ESTeSC - Coimbra Health School

SCREENING AND ASSESSMENT OF RISK OF FALLING

Basis for exercise prescription

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"It`s not how old you are, it`s how you are old."
— Jules Renard

Abstract

Introduction: Falls are currently considered one of the most common and serious public health problems (Gschwind et al 2013). Faced with this problem, it becomes necessary to explore which factors can better predict the risk of falls in individuals living in the community, so that, preventive measures can be considered. **Objectives**: To identify fall risk indicators and to relate them to exercise prescription levels; to relate the history of fall, the functional capacity (measured through the Timed Up & Go, 10-meter walking speed test, Step test) and the fall risk factors and propose a guide based on those relations to address exercise prescription. **Material and Methods**: Descriptive and exploratory study. Two hundred community dwelling adults aged 55 or older were assessed, integrating two sub-samples, a Portuguese and a Polish. Study participants were assessed for socio-demographic data, history of falls, fear of falling, exercise, sedentary lifestyle, hearing problems and/or dizziness, visual problems, alcohol consumption, exercise self-efficacy and confidence in activities of the daily life (FES-Portuguese version). They were also subjected to three functional tests, golden measures in the assessment of fall risk, Timed Up and Go (TUG), 10-meter walking speed test and Step Test (15s).The statistical design included descriptive analyses, inferential analyses (bivariate: t-test for independent samples, One-Way ANOVA and Pearson's correlation coefficient. **Results**: The percentage of fall in the population was 39.5% and 45.3% in total and Portuguese samples, respectively. TUG, 10-meter walking speed test and step test could distinguish those with history of fall and those without, with statistically significant differences ($p \leq 0.05$). Taking more than 4 different medications per day, fear of falling, hearing problems and/or dizziness and the need for help getting up from a chair were related to the history of falls, TUG, walking speed and step test ($p \leq 0.05$).The sedentary lifestyle and the use of assistive devices were associated to worst results of the functional tests($p < 0.05$) in the Portuguese population. TUG, 10-meter walking speed test, step test were correlated with self-efficacy for the exercise. **Conclusions**: The incidence of falls are higher than literature have reported and it is inversely associated with the functional capacity of the community dwelling adults aged over 55 years old. Data from this study is a valuable basis for exercise prescription, taking into account the levels of risk and the levels of exercise prescription.

Keywords: risk of fall, functional capacity, prevention of falls, exercise, self-efficacy

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To all my family for the patience in these last months. I dedicate this work to you.

Acronyms and abbreviations list

DLA - Daily Life Activities

FES- Falls Efficacy Scale

M - Mean

Max- Maximum

Min- Minimum

NICE - National Institute for Clinical Excellence

SD - Standard deviation

SE- Self-efficacy

SPSS - Statistic Package for Social Sciences Software

ST- Step test

TUG - Timed Up & Go

WHO - World Health Organization

WST- Walking speed test

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Introduction

Falls are currently considered one of the most common and serious public health problems, thus leading to increased costs in health services (Gschwind et al., 2013).

Given this reality, it is necessary to identify factors that may better predict the risk of falling in individuals living in the community, so that they can take into account preventive measures (Swedish National Institute of Public Health, 2010).

We intend to actively promote the quality of life and interactions for an active and healthy aging, with the highest standards, providing adults aged 55 years old or older access to screening and advice on the best evidence-based approach. We seek a customized referral to meet their needs and expectations, with the result of this screening as the basis for prescribing physical activity based on the guidelines of the National Institute of Public Health of Sweden.

Thus, this study aims to identify fall risk indicators and relate them to exercise prescription levels. This study also aims to characterize the functional capacity, history of falls, fear of falling, the existence of polypharmacy, use of assistive devices, lifestyles, among other factors and even self-efficacy for exercise and to outline a participatory approach to develop fall prevention strategies, passing among others by exercise, taking into account the four prescription levels.

To promote a systematic approach to identify individuals at high risk of falls and prevent them from experiencing an initial fall, a screening routine of the risk of falling is required. The relevance of this project relates to the fact that there is an increasing need to develop a screening program, accessible to the entire population aged 55 or more and accurately predictive of the risk of falling. Through this assessment, referral to an adequate intervention program becomes possible.

In this study, a convenience sample was assessed. The data were collected during screening the risk of falls among the population that agreed to cooperate in this study. For the measurement and evaluation of results the following measuring instruments were used: 10-meter walking speed test, Timed Up & go (TUG) test, Step Test, The Self-Efficacy Scale for Exercise (Annex 1 an 3) and the Falls Efficacy Scale (Annex 2 and 4) were applied.

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PART I

Theoretical Framework

CHAPTER I

Relevant Theoretical Constructs in the subject approach

Falls and Risk factors

Epidemiology

Falls are currently considered one of the most common and serious public health problems (Gschwind et al, 2013). Especially when they cause injuries, they can have serious consequences, leading to loss of functional capacity and independence, and early admission to health services, contributing to increased costs in healthcare services. (Gschwind et al., 2013).

These costs are due not only to the direct injuries they caused, but also because of the risk of long-term disability, costly hospital admissions and subsequent admissions in several institutions (Tinetti and Kumar, 2010;Bleijlevens et al. 2010).

They are also the main factor that leads to emergency services in hospitals, premature death (annex 5) and psychological dysfunction (Gillespie, Robertson, and Gillespie, 2012; NICE, 2013).

Injuries due to falls have serious consequences and the hip fracture is the most frequent (Gillespie, Robertson, and Gillespie, 2012;Shubert, 2011).

Literature suggests that despite the rehabilitation, many people fail to recover the previous functional level they had before the fracture (Lee et al, 2012). This fact proves the importance of an adequate fall prevention program.

More than 33 % of adults over 65 living in the community fall at least once a year (Scott et al, 2007; Gillespie et al., 2012; NICE, 2013) and among these, 50% have recurrent episodes. With aging, this percentage can increase, reaching 60 % (Scott et al.,, 2007).

Depressive disorder after a fall is quite common (30 to 70% of the cases) due to the fear of falling again. Because of that, there is an increased probability of disability and institutionalization (Ungar, Rafanelli, Iacomelli & Tesi, 2013).

Although falls are quite common in older people (Cabral et al.,2013) and influence mortality, loss of functional capacity and institutionalization, throughout history they were not considered as a public health problem. Before the 40's they were not even considered predictable events (Malasana, Brignole, Daccarett, Sherwood & Hamdan, 2011).

The interest in this area and the emergence of studies that prove the incidence, consequences and its multifactorial etiology appeared 20 years ago and since then, the concern around this issue has grown substantially (Scott et al., 2007; Zijlstra et al., 2007;

Moncada, 2011; Perell et al., 2001; Tinetti et al., 2003;; Voss, Elm, & Wielinski, 2013; Svantesson, Babagbemi, Foster, & Alricsson, 2014).

The risk of falls and their consequences increase with age, but falls are not an inevitable consequence of aging (Tinetti & Kumar, 2010). Fall prevention is not discussed nor implemented in population under 65 years and this is one of the reasons why falls remain a public health problem, since there is no actual focus on prevention (Ungar et al., 2013).

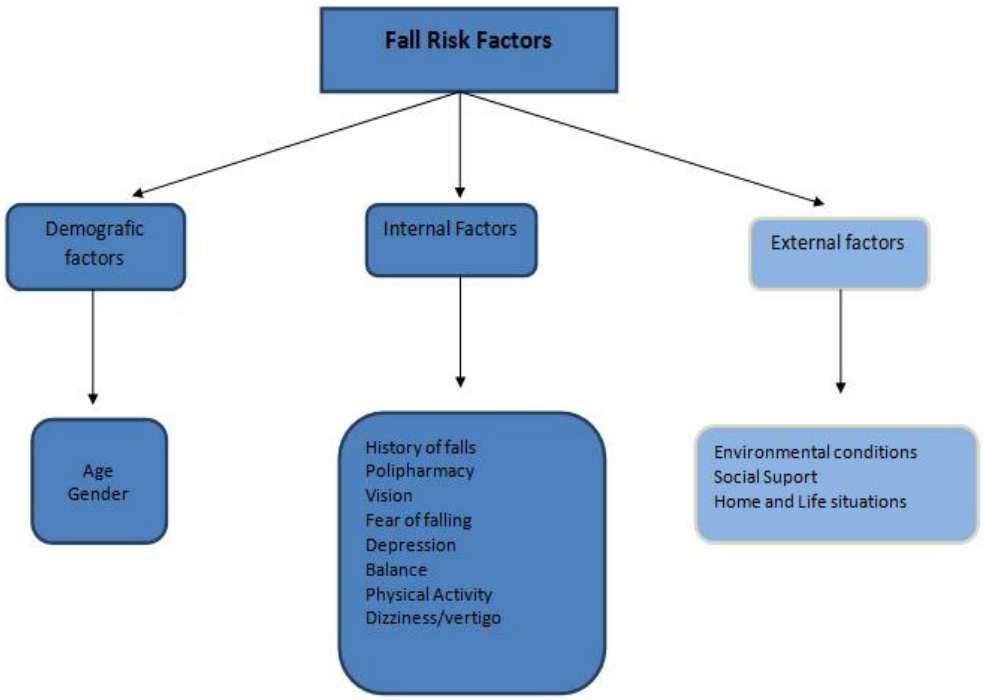
Falls among older people living in the community are common and that a simple clinical assessment can identify the individuals who are at the greatest risk of falling (Tinetti et al., 1988).

Etiology and risk factors

The etiology of falls is generally considered to be multifactorial, involving extrinsic (environmental) and intrinsic (related to the person) factors.

Numerous epidemiological studies have identified a multitude of fall risk factors in the older people, as shown in Figure 1.They are described as factors that influence the risk of falling, age, gender, polimedication, history of falls, fear of falling, physical activity, quality of vision, the presence of dizziness and balance deficits. (Pinheiro at al, 2010; Renfro & Fehrer, 2011).

Figure 1 Risk factors of falls



(Adapted from Rodriguez et al, 2003)

A correct detection of risk factors is needed to implement specific and tailored strategies of prevention (Gschwind et al, 2013). Assessment protocols can help identify individuals at risk and optimize prevention strategies (Bloch et al, 2013).

With increasing age, there are many problems, such as lack of balance and walking difficulties that contribute to the high risk of falling (Tinetti & Kumar, 2010).

There are changes occurring in the central nervous system such as changes in brain volume and properties of the neuromuscular system, with motor and sensory neuron loss. These changes result in balance deficits, decreased muscle strength and gait changes (Granacher, Muehlbauer, and Gruber, 2012).

The identification of gait changes in clinical settings is not only for diagnostic purposes, but it also aids in predicting falls. The physiotherapist who evaluates adults over 55 can use gait assessment information to identify fall risk and institute prevention strategy, such as gait training and balance, as well as changes in the family environment (Verghese, Ambrose, & Lipton, 2010).

Multidimensional perspective of falls

According to the International Functionality Classification (ICF), the perspective of falls iis multimensional. We talk about changes in body functions and structures (strenght, balance, coordination and agility) which have an impact on the activities and participation (In community and social life, domestic life, education, etc).

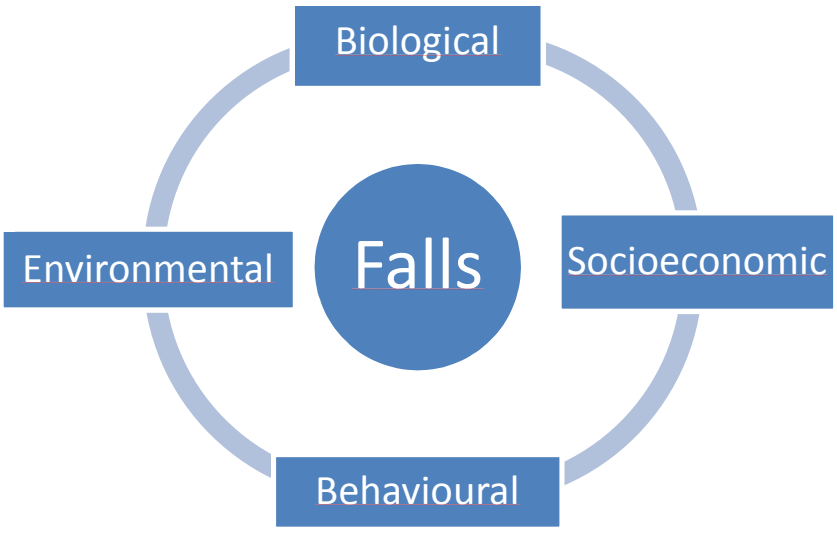
Social participation refers to the social perspective of functionality, which concerns the involvement of the individual in a real-life situation (Sabino et al, 2008; WHO,200; WHO, 2002).

The personal factors that are related to falls are: age, sex, fear of falling and health conditions. They are changes related to aging (physical and cognitive decline).

Behavioral factors that are potentially modifiable include polimediaction, emotional status, sedentary lifestyle, and alcohol consumption (Finger et al.,2006; WHO,2002).

Environmental factors alone are not a cause for falling, but in interaction with biological and behavioral factors leads them to become dangerous (WHO,2001).

Figure 2 - Multidimensional Perspective of falls



(WHO, 2007. European Comission 2015)

Fear of Falling and self-efficacy for exercise

The occurrence of a fall usually results in fear of falling again (Friedman et al., 2002; Ní Mhaoláin et al, 2012). However, the fear of falling may also be present in individuals who have never fallen (Zijlstra et al, 2007). Literature suggests that the fear of falling can have multiple and serious consequences (Gillespie, Robertson, and Gillespie, 2012).

Research has shown that self-efficacy and fear of falling are psychological dimensions that influence the incidence and frequency of falls in older people (Schepens et al., 2013). As mentioned before, the nature of falls is multifactorial, including psychosocial, behavioural, cognitive and physiological components. Results of fall prevention programs can be most successful when taking into account the physiological and psychosocial experience of the individual, including the fear of falling and self-efficacy (Svantesson et al, 2014). There are already a number of studies using multidimensional programs to indicate, clarify and prevent the effects of fear of falling on the incidence of falls. (Calhoun et al, 2011;Uemura et al, 2012),

Fear of falling has a prevalence between 20% and 83% in adults over 65 years in the community and has been described as one of the main causes of morbidity leading to reduced physical activity, decreased functional capacity and loss of independence (Oh-Park et al, 2011). Fear of falling is therefore responsible for many debilitating effects. Add to that it has an impact in terms of costs in health care (Zijlstra et al., 2007).

Fear of falling has already reference in numerous studies indicating that this factor is often responsible for fragility, social isolation, and decreased quality of life (Gomez & Curcio, 2007; Carvalho et al, 2007)). Moreover, it is described that better self-efficacy can lead to increased resistance, to a positive mood and energy during activities (Lee, Arthur, & Avis, 2008).

For people with large changes in balance and mobility, the fear of falling can somehow be an advantage in the sense that leads to a limitation of activities, leading to a decreased risk of falling. But on the other hand, this limitation of activities leads to an increasingly sedentary lifestyle and decreased muscle strength thereby increasing the risk of falling. When the fear of falling is not suitable to the actual functional capacity of the individual, tailored exercise programs are indicated (Martins, 2013).

