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INTERVENTION PROGRAM FOR FALLS PREVENTION FOR ELDERLY

Degree Programme in Physiotherapy

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As we know the world population is aging and will continue doing so. According to the United Nations there were 7.6 billion people on earth by middle of the 2017 of which 13 % were aged 60+. Due to the aging population there is increasing incidents of falls and stumbles amongst elderly which require medical attentions and can involve long term hospitalisation and eventually loosing independents. We know that medical and health care is costly, in United States the direct cost of fall related injuries is 0.1% from the total health care expenditure and corresponding number amongst EU countries can be up to 1.5% from total health care expenditure. This gives a reason to find more economical way to increase health span amongst elderly.

Objective of this thesis is to promote strength, stability and balance exercise program for elderly which would be shown on the Närpes community TV. Exercise program has 3 difficulty levels, were previous level helps to prepare for the next level. Objective is that by promoting exercise program which will be on Närpes TV 2-times a week that more community dwelling elderly would be exercising regularly and would get their daily dosage of exercise required to stay independent and active. Research on falls and stumbles prevalence, cost and benefits of exercising for elderly people was conducted.

As a result, neuromuscular exercise program for total joint replacement (NEMEX-TJR) was chosen. Later named as NEMEX exercise program because main target group is community dwelling elderly. Protocol has 10 exercises with 3 difficulty levels. Modifications were made to the original protocol to make it more suitable for widespread use. After every 4 weeks exercise from next level will be shown on the tv.

CONTENTS

1 INTRODUCTION

WHO has provided a definition for fall as "inadvertently coming to rest on the ground, floor or other lower level, excluding intentional change in position to rest in furniture, wall or other object." (Kalache, Fu & Yoshida, 2007) Key facts on falls from WHO fact sheet: falls are the second leading cause of accidental or unintentional injury deaths worldwide. Adults older than 65 years of age suffer the greatest number of falls, (37.3 million falls) that are sever enough to require medical attention occur each year. (WHO, 2018. Official statistic of Finland (OSF): Causes of death, 2017. Todd & Skelton, 2004, 4. Ambrose, Paul & Hausdorff, 2013)

All falls may not need a medical attention, but it can make elderly fearful which in turn make them avoid some activities that were normal for them before and that one fall can be a beginning of functional deterioration. (Gale, Cooper & Sayer 2016, 789)

Muscle weakness and poor ability to move, everyday problem of elderly, rise the hazard of falls, fractures, and becoming functionally dependent. (Fiatarone, Marks, Ryan & Evans, 1990) In US 28% of age 50 or more years old, (31,1 million) don't take part in any other physical activities, then their everyday habits, which would help to postpone, avoid, or control some lifelong medical conditions. (Watson, Carlson, Gunn, et al. 2016. 954–958) Injuries sustained through falls are directly related to disability, loss of self-independence and higher mortality rates. (Gale, Cooper & Sayer 2016, 789) Meta-analysis conducted by Province et al. (1995) were it was found that elderly participating in falls prevention program and who were in the group that exercised regularly reduced the risk of falls. The exercises chosen for this project are also available as a video material on internet and can be searched in regular search engines under the following name: Intervention program for falls prevention.vol.1, 2 or 3. The volume number is describing the level of difficulty off the exercises.

2 AIM AND OBJECTIVE

Objective of this thesis is to promote strength, stability and balance exercise program for elderly which would be shown on the Närpes community TV. NEMEX-TJR program was chosen, program has 3 difficulty levels, were previous level helps to prepare for the next level. Objective is that by promoting exercise program which will be on Närpes TV 2-times a week that more community dwelling elderly would be exercising regularly and would get their daily dosage of exercise required to stay independent and active.

Aim of this project is to great long-lasting change in the community dwelling elderly by creating means to prolong the healthspan of elderly person. Who can actively take part of social life, community life, can be independent and can live at own home. Which would help to relieve the economical burden on the society overall and instead great extra value in local communities.

