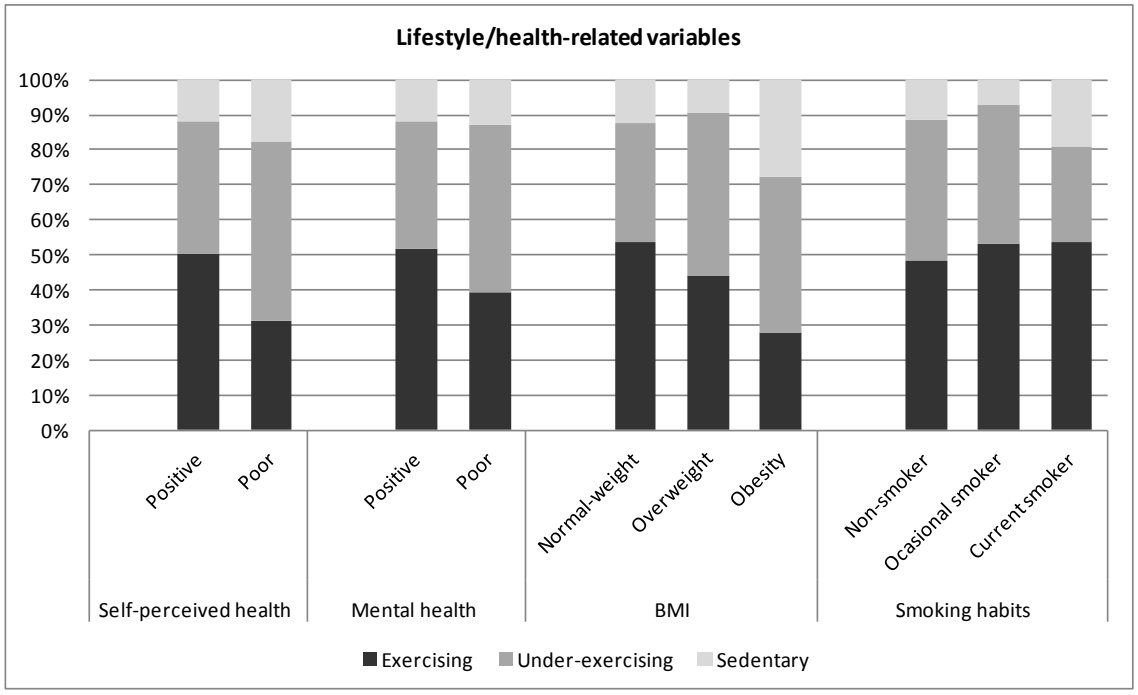
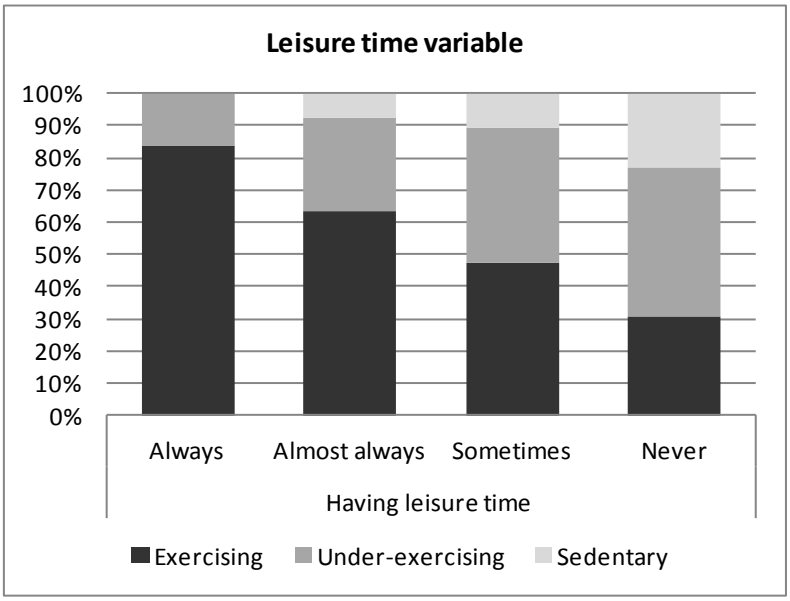


Figure 7. Physical activity level in relation to Leisure time variable.



Lifestyle risk factors

While 27.4% of physicians did not present any lifestyle risk factors (LRFs), 72.6% presented one or more from under-exercising, BMI ≥25kg/m^2 and a current smoking habit. The most common LRF among physicians was physical inactivity (24.1%) and the combination of under-exercise plus BMI ≥25kg/m^2 (17.5%).

After controlling for demographic and health-related data, under-exercising was best predicted by being aged 30 to 44, working in the public sector, having a BMI ≥25kg/m^2 and poor mental health. For BMI ≥25kg/m^2 the best predictors were being male, aged 45 to 56, under-exercising, having one or more chronic diseases and self-reporting 'poor' health status. Males were three times more likely than females to present the combination of under-exercising and a BMI ≥25kg/m^2 (OR=3.38; 95% CI=2.31-4.95) ($p<0.01$). Furthermore, those who perceived 'Poor' health status were three times more likely to have both LRFs (OR=3.61; 95% CI=1.88-6.94) than those who perceived positive health status ($p <0.01$).

Physical Activity Referral Scheme in Catalan context (study III)

This study is part of the national program "Plan of Physical Activity, Sport and Health" which implemented the PA prescription in Catalan primary care centres. The present results are from assessing one of the programs, the impact of PARS on PA adherence and on HRQL in primary care patients with CVRF.

27 primary care centres of different regions of Catalonia participated in the study during 2010-2011. Primary care physicians and referring nurses were responsible to identify and refer those patients with CVRF most needed of a supervised PA program. The patients were referred prospectively during 12 months in 2010-2011.

The procedures of collecting and processing data were performed by the researcher with the collaboration of sports sciences' students trained for taking part of the study. All patients answered a self-administered questionnaire before beginning the PA program (at baseline) and at 6 months (at the end of the PA program). At 12-month (six months of follow-up without intervention), patients were contacted by telephone to be interviewed to answer the questionnaire.

Population characteristics

During the period 2010-2011, 44 groups received PARS. Most of PARS began in September-October and others started in February-March. Sometimes the recruitment of patients was difficult for physicians and PA programs started months later.

323 patients were referred and 242 completed the PARS. The level of uptake to the intervention was of 75%.

Three quarters (74%) of the patients receiving PARS were female. The mean age of the sample was 62.6 ± 8.5 years old, being the youngest 45 years old and the oldest 80 years old. More than a half (55.4%) were aged between 45-64 years, 37.2% were aged between 65-74 years and 7.4% were aged between 75-80 years. PARS were during 2010-2011 more established in primary care centres from the north region of Catalonia than in central or south regions.

Physical Activity level at baseline

At baseline, a questionnaire was self-administered at the sport facility during 20 minutes during the first session of the PA program. When we asked the patients to recall PA in the past 7 days or a "normal week", a high proportion of patients already engaged in walking activity. Baseline data showed that 41.6% of the sample engaged in walking activity for ≥150 minutes weekly and 30.6% accumulated ≥150 minutes/week of MPA.

Significant differences were found at baseline in gender and age variables. Males engaged in more MPA than females (p=0.039) and adults (45-64 years) were more likely to engage in MPA than older adults (65-80 years) (p=0.038).

Adherence to the Physical Activity Referral Scheme

Participants had a high adherence to the sessions of the supervised PA program, with a mean attendance of about 84% of the total sessions.

Of the total referred patients, 16.5% dropped out during the PARS. The main reasons for dropout were the worsening of a disease and the perception of more pain. Droppers were predominantly females, slightly younger than the average sample (58.9 ± 1.3years vs. 62.6 ± 8.5 years), more likely to perceive poor health (72.7% versus 60.0%) and were slightly more active than the rest of the sample (average total PA min. / week: 576.8 ± 612.1 versus 473 ± 493.6).

During the follow-up, 7.9% of patients were missed due to telephone problems and changes in contact number.

Physical Activity Adherence at short-term

After the six months of PARS, 44% of patients increased their PA level and 70% achieved the HEPA level (p<0.001). The mean minutes of total PA per week was 520 minutes. The most increased activity was the MPA, but not the VPA or walking activity. Patients increased the frequency of PA, being active at moderate level at least 3 days a week compared to 1-2 days at baseline. The number walking days did not change over the PA program, showing that patients did not lose the walking habit. Patients regularly walk during the week at least 4 day a week.

Males were more active at MPA (86% versus 65%) than females (p=0.005). No significant differences were found between PA levels with age or attendance to the program.

Physical Activity Adherence at long-term

Of 242 participants who agreed to take part in the present study, 101 (78% of females) were followed six months after the finalization of the program, at 12 month, to be interviewed.

Patients at 12-month differed from baseline, by being more active at MPA (34.3% inactive and 38% regularly active at 12 month vs. 50% inactive and 31% regularly active at baseline) ($p<0.001$). Walking time did not change over the six of months follow-up without intervention, meaning that patients maintained their walking habit. However, PA level at moderate intensity decreased during this six months without intervention.

During the telephone interview patients were asked about the satisfaction of the program and the possibility to continue the supervised PA program. The majority were highly satisfied with the program and leader group; 75% of patients reported willing to continue exercising. While most of them express willing to exercise with the same group and PA leader in the sports facility, 21% of patients reported willing to exercise in a next future. The main barriers were perceiving pain, having chronic conditions, lack of time or family obligations, and the economical cost of the sport facility.

Health-related Quality of Life (HRQL)

In general, all dimensions of HRQL, both physical and emotional summary components, improved significantly during the six months of PARS ($p<0.01$). The most improvements were found in the emotional component, especially in self-perceived mental health; and in the physical component, particularly physical and social functioning. The self-perception of general health was the less improved component.

At long-term (at 12 months), the positive effects on HRQL were significantly retained, especially the self-perceived mental health, social functioning and the physical functioning ($p<0.05$).