In conclusion, falls and fear of falling are common events, serious and potentially preventable in adults in the community. Because each one is a risk factor of the other, a person who has one of these factors is at risk of developing the other. This may become a vicious cycle of falls, afraid of falling and adverse outcomes that result here as functional decline, decreased quality of life and institutionalization (Friedman, Munoz, West, Ruben, & Fried, 2002).

Functional Capacity and Fall Risk

There seems to be a significant interaction between risk factors and functional capacity of an individual (Cameron et al., 2010). Fear of falling can have a greater impact on the risk of falls for individuals with low functioning (Iinattiniemi, Jokelainen, & Luukinen, 2009).

The understanding of the complex interaction between functioning and risk factors is the basis for the development of targeted interventions to achieve the desired results. Effective interventions in fall prevention are responsible for contributing to the minimization of risk factors and implement appropriate interventions. Development of effective interventions to manage the risk of falls in the older people has been a significant challenge for researchers and clinicians (Shubert, 2011).

The American Geriatrics Society (AGS) recommended some clinical guidelines published in 2001 and complemented in 2011. According to these guidelines, regular fall risk screening is advised to adults over 65 years of age (Moncada, 2011; Shubert, 2011).

We conclude therefore that the fall risk assessment should be multifactorial and performed in all patients who report a single fall, have instability in gait assessment or seek medical attention due to a fall.

Early identification of fall risk among adults living in the community when combined with proactive interventions fall prevention should lead to a decrease in the risk of falling and resulting injuries (Shumway-Cook et al., 2007). Promote quality in primary care with a simple, objective and multifactorial tool, which focuses also on recommendations to the individual, is essential. (Renfro & Fehrer, 2011).

In summary, a multifactorial assessment should include among others the following factors:

- Falls history
- Assessment of gait, balance, mobility and muscle weakness (Nice, 2016).

Exercise Prescription and Exercise Prescription Levels

Physical Exercise and exercise prescription

First of all, a distinction should be made between the expressions exercise and physical activity.

According to Skelton (2001),physical activity describes any body movement which substantially increases energy expenditure, varying from daily actions (such as walking, gardening, etc.) to leisure activities such as swimming, dancing or bike riding. Exercise refers to planned and structured activities, where repetitive bodily movements are accomplished aiming to maintain or improve components of physical fitness (as it happens in strength training or in prescribed programs to improve cardiovascular endurance or to decrease falls). For Caspersen et al. (1985), physical activity is defined by any bodily movement, voluntary, produced by the skeletal muscles where there is energy expenditure above the levels of rest. Physical exercise is a concept that, although related to physical activity, it is characterized by having a structure, by being thought and planned and by being able to be repeated in order to improve or maintain the levels of physical fitness. Physical fitness means the set of characteristics possessed or acquired by an individual and that are related to the ability to carry out physical activity (Caspersen et al., 1985).

Physical activity is essential for health promotion, as well as to promote longevity. In the last decade,research has shown that physical activity has an effective benefit on health (Hellénius & Sundberg, 2011; Rantanenet al.,2013).

Lack of physical activity, unhealthy eating habits, tobacco use and alcohol are major causes of death and illness in modern society. A sedentary lifestyle implies marked increased risk of illness and premature death. Diseases related to lifestyle entail significant costs and therefore imply increased costs in health services.

Increasing physical activity is therefore an important task for society in general and for the health care in particular. Physical exercise is considered an important component in the treatment and prevention of various diseases (Swedish National Institute of Public Health, 2010).

Evidence shows that the most effective interventions to reduce the risk of falling are those that incorporate exercise (Gillespie et al, 2012; NICE, 2013; Shubert, 2011). Due to this fact, we realize the importance of exercise prescription in a falls prevention program. Nowadays, the process of clinical decision making by physiotherapists in prescribing exercises to prevent falls seems to be influenced by assessment results and therapist perceptions of the patients' ability and not by the structure of successful exercise programs described in the literature (Haas et al, 2012).

Fall prevention programs should be adapted individually. Therapists need to coordinate with other health professionals to ensure that all risk factors are addressed (Shubert, 2011; Svantesson et al., 2014).

Literature indicates that exercise is really effective in reducing the risk of falling. (Gillespie et al., 2012;). However, not all exercise programs reduce the risk equally in different individuals (Liu-Ambrose et al, 2004)**,** revealing the importance of adapting the exercise programs taking into account the results of a proper individual assessment of fall risk. Therefore, we talk about customized programs that meet the needs and individual characteristics.

Choosing the right prescription for each individual is part of the clinical rationale that should always be associated with clinical practice in order to enable the most appropriate decision to the individual (Haas et al., 2012).

Training on performing physical assessments, interpretation of the results and understand how the results of these assessments should influence the exercise prescription process is essential. The evidence showing that exercise is beneficial for preventing falls is now substantial (Shubert, 2011;Gillespie et al, 2012; Haas et al, 2012) . Assessment procedures are a central component established both for exercise prescription (Swedish National Institute of Public Health, 2010) and for reducing the risk of falling in adults (Keith Hill, 2009; Spice et al, 2009).

A major challenge we face today is to go from theory to practice, that is, to be able to effectively and naturally integrate physical activity in activities of daily life (Huang, 2005; Swedish National Institute of Public Health, 2010; Haas et al, 2012;) Physical therapists are professionals who maintain an essential role in exercise prescription for the prevention of falls, as documented in older publications (Hill, Smith, & Schwarz, 2001) up to today.

In many countries, the prescription of physical activity has become increasingly common because it is a way to promote the practice of exercise among the population more systematically. (Elley, Kerse, Arroll, & Robinson, 2003; Sørensen, Skovgaard, &

Puggaard, 2006; Hellénius & Sundberg, 2011). And it has proven to be an effective way to increase physical activity in the population (Grandes et al, 2009; Kallings et al, 2009; Lawton et al., 2009).

Concluding, physical exercise based on prescription is a customized and individualized prescription for any individual seeking a health professional with certain symptoms or health condition where exercise can improve recovery. The prescription may be used in the prevention and / or treatment. It is essential that the prescription is based on the individual situation and on the dialogue between the patient and the health professional. (Hellénius & Sundberg, 2011).

Exercise prescription levels and exercise prescription

According to the National Institute of Public Health of Sweden (2010), the exercise prescription is divided into 4 levels.

Level 1 is relevant to people with problems or very high risk of developing it. It is characterized by physical therapist supervision with programs since they are considered unfit to participate in physical activities without being accompanied by a health professional.

Level 2 means that individuals are targeted for participation in specially adapted programs or activities, such as the low-intensity group activities. It includes individual or group programs in less differentiated clinical settings or community health. These are programs with supervision of exercise / physio experts.

Levels 3 and 4 are suitable if the individual is considered to be able to participate in normal life activities and can manage and maintain their own activity. Oral or written advice on the activity itself (level 4) is appropriate if:

• The individual is receptive, motivated and able to follow the recommendations on its own or with the help of social support.

• The individual commands enough strategies to increase safely and effectively his physical activity.

• The individual's health (and their social, emotional and medical needs) does not require monitoring of a professional (Swedish National Institute of Public Health, 2010).

As the health status of the patient may vary between the different levels, the selection of appropriate activities also varies.

Levels 1 and 2 are customized programs, "formalized" in writing or in another format, according to the health literacy (including exercise and other advice).

Levels 3 and 4 include programs for people able to participate in regular physical activity programs in a community context; they are programs in group to maintain or increase daily activity profiles, although they are also useful at home or places of work and leisure. The level selection should, whenever possible, be controlled by the individual's own preferences.

For levels 1 and 2, the knowledge required is higher than for those who work with levels 3 and 4 (Swedish National Institute of Public Health, 2010).

A prescription of any physical activity should always be individual and tailored to the characteristics of each person. It is necessary to adjust the intensity, duration, frequency and type of activity, taking into account the individual's condition, his/her functional capacity and possible contraindications for a certain activity (Haas et al, 2012).

Therefore, it is necessary to decide the appropriate prescription level taking into account the evaluation made to the individual. According to the literature and mentioned earlier, there are several risk factors that influence the risk of falling. Therefore, a correct assessment of those risk factors allows a correct identification of the prescription level appropriate to the assessed person. An individual with associated risk factors should be addressed to lower prescription levels (1 and 2) and the individuals with less risk or no risk (more autonomous and better functional capacity) will be forwarded to the levels 3 and 4 (Martins, 2013).

The type and amount of exercise needed for the prevention of falls has been studied over the years, it is not a new subject (Gillespie et al., 2012). There is already clear evidence that certain types of exercise programs are effective when addressing falls prevention.

Several studies throughout the years show that an adapted and tailored exercise program can lead to a decrease of 54% in falls (Skelton et al, 2005).

The most important consideration when dealing with exercise prescription for falls prevention is that there is no "one-size fits all" solution. Programs should be adapted to the individual so they can be actually effective, which means that a proper level of exercise should be prescribed and it should allow participants to develop. The clinical conditions and the history of falls should also be taken into account. Thus, while tai chi will be effective for those who haven’t fallen yet (or those who have mild deficits of strength or balance), it is less effective for those who have a falls history or with signs

of frailty.

When dealing with the type of exercise, it is also important to stress that, although the programs for both primary prevention (preventing first falls) and secondary prevention (preventing additional falls) are the same (that is, they both focus on strength and balance), they should be adapted in the way they are accomplished, in order to satisfy the individual's needs, especially where there is greater risk of falls (NICE, 2013).

It is possible to improve muscle strength and balance regardless of the age, but in order to be effective in falls prevention and to be accomplished safely, the exercise program should be challenging and progressive enough for the individual. This aspect can be assured by the employment of specialized professionals to offer adequate programs of falls prevention, who can properly assess individuals at the beginning of any intervention, adapt exercises whenever necessary and guarantee that participants progress at the right level, for example, advising on the correct number of repetitions and the use of support (for instance, the hand holding a chair) progressing for non-support (Buttery et al., 2014).

NICE guidelines (2003) about the assessment and prevention of falls in older people are clear about the central role that strength and balance play in successful multifactorial intervention programs.

Intervention exercises are described in literature. The majority is accomplished in group. However, some studies mention home exercise.

The most mentioned types of exercises are:

- gait and balance training
- functional training
- strength and endurance training
- Tai chi
- physical activity in general (Gillespie et al., 2012).

Programs which include only gait and balance training or functional training manage to get a decrease in the fall rate but not in the risk of fall. Home interventions are much more effective in reducing the fall rate in individuals at greater risk.

Intervention programs including various types of exercise are effective both in reducing the fall rate and the fall risk. These programs can be either in group or individual or even be part of home programs.

Thus, this study aims to establish the basis for exercise prescription taking into account the four prescription levels through the fall risk indicators.

CHAPTER II

Formulation of the problem and aim of the study

Research questions and study objetives

According to data from the literature review, there are some gaps in the research on which tests better predict the risk of falling and, to add to that fact, there are few studies in individuals under 65 years.

If we want to talk about prevention, it is necessary to act as soon as possible, so it is important to evaluate people in a lower age group.

The prescription of adapted and adjusted exercise is only possible following a thorough assessment of the risk of falls.

Thus, this study aims to answer the following question:

How do falls risk factors, sociodemographic factors and funcional capacity of community dwelling adults contribute to the physiotherapist's decision-making in prescribing exercise to reduce the risk of falls?

The aim of this work is to characterize the profile of community dwelling adults aged 55 years or, taking into account the following factors, described as determinants in the assessment of fall risk:

- History of falls;
- Fear of falling;
- Existence of four or more medications per day;
- Use of assistive device;
- Alcohol consumption;
- Visual problems
- Hearing problems/dizziness
- Self-efficacy for exercise;
- Functional capacity (Walking speed, dynamic balance, lower limb strength, coordination and agility).

After characterizing the sample in relation to fall risk factors, it is intended to relate them to the levels of exercise prescription.

Specific objectives are listed as follows:

- To verify the relation between history of fall and risk factors of falls (taking mores than 4 medications per day, fear of falling, hearing problems and/or dizziness, vision problems, alcohol consumption, exercise practice and

use of assistive devices to walk)

- To Verify the relation between functional capacity and risk factors of falls (taking mores than 4 medications per day, fear of falling, hearing problems and/or dizziness, vision problems, alcohol consumption, exercise practice and use of assistive devices to walk)
- Propose a guide based on those relations to address exercise prescription

Selection of the study participants

After formal request for authorization, and its approval of the institutions was implemented the protocol described below.

The study population consisted of individuals aged 55 or more and over residing in the community.

The sampling technique was for convenience. In addition, they were individuals who agreed to participate in this study voluntarily and that met the inclusion criteria mentioned below

Inclusion criteria

- Acceptance to participate in the study (informed consent);
- Community dwelling adults aged 55 years or more

Exclusion criteria

- Individuals with difficulty in understanding the instructions for the tests (cognitive or other changes) or under 55 years.

The participation of individuals in this study was subject to informed consent after informed of the study objectives and goals, as well as the commitment to confidentiality of data and the voluntary nature of their participation.

Data from this study were collected in the following institutions: Principal Health Centre of Soure, Principal Health Centre of Penacova, Principal Health Centre of Celas, Santa Casa da Misericórdia Alvaiázere, Physio Mondego and Poznan community (Poland) in protocol with the University School of Physical Education in Poznan.

With regard to the equipment required to carry out this project we had the support

of Health Technology School of Coimbra.

Study variables

Dependent variables

In this study is considered as dependent variable the risk of fall, measured by the following"golden measures":

- History of falls
- Timed Up & Go test (TUG)
- 10 meter walking speed test (10 - meter Wst)
- Step test (15s)
- Falls Efficacy Scale (FES)

Independent Variables

They were considered as independent variables: fear of falling, four or more medications daily, alcohol consumption, exercise practice, use of assistive devices, hearing problems/dizziness, visual problems and self-efficacy for exercise.

PART II

Practical study

CHAPTER III

Methodology

Study design

Data collection was performed in a single moment in several places through the use of questionnaires, administered by interview, and performing a protocol of functional tests.

This is a descriptive, exploratory study with both Portuguese and polish sub-samples.

In this chapter, and after the variables have been presented, a detailed description of the instruments included in the data collection protocol is given.

We have also included a detailed description of the procedures for data collection and statistical analysis.

Procedures

After some months of direct or telephonic contact with various institutions as to ascertain their availability to participate in the study and after authorization from the directing board of those institutions was obtained, data collection procedures were agreed.

The institutions which participated in this study were:

- Principal Health Centre of Soure
- Principal Health Centre of Penacova
- Santa Casa Misericórdia Alvaiázere
- Physio Mondego, Coimbra
- University School of Physical Education

Individuals who accepted to participate in the study received previously numbered questionnaires (annex 1 and 3). Participants were given an explanation of the study, instructions to filling in the questionnaires and were clarified any arising questions. Confidentiality and anonymity were guaranteed at all times, as well as any future clarifications.