3 AGING

As people age the ability to carry out bodily activities is gradually diminished, even amongst physically fit peoples, which consequently increases the frailty, health care usage, also decrease independence and quality of life. (Sieck, 2003, 1334. Kenney, 1985. 37 - 59) One´s routine can inhibit the onset of functional changes that come with the age. Human operating reserves are contested by the increasing age to permit functioning above the rest level and sustaining the internal environment. (Kenney, 1985. 37 - 59) Keeping up the functional reserve, in another word "health", in aging residents lowers the demand of medical care by older people. (Sieck, 2003, 1333) Components like muscle strength, energy balance and bone health which are deteriorating with the increasing age are impacting the ability to carry out daily living tasks and the effort needed for those tasks. (Sieck, 2003, 1334)

3.1 Demography of aging

Life expectancy is growing in all the OECD (The Organisation for Economic Co-operation and Development) countries and is predicted to continue so. In 2015 – 2020 at age 65+ women are predicted to live 21.3 and men 18.2 extra years which by year 2060 – 2065 is expected to increase 4.2 years for woman and 4.6 for men. Comparison with other OECD countries by gender and birth year in Figure 1 and Figure 2 (The Organization for Economic Co-operation and Development (OECD): Pensions at a Glance 2017. Katch, McArdle & Katch, 2011,597)

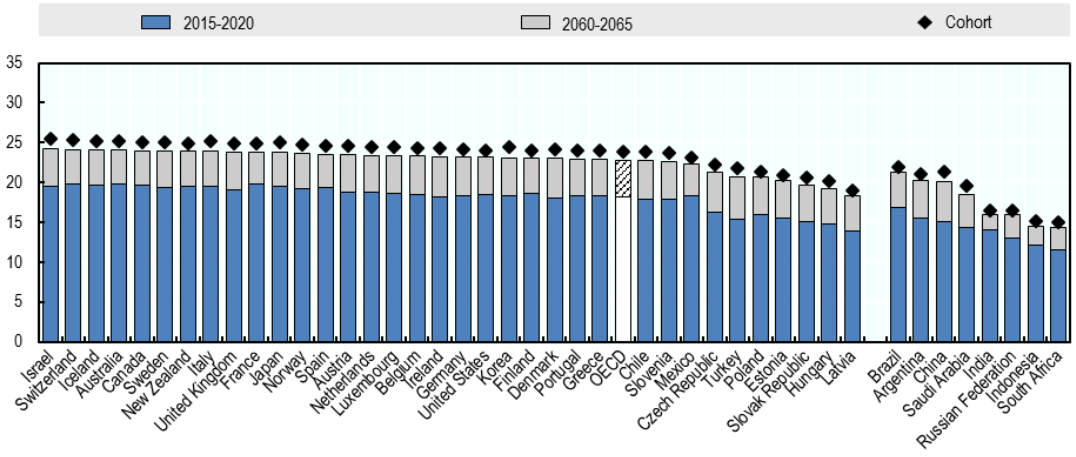

Figure 1. Expected remaining life expectancy at age 65, in years for men in 2015-2020 and 2060-65. (OECD, 2017)