5. GENERAL DISCUSSION

The behaviour of individuals, communities and populations is one of the major determinants of their health outcomes. This thesis presents the findings from three research projects related to the need of health care systems to focus in health behaviour change related to PA to manage the current burden of chronic diseases.

This set of studies set out to investigate the adherence to the current physical activity recommendations in Catalan population, which appears to support low levels of inactivity in Catalan adults that add an avoidable burden to the nation's Public Health system. This was undertaken because existing work in Spain – consistent with that in many other countries - has been based on isolated studies, conducted under different policies and through different economic circumstances. Three studies were conducted with the collective aim of exploring adherence to physical activity in the Catalan population and in Catalan physicians and to assess the outcomes of a primary care-based programme to promote PA in Catalonia. Collectively this work focuses on different and important facets of the challenge that underpins the promotion of behaviour change in adults (Spring et al., 2013). The main findings of the studies were (i) high adherence to HEPA level by Catalan population but high prevalence of sedentary leisure time, (ii) poor lifestyle behaviours related to physical inactivity and overweight among Catalan physicians and (iii) the effectiveness of a PA referral scheme, promoted by the PAFES plan on PA adherence, and associated improvements in quality of life of primary care patients. Taking each of these in turn, the Discussion will address how they link to existing literature, while also reflecting on the strengths and limitations of this evidence.

Physical Activity adherence in Catalan population

Population health surveys can provide wide information on health status and on health-related behaviours that help to plan new strategies and approaches to behaviour change. Most of surveys in Catalonia assessing PA level use descriptive questionnaires or classified individuals according intensities or PA levels. Study I differs from others surveys in Catalonia by using the IPAQ and classifications based on HEPA recommendations.

Given that the sample is representative and that IPAQ has acceptable validity, findings from study I can be generalised to Catalan adults, with regard to (i) level of adherence to the current PA recommendations and (ii) associations between the study variables and respective categories of PA.

The main findings pointed out that a considerable proportion of Catalan respondents adhered to the recommended HEPA level, but half were sedentary during leisure time. Data show that Catalans, as in other developing countries, are often active in domains such as active commuting, during occupational time or household chores activities. This is consistent with findings from other studies (Bauman A et al., 2009; European Commission, 2010), showing that Spanish population were more likely to exercise outdoor and during active commuting. It suggests that countries with an infrastructure (for example: connected streets, mixture of land uses or residential density) and/or culture that support walking can achieve high levels of PA through this specific single mode. However, compared to other countries, Mediterranean countries are less physically active than Nordic countries such as Finland, Norway or Denmark (Makinen et al., 2012), where there may be more promotion on sports and PA. This is in line with the results of the current study, showing the relatively low prevalence of PA during leisure time in Catalans.

Regarding the associations between certain socio-demographic and health-related variables with PA, the most active were young adults and those presenting normal weight. Consistent with existing literature were the positive association between being young and high PA level (Guthold, Ono, Strong, Chatterji, & Morabia, 2008; Bauman A et al., 2009) and the association between low levels of PA and obesity (Norman, Bellocco, Vaida, & Wolk, 2002; Bergman, Grjibovski, Hagstromer, Bauman, & Sjostrom, 2008). Present findings also support the association between active leisure time with gender and education level, being the most active males and those with high education level.

The target population to increase Physical Activity level

Physical inactivity is one of the seven important factors that contributes to cardiovascular health, together with smoking, diet, BMI, blood pressure, blood cholesterol and fasting blood glucose (Lloyd-Jones et al., 2010). It is important to target those groups in Catalan population that present some of these factors. Based in our study, those most needed of health behaviour changes were those presenting low levels of PA and high BMI. PA interventions should especially target housewives, obese individuals, middle-aged adults and those with low education levels in Catalonia. Other groups would also benefit from increased PA, including people who reported being married and those who reported having children. It is likely that these groups have both shared and distinctive barriers to adopting PA. These barriers need to be identified and then targeted in new interventions.

Regarding gender, males and females presented similar overall PA levels, but females were mostly sedentary during leisure time. Similar to previous results, females and especially housewives may achieve their high activity levels by through completing household chores, active commuting or occupational time rather than through leisure time activities (Dong, Block, & Mandel, 2004; Jacobi et al., 2009). Catalan females were more likely to be physically active in modes characterised by light and moderate intensities rather than vigorous intensities. Compared to males, females may have more barriers to engage in PA linked to lack of time arising from extensive and prolonged domestic obligations. Findings from study III indicated that PARS issued by physicians and nurses are more likely to be welcomed by females, which suggest their responsiveness to further approaches about becoming more active.

Obese individuals are an important population group to target due to the association with overall lower levels of PA and sedentary behaviour during leisure time. Similar findings were reported in other studies (Ball, Owen, Salmon, Bauman, & Gore, 2001; Trost et al., 2002). Most obese individuals may have substantial barriers for engaging in PA. Moreover, our results showed that obese were more likely to exercise at moderate intensity than at vigorous intensities. The high prevalence of low levels of PA in obese individuals pointed out the necessity to develop different PA interventions to support obese individuals. An important starting point may be to start by reducing sedentary behaviour rather than by increasing PA.

Replacing sedentary activities for light intensity activities of daily life will increase energy expenditure and be more easily adopted and maintained than structured exercise programmes. These issues highlight the sensitivity of promoting PA with obese groups.

The age-related decline in PA was also observed in the present study as previous literature (J. F. Sallis, 2000; Trost et al., 2002). However, in our study, middle-aged group was more sedentary than older adults and also presented higher index of overweight; concurrent with the age period of the onset of chronic diseases. Certain life events may be a contributing factor to the low PA level during this age period (Engberg et al., 2012). For example, lack of time due to new career opportunities, occupational time pressure or caring for growing family could disrupt a persons' daily routine decreasing PA habits. In women, life events such as marriage, childbirth, stressful events such as divorce, harassment at work are associated with PA changes (Brown, Heesch, & Miller, 2009). In contrast, during retirement older adults increase their PA levels. This can explain the low levels of PA in middle-aged adults and the increasing PA in older. Considering this as critical period, promoting healthy lifestyle in this target group could be a challenging strategy. Based in the results of study III, middle-aged were low prevalent in PARS interventions. Specifically tailoring PA interventions in primary care for those under 55 years old could increase their retention, through deployment of age-sensitive approaches. Otherwise, counselling on how to integrate PA at daily life or during leisure time could be considered, for example counselling on healthy walking routes. The PAFES program has developed about 677 healthy walking routes in 207 Catalan towns. Further, undertaking qualitative studies to improve understanding about why PARS is not as successful for this group, could lead to the development of more appropriate interventions.

On the other hand, significant events or transition points in people's lives present an important opportunity for intervening at some or all of the levels, because it is then that people often review their own behaviour and contact services.

Both married individuals and those reporting having children are target groups for increasing PA. Each group is likely to have more time constraints, such as limited time due to children care giving, than their unmarried and childless counterparts. Considering the influence that parents exert on their children's PA behaviour, interventions to target families can be important to impact on the PA levels of both adults and children. Physically active parents influence PA levels of their children (J. F. Sallis, Prochaska, & Taylor, 2000). Moreover, within

the family, as social networking suggests, socially connected individuals, such as married people, can have unintended health effects on others (Christakis N.A., 2004). Health care providers, such as physicians, referring nurses and paediatricians, can target these groups and promote strategies such as active leisure time during weekend or active commuting to and from school. Equally, it is important to consider how individual preferences differ and different external factors create their impacts.

Individuals with high education level are higher active in leisure time than those with lower education level, as previous studies showed (Finger, Tylleskar, Lampert, & Mensink, 2012; Makinen et al., 2012). This association may be influenced by vigorous work activity, which supports the hypothesis that low-socioeconomic groups are less physically active in their leisure time because they are more likely to be physically active during occupational time. In addition, the prevalence of overweight and obesity in individuals with low education level, can act as a barrier to engage in LTPA. This relation might partly explain the education disparities in LTPA. While Marmot (The Marmot Review Team, 2010) has shown that a social gradient of disease exists across societies, with the lowest socio-economic groups experiencing the highest levels of illness and disease, these data suggests that a profile exists within specific social strata. Strategies for reaching and working with disadvantaged groups and the health equity implications should be addressed.

Other relation was found between work status and LTPA. The most active during leisure time are mostly sedentary during their occupational time. This may be an intentional counter-balancing behaviour. Certainly, many white-collar workers would formerly have completed their roles more actively. Taking into account the recent evidence on the negative effects of too much sitting time (Hamilton et al., 2008; Katzmarzyk et al., 2009; Owen et al., 2010), interventions to increase PA level should be promoted alongside strategies to reduce sedentary time in these groups. Raising awareness on the importance of an active lifestyle should be promoted among general population to show that not only engaging in PA during leisure time is enough to achieve great benefits for health. For example, exercising at work is linked with improved work performance and mood, being an important task for businesses to provide facilities for staff to exercise (Coulson, McKenna, & Field, 2008).

Given the high proportion of persons employed in low activity occupations, effective method for promoting workplace activity may include incentives for walking or biking to work and creating more activity-friendly work environments, or placement of point-of-decision prompts to encourage stair use instead of elevator or escalator (Kahn et al., 2002).

Regarding the high prevalence of sedentary behaviour during leisure time and the high prevalence of overweight and obesity in Catalonia, many individuals have considerable potential to improve lifestyle, potentially facilitated by the help of their physician. The results from the population survey highlight the importance of PA promotion in general population, especially during leisure time and in the target groups.

Physical Activity promotion in primary care: The role of physicians

There is growing evidence to indicate that health systems have significant potential to change health behaviours and improve health. It is in addition to the potential for specific programmes and interventions delivered by health professionals to have a positive impact on health behaviour and health outcomes.

PA counselling in primary care is an important approach to target these under-active and health needy groups. The effectiveness of PA counselling is highly dependent on the health care providers and their own behaviours. Physicians with positive health behaviours, such as those who regularly exercise were more effective in PA counselling than those who presented poor health behaviours (Abramson et al., 2000; Frank et al., 2000; Lobelo et al., 2009; Frank et al., 2010).