Regarding the implementation of the project itself, a protocol as described below has been followed, which describes the data collection methods.

Protocol for the implementation of the project (data collection methods):

All participants were assessed in a Community context.

Data was collected through the use of a questionnaire (annex 1 and 3). The used questionnaire model had been previously used in other studies and thus contained variables which are not used in this study.

In this study, participants were assessed on sociodemographic details (age and sex), history of falls, fear of falling, sedentary lifestyle, exercise practice, visual problems, hearing problems and/or dizziness, alcohol consumption and self-efficacy for exercise.

Functional capacity was measured with:

- 10-meter Walking speed test
- Timed Up and Go (TUG) test
- Step test (15 seg)

Two scales were applied:

- Self efficacy scale for exercise (anex 1)
- Falls Efficacy Scale (annex 2)

A description of each of the functional tests follows bellow.

10-meter walking speed test

This test determine the speed of gait in meters per second (Bohannon, Andrews, & Thomas, 1996) and aims to assess gait space-time and kinematic attributes (Watson, 2002).

It requires a 20 m straight path, with 5 m for acceleration, 10 m for steady-state walking, and 5 m for deceleration. Markers are placed at the 5 and 15 m positions along the path. The individual begins to walk "as fast as possible without running" at one end of the path, and continues walking until he or she reaches the other end. The physical therapist uses a stopwatch to determine how much time it takes for the individual to traverse the 10 m center of the path, starting the stopwatch as soon as the patient's limb crosses the first marker and stopping the stopwatch as soon as the patient's limb crosses the second marker.(Fritz & Lusardi, 2009).

There are currently reference values for this test:

- >25 seg - Probably need to use assistive device to walk in home
- 12,5- 25 sec - limited mobility in community
- 8 – 12,5 sec - Ambulate in the community with some risks

- ≤10 sec - Should start a program to reduce fall risk
- 7 seg – safe crossing streets . (Fritz & Lusardi, 2009)

Figure 3 - 10-meter walking speed test

(Fritz & Lusardi, 2009)

The reference values in meters per second are: 1,42m/s or more – safe crossing streets. 1m/s or less - Should start a program to reduce fall risk. Between 0,8 m/s and 1,25 m/s - ambulate in the community with some risks (Fritz & Lusardi, 2009)

For this test the individual should wear comfortable shoes to minimize the risk of injury and improve test performance (Bohannon et al., 1996). The individual performs this test at maximum speed with or without an assistive device (Novaes, Miranda, & Dourado, 2011)

Walking speed test is "almost the perfect measure"it has the potential to predict future health status, and functional decline include hospitalization, and mortality. Walking speed reflects both functional and physiological changes, is a descriminating factor in determining potential for potentially modiafiable risk factor (Fritz & Lusardi, 2009). Due to its ease of use and psychometric properties, the walking speed test was used as a predictor and, being considered the 6th vital sign, also as a measure of outcome in several diagnoses (Fritz & Lusardi, 2009, Salbach et al., 2015). The 10 meter walkinh speed test is a safe, highly reliable measure, requires no special equipment, adds no additional cost to evaluation, requires little additional time and is easy to interpret based on published standards (Peters, Fritz & Krotish, 2013; Salbach et al., 2015).

Timed Up and Go test

The Timed Up and Go test **(**TUG) test goals to assess functionality, namely its components of strength, agility and dynamic balance (Rehabilitation Measures Database, 2010; Schoene et al., 2013).

The TUG measures, in seconds, the time taken by an individual to stand up from a chair, walk a distance of 3 meters, turn, walk, back to the chair, and it down again.

The subject wears his regular footwear and uses his customary walking aid (none, cane or walker). No physical assistance is given. He starts with his back against the chair, his arms resting on the chair's arms, and his assistive devices at hand. The chair must have the standard height (Shumway-Cook, A.et al., 2000).

This test is used to identify individuals at risk of falls and mobility restrictions (Podsiadlo and Richardson, 1991). The TUG test is an efficient test, taking less than a minute to administer

For its performance is necessary a chair, a cone or other obstacle and a stopwatch. The assessed person should be warned that it should not run and perform the test as fast as possible. The test should be shown first. (Podsiadlo & Richardson, 1991).

Test results of 10 seconds or more indicate risk of falls and the need to engage on an exercise program to address this. The individual should undergo a specific assessment of postural instability (Moraes, 2008; Shumway-Cook et al.,2000;).

A fastest time in performing this test means a better functional performance, while a slower time means a greater fall risk in a community environment. National Institute of Clinical Evidence (NICE) guidelines defend the use of TUG to assess gait and balance, to prevent falls in elderly people (Barry et al., 2014; NICE, (2013); Noonan, (2000); Steffen, Hacker & Mollinger, 2002).

The advantage of this test is the speed and the easiness in performing it in any place; it does not require training or specialized equipment and can be easily implemented in the community and in long-stay institutions (Faria, Teixeira-Salmela& Nadeau, 2009), besides the important information on lower limbs strength, balance capacity and the strategies the elderly drawn upon to execute his movements, which areaspects which could make a decisive contribution for performing Daily Life Activities (DLA), (Camara et al., 2008; Moraes,2008). These factors support its viability in clinic practice.

Step test (15 s)

The purpose of this test is the assessment of dynamic balance (the rehabilitation measures database, 2013) and strength, coordination and control of the lower extremities (Mercer, Freburger, Chang, & Purser, 2009).

For this test it's necessary a step with the height of 7,5 cm and a chronometer. Participants who are unable to perform the test is given a score of "0" to both lower extremities (Mercer et al., 2009; Scrivener, Schurr, & Sherrington, 2014).

The individual performs the test without the use of any assistive devices. Individuals who need support are given a score of zero. A demonstration is performed first. The test result is the number of repetitions an individual can perform in 15 seconds or until balance is lost (Brauer, Burns, & Galley, 2000).

The test is performed always with the same foot (the most comfortable one). The individual should keep his arms alongside the body and must not move the support foot (Scrivener et al., 2014). The step should be placed against a wall so that it prevents the step from moving during test performance. The assessor should stand to the side of the individual and prepared to offer support. There should be a chair nearby in case the individual has an urgent need for support.

The estimated cut-off point value to distinguish individuals at greater or lesser risk of falling was ten steps, according to the study of Sousa et al (2016) (estimated value with a sample of 196 people with age 55 or older, in a screening session setting).

The following table summarizes the functional tests and their normative values.

Table 1 - Functional tests

Test	traditional measure	Normative values		Bibliography
		Low Risk	High Risk	
10-meter walking speed test	time to complete	<10s	≥10s	(Fritz & Lusardi, 2009)
Timed Up and Go	time to complete	<10s	≥10s	(Rose, Jones, & Lucchese, 2002; Arnold & Faulkner, 2007
Step test	Number of steps	>10	≤10	(Sousa et al,2016)

We shall now describe the two applied scales.

Falls Efficacy Scale

The Portuguese version of Falls Efficacy Scale (FES) was used to assess the confidence in falls in portuguese sample (annex 2).

This instrument was developed by Tinetti and collaborators (1990) to measure the fear of falling, having been translated and validated for the Portuguese population by Martins (2013) within the scope of the Aging@Coimbra Project. This scale assesses the confidence that individuals present in carrying out relevant daily activities that are

essential for independent living and not dangerous. It is an easy-to-understand and quick-fill scale that contains the essentials for assessing the fear of falling. It presents the inverted Lickert scale, relative to the original scale, since it is understood that it is more intuitive to those who answer. Its psychometric properties remained adequate and in agreement with the original. The confidence that individuals have in performing activities without falling is represented by 10 items punctuated on a 10-point analogue scale ranging from "No Confidence" (1 point) to "Completely Confident" (10 points). The FES score is the sum of the scores obtained on each of the 10 items and ranges from 10 to 100. This Portuguese version, using the Lickert scale inverse to the original scale of Tinetti, Richman and Powell (1990), converts the total score to the original scale so that we can continue to have the normative values of the original authors as reference (Values higher than 70 associated with greater risk of falls).

The Polish version of Falls Efficacy Scale (FES) was used to assess the confidence in falls in polish sample (annex 4).

In addition to the FES, the fear of falling was evaluated by a unique question through the questionnaire: "Are you afraid of falling?".

Self-efficacy for exercise

The self-efficacy for exercise was translated and validated for the portuguese population in the Ageing@Coimbra programme Ageing@Coimbra (Martins,2013) (annex 1). The construct of perceived self-efficacy represents one core aspect of social cognitive theory (Bandura, 1992, 1997). A person who believes in being able to produce a desired effect can conduct a more active and self-determined life course.

The self-efficacy for exercise scale reflects the individual's perceived ability to perform exercise according to his or her emotional status, when experiencing worries and problems, depressed, tense, tired or busy.

It is composed by a Likert scale ranging from 1, "Not true at all" to 4, "Exactly true". The obtained result ranges from 5 to 20. The higher the score, the higher the self-efficacy for exercise is.

There are no reference values for this scale. Its central point is 12,50. Individuals with a score lower than 10 are considered to have low self-efficacy for exercise. Individuals with scores higher than 18 are considered to have high self-efficacy for exercise (Fall sensing project 2017- In a sample of 385 individuals where 25% had more than 18 in the SE for exercise and 25% had between 5 and 10 in the SE for exercise).

The following table summarizes the questionnaires used in this study and their normative values.

Table 2 - Questionnaires used in this study

Questionnaire	Normative values		Bibliograpy Reference
	Low Risk	High Risk	
Self-efficaccy for exercise	**		Fall sensing project 2017
FES	<70	≥70	(Tinetti, 1990)

** Individuals with a score lower than 10 are considered to have low self-efficacy for exercise. Individuals with scores higher than 18 are considered to have high self-efficacy for exercise

Statistic Analysis

After collecting all the data from the research, the statistical analysis was made using the Statistic Package for Social Sciences Software (SPSS) in its most current version (version 21.00). We will now justify the options taken in terms of statistical procedures for data processing.

In a first stage of our study, simple descriptive statistics were applied for characterization and description of the sample (Frequencies and percentages), as well as measures of central tendency (Medium or M) and dispersion (Standard Deviation or SD).

To compare the mean of the different functional tests with history of falls, it was used the statistic test t S*tudent* (comparison between two groups). To compare the mean of the different functional tests with the self-efficacy scale groups for exercise it was used the statistic test One-Way ANOVA (comparison of three groups).

To verify the relation between the various dichotomous variables and the history of falls, it was used the Chi-Square test.

The study of correlation among the dependent variables (TUG, step test e 10-meter walking speed test) was made with the Pearson Coefficient (r Pearson). As to the reading of the association, regarding its dimensions, it was used the reference values of Pestana&Gageiro (2014). According to this authors, a correlation inferior to 0,20 shows a very low association (week or despicable); between 0,20 and 0,39 shows that the association is low (week); a correlation between 0,40 and 0,69 shows a moderate association; between 0,70 and 0,89, the association is high and if it is between 0,9 and 1,00 is very high.

The statistic tests interpretation was made based on the level of significance of $\alpha = 0.05$ with a 95% confidence interval. For a significant α (≤ 0.05) the differences or association between the groups are observed. For $\alpha > 0.05$, there were no significant differences or association between the groups.

CHAPTER IV

Results

Participants

In the course of this chapter, we shall proceed to the submission of the results regarding the collected data, which are displayed in a table, followed by the correspondent analysis.

In table 3 we shall present a characterization of the sample regarding the factors of fall risk.

The studied sample was selected by convenience sampling, being composed by 200 individuals aged more than 55 years old living in the community. This study consists of two sub-samples: a Portuguese sub-sample with 150 individuals from both sexes and a Polish sub-sample with 50 female individuals.

The following tables concern the fall risk factors identified by the population in our sample.

Table 3 - Analysis of the fall risk factors in the three samples in this study

		Total Sample N (%)	Pt Sample N (%)	Pl Sample N (%)
>4 medication	*No*	89 (44,5)	69 (46,0)	20 (40,0)
	Yes	111 (55,5)	81 (54,0)	30 (60,0)
Walking assistive device	*No*	166 (83,0)	131 (87,3)	35 (70,0)
	Yes	34 (17,0)	19 (12,7)	15 (30,0)
Help getting up chair	*No*	135 (67,5)	87 (58,0)	48 (96,0)
	Yes	65 (32,5)	63 (42,0)	2 (4,0)
Less than 30 minutes (2x/week)	*No*	110 (55,0)	77 (51,3)	33 (66,0)
	Yes	90 (45,0)	73 (48,7)	17 (34,0)
Alcohol	*No*	162 (81,0)	113 (75,3)	49 (98,0)
	Yes	38 (19,0)	37 (24,7)	1 (2,0)
Hearing problems/dizziness	*No*	73 (36,5)	41 (27,3)	32 (64,0)
	Yes	127 (63,5)	109 (72,7)	18 (36,0)
Vision Problems	*No*	48 (24,0)	24 (16,0)	24 (48,0)
	Yes	152 (76,0)	126 (84,0)	26 (52,0)
Fear of falling	*No*	85 (42,5)	58 (38,7)	27 (54,0)
	Yes	115 (57,5)	92 (61,3)	23 (46,0)
Sedentary lifestyle	*No*	126 (63,0)	104(69,3)	22 (44,0)
	Yes	74 (37,0)	46 (30,7)	28 (56,0)

The total sample in this study is composed by individuals with ages between 55 and 92 years old (M = 68.13, SD = 8,79)

Concerning the total sample of this study, 81% of the assessed individuals were females.

115 (57,5%) referred to feel fear of falling. 111 (55%) referred to take more than 4

medications per day, 34 (17%) use walking assistive devices. Hearing problems and dizziness were mentioned by 127 (63,5%) and 152 (76%) mentioned vision problems. 65 (32,5%) indicated the need for help getting up from a chair.

In relation to exercise practice, 90 (45%) don't practice exercise for 30 minutes twice a week and 74 (37%) spends more than four hours per day sitting.

Portuguese sample

In this study, the Portuguese sample consists of 150 individuals aged between 55 and 92 years old (M = 68,71, SD = 9,1), resident in the districts of Coimbra and Leiria, non institutionalized, being 112 females (74,7%).

68 individuals (45,3%) had experienced at least one fall and 61,3% admitted being afraid of falling. 81 (54%) were treated with more than four different medications daily, 63 (42%) reported difficulties in getting up from a chair, while only 19 (12,7%) use assistive devices to walk.

Hearing problems and dizziness were mentioned by 109 (72,7%) and 126 (84%) mentioned vision problems. In relation to exercise practice, 73 (48,7%) don't practice exercise for 30 minutes twice a week and 46 (30,7%) spends more than four hours per day sitting.

Among the individuals that have fallen, 57 were females, while 11 were males.

Polish sample

The Polish sample consists of 50 female individuals, aged between 58 and 85 years old, resident in Poznan (Poland).

23 individuals (46%) admitted being afraid of falling. 30 (60%) were treated with more than four different medications daily, 2 (4%) reported difficulties in getting up from a chair, while 15 (30%) use assistive devices to walk.