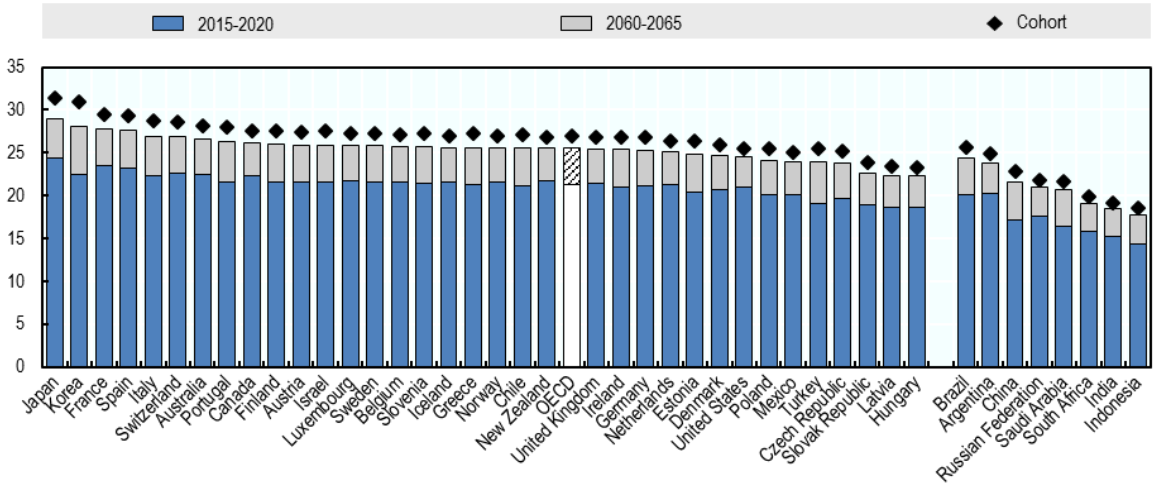

Figure 2. Expected remaining life expectancy at age 65, in years for women in 2015-2020 and 2060-65. (OECD, 2017)

These global projections also reflect in Finish population demographics in present and future. Which means that proportion of elderly people in total population is growing. In 2017 there were 21,4% of 65+ year old people from the 5,513 million total population in Finland which is 1,179 million people. This is expected to grow up to 28.8% by the year 2060 as shown in the Table 1. (Official statistics of Finland (OSF), Population Projection 2016.)

Table 1. Population Projection 2020-2065. (Official Statistic Finland (OSF) 2016, 4) Modified from Official Statistics, Population Projection.

	Unit	**2020**	**2030**	**2040**	**2050**	**2060**
Population	1,000	5,595	5,769	5,861	5,914	5,979
0–14	%	16.2	15.3	14.8	14.6	14.3
15–64	%	61.2	59.1	58.9	58.1	56.9
65–	%	22.6	25.6	26.3	27.3	28.8

3.2 Healthy aging

Gerontologists are agreeing that future research should concentrate to increase the health span, which means increasing the amount of years were individual remains in superb health. (Katch, McArdle & Katch, 2011, 596) Definition provided by Rowe et al. (1997) notes that successful ageing is characterized by a combination of small probability for disease and it is related frailty, great cognitive and physical capability and active social life. Where´s small probability for disease increase the cognitive and physical capabilities which in turn gives greater possibilities for social life.

As explained before, population is getting older which puts pressure on the health services. That's why it is imperative to provide means, to increase the health span, for elderly living in the community which reduces the need of state provided health services. Such can be long term health promotion project. (Katch, McArdle & Katch, 2011, 596; Royall, Troiano, Johnson, Kohl, & Fulton, 2008)

3.3 Falls prevalence

Self-reported observation in U.S. showed that 27.5% over 50-year-old individuals did not do any physical activity in past 30-31 days. Sedentary life style crew with the age accordingly: 50-64-year-old inactivity level was 25.4%, 65-74-year-old inactivity level was 26.9% and over 75-year-old inactivity level was 35.3%. It was also noted that female individuals were more sedentary then men. (Watson et al., 2016)

As mentioned before there was 37.3 million falls world-wide, severe enough that required medical attention, among 65+ years old and the number of falls increase with the age. It has reported in 2014 in USA that amongst 65+ years old 672 persons fell out of 1000 and older than 85+ years the number rises to 820 persons out of 1000. It was also noted that when developing dementia, the risk of falls rises significantly. (Larson, 2017, 1659) In UK every year 35% of 65 years or older will fall one or more times. 45% of 80-year-old fall every year from whom 10 – 25% sustain a severe trauma. (Harries et al. 2009, 6. Ambrose, Paul & Hausdorff. 2013)

According to Official Statistics of Finland (OSF, 2017) report released of year 2016 there died 54 000 people all together. The most casualties claimed by accidental and violent death which are fatal stumbles, suicides and accidental poisonings. All together 3400 people died in accidental or violent way - not natural causes of death. It means that in year 2016 out of 3400 accidental and violent deaths there were 1200 fatal falls and stumbles. As seen in the Figure 3 the mortality rate has decreased over the 10 years by one fifth but, accidental falls as reason of death has remained the same. Nine out of ten fatal stumbles and falls happened to persons aged over 65. When looking Figure 4 and Figure 5, the average age for men was 79 and for women 87 at the point of fatal stumble or fall.