The study II expands the understanding of the lifestyle-related behaviours of a sample of Catalan physicians, paying special attention to their adherence to current PA recommendations. These physicians represent the core of the Catalan health care system and their well-being reflects not only its processes but also its outcomes. It is important to point out that the study II reached almost all the expected sample and it is representative of the population of Catalan physicians. The current sample size of 762 compares favourably with similar international studies; 298 in the US (Abramson et al., 2000), 735 in the UK (McGrady et al., 2007) and 496 in Switzerland (Cornuz, Ghali, Di Carlantonio, Pecoud, & Paccaud, 2000).

The main findings of study II pointed out (i) the low compliance with PA recommendations by Catalan physicians and (ii) the high prevalence of overweight and obesity among male physicians. The low compliance with PA recommendations by Catalan physicians may negatively influence the PA promotion that, in turn, influences – or fails to influence - patients' health. Previously, physically inactive physicians reported lower counselling compared to their physically active counterparts (Frank et al., 2010). Physicians who do not exercise sufficiently may not present positive role modelling of behaviour, self-discipline or commitment that supports regular PA (Frank et al., 2000). In our sample, contrary to findings in the general population, young physicians exercise less than those who were older than 45 years. This finding suggested that younger physicians may have more time limitations and have more unstable lifestyles than their older colleagues. Given their visibility and the influence of their behaviour on both their promotional activities and their modelling effects on patients, it makes good public health 'sense' to help them to increase their PA level and overcome PA barriers.

The low compliance with PA recommendations in our sample could also have a negative impact on the population. Social networking suggests that health improvements in one person can spread to others. Medical interventions may be cost-effective due to the impact to patients' health plus patients' social environment (Christakis N.A., 2004); (Christakis & Fowler, 2007). More of the Catalan population could benefit from medical intervention and achieve higher health standards, if more Catalan physicians were more active, which would lead them to promote lifestyle medicine more readily. With every Catalan physician handling around 1500 patients, these 370 under-exercising and sedentary physicians may be offering a less than optimal service regarding lifestyle counselling to more than 555,000 patients (Government of Catalonia, 2009b). Furthermore, this number will be extended by including physicians who exercise, but who do not currently promote PA because of the range of barriers that limit delivery and impact in most health care systems.

The high prevalence of overweight/obesity among Catalan males' physicians may also undermine the credibility of lifestyle messages they do deliver. However, this may not be a uniquely Catalan concern; these levels of overweight/obesity were similar to those found in EU physicians, where overweight/obesity prevalence among males' physicians was also high (Ajani et al., 2004; Peckham C., 2012). Previous literature has shown that physicians with overweight or poor personal habits are less likely to counsel patient about healthy lifestyle (Reilly, 2007). Moreover, patients have less confidence in the advice of physicians that are overweight than of physicians with healthy weight (Wells, Lewis, Leake, & Ware, 1984; Abramson et al., 2000; Reilly, 2007). Patients may also perceive overweight/obesity as being less unhealthy when they see it in their own physician or in large groups of physicians. These results could be related to the results of the study I, which showed a high percentage (50.2%) of overweight and obese individuals in Catalan adult population. When physicians present themselves with a high BMI this is associated with low levels of patient counselling about lifestyle, while what these physicians say about lifestyle holds low credibility for patients. Further, with many overweight physicians, this may implicitly promote the idea that overweight is normal. Counselling on overweight prevention and management should be more promoted in routinely visits in primary care centres.

Regarding healthy habits, Catalan physicians were characterised by a good level of self-perceived health and low prevalence of smoking. When we compared the physicians to general population, physicians presented better health status (Generalitat de Catalunya, 2006b) and less smoking habit than the population (33.3% smokers in general population versus 19.3% smokers in physicians). However, about 73% of Catalan physicians presented at least one modifiable LRF. Study II also extends previous work by showing the most common LRFs among physicians, their combinations and their predictive factors. Unsurprisingly, overweight and under-exercising were linked and the most common; multiple unhealthy behaviours were also commonly combined. While older physicians were more likely to present overweight/obesity, younger physicians under-exercised. Further, physicians working in public sector were more likely to under-exercise but were not overweight. Being male and reporting "poor health" were the strongest predictors for both under-exercise and obesity and are a target group to promote health-related behaviours.

Compared to the low prevalence of smoking behaviour among physicians, which is supported by smoking cessation counselling, the current data confirm that a more active approach is needed to promote PA and healthy weight among Catalan physicians, especially males. Smoking cessation message is recommended to be systematic and repetitive in every visit, but no protocols regarding PA counselling were established in Catalan primary care. Before the implementation of PAFES, physicians counselled on PA when they deem it appropriate and at least once every two years (Health Department, Catalonia). It is important to raise awareness of the priority of PA counselling during regular visits. Physical inactivity and smoking have similar population attributable risks (Wen & Wu, 2012), so PA counselling can be promoted at the same level as smoking counselling. Further, with recent data showing that PA has comparable effects as many widely prescribed drugs (Naci H & PA Ioannidis, 2013) there is a strengthening economic argument for promoting PA more widely and regularly.

The implementation of the PAFES program in 2007 confirmed that PA promotion is a "vital sign" in patients' routine health screening. In PAFES, promoting the PA assessment is part of the routine. PAFES raise awareness among primary health professionals on the importance of the substantial improvement on the outcomes for many chronic health conditions by increasing PA levels. Given the prominence of inactivity, and low levels of PA, discussion about PA should be treated as a priority during health-care visits, although it must be recognised that barriers such as time limitations and competing demands may influence the exact nature of forms of these discussions.

The findings from the study II are relevant to managers of health care systems for different reasons. First, to identify the best profile of PA promoters; this is important because healthy staff attend work more regularly and they counsel more regularly and effectively on healthy lifestyle habits than their inactive counterparts (Frank et al., 2000). Compared to females, male doctors were six times more likely to be overweight and were three times more likely to present the combination of under-exercising and overweight. Our findings suggest that females' physicians are more likely to support the most optimal lifestyles. Results from a recent study of Galatea Foundation showed an increasing feminization of the medical university population, with women contributing 75% of the sample of Catalan medical students (Fundació Galatea Working group, 2012). It suggested that in the next future more females' physicians will be working in this sector.

Second, these findings can help managers to target the groups of physicians most in need of PA interventions. It is clear that not all physicians practice what they may (or may not) preach, especially male physicians where overweight/obesity is also common. The current data confirms that a more active approach is needed to promote PA among physicians and healthy weight in males. The Galatea Foundation, created in 2001 by the Catalan Medical Council, aimed to encourage healthy lifestyles among health professionals through different health promotion programmes. This study emphasises the necessity for including programmes to increase and maintain PA habits in those most needed physicians through the Galatea Foundation.

Although these data relate to the Catalan system, they align with results from studies from other countries, which suggest, above all, that physical activity is often difficult to maintain in adult life, irrespective of country of residence. Previous literature within US or EU physicians' population, showed similar PA level or slightly higher than the Catalan physicians (Livaudais et al., 2005; McGrady et al., 2007). This could be related to the use of different questionnaires or differences in the Health care systems. Moreover, similar levels of overweight/obesity were found in US physicians, including notably high levels among males (Ajani et al., 2004). The most unhappy of US physicians also combined poor self-rated health, little exercise and obesity (Peckham C., 2012). This study confirms that the value of such case studies; the specific often illustrates the general. Further, these are all issues that influence current moves toward global management of non-communicable disease.

The current data, which coincide with those from studies from other countries, justify the need to carry out programmes aimed at engaging physicians in healthy and active lifestyle as a strategy. This will not only improve physicians' own health but also have a possible knock-on effect for PA levels in the general population. Increased PA among physicians may be a powerful strategy for increasing the rates and quality of PA counselling (Lobelo et al., 2009). Furthermore, to help this to happen among young doctors – who were among the least active - training on PA prescription and lifestyle promotion may be helpful when included within the medical curricula.

Previous studies showed that physicians agreed that they were not adequately trained in non-pharmaceutical methods such as lifestyle medicine during medical school. Moreover, they reported no experiences in prescribing PA that could also lead to low self-efficacy. The actual health care system is more illness centred than health centred, in the same way that medical training is more based on pharmaceutical methods than lifestyle medicine. Considering that the amount of evidence on the mortality benefits of exercise is considerably smaller than that on drug interventions, clinicians opt to drug-based treatment (Naci H & PA Ioannidis, 2013). In medical schools training on PA promotion is scarce. For example, in US, only 13% of 102 medical schools in 2002 included PA and health in their curricula (Garry, Diamond, & Whitley, 2002). In Catalan Universities, PA promotion has not been included on the medical curriculum since 2010. More effort should be done, especially in the beginning of medical career, to include lifestyle medicine in primary care than other pharmacological treatments (Persson, Brorsson, Ekvall Hansson, Troein, & Strandberg, 2013). One of the implications of the study II is the support, together with the Galatea Foundation, on the promotion and development of activities focusing in improving healthy habits and lifestyle within this collective of professionals.

Conclusions of study II showed that PA promotion in Catalonia may be partly influenced by physicians' own behaviours. The findings pointed out the low compliance with the current PA guidelines and the high rate of overweight and obesity in males' physicians that may each negatively impact on the Catalan Health Care system.

The PAFES program: Physical Activity Referral Scheme in the Catalan context

To address the needs of adult behaviour change in relation to PA, the Government of Catalonia, following the national strategies NAOS and PAAS, promote the implantation in primary care of the Plan of Physical Activity, Sport and Health (PAFES) (Government of Catalonia, 2007).