Hearing problems and dizziness were mentioned by 18 (36%) and 26 (52%) mentioned vision problems. In relation to exercise practice, 17 (34%) don't practice exercise for 30 minutes twice a week and 28 (56%) spends more than four hours per day sitting.

Descriptive analysis of the studied variables.

After the sample characterization previously presented, we proceed, describing the obtained results in relation to each studied variable (Minimum (*Min*), Maximum (*Max*), Mean (*M*) and standard deviation (*SD*)).

Table 4 - Minimum, Maximum, Mean and Standard deviation of age, functional tests, self-efficacy for exercise, FES and number of falls

	Total Sample (N=200)				PT Sample (N=150)				PL Sample (N=50)			
	Min	**Máx**	**M**	**SD**	**Min**	**Máx**	**M**	**SD**	**Min**	**Máx**	**M**	**SD**
Age	55	92	**69,13**	8,793	55	92	**68,71**	9,09	58	85	**70,38**	7,76
10 meter wst (m/s)	0,17	2,79	**1,22**	2,01	0,17	2,22	**1,13**	1,82	0,64	2,79	**1,61**	5,38
TUG (s)	3,71	48,23	**9,712**	5,694	4,99	48,23	**10,7**	6,02	3,71	24,29	**6,81**	3,17
Step test	0	28	**13,29**	5,972	0	23	**11,76**	5,21	0	28	**17,88**	5,798
FES	10	96	**21,84**	18,277	10	94	**22,61**	18,547	10	96	**19,52**	17,416
Self-efficacy	5	20	**12,63**	5,145	5	20	**12,23**	5,05	5	20	**13,84**	5,289
Number of falls	1	20	**3,52**	4,078	1	20	**3,71**	4,339	1	6	**2,42**	1,73

79 individuals (39,5%) have experienced at least one fall episode during the last 12 months From the 200 individuals subject to the 10-meter walking speed test, 37 (18,5%) showed values equal or inferior to 1,0m/s, point of cohort for the need to start a falls prevention program; 92 (46%), equal or inferior to 1,42 m/s, (table 5) point of cohort for safe street crossing. The time spent in the 10-meter walking speed test was on average 8,20 seconds corresponding to a speed of M=1,22 m/s

51,5% of the individuals took more than 10 seconds to accomplish the TUG test. The time spent in TUG was on average 9,7 seconds (SD=5,69). The step test average was 13,29 (SD=5,97), with 35,5% of the individuals completing a score lower than 10. The FES achieved an average of 21,84% (SD=18,27), with 5% of the individuals reaching a score equal or higher than 70.

Concerning the self-efficacy for exercise, a value M=12,63 (SD=5,145) appeared.

The average number of falls mentioned by this population was 3,52.

Table 5 - Cohort points of the gold measures used in this study in the 3 samples analyzed

		Total Sample (N=200)		**PT Sample (N=150)**		**PL Sample (N=50)**	
		n	**% (M)**	**n**	**% (M)**	**n**	**% (M)**
TUG (s)	<10s	139	69,5 (7,05)	92	61,3 (7,49)	47	94 (6,96)
	≥10s	61	30,5 (15,78)	58	38,7 (15,74)	3	6 (16,59)
10 meter WST (m/s)	>1m/s	163	81,5 (1,49)	114	76 (1,45)	49	98 (1,66)
	≤1m/s	37	18,5 (0,67)	36	24 (0,67)	1	2 (0,64)
	>1,42	108	54 (1,71)	66	44 (1,68)	42	84 (1,76)
	≤1,42	92	46 (0,91)	84	56 (0,89)	8	16 (1,09)
Step test	>10	130	65(16,77)	84	56 (15,50)	46	92 (19,09)
	≤10	70	35 (6,81)	66	44 (6,98)	4	8 (4)
FES	<70	190	95 (18,73)	141	94 (18,99)	49	98 (7,69)
	≥70	10	5 (81)	9	6 (79,33)	1	2 (86)
History of falls	No	121	60,5	82	54,7	39	78
	Yes	79	39,5	68	45,3	11	22

Portuguese sample

68 individuals (45.3%) had experienced at least one fall and 61,3% admitted being afraid of falling. From the 150 individuals subject to the 10-meter walking speed test, 36 (24%), showed values equal or inferior to 1,0m/s, point of cohort for the need to

start a falls prevention program; 84 (56%), equal or inferior to 1,42 m/s, point of cohort for the safe street crossing. The time spent in the 10-meter walking speed test was on average 8,86 seconds corresponding to a speed of M=1,13 m/s with SD=5,49 step test average was 11,76 (SD=5,21), with 44,7% of the individuals completing a score lower than 10. The FES achieved an average of 22,61% (SD=18,54), with 6% of the individuals reaching a score equal or higher than 70.

Concerning the self-efficacy for exercise, a value M=12,23 (SD=5,05) appeared.

The average number of falls mentioned by this population was 3,52. In relation to the TUG test, the average time reached was 10,68 seconds (SD=6,02), with 37,3% of the individuals taking more than 10 seconds to complete the test. The average number of falls mentioned by this population was 3,71.

Polish Sample

11 individuals (22%) had experienced at least one fall. From the 50 individuals subject to the 10-meter walking speed test, one (2%), showed values equal or inferior to 1,0m/s, point of cohort for the need to start a falls prevention program; and 8 (16%), equal or inferior to 1,42 m/s, point of cohort for the safe street crossing. The time spent in the 10-meter walking speed test was on average 6,22 seconds corresponding to a speed of M=1,61 m/s (SD=1,86).

In relation to the TUG test, the average time reached was 6,81 seconds (SD=3,17), with 6% of the individuals taking more than 10 seconds to complete the test. The step test average was 17,88 (SD=5,79), with 4% of the individuals completing a score lower than 10. The FES achieved an average of 19,52% (SD=17,42), with 1% of the individuals reaching a score equal or higher than 70.Concerning the self-efficacy for exercise, a value M=13,84 (SD=5,29) appeared.

The average number of falls mentioned by this population was 2,42.

Risk factors of falling incidence among fallers and non-fallers

Table 6 - Risk factors among adults with history of falls and those with no history of falls - total sample

	NonFallers (121)		Fallers (79)	
	N	%	N	%
≥4 medication	57	47,11	54	68,35
Walking assistive device	17	14,05	17	21,52
Help getting up chair	25	20,66	40	50,63
Less than 30 minutes (2x/week)	49	40,49	41	51,89
Alcohol	22	18,18	16	20,25
Hearing problems/dizziness	65	53,72	62	78,48
Vision Problems	87	71,90	65	82,28
Fear of falling	54	44,63	61	77,22
Sedentary Lifestyle	43	35,54	31	39,24

As we can see in table 6, of the 79 subjects who sustained a fall in the last 12 months, 54 (68,35%) reported taking more than 4 medications per day.

The rate of use of assistive devices is higher for those who reported a fall in the last 12 months (21,52%). 62 of the subjects (78,48%) have hearing problems/dizziness, 65 (82,28%) referred vision problems, 16 (20,25%) drink alcohol daily and 61 (77,22%) have fear of falling.

31 of the subjects who reported a fall in the last 12 months (39,24%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 40 (50,63%) need help getting up from a chair and 41 (51,89%) practice less than 30 minutes of exercise twice a week .

Table 7 - Risk factors among adults with history of falls and those with no history of falls - portuguese sample

	NonFallers (82)		Fallers (68)	
	N	%	N	%
≥4 medication	36	43,90	45	66,18
Walking assistive device	7	8,54	12	17,65
Help getting up chair	24	29,27	39	57,35
Less than 30 minutes (2x/week)	35	42,68	38	55,88
Alcohol	21	25,61	16	23,53
Hearing problems/dizziness	53	64,63	66	97,06
Vision Problems	68	82,93	58	85,29
Fear of falling	37	45,12	55	80,88
Sedentary Lifestyle	23	28,05	66	97,06

As we can see in table 7, of f the 68 subjects who sustained a fall in the last 12 months, 45 (66,18%) reported taking more than 4 medications per day. The rate of use

of assistive devices is higher for those who reported history of fall (14,65%). 66 of the subjects (97,06%) have hearing problems/dizziness, 58 (85,29%) referred vision problems, 16 (23,53%) drink alcohol daily and 55 (80,88%) have fear of falling.
66 of the subjects who reported a fall in the last 12 months (97,06%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 39 (57,5%) need help getting up from a chair and 38 (55,88%) practice less than 30 minutes of exercise twice a week

Table 8 - Risk factors among adults with history of falls and those with no history of falls - polish sample

	NonFallers (39)		**Fallers (11)**	
	N	%	N	%
≥4 medication	21	53,85	9	81,82
Walking assistive device	10	25,64	5	45,45
Help getting up chair	1	2,56	1	9,09
Less than 30 minutes (2x/week)	14	35,90	3	27,27
Alcohol	1	2,56	0	0,00
Hearing problems/dizziness	12	30,77	6	54,55
Vision Problems	19	48,72	7	63,64
Fear of falling	17	43,59	6	54,55
Sedentary Lifestyle	20	51,28	8	72,73

As we can see in table 8, of the 11 subjects who sustained a fall in the last 12 months, 9 (81,82%) reported taking more than 4 medications per day. The rate of use of assistive devices is higher for those who reported a fall in the last 12 months (45,45%). 6 of the subjects (54,55%) have hearing problems/dizziness, 7 (63,64%) referred vision problems and 6 (54,55%) have fear of falling.
8 of the subjects who reported a fall in the last 12 months (72,73%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 1 (9,09%) need help getting up from a chair and 3 (27,7%) practice less than 30 minutes of exercise twice a week .

None of the subjects who sustained a fall in the last 12 months drinks alcohol daily.

Association between history of falls and other risk of falls

Table 9 - Association between history of falls and other risk of falls - Chi-square

	History of fall		
	Chi-square (Asymp.sig (2-sided))		
	Amostra total	Amostra pt	Amostra pl
>4 medication	**0,003**	**0,006**	0,094
Walking assistive device	0,169	0,095	0,205
Help getting up chair	**0,000**	**0,001**	0,329
Less than 30 minutes	0,113	0,107	0,594
Alcohol	0,715	0,769	0,592
Hearing problems/dizziness	**0,000**	**0,015**	0,147
Vision Problems	0,093	0,694	0,382
Fear of falling	**0,000**	**0,000**	0,52
Sedentary lifestyle	0,596	0,445	0,206

As we can see in table 9, consuming more than 4 medications per day, needing help getting up from a chair, hearing problems / dizziness and fear of falling are related to the history of fall ($p \leq 0.05$).

In the Portuguese sample the same factors are related to the history of fall.

In the Polish sample, none of the factors is related to the history of fall.

Risk factors of falling incidence among TUG<10 and TUG≥10

Table 10 - Risk factors among adults with TUG<10 and those with TUG **≥10**- Total sample

	TUG <10 (139)		TUG ≥10 (61)	
	N	%	N	%
≥4 medication	66	47,48	45	73,77
Walking assistive device	13	9,35	21	34,43
Help getting up chair	25	17,99	40	65,57
Less than 30 minutes (2x/week)	55	39,56	35	57,38
Alcohol	23	16,55	15	24,59
Hearing problems/dizziness	77	55,39	50	81,97
Vision Problems	103	74,10	49	80,33
Fear of falling	68	48,92	47	77,05
Sedentary Lifestyle	47	33,813	27	44,26

As we can see in table 10, of 61 subjects who take 10 seconds or more to complete the TUG, 45 (73,77%), reported taking more than 4 medications per day, 40 (65,57%) need help getting up from a chair, 35 (57,38%) practice less than 30 minutes of exercise twice a week and 27 (44,26%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 50 (81,97%) have hearing problems/dizziness, 49 (80,33%) referred vision problems, 21 (34,4%) use an assistive device to walk, 15 (24,59%) drink alcohol daily and 47 (77,05%) have fear of falling.

Table 11 - Risk factors among adults with TUG<10 and those with TUG ≥ 10- portuguese sample

	TUG <10 (92)		TUG ≥10 (58)	
	N	%	N	%
≥4 medication	38	41,30	43	74,14
Walking assistive device	1	1,09	18	31,03
Help getting up chair	24	26,07	39	67,24
Less than 30 minutes (2x/week)	38	41,30	35	60,35
Alcohol	22	23,91	15	25,87
Hearing problems/dizziness	61	66,30	48	82,76
Vision Problems	78	84,78	48	82,76
Fear of falling	47	51,09	45	77,59
Sedentary Lifestyle	21	22,83	25	43,10

As we can see in table 11, of 58 subjects who take 10 seconds or more to complete the TUG, 43 (74,14%) reported taking more than 4 medications per day, 39

(67,24%) need help getting up from a chair, 35 (60,03%) practice less than 30 minutes of exercise twice a week and 25 (43,10%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 15 (25,87) drink alcohol daily, 48 (82,76%) have hearing problems/dizziness, 48 (82,76%) referred vision problems, 18 (31,03%) use an assistive device to walk and 45 (77,59%) have fear of falling.

Table 12 - Risk factors among adults with TUG<10 and those with TUG ≥10- polish sample

	TUG <10 (47)		**TUG≥10 (3)**	
	N	%	N	%
≥4 medication	28	59,57	2	66,67
Walking assistive device	12	25,53	3	100,00
Help getting up chair	1	2,13	1	33,33
Less than 30 minutes (2x/week)	17	36,17	0	0,00
Alcohol	1	2,13	0	0,00
Hearing problems/dizziness	16	34,04	2	66,67
Vision Problems	25	53,19	1	33,33
Fear of falling	21	44,68	2	66,67
Sedentary Lifestyle	26	55,32	2	66,67

As we can see in table 12, of 3 subjects who take 10 seconds or more to complete the TUG, 2 (66,67%) reported taking more than 4 medications per day, 1 (33,33%) need help getting up from a chair and 2 (66,67%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 2 (66,67%) have hearing problems/dizziness, 1 (33,33%) referred vision problems, 3 (100%) use an assistive device to walk and 2 (66,67%) have fear of falling.

None of the subjects who take 10 seconds or more to complete the TUG, practice less than 30 minutes of exercise twice a week and drink alcohol daily.

Association between TUG and other risk of falls

Table 13 - Association between Timed Up & Go and other risk of falls - Chi-square

	TUG cutoff		
	Chi-square (Asymp.sig (2-sided))		
	Amostra total	Amostra pt	Amostra pl
>4 medication	**0,001**	**0,000**	0,808
Walking assistive device	**0,000**	**0,000**	**0,006**
Help getting up chair	**0,000**	**0,000**	**0,007**
Less than 30 minutes	**0,020**	**0,023**	0,200
Alcohol	0,182	0,467	0,799
Hearing problems/dizziness	**0,000**	**0,028**	0,254
Vision Problems	0,342	0,742	0,504
Fear of falling	**0,000**	**0,001**	0,459
Sedentary lifestyle	0,159	**0,009**	0,701

As we can see in table 13, consuming more than 4 medications per day, walking assistive devices, needing help getting up from a chair, hearing problems / dizziness, exercise practice less than 30 minutes twice a week and fear of falling are related to TUG ($P \leq 0.05$).