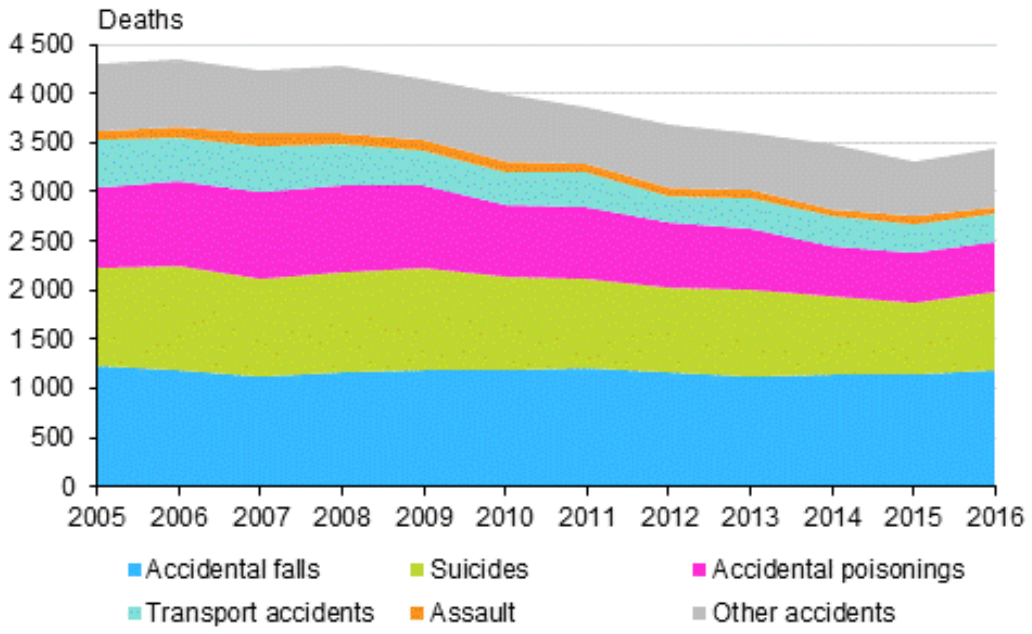

Figure 3. Accidental or violent deaths from 2005 to 2016. (Official statistic of Finland (OSF) 2017)