PAFES emphasis on the goal of AHA (Spring et al., 2013) in preventing disease by addressing health behaviours in (i) preserving positive cardiovascular health by promoting healthy lifestyle behaviours; (ii) treating unhealthful behaviours (physical inactivity), in addition to risk biomarkers (adverse blood lipids, high blood pressure, hyperglycemia, obesity); and (iii) a combination of individual-level and population-based health promotion strategies that aim to shift the majority of the public toward the next level of improved cardiovascular health.

The PAFES program is intended to positively impact on both the promotion of PA in Catalan population and on physicians' habits and attitudes related to PA. Although PA counselling and referrals have been found to be effective in previous studies (Kallings, Leijon, Hellenius, & Stahle, 2008; Leijon, Bendtsen, Nilsen, Festin, & Stahle, 2009), there was a need to test PARS program in the Catalan context, to assess its effectiveness and justify its implementation. Study III presents the first results of the six-month PARS program on PA adherence and HRQL in primary care patients with CVRF. The main findings showed that a six-month PARS program increases PA level and decreases the number of physically inactive patients up to six months post-intervention. Similar to previous studies, there was a decrease in PA adherence after the finalization of the intervention (Grandes et al., 2011; T. Pavey et al., 2011; Orrow et al., 2012). One highlight of the positive impacts of the intervention was the impact on quality of life up to six months post-intervention. This was reflected in better emotional, social and physical functioning.

Population characteristics

Importantly, PARS was successful in recruiting the intended target group specified in the inclusion criteria. The most prevalent participants were females, shown to be a target group in the study I, and adults aged >60 years with some CVRF. Housewives and retired older adults were more able to attend PARS sessions because they were usually schedule in the morning. Previous studies showed the high prevalence of females in PA prescription programmes in primary care setting (British Heart Foundation (BHF), 2009; National Institute for Clinical Excellence (NICE), 2010; T. G. Pavey et al., 2011). Reasons of this high prevalence is that females are likely to visit primary care centres more often than other populations groups (Generalitat de Catalunya, 2012). However, and notwithstanding that females being more likely to participate in such schemes, they are also more likely to drop out due to personal time constraints, such as caring for others and because of household chores (Pavey et al., 2012).

Older adults (65+ years old) were also commonly referred to PA schemes. Reasons for their recruitment were that (i) they are also likely to visit primary care centres regularly and (ii) they were more likely to meet the inclusion criteria for PARS. Older adults are more likely to present multiples CVRF and they may have more availability to attend the PARS' sessions. In comparison, middle-aged adults may have less availability due to time limitations and occupational activity.

It is important to emphasise that before PARS about 42% of recruited patients were already met PA recommendations through their walking. This concurs with results of the study I and II showing that walking was the principal PA engaged by Catalan population and also by Catalan physicians. Physicians are more likely to promote walking to their patients, particularly to older adults or patients with chronic conditions, presumably for its simplicity, safety and because of the many health benefits associated with it. Walking is a common, accessible and inexpensive form of PA and is an important component in energy expenditure of adults' populations. These results showed that the habit of walking as a form of healthy PA has been already integrated by some of primary care patients with chronic conditions.

Physical Activity adherence

The success of health behaviour change intervention is the adherence to the prescription. In this case, two finding were positive. Primary care patients highly adhered to PARS sessions. A mean attendance of 85% of the sessions was high compared to previous studies (Pavey et al., 2012). Regarding the adherence to PA recommendations, the six-month referral scheme significantly increased levels of PA at moderate intensity in inactive patients with CVRF. Enabling factors to PA adherence were reported by patients during follow-up. Adherence was positively related to the relationship with the PA leader, the interaction with the group and the level of enjoying the activity.

Social support was one of the most mentioned positive parts of participating in PARS. Participants mentioned that it was easier to exercise when it was being done with people having the same or similar characteristics; this was linked to supporting and motivating one another. This means that participating in PARS represented an important step, especially for older adults, in breaking social isolation. Moreover, through the exercise groups participants made and met new friends, had fun and also organize social meeting beyond the classes, such

as dinners together. Interestingly, and suggesting that PARS was a springboard into further exercise, some groups organized further meeting to exercise together, such as walking days during the weekend or the holiday period. The group setting was a key factor in maximizing attendance and adherence to the PA prescription. This was seen as enhancing motivation, offering peer support and providing and consolidating group cohesion. Some patients commented that they would continue exercising if it was with the same group and PA leader.

Participants also positively valued the support of their primary care professionals. Involvement of the referring nurses and physicians was important to promote initial PA adoption. A first meeting with the referring nursing and the professional of PA in the sport facility was a positive point for the referral of the patients. The feedback between the sport facility leader and primary care staff can help to facilitate the follow-up of patients.

Enhanced motivation also enhanced programme adherence. The PARS was identified as being a good way to get started in becoming physically active. Feeling better, increasing knowledge, instilling a positive attitude to PA, helping participants to overcome barriers to exercise, a feeling motivated by the PA leader and group cohesion were all important motivational factors. Increasing self-efficacy, based on an enhanced sense of self established through better physical and social functioning, was also crucial to improve PA adherence. Having PA leaders who could adapt the intensity and level of every session to every patient condition and PA level enabled participants to feel capable to engage in all types of PA and this increased their self-efficacy even further. It is important to consider that the positive attitudes and motivation of health care professionals and PA professional toward PARS may also enhance the motivation of the participants to become more physically active. These are important messages about what features are successful, especially those reflecting how to interact with participants, in helping adults to become more physically active.

Physical Activity adherence at long term and Dropouts

It is certainly important to explore further the long-term effects of PA referral schemes on PA behaviour and health outcomes. Based on the present study, at 12-month follow-up assessment the adherence to PA level decreased. These results are consistent with systematic reviews that have shown similar declines on PA level after interventions (T. G. Pavey et al., 2011; Orrow et al., 2012). Long-term adherence to PA is essential for the maintenance of health benefits. For this reason it is important to explore the reason of this low adherence.

The principal reasons of declines in PA adherence in the present study may be due to (i) inadequate provision of the intervention beyond the study period, (ii) deployment of reinforcement strategies around clinical benefits and (iii) lack of behavioural strategies.

The lack of a continuous intervention was reported by most of participants to be a barrier to exercise after the finalization of PARS. They commented during the follow-up assessment that they would continue exercising if an on-going PARS was available. The PARS intervention lasted six months. After that, patients were offered access to the most appropriate PA sessions within the sport facility. However, some patients reported not being willing to exercise under conditions that were different to PARS; they wanted what was not possible - PARS with the same group and the same PA leader.

The problem of maintaining behaviour change is challenging but the support of healthcare provider could be an important point. Healthcare provider can help on behaviour change in giving encouragement, positive feedbacks or incorporate multiple counselling sessions during routine visits. Patients' follow-up during post-intervention may increase patients' motivation and could be also a support tool if problems or questions arise along the way. It is also important to empower individuals and provide them with the most effective behaviour change strategies to maximize the impact of the PARS. Some of the most successful behavioural strategies to enhance adherence are goal setting, social support, behavioural reinforcement through self-reward, barriers solving, relapse prevention and increasing self-confidence regarding patients' ability to become and stay physical active is helpful (Marcus & Forsyth, 2008).

During the follow-up, reasons for drop out were discussed during the telephone interviews with people who dropped out from the programme. The main reasons of dropout during the intervention were (i) the presence of chronic or acute diseases, (ii) lack of time due to family caring and (iii) financial cost. While older adults attributed their drop-out to the worsening of a disease, adults and females explained theirs by referring to lack of time.

The most common reasons to dropout were the worsening of a chronic disease and the perception of more pain followed by an injury or a surgery. This is unsurprising given that sample consisted of patients with CVRF. It is necessary most support to patients with chronic conditions in order to maintain their motivation to follow-up with the prescription after the

acute periods. Lack of time due to family caring was the third most common explanation for low adherence and/or dropout.

Females were most likely to dropout to take care of the spouse, grandchildren or other family members. Considering that most of the sample was female, there is a need to address this situation and to integrate PA into women's lives. Interventions should also incorporate social support from peers of family members. Moreover, strategies that address unique barriers such as intermittent illness and the burden of care giving should be incorporated in PARS.

The less prevalent barrier to PA was the financial cost. This only became a barrier once PARS was complete. The prescription facilitated subsidized prices, a small fee of €15-25 per month for the participants during the PAR. After the finalization of the PARS, patients had to pay the normal fee of the sport facility in order to exercise; usually this was €30-45 per month. Considering the current economic crisis in Spain, this could be a strong barrier to participate in PA programs, especially among retired older adults with limited financial resources.

Above all, seasonal changes and the schedule of PA sessions were important in PA adherence. During PARS, many participants drop out after holiday's period. PAR sessions used to coincide with Christmas or summer holidays. Most of the female participants' attendance was interrupted in July because of the need to care for their grandchildren. It is important to take into account the seasonal changes when PA interventions are designed. Moreover, the sessions were delivered in the morning, making them accessible predominantly by housewives, retired individuals or unemployed adults.

Positive effects on health-related quality of life

Although, the primary outcome measure was the change in self-reported PA from baseline to six and 12 months, the secondary outcome included in the analysis was HRQL. The concept of HRQL as outcome in health evaluation in patients with CVRF is important to assess the perspective of the person and his/her experience in life and the consequences of his/her health condition. Health status is deeply influenced by mood, coping mechanisms to various situations and social support.

Improving quality of life is a health objective in primary care patients, particularly in those presenting chronic conditions. Indeed, individuals with CVRF are more vulnerable to suffer from other related conditions as well as older adults which are more susceptible to various chronic conditions, functional disability and comorbidity. These factors compromised physical, emotional, and psychological health as well as reduced quality of life and point out the need of improve quality of life in this group of population.