In portuguese sample the same factors are related to TUG, adding the sedentary lifestyle ($p<0,05$).

In polish sample are related to TUG the use of an assistive device and needing help getting up from a chair ($p<0,05$).

Risk factors of falling incidence among 10-meter WST > 1 m/s and 10-meter WST ≤ 1m/s

Table 14 - Risk factors among adults with and those with WST>1 m/s and those with WST≤1m/s - total sample

	WST >1m/s (163)		WST≤ 1m/s (37)	
	N	%	N	%
≥4 medication	81	49,69	30	81,08
Walking assistive device	17	10,43	17	45,95
Help getting up chair	37	22,69	28	75,68
Less than 30 minutes (2x/week)	68	41,72	22	59,46
Alcohol	29	17,79	9	24,32
Hearing problems/dizziness	97	59,51	30	81,08
Vision Problems	122	74,85	30	81,08
Fear of falling	83	50,92	32	86,49
Sedentary Lifestyle	56	34,36	18	48,65

As we can see in table 14, of 37 subjects who take 10 seconds or more to complete 10-meter walking speed test, 30 (81,08%) reported taking more than 4 medications per day, 28 (75,68%) need help getting up from a chair, 22 (59,46%) practice less than 30 minutes of exercise twice a week and 18 (48,65%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 9 (24,32) drink alcohol daily, 30 (81,08%) have hearing problems/dizziness, 30 (81,08%) referred vision problems, 17 (45,95%) use an assistive device to walk and 32 (86,49%) have fear of falling.

Table 15 - Risk factors among adults with and those with WST>1 m/s and those with WST≤1m/s - portuguese sample

	WST >1m/s (114)		WST≤ 1m/s (36)	
	N	%	N	%
≥4 medication	52	36,11	29	80,56
Walking assistive device	3	2,08	16	44,44
Help getting up chair	36	25	27	75
Less than 30 minutes (2x/week)	51	35,42	22	61,11
Alcohol	28	19,44	9	25
Hearing problems/dizziness	80	55,56	29	80,56
Vision Problems	97	67,36	29	80,56
Fear of falling	61	42,36	31	86,11
Sedentary Lifestyle	29	20,14	17	47,22

As we can see in table 15, of 36 subjects who take 10 seconds or more to complete 10-meter walking speed test, 29 (80,56%) reported taking more than 4 medications per day, 27 (75%) need help getting up from a chair, 22 (61,11%) practice less than 30 minutes of exercise twice a week and 17 (47,22%) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 9 (25%) drink alcohol daily, 29 (80,56%) have hearing problems/dizziness, 29 (80,56%) referred vision problems, 16 (44,44%) use an assistive device to walk and 31 (86,11%) have fear of falling.

Table 16 - Risk factors among adults with and those with WST>1 m/s and those with WST≤1m/s - polish sample

	WST >1m/s (49)		**WST≤ 1 m/s (1)**	
	N	%	N	%
≥4 medication	29	59,18	1	100
Walking assistive device	14	28,57	1	100
Help getting up chair	1	2,04	1	100
Less than 30 minutes (2x/week)	17	34,69	0	0
Alcohol	1	2,04	0	0
Hearing problems/dizziness	17	34,69	1	100
Vision Problems	25	51,02	1	100
Fear of falling	22	44,9	1	100
Sedentary Lifestyle	27	55,1	1	100

In the polish sample (table 16), only 1 person take more than 10 seconds to complete the 10-meter walking speed test.

Association between 10 -meter walking speed test and other risk of falls

Table 17 - Association between walking speed test and other risk of falls - Chi-square

	WST cutoff		
	Chi-square (Asymp.sig (2-sided))		
	Amostra total	**Amostra pt**	**Amostra pl**
>4 medication	**0,000**	**0,000**	0,409
Walking assistive device	**0,000**	**0,000**	0,123
Help getting up chair	**0,000**	**0,000**	**0,000**
Less than 30 minutes	0,055	0,087	0,468
Alcohol	0,366	0,958	0,885
Hearing problems/dizziness	**0,014**	**0,023**	0,178
Vision Problems	0,423	0,518	0,332
Fear of falling	**0,000**	**0,000**	0,274
Sedentary lifestyle	0,104	**0,013**	0,371

As we can see in table 17, consuming more than 4 medications per day, walking assistive devices, needing help getting up from a chair, hearing problems / dizziness and fear of falling are related 10-meter walking speed test ($p \leq 0.05$).

In the Portuguese sample the same factors are related to the 10-meter walking speed test, adding sedentary lifestyle ($p<0,05$).

In the Polish sample, help getting up from a chair is related to 10-meter walking speed test ($p<0,05$).

Risk factors of falling incidence among Step test >10 and Step test ≤10

Table 18 - Risk factors among adults with step test > 10 and those with step test ≤10 - total sample

	Step test >10 (130)		Step test ≤10 (70)	
	N	%	N	%
≥4 medication	62	47,69	49	70,00
Walking assistive device	14	10,77	20	28,57
Help getting up chair	19	14,62	46	65,71
Less than 30 minutes (2x/week)	53	40,77	37	52,86
Alcohol	20	15,38	18	25,71
Hearing problems/dizziness	71	54,62	56	80,00
Vision Problems	95	73,08	57	81,43
Fear of falling	63	48,46	52	74,29
Sedentary Lifestyle	44	33,85	30	42,86

As we can see in table 18, of 70 subjects who performing 10 or less steps in the step test, 49 (70%) reported taking more than 4 medications per day, 46 (65,71%) need help getting up from a chair, 37 (52,86%) practice less than 30 minutes of exercise twice a week and 30 (42,86 %) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 18 (25,71%) drink alcohol daily, 56 (80%) have hearing problems/dizziness, 57 (81,43%) referred vision problems, 20 (28,57%) use an assistive device to walk and 52 (74,29%) have fear of falling.

Table 19 - Risk factors among adults with step test > 10 and those with step test ≤10 - portuguese sample

	Step test >10 (84)		Step test ≤10 (66)	
	N	%	N	%
≥4 medication	33	39,29	48	72,73
Walking assistive device	1	1,19	18	27,27
Help getting up chair	18	21,43	45	68,18
Less than 30 minutes (2x/week)	36	42,86	37	56,06
Alcohol	19	22,62	18	27,27
Hearing problems/dizziness	55	65,48	54	81,82
Vision Problems	71	84,52	55	83,33
Fear of falling	43	51,19	49	74,24
Sedentary Lifestyle	20	23,81	26	39,39

As we can see in table 19, of 66 subjects who performing 10 or less steps in the step test, 48 (72,73%) reported taking more than 4 medications per day, 45 (68,18%) need help getting up from a chair, 37 (56,06%) practice less than 30 minutes of exercise twice a week and 26 (39,39 %) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair), 18 (27,27%) drink alcohol daily, 54 (81,82%) have hearing problems/dizziness, 55 (83,83%) referred vision problems, 18 (27,27%) use an assistive device to walk and 49 (74,24%) have fear of falling.

Table 20 - Risk factors among adults with step test > 10 and those with step test ≤10 - polish sample

	Step test >10 (46)		**Step test ≤10 (4)**	
	N	%	N	%
≥4 medication	29	63,04	1	25
Walking assistive device	13	28,26	2	50
Help getting up chair	1	2,17	1	25
Less than 30 minutes (2x/week)	17	36,96	0	0
Alcohol	1	2,17	2	50
Hearing problems/dizziness	16	34,78	2	50
Vision Problems	24	52,17	2	50
Fear of falling	20	43,48	3	75
Sedentary Lifestyle	24	52,17	4	100

As we can see in table 20, of 4 subjects who performing 10 or less steps in the step test, 1 (25%) reported taking more than 4 medications per day, 1 (25%) need help getting up from a chair, 4 (100 %) referred a sedentary lifestyle (more than 4 hours a day sitting on a chair),2 (50%) drink alcohol daily, 2 (50%) have hearing problems/dizziness, 2 (50%) referred vision problems, 2 (50%) use an assistive device to walk and 3 (75%) have fear of falling.

None of the subjects who performing 10 or less steps in step test, practice less than 30 minutes of exercise twice a week.

Association between Step test and other risk of falls

Table 21 - Association between step test and other risk of falls - Chi-square

	Step test Cut-off		
	Chi-square (Asymp.sig (2-sided))		
	Amostra total	Amostra portuguesa	Amostra polaca
>4 medication	**0,002**	**0,000**	0,136
Walking assistive device	**0,002**	**0,000**	0,363
Help getting up chair	**0,000**	**0,000**	**0,025**
Less than 30 minutes	0,068	0,108	0,134
Alcohol	0,058	0,320	0,0766
Hearing problems/dizziness	**0,000**	**0,026**	0,543
Vision Problems	0,125	0,844	0,933
Fear of falling	**0,000**	**0,004**	0,225
Sedentary lifestyle	0,208	**0,04**	0,089

As we can see in table 21, consuming more than 4 medications per day, walking assistive devices, needing help getting up from a chair, hearing problems / dizziness and fear of falling are related step test ($p \leq 0.05$).

In the Portuguese sample the same factors are related to the step test, adding sedentary lifestyle ($p<0,05$).

In the Polish sample, help getting up from a chair is related to step test ($p<0,05$).

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Differences between fallers and non-fallers related to functional tests

- Total Sample

Table 22 - Differences between fallers and non-fallers related to functional tests- total sample - t-Student

		n	*M (DP)*	*t*	*p*
10 meter walking speed test (m/s)	No	121	1,35 (3,04)	-2,54	**0,012**
	Yes	79	1,06 (9.43)		
TUG (s)	No	121	8,79 (4,99)	-2,901	**0,004**
	Yes	79	11,13 (6,40)		
Step test	No	121	14,66 (5,89)	4,201	**0,000**
	Yes	79	11,18 (5,48)		

In table 22, we can see that those who report history of falls in the last 12 months show lower walking speed (1,06 m/s), need more seconds to complete the TUG test (11,13s), and have lower scores on the step test (11,18). These differences were statistically significant (p≤0,05).

- Portuguese Sample

Table 23 - Differences between fallers and non-fallers related to functional tests- portuguese sample - t-Student

		n	*M (DP)*	*t*	*p*
10 meter walking speed test (m/s)	No	82	1,26 (2,74)	-2,347	**0,02**
	Yes	68	1 (1,44)		
TUG (s)	No	82	9,687 (5,351)	-2,249	**0,026**
	Yes	68	11,88 (6,578)		
Step test	No	82	13,10 (5,044)	3,612	**0,000**
	Yes	68	10,13 (4,971)		

In table 23, we can see that those who report history of falls in the last 12 months have lower walking speed (1 m/s), need more seconds to complete the TUG test (11.88) and have lower scores on the step test (10,13). These differences were statistically significant (p≤0,05).

- Polish Sample

As we can see in table 24, there were no statistically significant relations between the history of falls and 10-meter walking speed test, TUG and step test.

Table 24 - Differences between fallers and non-fallers related to functional tests- polish sample - t-Student

		n	*M (DP)*	*t*	*p*
10 meter walking speed test (m/s)	No	39	1,59 (4,94)	0,512	0,611
	Yes	11	1,68 (8,58)		
TUG (s)	No	39	6,889 (3,490)	0,339	0,736
	Yes	11	6,52 (1,688)		
Step test	No	39	17,95 (6,262)	0,156	0,877
	Yes	11	17,64 (3,957)		

Association between functional tests

Table 25 - Pearson Correlation between TUG, walking speed test and step test- total sample

		10-meter WST	TUG
10-meter WST	*p*		
TUG	Pearson Correlation	-0,902	
	p	,000	
StepTest	Pearson Correlation	0,537	-0,649
	p	,000	,000

In table 25, we can see that in total sample, the 10-meter walking speed test had a very strong inverse relation (r = 0,902, p <0,01) with the TUG and a moderate relation with the step test (r = -0,537, p <0,01).

The TUG shows an inversely moderate relation with the step test (r=-0,649, p<0,01).

Table 26 - Pearson Correlation between TUG, walking speed test and step test- portuguese sample

		10-meter WST	TUG
10-meter WST	Pearson Correlation		
	p		
TUG	Pearson Correlation	-0,901	
	p	0,000	
StepTest	Pearson Correlation	0,511	-0,617
	p	0,000	0,000

In portuguese sample, the 10-meter walking speed test had a very strong inverse relation (r=0,901, p<0,01), with the TUG and a moderate relation with the step test (r=-0,511, p<0,01). The TUG shows an inversely moderate relation with the step test (r=-0,617, p<0,01).

Table 27 - Pearson Correlation between TUG, walking speed test and step test- polish sample

		10-meter WST	TUG
10-meter WST	Pearson Correlation		
	p		
TUG	Pearson Correlation	-0,911	
	p	0,000	
StepTest	Pearson Correlation	0,737	-0,689
	p	0,000	0,000

In the polish sample, the 10-meter walking speed test had a very strong inverse relation (r=0,911, p<0,01) with the TUG and a strong relation with the step test (r=-0,737, p<0,01). The TUG shows an inversely moderate relation with the step test (r=-0,617, p<0,01).

Differences between self-efficacy groups related to functional tests

Table 28 - Analysis of the differences of self-efficacy groups related to Walking Speed test, TUG and Step test - Total sample - ANOVA

		N	M	F	*p*
10-meter WST	≤10	71	1,07		
	10,1-17,9	83	1,26	3,64	0,028
	≥18	46	1,45		
TUG	≤10	71	11,501		
	10,1-17,9	83	9,08	6,188	0,002
	≥18	46	8,09		
Step test	≤10	71	11,44		
	10,1-17,9	83	13,24	9,762	0,000
	≥18	46	16,22		

As it is observed in the table 28, that presents the values of TUG, of the 10-meter walking speed and of the step test according to the SE in total sample, the differences (ANOVA) are statistically significant ($p<0,05$).

Those who score less than 10 on the SE for exercise, take 11,50 seconds to complete the TUG, have a walking speed test of 1,07 m/s and perform 11,44 steps on the step test.

Those who score between 10,1 and 17,9 in the SE for exercise take 9,08 seconds to complete the TUG, have a walking speed of 1,26 m/s and perform 13,24 steps in the step test.

Those who score more than 18 in SE for exercise take 8,09 seconds to complete the TUG, have a walking speed of 1,45 m/s and perform 16,22 steps in the step test.

Table 29 - Analysis of the differences of self-efficacy groups related to Walking Speed test, TUG and Step test - Portuguese sample - ANOVA

		N	M	F	*p*
10-meter WST	≤10	57	0,99		
	10,1-17,9	62	1,19	2,659	0,073
	≥18	31	1,34		
TUG	≤10	57	12,69		
	10,1-17,9	62	9,74	5,67	0,004
	≥18	31	8,88		
Step test	≤10	57	9,88		
	10,1-17,9	62	12,23	8,303	0,000
	≥18	31	14,27		

As it can be observed in table 29, that presents the values of the walking speed test and of the step test according to the SE for exercise in the portuguese sample, the differences (ANOVA) are statistically significant ($p<0,05$) in the TUG and in the step test, but they are not significant in the 10-meter walking speed test ($p=0,073$)

Those who score less than 10 on the SE for exercise, take 12,69 seconds to complete the TUG, have a walking speed of 0,99 m/s and perform 9,88 steps on the step stest.