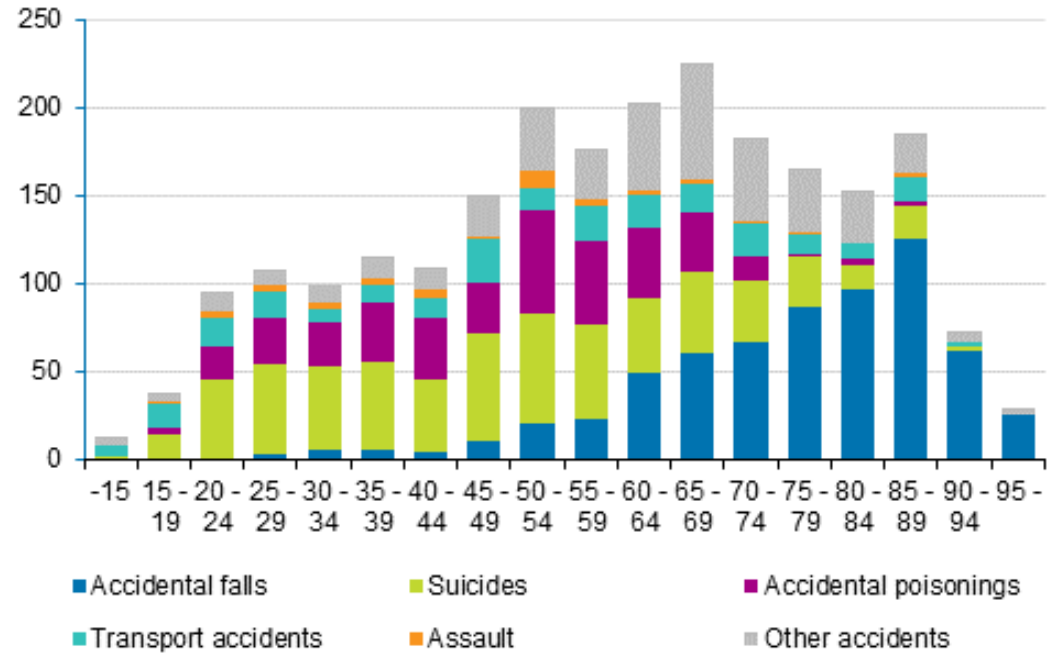

Figure 4. Men's accidental and violent deaths by age in 2016. (Official statistic of Finland (OSF), 2017)

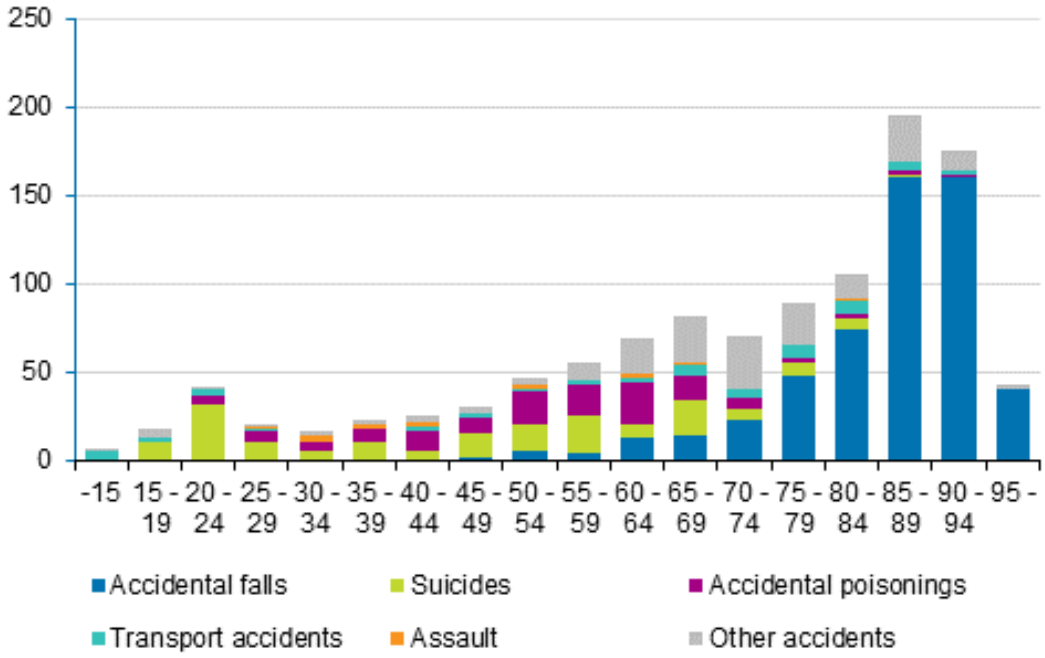

Figure 5. Women's accidental and violent deaths by age in 2016. (Official statistic of Finland (OSF), 2017)

3.4 Cost of falls

In United States the Direct cost of fall related injuries is 0.1% from the total health care expenditure and corresponding number amongst EU countries can be up to 1.5%. from total health care expenditure. (Ambrose, Paul & Hausdorff. 2013) In year 2015 Finland total expenditure in health care was 19.8 milliard Euros which is 3 803 Euros for each person. Total expenditure in elderly car was 4.326 million Euros in total. (Matveinen & Knape, 2017. 0-3) Nurmi & Lüthje conducted a study in 2002 to determent the average cost of a fall amongst elderly in Finland and they conclude that it is 944 euros per fall. They also compared it with the U.S were cost of on fall was 680 euros. They pointed out that most costly fall injurie are hip fractures.