As previous studies, the present study adds evidence on the wide range of positive effects of PA on quality of life in patients with CVRF (Acree et al., 2006; Bize, Johnson, & Plotnikoff, 2007; Kallings et al., 2008). The six-month PA referral scheme improves significantly all components of HRQL. Interestingly was the retention up to six months post-intervention of the positive effects on social, physical functioning and emotional component. Given the important of the assessments of the long-term effects of an intervention, this improvement in the quality of life represents a peak of the PARS program. The reasons of the importance of these three improved quality of life improvements are the following. The positive effects in emotional component, particularly the self-perceived mental health is important due to the increasing prevalent of emotional-related diseases in Catalonia. Statistical data show especially depression and anxiety represent one of the most prevalent current diseases (Generalitat de Catalunya, 2012). In addition the current economic crisis in Spain and the profound reforms in the healthcare sector may also significant have a negatively impact on the well-being of population. Translating this into the practice, PA promotion may have wide repercussion on individuals, being an effective strategy to improve all levels of health, specially the emotional health. Furthermore, the second most improved component was social functioning, especially significant in elderly people. Elderly are more likely to suffer the negative effects of being isolated and socially excluded (Rimer et al., 2012) and it impacts to their mental health and quality of life. For this reason one of the powerful points of PARS is the fact that is a group-based intervention, providing those side effects on their health.

Similarly, the improved physical functioning is important to promote the independence and autonomy of older adults. As previous studies showed, interventions on PA represent an effective strategy for attenuating functional decline and reducing risk of disability in older.

In addition, risk of falling is one of the leading causes of hospitalization and responsible for high healthcare costs, which could be improved through PA intervention (Singh, 2004; Gama da Silva ZA, Gómez Conesa A, & Ferreira Sobral M, 2008). PARS may be an effective way to achieve wide-spread improvements in middle-aged and older adults' health in terms of physical functioning, social and mental health.

Altogether, seems that the impact of the schemes involved not just those taking part but also others around them including family and friends and also the professionals involved in the schemes (C. Riddoch, Puig-Ribera, & Cooper, 1998).

Effectiveness of Physical Activity Referral Scheme

There is growing evidence to indicate that health systems have significant potential to change health behaviours and improve health. This is in addition to the potential for specific programmes and interventions delivered by health professionals to have a positive impact on health behaviour and health outcomes. This study adds evidence of the effectiveness of PA referrals schemes in improving PA level and quality of life of patients with chronic conditions. Comparing with drug-based treatments, PA intervention provides most of the cases the same improvements, but yield more profound and sustainable gains in health (Fineberg, 2012). Further, recent data shows potentially similar effects of PA interventions than drugs prescriptions in mortality benefits in the secondary prevention of coronary heart disease, rehabilitation after stroke, treatment of heart failure, and prevention of diabetes (Naci H & PA Ioannidis, 2013). Moreover, PA intervention also differed from other treatments in promoting a wide range of benefits at all health levels and improving other health factors from the Life's Simple 7 (Lloyd-Jones et al., 2010). It is an important argument to promote and achieve an ideal cardiovascular health through PARS interventions. These small lifestyle changes related to PA, as they accrue over time, can yield substantial improvements in the population's cardiovascular disease morbidity and mortality (Spring et al., 2013).

The effectiveness of PARS in changing patients' behaviours depends also on the attitudes and trust from healthcare providers on PA counselling. According to a qualitative study, physicians distrust from the effectiveness of PA intervention due to a lack of feedback of the final outcomes (Persson et al., 2013). They reported prefer pharmacological treatment, which usually leads to a quick recovery compared to PA, which takes longer to see. In PAFES program PARS was initially designed to obtain the results from the intervention through the checkout pre- and post-intervention by the sports medicine doctors.

However, the economic cut backs from the actual crisis may have a repercussion in the evaluation system of PARS and sometimes the results did not arrive to healthcare providers. Notwithstanding, physicians got the feedback from the patients during the routinely visits.

A similar situation and equally important is to give a feedback of the outcomes of PARS to the patients. According to recent literature, most interventions fail to track those outcomes or costs that matters to patients (Porter & Lee, 2013). In patients with CVRF, for example, reducing levels of cholesterol or hypertension is important, but they also value the improvements of their quality of life, translating in improvement in their physical function, in emotional health, the reduce of the risk of associated complications or reduce of drugs dose. This is important to consider when PA interventions are designed. It is also necessary to educate patients on the numerous benefits of PA on their health and specifically in their particular condition. It made patients to value the effects of PA on their health and chronic condition and motivates them to follow the prescription. A growing body of evidence demonstrates that patients who are more actively involved in their health care experience better health outcomes and incur lower costs (Health Policy Brief. Patient Engagement, February 14, 2013). It is commonly referred to as Patient engagement, a broader concept that combines the patient's knowledge, skills, ability, and willingness to manage his or her own health and care with lifestyle interventions (Health Policy Brief. Patient Engagement, February 14, 2013).

Future interventions should consider providing feedback to health care providers and patients from the specific results of PARS on patients' health. It may enhance first physicians' trust on PA interventions giving them knowledge on the benefits of PA for specific conditions and second may empower patients to manage their own health.

The unique about the findings is that this research provides new information about PARS effectiveness in the Catalan routine primary care setting. Overall, the findings presented provide the first results of the recent implantation of one of the PAFES program, particularly the importance for the implementation of PARS in the Catalan context. Our results showed PARS as an effective and easily practicable method for increased PA and quality of life in routine primary care patients. In addition, PARS promote increased PA in a wide part of the population who otherwise are hard to reach or have a low motivation for lifestyle changes.

Physical Activity promotion before and after the PAFES program

The PAFES program has powerful repercussions for changing health behaviour related to PA in Catalan adults. The PAFES is finalizing its implementation. The number of people who have received counselling and / or participated in community activities tripled in the last year 2012. Since 2006, prevalence of physical inactivity in Catalonia clearly decreases, especially in PAFES target group, estimated relative savings in health spending close to 54 million. 374,156 recodings on stage of change were achieved among primary care patients and 297,178 were registered in the electronic record for receiving PA counselling.

Before the implementation of the PAFES, several powerful barriers were found for PA counselling in Catalan primary care centres. PA counselling was not integrated in routinely visits, while few physicians reported actively engaging with delivering it. PA promotion was opportunistic and based only on few, selected patients. Moreover, physicians reported mistrust about PA counselling resulting from two main factors; lack of protocols and having little relevant training (Ribera et al., 2005). In this context, few positive PA messages were likely to be presented to, or reinforced within, the Catalan population. Combining low levels of PA with high prevalence of overweight males physicians, as was found in the study II, this may contribute to even less PA counselling, which further pointed toward a worsening long-term trajectory.

However, since the implementation of PAFES program in 2007 PA counselling was integrated into the Catalan Health system. PAFES replaced some of the previously existing lacks among physicians. For example the doubtful motivation of relatively few physicians, most of them who knew little about delivering PA messages and who could hardly recommend any community site to exercise. The increases in resources and service delivery improvements generated by PAFES was intended to positively impact on both primary health care providers and Catalan population, to overcome many of the established barriers. Yet, the PAFES program is powerful for more reasons than just managing these barriers. It is the first to be implemented by two different departments, Sports and Health, meaning that it represents a new systemic alliance between powerful constituencies. It also establishes systematic PA counselling at national level by being promoted by the Catalan government and supported by the PAAS strategy and the Health Plan for Catalonia 2011-15.

The PAFES program developed several tasks to achieve its aims. Indeed, PAFES has resulted in numerous positive changes to Catalan primary care system while also establishing a positive overall impact on PA level among Catalan adults. Some of the most important outcomes are linked to the establishment of a systematic PA counselling protocol, which includes the inclusion of PA into electronic medical record, supported by PA-specific training of primary health care providers and the deployment of multidisciplinary teamwork.

The incorporation of the exercise vital sign in electronic medical record has been one of the most important advances in the promotion of PA in primary care settings. It has been successful for assessing self-reported PA and helps to initiate patient counselling. In this way it has helped to make PA counselling part of routine visits to the physician, which in turn highlights to patients that PA is as much a priority for establishing better health as other health related behaviours, including anti-smoking.

PAFES has also established better training of healthcare providers in PA counselling and motivation strategies over what existed pre-PAFES. This part of the PAFES approach has helped to overcome one of the principal barriers of physicians to not delivering PA message (Ribera et al., 2005; Persson et al., 2013). In PAFES healthcare providers also received print material such as well-established chronic diseases practice guidelines (Generalitat de Catalunya, 2007), information on resources for exercise practice in the community, while a targeted website (www.pafes.cat) was developed to address PA and health for (i) the general population and (ii) professionals. These tasks promote and improve physicians' knowledge, self-efficacy and positive attitude to PA counselling.

Another strength from PAFES is the multidisciplinary team work between different professionals and institutions. For Catalonia, PAFES created the first serious opportunity for primary care physicians, referring nurses, sports medicine doctors and PA professionals to work together to promote PA. Furthermore, PAFES established a much-needed protocol linking primary care centres with sport facilities and with community resources. This was needed because few PARS could demonstrate optimal communication between healthcare providers and PA leaders.

Combining the efforts of professionals groups from primary health care with that of the PA specialists increases exposure to positive messages about adopting PA and this may help patients to initiate PA and participate in PARS.

All of these efforts have been translated into an important positive health behaviour change in Catalonia. The last results of the implantation of the overall PAFES program reflects the powerful impact on population health, which means that the program has achieved one of the objectives of the Catalan Health Plan. The PAFES program decreased sedentary behaviour in the Catalan population from 2006 to 2013, especially in its target groups; females and adults aged 56-74 years old. More specifically, sedentary behaviour decrease a 20% in women and 34% in adults aged 56-74 years old (Gonzalez, 2013).