Those who score between 10,1 and 17,9 in the SE for exercise take 9,74 seconds to complete the TUG, have a walking speed of 1,19 m/s and perform 12,23 steps in the step test.

Those who score more than 18 in SE for exercise take 8,88 seconds to complete the TUG, have a walking speed of 1,34 m/s and perform 14,27 steps in the step test.

Table 30 - Analysis of the differences of self-efficacy groups related to Walking Speed test, TUG and Step test - Polish sample - ANOVA

		N	M	F	*p*
10-meter WST	≤10	14	1,59		
	10,1-17,9	21	1,52	1,047	0,359
	≥18	15	1,49		
TUG	≤10	14	6,67		
	10,1-17,9	21	7,14	0,207	0,813
	≥18	15	6,47		
Step test	≤10	14	17,79		
	10,1-17,9	21	16,24	2,22	0,120
	≥18	15	20,27		

As it can be observed in table 30, that presents the values of TUG test, of the

walking speed test and of the step test according to the SE for exercise in the polish sample, the differences (ANOVA) are not statistically significant (p>0,05).

History of falls according to self-efficay for exercise

Table 31 History of falls according to self-efficacy for exercise - Total Sample

			SE Groups			
			≤10	10,1-17,9	≥18	*p*
History of falls	No	N	32	54	35	0,002
		%	26,4	44,6	28,9	
	Yes	N	39	29	11	
		%	49,4	36,7	13,9	

In total sample, from the individuals who report history of falls, 49,4% have a score of 10 or less points in the SE for exercise scale, 36,7% have a score of 10,1 to 17,9 and 13,9% scored 18 or more. The differences are statistically significant (*p*=0,002)

Table 32 History of falls according to self-efficacy for exercise - Portuguese sample

			SE Groups			
			≤10	10,1-17,9	≥18	*p*
History of falls	No	N	23	36	23	0,008
		%	28	43,9	28	
	Yes	N	34	26	8	
		%	50	38,2	11,8	

In portuguese sample, from the individuals who report history of falls 50% scored 10 or less points in the SE for exercise scale, 38,2% scored 10,1 to 17,9 and 11,8% have a score of 18 or more. The differences are statistically significant (*p*=0,008).

Table 33 -History of falls according to self-efficacy for exercise - Polish sample

			SE Groups			
			≤10	10,1-17,9	≥18	*p*
History os falls	No	N	9	18	12	0,317
		%	23,1	46,2	30,8	
	Yes	N	5	3	3	
		%	45,5	27,3	27,3	

In polish sample, from the individuals who report history o falls 45,5% scored 10

or less points in the SE for exercise scale, 27,3% scored 10,1 to 17,9 and 27,3% have a score of 18 or more. The differences are not statistically significant (p=0,317).

CHAPTER V

Analysis of results

Discussion

In this chapter, we will interpret and discuss the data presented in the previous chapter. For this purpose, we compare the results from our study with results from other studies about the issue of falls and the prescription of exercise.

Physiotherapists should assess the risk of fall, turning such evaluation into a routine procedure in their clinical practice, being essential to the prevention in the health sector.

The purpose of this study was to identify factors of fall risk and to relate them with the levels of exercise prescription. It also intended to be a contribute to the validation of a protocol easily applicable and indicator of fall risk.

In this study, we assessed 200 individuals divided into two sub-samples. We acknowledge the discrepancy between them in relation to number and gender, since the Polish sample represents ¼ of the total sample and it is composed exclusively by female participants. Consequently, it is not a comparative study. There was an opportunity to add to this study a sample with a European context different than Portugal's, which we took to discuss some differences, although always keeping in mind the limited size of that sub-sample.

The Polish sample consisted of only 50 women, while the portuguese sample consisted of 74% women. From the analysis of other studies already carried out in this area, we can verify that there is much more participation of women in these projects. In a study conducted in Poland in 2015, we can see a discrepancy between the number of male and female participants. In that study 112 women and only 21 men participated (Ignasiak, Skrzek, Stawinska, Postuszny, & Rozek, 2015).

This fact can be explained because female individuals are more more active in community roles (Balliet, Li, Macfarlan, & Van Vugt, 2011). It is a female characteristic of the search for health services, which facilitates the diagnosis and early treatment of diseases (Mais, Duarte, Lebrão & Santos, 2006). Since the sample was collected mostly in health services, this aspect is evidenced in this study.

As previously mentioned, the fall rate pointed in the literature is around 33% in individuals aged more than 65 years old in the community (Gillespie et al., 2012; NICE, 2013). The majority of studies describing the problem of falls and questions related to aging in general include individuals over 65 years old. However, if we wish preventive measures to act at a prevention level it is essential to evaluate and take action as soon as possible. It is proven that at this age the fall rate is lower, but it exists (Talbot at

al.,2005). It is then the perfect time to intervene. In this study, we find a higher fall rate. 39,5% of the individuals said they have fallen at least once over the last 12 months. This percentage is even higher in the Portuguese sample, reaching 45,3%. Only in the Polish sample is it lower (22%). The fall rate in this study is higher in relation to the studies in analysis, comprising a younger population (over 55 years old), so we understand that the fall rate is quite high. In this perspective, the present study confirms the importance of falls as a public health issue, since it represents an impact on the life of individuals that fall and their families, as well as in the health system, involving economic and social costs, as previously described (Tinetti and Kumar, 2010;Bleijlevens et al. 2010).

Literature reveals a high risk of falls in individuals with history of falls. Earlier publications show that the history of falls is one of the most strong factors associated to the fall risk in adults living in the community (Pinheiro at al., 2010; Renfro & Fehrer, 2011).

Through the data analysis we conclude that the TUG, the 10-meter walking speed test and the step test were able to differentiate the group of individuals with a history of falls from the individuals without history of falls. This conclusion meets our expectations, being the TUG and the 10-meter walking speed test golden measures in the assessment of fall risk. In a 2013 study, a strong association between falls and functional capabilities was found (Brito et al., 2013). Results show a much higher proportion of falls in dependent individuals in terms of functions than in independent individuals (Desai et al., 2010; Brito et al., 2013).

In the total sample, those who haven't fallen need less time to complete the TUG, being the mean value found inferior to the cohort point (10 points). For those who haven't fallen, the 10-meter walking speed test is higher than 1m/s, which is seen as reference value for the fall risk, but inferior to 1,42m/s (safe street crossing) (Fritz & Lusardi, 2009). The 10-meter walking speed test for those who haven't fallen is higher to 1,42 m/s only in the Polish sample, but the differences are not statistically significant.

We can see that the Polish sample shows in average better results in all the functional tests evaluated, being the mean always below the threshold of the falls risk. The 10-meter walking speed test mean is 1,61 m/s translating into a safe street crossing (Fritz & Lusardi, 2009). The TUG mean is 6,81 seconds, not being considered a risk value since it is inferior to 10 seconds (Arnold et al.,2007).

These results may be originated by the fact that the sample was composed by individuals practicing exercise more often in sports and social institutions.

However, comparing the differences between the several functional tests in terms of falls history, we confirm that those differences are not statistically significant in this sample. Besides the reduced number of participants, we admit that there might be other factors influencing the fall, since in this group the falls rate is lower, but it exists.

In the Portuguese sample, however, the TUG mean (10,75s) is above the cohort point of fall, while the mean score of the step test (11,76) and the 10-meter walking test (1,13m/s) don't represent risk of fall. The 10-meter walking speed test represents an ambulation in the community with some risks (Fritz & Lusardi, 2009).

The FES scale in this study doesn't differentiate the individuals at risk from the ones without fall risk, since only 5% of the total sample scored over 70 (value considered cohort for the risk of fall) (Tinetti et al.,1990). For that reason, we didn't consider the FES in the data discussion.

As we have previously seen, more than half of the studied sample mentioned being afraid of falling (57,5%), number reaching 69,3% in the Portuguese sample. In the Polish sample, this percentage is 46%. These numbers are in line with the studies which indicate that the fear of falling shows a prevalence between 20 and 83% in adults over 65 years old living in the community (Oh-Park et al, 2011). We can confirm that these results are maintained although in this study the assessed population is younger (over 55 years old).

The question "Are you afraid of falling?" is a subjective question, but important because it reveals the health perception of the individual and can identify risk factors indicative of greater or lesser vulnerability (Busato et al., 2014; Borim et al., 2012). Vieira and colleagues (2016) reported that the fear of falling decreases the quality of life by further reducing the practice of physical activity.

From the 79 individuals who have fallen over the last 12 months, 61 admitted being afraid of falling, representing 77,2%. We also know that the fear of falling is a major factor in the limitation of activities, leading to a decrease in functionality (Lachman et al., 1998; Zijlstra et al., 2007). In this study, the fear of falling is related to the history of falls, the walking speed, the dynamic balance and the lower limbs strength.

As mentioned before, a fall may cause fear of a further fall (Friedman et al., 2002). This fear can cause emotional, psychological and social changes. Thus, when an individual falls, there is a tendency to decrease their daily activities, even as a protective measure to avoid further falls. In addition to fear of falling, which may justify the association between falls and functional capacity, it is well known that changes in muscle strength, which mainly affect lower limb muscles, may affect balance and performance in daily life activities (Frontera et al. 2000). Because of these changes, the likelihood of falls associated with functional capacity is increased. However, the fear of falling is often present even without a fall having occurred (Boyd & Stevens, 2009).

The fear of falling within a certain level can even be beneficial because there is an activities restriction to those which are safe, considering the functional capabilities of the individual. However, as a result from that inactivity, the risk of fall may increase due to muscle atrophy and to the long-term physical inactivity (Lachman et al., 1998). A decrease in muscle strength is an important factor in fall risk (Moreland et al.,2004).

Bibliographic research shows us that inactivity can lead to a loss of 25% in muscle strength due to a limitation in activities, which means a decrease in functionality and an increase in the fall risk (Moreland et al., 2004). We confirm in this study that, among the individuals who have fallen, less than half admits having a more sedentary lifestyle (39,24%).Those who are more inactive don't show a higher fall rate. This fact is justified because the more sedentary individual participates less in activities, even decreasing movement, leading to a lower fall rate but not to a lower fall risk. In fact, in this study, in the Portuguese sample, the sedentary lifestyle factor (spending more than 4 hours a day sitting) relates to the functional variables assessed by the TUG, the 10-meter walking speed test and the step test, but it doesn't relate to the previous fall history.

Even though the Polish sample shows in general better results in the functional tests, the age average is curiously higher (70,38) in relation to the Portuguese sample (68,71).Tinetti and collegues (2010) argued that the occurrence of falls may increase with age, but it is not an inevitable consequence of aging.

We understand by the results analysis that most of the assessed fall risk factors have a greater presence in the Portuguese sample, with the exception of the walking assistive device, the sedentary lifestyle and the take of more than 4 medications per day.

Many people need assistive devices to achieve independence in walking, as well

as their safety. It is pointed that many users of assistive devices feel difficulties in using their devices, and for that reason its use can lead to an increase of fall risk. However, if the same devices are correctly used, they could be beneficial to the increase in confidence and, therefore, in stability. Some studies characterised some of the requirements related to the use of support technologies and identified specific situations where the clinic and biomechanical evolution of the walking assistive devices can improve balance and mobility. However, these devices can in certain situations interfere with the capacity to maintain balance and the needed strength can be excessive (Bateni & Maki, 2005).In the Polish sample, the use of walking assistive devices may be related to an increase in the individuals' confidence, since they also describe less fear of falling (46% against 61,3% in the Portuguese sample) and a higher confidence in daily activities (lower score in FES), showing an average of 19,52 (22,61 in the Portuguese sample). The use of assistive devices to walk, showed a relationship with the dynamic balance, strength of the lower limbs, agility, coordination and walk speed components, measured by functional tests used in this study. However, it was not connected with the previous fall history.

More than half of the studied sample (55,5%) said to be taking more than 4 different medications per day. In the Polish sample, this number reaches the 60%. From the 79 individuals who have fallen in the total sample, 68,35% indicated to be under polymedication. In this study, we found association between the take of 4 or more medications per day and the history of falls, with the TUG, the 10-meter walking speed test and the step test. In the literature there are studies which try to show association between the fall risk and the increase of medication. Data from most of the studies suggest that the use of excessive medication increases the fall risk, especially in frail elderly patients. Cranwell-Bruce, (2008) indicated that the fall risk increases with the increase of medications taken. Hartikainen, Lönnroos, & Louhivuori, (2007) concluded that the prescription of 4 or more medications per day is associated with an increase in falls. Medication for the central nervous system, especially psychotropic, are associated to an increased risk. The use of NSAIDs (nonsteroidal anti-inflammatory drugs) is also associated with an increase in the fall risk (Hegeman, Duysens, & Van Limbeek, 2009).

A very high percentage mentioned hearing problems and dizziness (63,5), belonging 109 of those individuals to the Portuguese sample (72,7% among the Portuguese). As seen in the previous chapter, among the 79 individuals who show a

history of falls, 78,45% indicated hearing problems/dizziness. In this study, hearing problems and dizziness are associated with the history of falls, the dynamic balance, the lower limbs strength and the walking speed. The presence of dizziness is associated to an increase in the fall risk. Ramdas and colleagues (2009) indicate that individuals with vestibular dysfunction symptoms (such as self-reported dizziness) show a higher probability of falling (up to 12 times). They concluded that the outcomes which better predicted the fall risk were the history of falls and the orthostatic hypotension (Ramdas, van der Velde, van der Cammen, & Wolfs, 2009).

A very high percentage (76%) mentioned vision difficulties; 126 of these individuals belong to the Portuguese sample, which corresponds to 84% of that sample. From the 79 individuals who have fell in the last 12 months, 82,28% mentioned visual changes or vision checking for more than 2 years. Previous studies showed that visual impairment is a significant factor in assessing fall risk. An appropriate perception of visual depth is crucial to keep the balance and identify environmental hazards, and thus, it will be easier to avoid them (Lord, 2006). None the less, it was not found, in this study, any relation between the changes with any of the golden measures of assessment of fall risk.

In a multifactorial programme, the existence of polimedication, as well as hearing problems and/ or dizziness and vision changes must be signalized and referenced for other professionals.

We found that taking more than 4 different medications per day, the need of help to getting up from a chair, hearing problems and/ or dizziness and the fear of falling, are related with the golden measures of assessment of fall risk used in this work. Renfo and colleagues (2011) state that, among others, these are decisive features for fall risk.

Impaired balance is related to an increasing of fall risk and improving balance after an intervention programme is related to a reduction of fall risk (Barnett, Smith, Lord, Williams & Bauman, 2003). Balance must be assessed as a fall risk factor, and impaired balance requires an intervention, as fast as possible (Renfro & Fehrer, 2011). In a systematic review in 2007, it was concluded that the TUG was one of the most adequate tests to assess balance (Langley and Mackintosh 2007). TUG assesses the functional ability, especially strength, agility and dynamic balance, which are fundamental abilities to perform the basic tasks of transfer and gait (Schoene et al.,

2013). Changes at these levels could help bring about isolation for the individuals in a more controlled environment, such as the domestic environment, avoiding certain activities which can give them the perception of hazard.

In spite this test has been considered a gold measure in assessing fall risk, a 2004 study concludes that TUG should not be used in an isolated form to identify individuals at fall risk (Barry et al., 2014). That is to say, and as it was mentioned before, the assessment of fall risk cannot be limited to a single factor/ test, being this assessment, as well as the intervention, always multifactorial.

There is not one gold measure, but rather golden measures and therefore, they must be used in the assessment and not in an isolated form.

As we could see in the previous chapter, there is a statistically significant relationship between these several functional tests, used in this study (10-meter walking speed test, TUG and step test). In the case of 10-meter walking speed test and TUG, that relationship is very strong. Thus, in the impossibility to perform these two tests we can opt by one of them. We could see that in this study the TUG test discriminates more persons that have fallen, comparatively to the test of 10-meter walking speed test. If we want to talk about prevention, it matters an assessment test that identifies more people at risk. Therefore, and since these two tests can be redundant, we would opt, in this case, for the TUG test.

Evidence suggests that fall risk can be reduced by integrated actions. If we go back in time, in a 1994 study it was concluded that many of the factors for fall risk has, also, contributed to impair mobility and functional downfall (Tinetti et al, 1994).

Exercise and exercise prescription levels

The programmes for fall prevention have been proven, in several studies, to be extremely efficient in reducing fall risk (Gillespie et al., 2012).

As mentioned before, an adapted exercising programme can reduce fall rates as much as 54% (Skelton et al, 2005). The most effective component in a multifactorial intervention programme is therapeutic exercising (Sherrington & Tiedemann, 2015).

As we can understand, by the bibliographic research, exercising is crucial in fall prevention. In this study we could see that the polish sample exercises more (66%) comparing to the Portuguese sample (51,3%). Literature outlines the protective influence of physical activity in health and psychologic well-being in adults, as well as in a positive and direct impact in fall risk (Sherrington et al.,2016).

In a literature review of 2007, it was demonstrated a statistically significant

improvement in balance in interventions that include exercising (Howe, Rochester, Jackson, Banks, & Blair, 2007). Regular physical activities can mitigate fall risk (Kruger, Ham, &Sanker, 2008). Subsequently, it could be found significant improvements in physical functions that, also, include, in addition, fall risk decreasing, blood pressure, depression, and anxiety decreasing (Rogers, Larkey, & Keller, 2009). In 2005 it becomes, already, clear that a well-structured exercising programme is efficient in preventing fall risk in the general population and the physiotherapist should give support for such interventions (Sherrington & Tiedemann, 2015).

However, in this work, exercising for 30 minutes twice a week, it is only related to TUG not being related with the variables assessed by the 10-meter walking speed test and step test. It is necessary to think what should and can be considered physical exercise/activity. For higher level of risks, the exercise performed by the individual may not be the better approach. In this case it is important to mention the need of a programme adapted to the individual necessities. The programmes must be adapted to the individual in order to be efficient (Ribeiro et al., 2013), which means that the exercise must be prescribed in accurate level and allow the participants to progress (Sherrington et al., 2011; Buttery et al., 2014)). Exercise has been shown to reduce the risk of falls in older people in many trials and systematic reviews (Gillespie et al., 2012). However, not all exercise programs reduced fall rates (Liu-Ambrose et al., 2004) suggesting that some exercise programs can be more effective than others, or only effective in clinical settings and limited populations. Thus it is revealed the importance of a correct assessment of the individual risk of falling and, consequently, of a custom program that meets these specific needs.

Since all functional tests used in this study are related, the exercising programmes must cover strength, balance, coordination and mobility components. Impairment of balance and muscular weakness caused by the increase in age and immobility, are the factors of fall risk which can be more modifiable through an adapted intervention exercising programme (Gillespie et al., 2012).

As already mentioned before and, according to the National Institute of Public Health of Sweden, the exercise prescription is divided into 4 levels.

Level 1 is indicated for people with fall risk or very high risk of undertakes it. In this level, individuals are not apt in participating in physical activities alone.

Level 2, prescription of exercise, refers to the participation in programmes specially adapted, individual or in group, in clinic contexts less differentiated or in community health but, nonetheless, guided by an exercising professional. With more

than the half of the sample taking more than 4 medications per day, afraid to fall, with hearing problems and/or dizziness, the frontier between the two first levels needs constant monitoring.

We can, thus, determine that, according Renfro and colleges (2011) 39% of the individuals of this sample are at risk of falling, due to their previous falls. Using the cohort point of Fritz & Lusardi, (2009), 18,5% of the total sample of the individuals in this study, who obtained equal or inferior values of 1 m/s in the 10-meter walking speed test, are at risk of falling (Fritz & Lusardi, 2009; Lusardi et al., 2003).Using the cohort point of Rose and colleagues (2002) and Arnold & Faulkner (2007), 30,5% of the total sample in this study, is at risk of falling, since they have the TUG test time exceeding 10 seconds. Using the cohort point of Sousa and colleagues (2016), 35,5% of the total sample in this study are within the group of risk, since they have a score inferior to 10 in the step test. These individuals will benefit, then, from a specific programme to reduce the fall risk. It would be, then, a group forwarded to levels 1 and 2 of prescription. They should, therefore, be included in a lower prescription level, where there shall be constant supervision by a health professional, specifically, of a physiotherapist.

When we face the fear of falling, once more, it is essential the supervision of the physiotherapist, where we have included 57,7% of our sample (61,3% of the Portuguese sample).

Levels 3 and 4 of prescription, and as mentioned above, are levels that are adequate, if the individual is considered to be able to participate in normal life activities and can manage and maintain their own activity.

Levels 3 (group) and 4 (individual) are suitable for people able to participate in regular physical activity programs, eventually the younger participants or better functional indicators. Usually in groups, can be promoted by various sports, recreational and social agents (gyms, associations or other), although it is also useful to promote specific types of activity or maintaining or increasing their own daily activity profiles, in their own homes or workplaces.

According to dada retrieved from bibliographic research, individuals with 10-meter walking speed test superior to 1,4m/s (Fritz & Lusardi, 2009) and time spent in TUG inferior to 10 seconds (Arnold & Faulkner, 2007) with unknown risk factors, could be forwarded to levels 3 and 4 of prescription.

It does not give us much to think, only, in the components of the exercise (strength, balance, mobility, etc.) It is, therefore, vital to think about the adhesion to exercising programmes.

The level selection must be controlled, mainly by the own preferences, however, the levels of self-efficacy are a good indicator to realize the individual's ability to manage a physical activity program without supervision or group programs. The prescription of a self-administered activity program (level 4) is appropriate if the individual proves to be receptive to counsel, be motivated and be able to understand and follow the prescribed recommendation.

Individuals with high scores in self-efficacy for exercise are a target group for individual programs, i.e.,for example, prescription for exercise at home. If on the other hand individuals with lower scores of self-efficacy for exercise should be referred for group programs.

The average values of self-efficacy for exercise are of 12,64 in the total sample, being, therefore, above the average point of the self-efficacy scale presented.

Individuals with strength, balance, agility, coordination and gait disturbance deficit (variables assessed by the functional tests of this study, considered as gold measures in the assessment of fall risk), are prescribed to have exercising programmes to reduce the risk of falling. Self-efficacy for exercise help us understanding how the individual will “react” to the intervention programme proposed. Hence, people with those same characteristics (prescribed for the intervention programme), but with low self-efficacy for exercising, will benefit from programmes supervised, more often, by the physiotherapist. The programmes are adapted to the personal needs of the individual.

In our sample at study, from of the individuals that have fallen in the last 12 months, 49,4% have less than 10 points in the self-efficacy scale for exercising, manifesting, thus, a low self-efficacy. Individuals with the same characteristics, but with higher level of efficacy for exercising, may be prescribed for more autonomous programmes. 13,9% of the individuals with history of falls have 18 points more in the self-efficacy for exercising scale, being, therefore, a group adequate for individual and household environment programmes, with no need of constant supervision by the physiotherapist. In these cases, we can, actually, think about the use of technology and/ or video, in order to encourage motivation for exercising.

Considering the analysis of the results, in average, those who take longer in completing the TUG, those who have lower walk speed and those who have less score on step test, has, also, worst Self-Efficacy for Exercise, being the differences

statistically significant, revealing, therefore, a relation between strength, dynamic balance, agility and coordination with self-efficacy for exercise These data are in agreement with the studies of Everett and colleagues (2009), Silva and colleagues (2015) and Pang and colleagues (2008)

The table below (table 34) is a schematic of what can be construed as a reference for channelling the individual to an adequate level of exercising prescription, after the multifactorial assessment of fall risk, with the risk factors assessed in this study, and that we have proved to be decisive in identifying fall risk in the Portuguese sample.

Table 34 - Exercise prescription criteria to prevent falls based on Risk factors

	More Risk of falling		**Less Risk of falling or no risk**	
	Fall Prevention		Fall prevention or promotion of functional capacity	
Exercise prescription level	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Approach through exercise	History of falls TUG≥10s 10-meter-WST ≤1m/s Step test≤10 Need help getting up from a chair Sedentary Lifestyle		whithout history of falls TUG<10 10-meter- WST >1m/s Step test>10 without help getting up from a chair Active Lifestyle	
	Fear of falling Self Efficacy for exercise		Without fear of falling Self Efficacy for exercise	
Referral to other professionals	More than 4 medications per day hearing problems / dizziness		Less than 4 medications per day without hearing problems/dizziness	

Regarding physical exercise, there seems to be evidence of success on the implementation of prevention of falling programs either as a single component or as part of a multifactorial strategy (Sherrington, Tiedemann, Fairhall, Close, & Lord, 2011; Sherrington et al. al., 2016) As we have seen previously, there are several studies that have been successful in the reduction of falling.

Exercise program for the prevention of falling is essential to improve quality of life and to achieve economic benefits in the healthcare service (Gillespie et al., 2012; Sherrington & Tiedemann, 2015).

As barriers to physical activity we can identify several factors. Age can be a limiting factor since over the years there is a decline in physical fitness, aerobic capacity, muscle strength, flexibility, balance, reaction times, movement, agility, coordination and the increase of number of diseases. Like other barriers, we identified physical limitations, lack of disposition, lack of motivation, cultural issues, lack of companionship and safety and, as previously mentioned, fear of falling and low self-efficacy for exercise. The fact that physical activity is not a priority or considered necessary is another barrier to note. The lack of knowledge about the benefits of physical activity in the overall health condition and the prevention of falling in particular is another important aspect to highlight (Krug, Lopes, & Mazo, 2015).
It is necessary to alert and educate the general population that the practice of exercise when it is adapted to the individual's condition, followed by a specialised professional has very positive implications to health in general.

As a suggestion to promote the exercise practice amongst older people it is essential that the exercises are appropriate to their individual limitations, their own availability to exercise as well as their culture and preferences. Therefore, the follow-up by a specialised professional is a key factor (Sherrington & Tiedemann, 2015). Also, for the individual to know the benefits of physical activity it is of extreme importance that they believe the exercise is beneficial enough to overcome the costs (Physical Activity Guidelines Advisory Committee Report, 2008).

Socialising can also be a determining factor that leads the individual to exercise. Some studies have demonstrated the importance of social support as a motivator element towards the practice of exercise (Orsega-Smith et al., 2007).

Some individuals prefer group exercises, others prefer programs that can be done at home, but the literature states that both modalities are effective in preventing falls (Sherrington et al., 2011).

The interventions should always be multifactorial and adjusted to the risk factors identified in the screening for a risk of fall. For these programs to be truly adjusted for the individual, it is of most importance to do a proper evaluation through an appropriate screening. This screening would be with tests and indicators which would best identify the individuals at risk of falling. Until such evaluation, only then can they be effective in reducing the risk of falling.

Exercise programs must focus on balance, agility, muscle strength and gait (NICE, 2013), always tailored and personalized by the physiotherapist at home or in the community, individually or in group programs. The programs should promote an improvement in strength, endurance, and balance functions.

With regards to this study limitation, the reduced number of the Polish test group and the fact that these were not homogeneous with respect to the gender. The Polish test group consisted exclusively of women, and the Portuguese test group consisted mainly of women. Consequently, the reduced group test might lead to hardly any significant differences in the Polish test group.

The literature shows that the decrease in functional capacity is present either as a risk factor or a consequence of fallings. And since this is a cross-sectional study, it is not possible to identify temporarily which of the events occurs first, compromising the evidence of a causal relationship.

I will leave the challenge for more future studies of longitudinal design, where other factors not evaluated in this study, such as environmental factors and other personal factors that may condition adherence to the exercise program.

Conclusions

This study aimed to contribute to objectively identify and quantify the risk of falling, and that this method was the basis of the exercise prescription. It allowed us to sketch a brief reflection on the factors that can influence the decision regarding fall prevention programs, namely the exercise prescription, aiming to reinforce the importance of tailor-made interventions for each person and their environment.

The assessment of the risk of falling can not be limited to a single factor / test, and this evaluation, as well as the intervention, is always multifactorial. There is no golden measure, but several golden measures and as such, their use should be combined in assessing the risk of falling and not in isolated form.

The incidence of falls are higher than literature have reported and it is inversely associated with the functional capacity of the community dwelling adults aged over 55 years old.

Take more than 4 medications per day, fear of falling, need help to getting up from a chair, hearing problems and/or dizziness are related with risk of falling determined by history of fall, dynamic balance, lower limb strength, agility, coordination and walk speed measured by the golden measures of risk fall evaluation: TUG, 10-meter walking speed test and step test. The use of assistive devices and sedentary lifestyle were associated to worst results of the functional tests but not with history of falls.

The intervention should be multifactorial and through the prescription of exercise, appropriate to the level of each individual, and only then an appropriate intervention will achieve an effectiveness in reducing the risk of falling. Data from this study is a valuable basis for exercise prescription, taking into account the levels of risk and the levels of exercise prescription.

It is known that the golden measures of functional capacity assessment give us important information regarding the risk of falling, but as physiotherapists we can not neglect the other risk factors mentioned in this study, since only then will it make sense to speak in multifactorial intervention.

Currently more in-depth studies are being carried out on this subject. It is expected that in the near future intervention programs to prevent falls are a reality in the community. Only then it will make sense to talk about health, existing prevention strategies.

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ANNEXS

Annex 1 - Questionnaire for collecting data from study participants. Self-efficacy scale for exercise and risk factors assessed - Portuguese sample

Nome _____

Data de nascimento _____

Masculino [ ] Feminino [ ] Idade:_____ Peso (kg):_____ Altura (m): _____

LEIA AO PARTICIPANTE NO RASTREIO: *Para cada uma das cinco afirmações que se seguem, escolha o número que melhor exprime a sua opinião. Não há respostas certas ou erradas.*
(QUEM ENTREVISTA, FAZ UM CÍRCULO À VOLTA DO NÚMERO ESCOLHIDO).