It is likely that the power of PAFES to achieve this health behaviour change is based on producing different efforts at different levels. At the individual level, PA counselling aimed at changing health outcomes centred on changing knowledge, attitudes and behaviour. At a social level, PARS promoted group-based referrals schemes and this facilitated increased social support. According to the social networking approach, when one person experiences a health benefit this can transfer to similarly influence others in their social network (Christakis N.A., 2004). In this understanding, successfully promoting effective PA counselling can also result in a wide range of positive collateral effects affecting people who are not directly involved in doing more PA; they may not have even been directly encouraged to do more PA by their doctors. Social support is also promoted by the successes that PA promotion produces, even when levels of change are modest. While attention typically, and rightly, focuses on patients effects, the effects are more substantial and far reaching. For example, physicians are also likely to be positively influenced by the program, in their attitudes to PA, knowledge, self-efficacy and own habits. In addition, at the environmental level, creating a friendly environment in relation to exercise is, in its own right, an enabling factor for enhanced PA adherence. The PAFES program designed and recommended exercising by promoting the use of healthy walking routes and urban parks. This heightened access, especially to patients with limited incomes for undertaking PA in their neighbourhoods and with those where there were no local PAR schemes. Changes in the environment also increase the visibility of exercising, which increases the likelihood of adoption being achieved through promoting and nudging effects (Dolan P, Hallsworth M, Halpern D, King D, & Vlaev I, 2010).

In addition, the creation of the PAFES website (Government of Catalonia, 2009a) and the attention generated by promoting the World Day of Physical Activity (Government of Catalonia) combined with all these other effects. While it is not possible to identify which of these was the most potent factor, all have played a part in achieving the successes associated with the PAFES program and for recommending it as best practice for engaging patients in health behaviour change. According to the Fineberg study (Fineberg, 2012), health system requires of multiple changes to achieve a sustainable and successful health system. Shifting the population toward healthier behaviours will require time and systems support at the institutional, financial, and policy levels (Spring et al., 2013).

In conclusion, adherence to PA in Catalan general population and in Catalan physicians' population has been positively influenced by implementing the national Plan on Physical Activity, Sport and Health (PAFES) through primary care settings. The PAFES program provides a comprehensive strategy that can be deployed with relative ease for directly addressing the widespread clinical challenges that modern inactive lifestyles create for public health. This effectiveness is wide ranging and can be seen in changed health-related behaviours, which in turn reduce risk, morbidity and mortality.

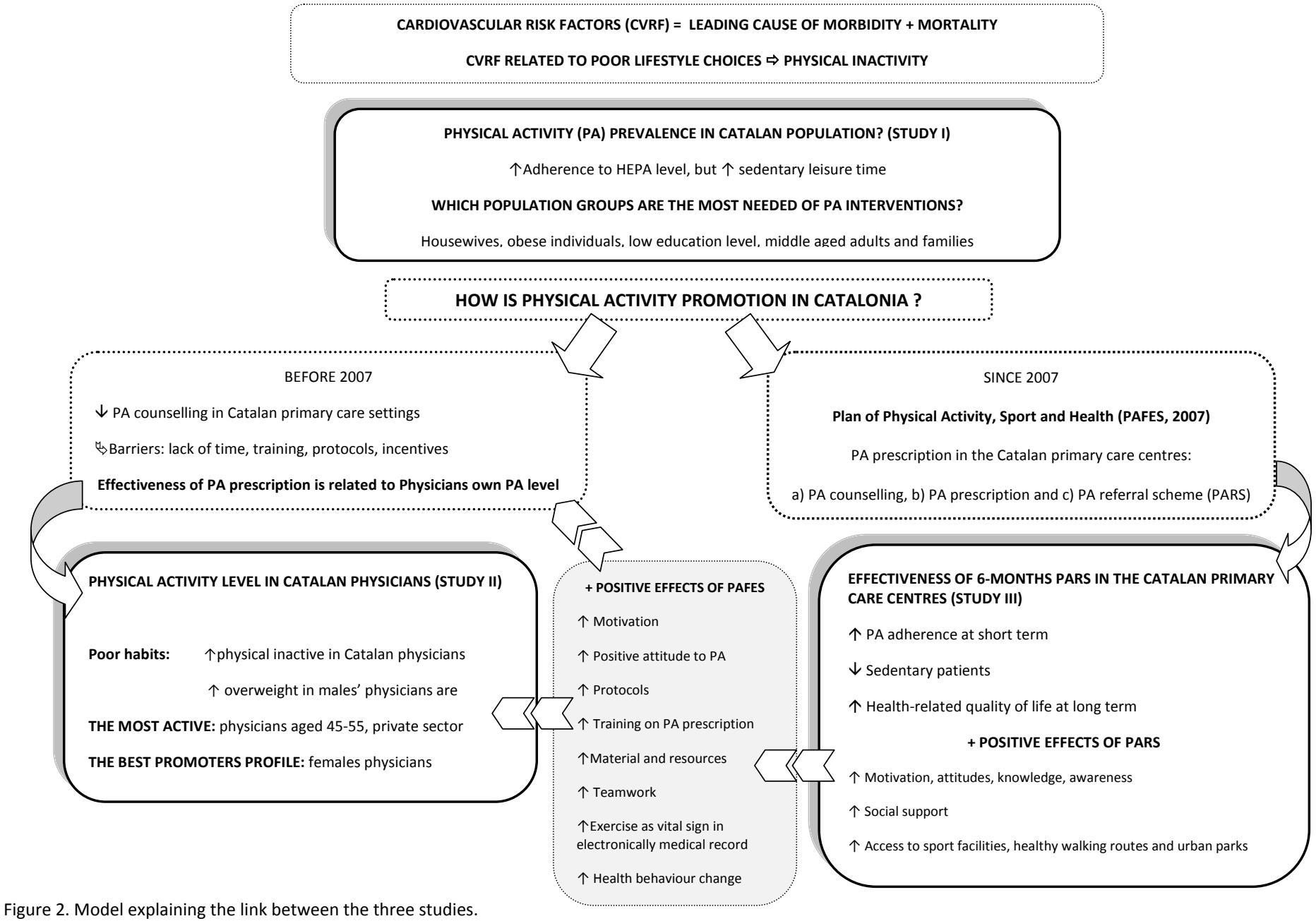


Figure 2. Model explaining the link between the three studies.

STRENGHTS

The strengths of this thesis are the combined approach of evaluating Physical Activity adherence in three different but interrelated samples and the overview of the Physical Activity promotion recent implemented by a national plan at regional level in Catalonia.

Strengths of both studies I and II are the sample size and that are representative of their population groups. Study II shows originality in be the first assessing PA level according the current PA guidelines and identifying combination of lifestyle risk factors from Catalan physicians.

Other common strength of the studies I and III is the use of the validated International Questionnaire of Physical Activity that enable inter-country comparison.

Study III strength in presenting some of the first results from the assessment of a PA prescription program, promoted by a national regional plan in the Catalan context. Other important strength of the study III is the fact that was conducted under real conditions. Patients received physical activity referral from their primary care physicians as a part of routine primary health care. The findings from this study may be similar to patients in primary health care in Catalonia, as the study included a socio-economic diverse sample from different care units. The referral groups were recruited from different regions of Catalonia and worked under different conditions as regards their location and sport facility characteristics. All the primary care centres has in common all the protocols, training and written prescription. This shows the effectiveness of such schemes in real life, translating research into health promotion practice.

LIMITATIONS

General limitations for the present thesis are regarding the methodological problems of adequate measurement of PA. The three studies are based on self-reported methods that could lead to over and under estimations of PA levels, especially when the sample consisted of older adults. In addition, another common limitation in the three studies was the missed data due for two reasons: the data cleaning for inaccurate records or missed data and the non-contacts and refusals during telephone follow-up.

Besides methodological problems, the main limitation of the studies I and II was the time elapsed since the data collection. Another limitation in the study II and III was the lack of information from non-responders meaning that the representativeness of the sample is uncertain.

Other limitation should also be taken into consideration in Study III. Firstly, the lack of control group weakens conclusion about the causality of physical activity referral scheme in the different outcomes. Moreover, not all patients that were in need of increased physical activity or might be appropriate for PARS were recruited. This was partly explained because the study was conducted in the early implementation phase of the PAFES program in Catalan primary care centres and not all professionals were familiar with the method, which was still under development. Other disadvantages of the assessment under real conditions were the lack of control of some variables and the differences between referrals groups in terms of seasonal periods, number of participants, sport facility characteristics, physical activity leader with different levels of implication and motivation as the intermittent referral of the patients to the groups.

6. CONCLUSIONS

The sums of the finding from the three studies that comprise this thesis support the following conclusions:

- Three-quarters of the Catalan population are physically active reaching the Health-Enhancing Physical Activity Level.
- Half of Catalan population reported being sedentary during leisure time.
- The most physically active groups in Catalan population were young adults (18 to 34 years), normal-weighted individuals and those individuals living in a medium-sized town.
- There is a considerable need to increase PA level in middle-aged adults , overweight and obese individuals and housewives.
- The promotion of PA in Catalan primary care setting may be negatively influenced by the low compliance with the current PA guidelines by Catalan physicians and the high rate of overweight and obesity in males' physicians.
- 73% of Catalan physicians presented any lifestyle risk factors, being the most prevalent physical inactivity and overweight.
- Physical inactivity and overweight were predicted in Catalan physicians by "poor" self-perceived health status and being male.
- Females' physicians presented the most optimal lifestyle compared to males' physicians.
- The promotion of PA in Catalonia through PAR scheme was successful in increasing self-reported PA and improves health-related quality of life of primary-care patients with cardiovascular risk factors.
- At 12-month, PARS decreased the number of sedentary patients and retained the positive effects on the health-related quality of life, especially in the emotional components and physical functioning.
- Improvements in quality of life emphasize the effectiveness of PARS interventions to improve the health of older adults and individuals with chronic conditions.
- Further studies should explore PA adherence at long term after a PARS and include strategies to improve PA adherence.
- Primary care-based physical interventions are still relatively new in Catalonia, and according to the last statistics, it will grow up and be improved in the next years.