	De modo nenhum é verdade	Dificilmente é verdade	Provavelmente é verdade	Exatamente verdade
1. Eu consigo realizar exercício físico mesmo quando tenho preocupações e problemas.	1	2	3	4
2. Eu consigo realizar exercício físico mesmo quando me sinto deprimido(a).	1	2	3	4
3. Eu consigo realizar exercício físico mesmo quando me sinto tenso(a).	1	2	3	4
4. Eu consigo realizar exercício físico mesmo quando estou cansado(a).	1	2	3	4
5. Eu consigo realizar exercício físico mesmo quando estou ocupado(a).	1	2	3	4

	Não	Sim	Conselhos para quem responde "SIM"
Caiu alguma vez nos últimos 12 meses? Se sim, quantas vezes? _____ Onde? _____ _____			**Explique que deve procurar apoio para prevenir quedas e fraturas (por ex. despistar problemas de visão, audição, ...) Aconselhe sobre calçado, como eliminar obstáculos no domicílio, proponha adaptações no WC, exercício, etc.)**
Toma diariamente 4 ou mais medicamentos diferentes?			**Aconselhe a falar com o médico para rever a medicação**
Usa algum auxiliar de marcha? (bengala, canadianas, outro)			**Verifique se está ajustado e, se necessário, corrija/ensine**
Quando se levanta de uma cadeira, necessita de ajudar com os braços?			**Aconselhe sobre como fortalecer os músculos dos membros inferiores e biomecânica levantar/sentar**
Pratica MENOS de 30 minutos de EXERCÍCIO FÍSICO[a] 2x por semana?			**Aconselhe alguns exercícios para ganho de força e equilíbrio**
Bebe álcool diariamente?			**Aconselhe o limite o consumo de álcool a uma bebida por dia**
Ouve mal ou tem tonturas?			**Aconselhe procurar ajuda de otorrino/audiologista**
Vê mal ou passaram mais de 2 ANOS desde o último exame à visão?			**Aconselhe procurar um oftalmologista/médico de família**
Sente medo de cair?			**Explique que deve procurar apoio para prevenir quedas e fraturas (por ex. despistar problemas de visão, audição, ...) Aconselhe sobre calçado, como eliminar obstáculos no domicílio, proponha adaptações no WC, exercício, etc.)**

[a] andar, cortar a relva, varrer, jardinagem, caminhadas, jogging, ciclismo, dança, natação e tarefas moderadamente extenuante.

Perdeu mais de 4,5 Kg (ou 5% do peso corporal) nos últimos 12 meses, sem que tivesse nada para isso?
[ ] Não [ ] Sim

Passa mais de 4 horas por dia, 5 dias por semana, sentado?
[ ] Não [ ] Sim

Em geral, diria que a sua saúde é:
[ ] Excelente
[ ] Muito boa
[ ] Boa
[ ] Satisfatória
[ ] Pobre

[1] Teste Velocidade Marcha (10m)	_____ segundos
[2] Teste *Timed Up&Go*	_____ segundos
[3] Teste *Step* (15 seg)	_____ (número de passos)
[4] Força de preensão	_____ (Kg)

Abaixo estão explicações breves sobre como realizar os testes e valores referência para interpretar os resultados

[1] Este teste requer um percurso de 20 m em linha reta, com os 5m iniciais reservados para aceleração, 10m para andar em velocidade acelerada, e os 5m finais para desaceleração. Marcadores são colocados na posição 5 e 15 m ao longo do caminho. O paciente caminha "em um ritmo acelerado" de um extremo ao outro. O fisioterapeuta utiliza um cronómetro para determinar quanto tempo demora a percorrer os 10 m centrais do percurso.

>25 seg - Probabilidade de necessitar de auxiliar de marcha em casa
12,5 - 25 seg - Probabilidade de mobilidade limitada na comunidade
8 – 12,5 seg - Deambulação na comunidade com alguns riscos
>10 seg - Deveria iniciar um programa para reduzir risco de queda
≤ 7 seg – Travessia segura de ruas

[2] Teste *Timed Up and Go* – avalia o equilíbrio e consiste em solicitar ao sujeito que se levante de uma cadeira, caminhe 3 metros, volte para trás e sente-se novamente na cadeira. O teste é cronometrado, desde o momento que o indivíduo se levanta até voltar a sentar-se (Mathias, Nayak & Isaacs, 1986, Podsiadlo & Richardson, 1991, citados por Wall, Bell, Campbell & Davis, 2000).

≥14 sec - Alertar para um maior risco de queda

[3] Número de passos em 15 segundos ou até perder o equilíbrio (degrau de 7,5 cm de altura, de frente para a parede para trancar).

>10 steps – Aceitável (valor estimado numa amostra de 196 pessoas com ≥ 55 anos)

[4] Força de preensão (≥65 anos de idade) (Azevedo da Silva, 2011)
Valores referência: Mulheres 15-19Kg; homens 21-32 Kg. Abaixo poderá indiciar alguma fragilidade com implicações nas atividades da vida diária.

Assinatura legível de quem registou

_____

Annex 2 - Falls Efficacy Scale - portuguese version

Escala de Eficácia das Quedas

Versão Portuguesa da Falls Efficacy Scale

Numa escala de 1 a 10, com **1= sem nenhuma confiança e 10= muito confiante,**

Qual a sua confiança ao executar cada uma das seguintes tarefas sem cair?

	Sem nenhuma confiança									Muito confiante
1. Tomar um banho ou duche	**1**	2	3	4	5	6	7	8	9	**10**
2. Chegar aos armários e roupeiros	**1**	2	3	4	5	6	7	8	9	10
3. Andar dentro de casa	**1**	2	3	4	5	6	7	8	9	**10**
4. Preparar uma refeição ligeira	**1**	2	3	4	5	6	7	8	9	10
5. Deitar/Levantar da cama	**1**	2	3	4	5	6	7	8	9	10
6. Atender a porta ou o telefone	**1**	2	3	4	5	6	7	8	9	10
7. Sentar/Levantar da cadeira	**1**	2	3	4	5	6	7	8	9	10
8. Vestir e despir	**1**	2	3	4	5	6	7	8	9	10
9. Fazer a higiene pessoal (lavar as mãos, fazer a barba, pentear, ...)	**1**	2	3	4	5	6	7	8	9	10
10. Usar a sanita	**1**	2	3	4	5	6	7	8	9	10

Falls Efficacy Scale © Tinetti, Richman, et al. 1990.

Escala de Eficácia das Quedas – Versão Portuguesa da Falls Efficacy Scale © Martins 2013.

Annex 3 - Questionnaire for collecting data from study participants in the Polish sample. Self-efficacy scale for exercise and Risk Factors Evaluated

Nazwisko i imię _____

Data urodzenia _____

Mężczyzna [ ] Kobieta [ ] Wiek:_____ Masa (kg):_____ Wysokość (m):

_____

1.Jak pewna/y jesteś w pokonywaniu następujących barier

	1.bardzo niepewnie	2.raczej niepewnie	3.raczej pewnie	4.bardzo pewnie
1.Wykonuję ćwiczenia nawet kiedy mam wiele zmartwień i problemów.	1	2	3	4
2.Wykonuję ćwiczenia nawet kiedy czuje się przygnębiony .	1	2	3	4
3.Wykonuję ćwiczenia nawet kiedy czuje się spięty	1	2	3	4
4.Wykonuję ćwiczenia nawet kiedy jestem zmęczony	1	2	3	4
5.Wykonuję ćwiczenia nawet kiedy jestem zajęty	1	2	3	4

2.Czy kiedykolwiek upadłeś/aś? (ostatnie 12 m-cy)
[ ] Nie [ ] Tak
Jeśli tak, Ile razy?_____
Gdzie?_____

3.Czy bierzesz dzienie 4 lub więcej różnych pigułek?
[ ] Nie [ ] Tak

4.Kiedy wstajesz z krzesła, czy używasz rąk?
[ ] Nie [ ] Tak

5.Czy używasz laski, kuli, wózka lub chodzika
[ ] Nie [ ] Tak

6.Czy wykonujesz dwa razy w tygodniu ćwiczenia trwające mniej niż 30 minut.
[ ] Nie [ ] Tak

7. Czy pijesz alkohol codziennie?
[ ] Nie [ ] Tak

8.Czy źle słyszysz lub masz zawroty głowy
[ ] Nie [ ] Tak

9. Czy źle widzisz lub minęło więcej niż 2 lata od ostatniego badania wzroku
   [ ] Nie [ ] Tak

10. Czy czujesz starch przed upadkiem?
   [ ] Nie [ ] Tak

11. Czy doświadczyłeś/aś niezamierzonej utraty masy ciała > 4,5 kg (lub 5% Twojej masy ciała) w ostatnich 12 miesiącach?
   [ ] Nie [ ] Tak

12. Czy średnio spędasz 4 lub więcej godzin w pozycji siedzej 5 razy w tyg
   [ ] Nie [ ] Tak

13. Ogólnie oceniasz swój stan zdrowia na:
   [ ] Doskonały
   [ ] Bardzo dobry
   [ ] Dobry
   [ ] Zadowalająco
   [ ] Słabo

[1] Gait speed test (10m) _____ seconds

[2] TimedUp&Gotest_____ seconds

[3] Steptest(15 seg) _____ (number of steps)

Below are brief explanations of how to perform the tests andbenchmarks to interpret the results

1 This test requires a distance of 20 m straight, with 5m reserved for initial acceleration, 10m to walk in accelerated speed, and the final 5m to slowdown. Markers are placed in the 5 meters and 15 meters position along the way. The patient walks "on a fast pace" from one extreme to another. The physiotherapist uses a stopwatch to determine how long it takes to walk the 10 stations of the route m.
> 25 sec - Probability of needing marching help at home
12.5 to 25 sec - limited mobility Probability community
8 to 12.5 sec - Wandering in the community with some risks
> 10 sec - should start a program to reduce fall risk
< 7 sec - safe streets crossing

2 Test Timed Up and Go - evaluates the balance; we ask the subject to stand up from a chair, walk three meters, turn back and sit down again in the chair. The test is timed from the moment that the individual rises to re-sit (Mathias, Nayak& Isaacs, 1986 Podsiadlo& Richardson, 1991 cited by Wall, Bell, Davis & Campbell, 2000).
≥14 sec - Alert for an increased risk of falling

3 Number of steps in 15 seconds or even lose balance (step 7.5 cm, facing the wall to be locked).
> 10 steps - Acceptable (estimated on a sample of 196 people aged ≥ 55 years)

Annex 4 - Falls Efficacy Scale - Polish population

Falls Efficacy Scale

On a scale from 1 to 10, with 1 being very confident and 10 being not confident at all, how confident are you that you do the following activities without falling?

wogóle niepewnie 1--2----3----4----5----6----7----8-----9----10 bardzo pewnie

Aktywność:	**Punktacja:** 1= wogóle niepewnie 10 = bardzo pewnie
Kąpiel lub prysznic	
Sięganie do szafek i półek	
Chodzenie po domu	
owywanie posiłków nie wymagających noszenia ciężkich lub gorących przedmiotów	
Kładzenie się I wstawanie z łóżka	
Podchodzenie do drzwi lub do telefonu	
Siadanie I wstawanie z krzesła	
Ubieranie się i rozbieranie	
obista pielęgnacja (np. Obmycie twarzy etc.)	
Siadanie I wstawanie z toalety	
Total Score	

Annex 5 - Fatal Falls Reported on EU Member states (2010-2012)

This factsheet is by:
- Samantha Turner, Swansea University (data analysis)
- Rupert Kisser, EuroSafe (data report);
- Wim Rogmans , EuroSafe (coordination and text).

Sources used :
- Fatal falls: World Health Organisation, Mortality database 2010-2012: http://www.who.int/healthinfo/mortality_data/en/
- Hospital visits and admissions due to falls: IDB Network & EU Commission, EU Injury Database 2011-2013: http://ec.europa.eu/health/data_collection/databases/idb/index_en.htm
- Estimated medical and social care costs of falls: Hartholt, K, Falls and drugs in older population: medical and societal consequences, Erasmus University Rotterdam, 2011
- ProFouND, Prevention of Falls Network for Dissemination: http://profound.eu.com/
- European Innovation Partnership on Active and Healthy Ageing: http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing&pg=about

EuroSafe
European Association for Injury Prevention and Safety Promotion

ProFouND
Prevention of Falls Network for Dissemination

Annex: Table on fatal falls reported by EU-member states to the WHO-office for the European Region over the years 2010-2012 (IR 65+ means age standardized incidence rate per 100.000 persons 65 and older,)

	Fatal falls 65+	Pop 65+	IR 65+
Austria	704	1706551	**41,23**
Belgium	1107	1676350	**66,06**
Bulgaria	128	1414308	**9,07**
Croatia	910	762664	**119,32**
Cyprus	16	5676956	**0,28**
Czech Republic	733	1185077	**61,88**
Denmark	439	823617	**53,30**
Estonia	46	982505	**4,72**
Finland	971	3655800	**26,55**
France	5015	10936782	**45,85**
Germany	8681	11553329	**75,14**
Greece	274	5734847	**4,78**
Hungary	1522	1135797	**133,97**
Ireland	176	558561	**31,57**
Italy	2864	7816841	**36,64**
Latvia	79	817381	**9,62**
Lithuania	164	364934	**45,03**
Luxembourg	42	906153	**4,67**
Malta	28	526893	**5,38**
Netherlands	1602	3711225	**43,17**
Poland	2776	4445561	**62,45**
Portugal	243	1373418	**17,72**
Romania	556	2316382	**24,02**
Slovakia	202	771813	**26,17**
Slovenia	449	767308	**58,52**
Spain	1718	8445526	**20,35**
Sweden	822	1201149	**68,46**
United Kingdom	3578	8669589	**41,27**

APPENDICES

Appendix 1 - Informed consent - Polish sample

Akademia Wychowania Fizycznego w Poznaniu
Katedra Biomechaniki

Oświadczenie – nr:.....

Nazwisko i imię osoby badanej: .....Wiek: .....

Wyrażam pełną i świadomą zgodę na udział w badaniach, po zapoznaniu się z celem badań i sposobem ich przeprowadzenia. Rozumiem na czym mają one polegać i oświadczam, że mój stan zdrowia pozwala na uczestnictwo w badaniach oraz, że nie są znane mi jakiekolwiek przeciwwskazania w tym zakresie.
Zostałem(am) poinformowany(na) również, że mogę odmówić zgody na udział w badaniach lub cofnąć ją w każdej chwili, także podczas wykonywania badań.
Oświadczam, że wyrażam zgodę na wykorzystanie uzyskanych przeze mnie wyników badań do celów statystycznych i naukowych.

Data i miejsce: .....

.....
Podpis kierownika tematu

.....
Podpis badanego