7. FUTURE RESEARCH

From the work of this thesis, some suggested future research topics are:

- Qualitative and quantitative research, including studies identifying in which domain are physically active the different groups of Catalan population.
- Research on the impact of the PAFES program on PA level, views and attitudes of Catalan physicians.
- Research on PA level of Catalan physicians after the implementation of the PAFES program, and its relationship with PA counselling and patients' recruitment rates.
- Research on PA prevalence of other primary health care professionals in Catalan health systems, such as referring nurses, paediatricians and geriatricians.
- Qualitative research addressing differences between physicians that adhere to the current PA guidelines and those who do not adhere.
- Qualitative research exploring the difficulties of primary care providers in PA counselling and the recruitment of patients for PARS.
- Use of objective and subjective methods in the assessment of PARS.

8. SUMMARY IN CATALAN

L'Adherència a l'Activitat Física i la seva Prescripció en la població Catalana

El comportament dels individus, les comunitats i les poblacions és un dels principals determinants de la salut. Actualment les malalties cròniques, concretament les cardiovasculars són la primera causa de morbiditat i mortalitat mundial. L'estil de vida és clau en l'adopció d'una salut cardiovascular optima així com també en el control i millora de factors de risc cardiovasculars. L'adopció i l'adherència a l'activitat física és un determinant clau per la salut que cal promocionar per gestionar la càrrega actual de malalties cròniques relacionades amb l'estil de vida així com també millorar la qualitat de vida.

En aquesta tesi es presenten els resultats de tres projectes d'investigació relacionats amb la necessitat de promoure el canvi de conductes relacionades amb la salut

Aquest conjunt d'estudis té com objectiu inicial investigar l'adherència a les recomanacions actuals d'AF en la població catalana, resultat que repercuteix en la salut de la població. El primer estudi es va dur a terme donat a que el treball existent a Espanya - en consonància amb el de molts altres països - s'ha basat en estudis aïllats, realitzats sota diferents polítiques i a través de diferents circumstàncies econòmiques. El segon estudi explora l'adherència a l'AF en una mostra de metges/esses catalans per explorar el nivell d'AF com el perfil òptim de metges/esses per promoure l'AF. El tercer estudi té com a objectiu l'avaluació d'un programa promogut pel "Pla d'Activitat Física, Esport i Salut" del programa nacional (PAFES), basat en l'atenció primària a Catalunya per promoure el canvi conducta relacionat amb la AF. Els principals resultats són: (i) alta prevalença de població catalana adherida a les recomanacions actuals d'AF, però alta prevalença de sedentarisme durant el temps de lleure (ii) alta prevalença d'inactivitat física entre els metges/esses catalans i alt índex de sobrepès entre els metges homes catalans i (iii) l'eficàcia d'un programa de prescripció d'AF supervisat en en la millora de l'adherència a l'AF i la qualitat de vida de pacients d'atenció primària amb factors de risc cardiovascular.

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ANNEX

Annex 1. Physical Activity Questionnaire in Physicians Survey

Annex 2. Ethics Statement from the Clinical research Ethics Committee of Sports Administration of the Catalan Government

Annex 3. Informed consent

Annex 4. Referral protocol document

Annex 5. The PAFES questionnaire

Annex 6. Acceptance letter from *Journal of Physical Activity and Health:* Paper II

Annex 7. Letter Submission Confirmation from *Apunts. Medicina de l'Esport*: Paper III

ANNEX 1.
Physical Activity Questionnaire in Physicians Survey

I. Lifestyle
The following questions refer to lifestyle habits that could affect your health state, such as the physical activity developed in the leisure time.
1. During the last 15 days, did you go for a walk? ☐ Yes ☐ No → *Go to the question 4*
2. How many times have you walked during the last 15 days? …….. times
3. How many minutes have you been walking every time? …….. minutes each time
4. During the last 15 did you do any type of physical activity or sport in your leisure time (like yoga, running, skiing, hunting, fishing, gardening, etc…)? ☐ Yes ☐ No → *Go to the question 8*
5. Which physical activities have you done during the last 15 days?
6. How many times did you practice theses activities during the last 15 days?
7. How many minutes have you practise these activities every time?

7a. Physical activity	7b. Times	7c. Minutes each time

ANNEX 2.
Ethics Statement from the Clinical research Ethics Committee of Sports Administration of the Catalan Government

Generalitat de Catalunya
Departament de la Presidència
Secretaria General de l'Esport
Consell Català de l'Esport

Av. Països Catalans, 40-48
08950 Esplugues de Llobregat
Tel. 93 480 49 00
Fax 93 480 49 10

Sra. Alba Pardo Fernández
C/.Sant Antoni Maria Claret, 339
08027 Barcelona

COM_ESPORT

Senyora,

En resposta a la vostra petició us trametem, adjunt, certificat de l'acord que el passat 24 de maig de 2013 que es va dur a terme en el Comitè d'Ètica d'Investigacions Clíniques en relació al projecte presentat per vostè titulat "Avaluació de l'adherència a l'activitat física durant i després d'un programa d'exercici físic supervisat, promogut pel Pla d'Activitat Física, Esport i Salut (PAFES)".

Atentament,

Carles Trullols i Clemente
Responsable de Suport Jurídic i Tècnic

Esplugues de Llobregat, 24 de maig de 2013

Generalitat de Catalunya
Comitè d'Ètica d'Investigacions Clíniques de l'Administració Esportiva de Catalunya

CARLES TRULLOLS I CLEMENTE, RESPONSABLE DE SUPORT JURÍDIC I TÈCNIC DEL CONSELL CATALÀ DE L'ESPORT, ACTUANT COM A SECRETARI DEL COMITÈ D'ÈTICA D'INVESTIGACIONS CLÍNIQUES DE L'ADMINISTRACIÓ ESPORTIVA DE CATALUNYA

CERTIFICO

Que en la reunió duta a terme el dia 24 de maig de 2013, aquest Comitè d'Ètica va acordar avaluar favorablement el projecte presentat per la senyora Alba Pardo Fernandez, titulat **"Avaluació de l'adherència a l'activitat física durant i després d'un programa d'exercici físic supervisat, promogut pel Pla d'Activitat Física, Esport i Salut (PAFES)".**

La qual cosa faig constar als efectes oportuns

Esplugues de Llobregat, 24 de maig de 2013

ANNEX 3.
Informed consent

COMPROMÍS DE PARTICIPACIÓ EN UN PROGRAMA D'EXERCICI FÍSIC

Informació sobre el compromís de participació

En el vostre centre d'atenció primària (CAP) us han aconsellat un programa d'exercici físic adaptat a les vostres necessitats. Per això, us demanem que accepteu el compromís de participació en un programa d'exercici físic que tindrà lloc en un equipament proper al vostre CAP.

Abans de signar aquest compromís de participació, llegiu atentament la informació següent:

1. Abans i després del programa, un metge especialista en medicina de l'esport valorarà els vostres riscos i limitacions per fer exercici.

2. Se us farà una entrevista telefònica d'una durada aproximada de 15 minuts, en la qual es mesurarà la vostra qualitat de vida relacionada amb la salut a l'inici del projecte i al cap de 6, 12 i 24 mesos.

3. Heu de signar una autorització perquè s'utilitzin les dades de la vostra història clínica a fi de valorar la utilitat del programa.

4. Cal que mantingueu el compromís d'assistir almenys a un 80% de les sessions d'exercici físic, que es duran a terme a l'equipament esportiu_____, els dies_____ en l'horari_____ i un cost de _____ (euros / mes).
5. La participació en el programa és voluntària i no modifica el tractament, les revisions o les visites previstes. Per això, podeu retirar-vos del programa en qualsevol moment, sense necessitat de donar explicacions i sens prejudici de la vostra relació amb els professionals de salut del CAP.

Considerant

—que la informació se m'ha facilitat de manera comprensible,[1]

—que he pogut formular preguntes i se m'han aclarit els dubtes plantejats,

—que entenc que la meva participació és voluntària i que em puc retirar de l'estudi quan vulgui, sense donar explicacions i sense repercussions en la relació amb els professionals del meu centre d'atenció primària i

—que les dades de la història clínica es poden utilitzar per avaluar el programa.[2]

Em comprometo a participar en aquest programa.

_____, _____ d _____ de 20__

La persona usuària

El/la professional que n'informa

[1] Podeu consultar qualsevol dubte que tingueu al vostre equip de professionals de salut habituals o a l'adreça electrònica pafes.salut@gencat.cat)

[2] Totes les dades personals obtingudes estan subjectes al tractament automatitzat a què es refereix la Llei orgànica 15/1999, de 13 de desembre, de protecció de dades de caràcter personal i al que estableix la Llei 5/2002, de 19 d'abril, de l'Agència Catalana de Protecció de Dades, i s'utilitzaran amb les finalitats esmentades

ANNEX 4.
Referral protocol document

Pla d'**Activitat Física Esport i Salut**
Generalitat de Catalunya

Informe mèdic de prescripció d'exercici físic del PAFES

Dades de l'usuari

Nom | Cognoms | Núm. Identificació

Motiu d'entrada

- ☐ H.T.A.
- ☐ Diabetes Mellitus II
- ☐ Dislipèmia
- ☐ Obesitat
- ☐ Altres:

Resultats de l'examen de salut

Objectius de l'exercici físic

No poden aparèixer resultats mèdics de les proves realitzades

Limitacions mèdiques per a l'exercici físic

Medicació i posologia a tenir en compte

Dades del facultatiu/va

Nom i cognoms | Núm. col·legiat | Col·legi

Signatura i segell | Data

Adaptat de la Guia de prescripció d'exercici físic per a la salut

ANNEX 5.
The PAFES questionnaire

Pla d'Activitat Física Esport i Salut
Generalitat de Catalunya

NOM:	
COGNOMS:	
DATA NAIXEMENT: __ / __ /19__	☐ Home ☐ Dona
TELÈFONS DE CONTACTE:	
MUNICIPI:	

ENQUESTA PAFES D'ACTIVITAT FÍSICA I SALUT

- Aquesta enquesta va dirigida als participants del programa d'exercici físic PAFES.
- L'enquesta avalua els hàbits saludables i l'estat de salut percebut.
- L'objectiu d'aquest estudi és millorar el funcionament del programa.
- Les seves respostes són importants.

MOLTES GRÀCIES PER LA SEVA PARTICIPACIÓ

ACTIVITAT FÍSICA

Ara li preguntarem sobre l'activitat física que vostè ha realitzat durant els últims 7 dies (l'última setmana). L'activitat física no només és la pràctica d'esport sinó també les activitats que suposen un cert esforç físic com fer les feines de casa o de jardineria, desplaçar-se d'un lloc a l'altre o l'exercici físic en el temps lliure.

Pensi només en les ocasions en què va realitzar alguna activitat física durant almenys 10 minuts seguits.

Primer pensi en l'activitat física vigorosa, que és la que requereix un **esforç físic dur** i que **fa respirar més fort del normal**. Exemples: aixecar pesos pesants, cavar, fer aeròbic, córrer, anar amb bicicleta a marxa ràpida.

1. En els últims 7 dies, quants dies ha realitzat activitat física vigorosa ?

☐ **dies a la setmana** ⇨ **2b.** En total, quant de temps sol fer activitat física vigorosa en **un** d'aquests dies?

o bé

☐ **hores** ☐ **minuts al dia**

☐ **cap dia**

Ara pensi en l'activitat física moderada, que és la que requereix un **esforç físic moderat** i que **fa respirar una mica més fort del normal**. Exemples: transportar pesos lleugers, anar amb bicicleta a ritme regular, fer exercici físic.

2. En els últims 7 dies, quants dies ha realitzat activitat física moderada?
No hi compti el temps de caminar.

☐ **dies a la setmana** ⇨ **3b.** En total, quant de temps sol fer activitat física moderada en **un** d'aquests dies?

o bé

☐ **hores** ☐ **minuts al dia**

☐ **cap dia**

3. En els últims 7 dies, quants dies ha caminat com a mínim 10 minuts?

Compti si camina a la feina, a casa, si camina per anar d'un lloc a un altre, i qualsevol altra vegada que camini per fer exercici o per passejar.

☐ **dies a la setmana**

o bé

☐ **cap dia**

⇨ **4b.** En total, quant de temps sol caminar en **un** d'aquests dies?

☐ **hores** ☐ **minuts al dia**

4. En els últims 7 dies, aproximadament quant de temps al dia ha estat assegut/da en un dia no festiu?

Pensi en el temps que està assegut a la feina, a casa, en el temps lliure, mirant la televisió, fent un cafè o al cotxe.

☐ **hores al dia**

Les següents preguntes fan referència a la confiança que té en vostè mateix/a per fer exercici físic de forma regular.

5. Confia que pot fer exercici físic de forma regular ENCARA QUE ...

	Gens	**Una mica**	**Moderad.**	**Bastant**	**Molt**
5a estigui cansat	☐1	☐2	☐3	☐4	☐5
5b estigui de mal humor	☐1	☐2	☐3	☐4	☐5
5c tingui poc temps lliure	☐1	☐2	☐3	☐4	☐5
5d estigui de vacances	☐1	☐2	☐3	☐4	☐5
5e estigui plovent /nevant	☐1	☐2	☐3	☐4	☐5

LA SEVA SALUT I BENESTAR

20. En general, vostè creu que la seva salut és:

Excel·lent	Molt bona	Bona	Regular	Dolenta
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

21. Les següents preguntes es refereixen a activitats o coses que vostè podria fer en un dia normal. La seva salut actual, el limita per fer aquestes activitats o coses?

	Sí em limita molt	Sí, em limita una mica	No, no em limita gens
21a Esforços moderats , com ara moure una taula, passar l'aspirador o caminar més d'una hora. ----------	☐ 1	☐ 2	☐ 3
21b Pujar alguns pisos per l'escala----------	☐ 1	☐ 2	☐ 3

22. Durant les 4 últimes setmanes, amb quina freqüència ha tingut algun dels següents problemes en el seu treball o a les seves activitats quotidianes, degut a la seva salut física?

	Sempre	Quasi sempre	Algunes vegades	Només alguna vegada	Mai
22a Va fer menys del que hagués volgut fer? ----------	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
22b Va haver de deixar de fer algunes activitats al treball o a la seva vida diària? ----------	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

23. Durant les 4 últimes setmanes, amb quina freqüència ha tingut algun dels següents problemes en el seu treball o a les seves activitats quotidianes, degut a alguns problema emocional (com estar trist, deprimit, o nerviós)?

	Sempre	Quasi sempre	Algunes vegades	Només alguna vegada	Mai
23a Va fer menys coses de les que hagués volgut fer, degut a algun problema emocional? ----	☐1	☐2	☐3	☐4	☐5
23b Va fer el seu treball o les seves activitats quotidianes menys acuradament que de costum, degut a algun problema emocional? ----------	☐1	☐2	☐3	☐4	☐5

24. Durant les 4 últimes setmanes, fins a quin punt el dolor li ha dificultat la seva feina habitual (inclòs el treball fora de casa i les feines domèstiques)?

Gens	Una mica	Regular	Bastant	Molt
☐1	☐2	☐3	☐4	☐5

25. Les preguntes que segueixen es refereixen a com vostè s'ha sentit i com li han anat les coses durant les 4 últimes setmanes.

	Sempre	Quasi sempre	Algunes vegades	Només alguna vegada	Mai
25a Es va sentir calmat i tranquil?	☐1	☐2	☐3	☐4	☐5
25b Va tenir molta energia? -----	☐1	☐2	☐3	☐4	☐5
25c Es va sentir desanimat i deprimit? ----------	☐1	☐2	☐3	☐4	☐5

26. Durant <u>les 4 últimes setmanes</u>, amb quina freqüència la salut física o els problemes emocionals li han limitat les seves activitats socials (com visitar els amics i familiars)?

Sempre	Quasi sempre	Algunes vegades	Només alguna vegada	Mai
☐1	☐2	☐3	☐4	☐5

Aquí s'acaba el qüestionari, gràcies per la seva col·laboració.

No emplenar

ID participant:	☐☐☐☐☐☐☐☐☐☐☐☐		
ID enquestadora:	☐		
Dia:	**Mes:**		**Any:**
☐1 ☐2 ☐3 ☐4 ☐5 ☐7 ☐8 ☐9 ☐10 ☐11 ☐12 ☐13 ☐14 ☐15 ☐16 ☐17 ☐18 ☐19 ☐20 ☐21 ☐22 ☐23 ☐24 ☐25 ☐26 ☐27 ☐28 ☐29 ☐30 ☐31	☐ Gener ☐ Juliol ☐ Febrer ☐ Agost ☐ Març ☐ Setembre ☐ Abril ☐ Octubre ☐ Maig ☐ Novembre ☐ Juny ☐ Desembre		☐ 2010

ANNEX 6. Acceptance letter from *Journal of Physical Activity and Health*: Paper II

18-Feb-2013

Dear Miss Pardo:

Congratulations. It is a pleasure to accept your manuscript entitled "Physical activity level and lifestyle-related risk factors from Catalan Physicians" JPAH_2012_0249.R2 in its current form for publication in the Journal of Physical Activity & Health.

Please be aware that substantive changes to text CANNOT be made after a manuscript has been submitted for publication. In addition, NO changes can be made to figures after a manuscript has been submitted to the publisher. If an error is found in a figure, please contact Alison Vaux-Bjerke immediately at jpah@hkusa.com; do not contact Human Kinetics personnel directly. Any request for changes may result in removal of your paper from its assigned issue and placement in a later issue, as space permits.

JPAH is now participating in Human Kinetics First Look program, which allows for early online publication of all articles. Articles are fully citable as In Press and access to the articles in the First Look system is gained through the JPAH website (http://www.humankinetics.com/JPAH/journalAbout.cfm).

When it is appropriate, you will receive galleys to review, notice of your publication date, and any other pertinent information from our Managing Editor. When the galley proofs from your manuscript are available, please review them very carefully and respond to Human Kinetics, following their instructions, within 48 hours. To avoid production delays, please respond with your changes in an expeditious manner.

Should you have a change of address during the publication phase, please notify Alison Vaux-Bjerke and she will notify the publisher. If you have any questions, please contact her at jpah@hkusa.com.

Again, congratulations on the acceptance of your manuscript and thank you for your support of JPAH.

Sincerely,
Loretta DiPietro, PhD, MPH

Editor-In-Chief
Journal of Physical Activity & Health

12-Nov-2013

JPAH_2012_0249.R2 - Physical activity level and lifestyle-related risk factors from Catalan Physicians

Dear Miss Pardo:

Your article, accepted to the Journal of Physical Activity and Health and available online in our In Press section, will be published sooner than expected.

The new publication date is Vol. 11, Issue 5, June 2014.

Please share this information with your co-authors.

You should expect to receive galley proofs of your article approximately one to two months prior to the publication date.

Thank you for your support of JPAH. We look forward to the publication of your paper.

Sincerely,
Mr. Avinash Chandran, MS
Journal of Physical Activity & Health

ANNEX 7. Letter of Submission Confirmation from *Apunts de Medicina de l'Esport*: Paper III

Estimado/a Ms. Pardo Fernandez:

Le confirmamos que se ha iniciado el proceso de revisión de su artículo "Effectiveness of a Physical activity referral scheme on physical activity adherence in patients with cardiovascular risk factors." (ref. APUNTS-D-13-00028), enviado a Apunts. Medicina de l'Esport para su posible publicación.

Para consultar el estado de su artículo debe seguir los siguientes pasos:

1. Acceda a la página http://ees.elsevier.com/apunts/.

2. Introduzca sus datos de registro.

3. Acceda como autor al sistema (esto le llevará a su menú principal).

4. Entre en "Submissions Being Processed".

Muchas gracias por el interés mostrado por nuestra revista.

Reciba un cordial saludo,

Silvia Bofill

Journal Manager

Apunts. Medicina de l'Esport

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Si tiene alguna duda sobre el uso del programa, póngase en contacto con el departamento de Ayuda-EES por teléfono (932 406 176) o correo electrónico (ayuda-ees@elsevier.com).