Field studies by Church et al. (2011) on cost effectiveness of falls prevention intervention for older community -dwelling people made in Australia showed that the most cost effective was tai – chi (AUD 44,205 = 32,625.50 EUR), second was group – based exercise (AUD 70,834 = 52,279.03), third was multiple intervention (AUD72,306 = 53,365.44EUR) and fourth was home exercise (AUD 93,432 = 68,957EUR). Exchange rate from year 2011 for Australia dollar was used to convert the prices (1 AUD = 0.73805 EUR). (Exchange-Rates, 2018)

4 FALLS RISK FACTORS

There have been recognised 3 groups for risk of falls: intrinsic, extrinsic and exposure to the risk. It is also acknowledged that there might be more than one factor effecting the individual and that one factor can be reasoned with another which means that those 3 groups interact between each other and contribute to the risk of fall. Impact of extrinsic factors have been under a dispute amongst scientist were some clam it is between 30 – 50 % and others claim that 20% of falls are due to extrinsic factors. (Todd, Skelton 2004. 7.) Risk factors are listed in the following Table 3.

Table 3. Intrinsic, extrinsic and exposure risk factors for falls. (Todd & Skelton 2004. 7. Kendrick et al. 2015. 10)

1. Intrinsic risk factors
• Previous falls and history of falling increase the risk. • Age itself is a risk factor and the risk increase as individuals get older. • Gender in the young elderly did not play a significant role but as age increases women have increased risk to fall and sustaining a fracture. • Living alone is a risk factor, it was noted that the housing type may contribute to the risk of falling. • Being a Caucasian increases risk of falling. • Medicines like benzodiazepine increase the risk of falling by 44% and taking more than four medicines rise the risk of falling by 9 times. • Different medical conditions like circulatory disease, chronic obstructive pulmonary disease, depression and arthritis increased the risk of falling 32%. • Impaired mobility and gait indicate decline in strength, endurance (after the age of 30 10% loss per decade) and muscle power (30% loss per decade) result in physical functioning dropping below the threshold where activities of daily living become difficult and then impossible to carry out. • Sedentary behaviour: fallers tend to be less active and may inadvertently cause further atrophy of muscle around an unstable joint through disuse.

• Those cutting back on normal activities because of a health problem in the 14 days before fall are at increased risk. • Those who are inactive fall more than those who are moderately active or very active but do so in safe environments. • Psychological status - fear of falling: Up to 70% of recent fallers and up to 40% of those not reporting recent falls acknowledge fear of falling (25,38,55). Reduced physical and functional activity is associated with fear and anxiety about falling. Up to 50% of people who are fearful of falling restrict or eliminate social and physical activities because of that fear. • Strong relationships have been found between fear and poor postural performance, slower walking speed and muscle weakness, poor self-rated health and decreased quality of life. • Women with a history of stroke are at risk of falls and fear of falling (42). • Nutritional deficiencies: a low body mass index suggesting malnutrition is associated with increased risk. • Impaired cognition: cognitive deficit is clearly associated with increased risk, even at a relatively modest level. For example, score <26 (49) or <24 (54) on the Mini-Mental State Examination is associated with increased risk. • Visual impairments (visual acuity, contrast sensitivity, visual field, cataract etc.) Multifocal glasses impair depth perception and edge-contrast sensitivity at critical distances for detecting obstacles in the environment. • Foot problems (bunions, toe deformities) and foot wear.
2. Extrinsic risk factors
• Environmental hazards (poor lighting, slippery floors, uneven surfaces, etc.) • Footwear and clothing. • Inappropriate walking aids or assistive devices.
3. Exposure to risk

- Individuals who are sedentary and who are highly active are both exposed to the risk of falling and sustaining an injuria. It means that every individual is exposed to the risk of falling and sustaining an injure because the intrinsic, extrinsic and exposure interact with each other resulting in the risk of fall, but it can be reduced to minimum by choosing the right environment and strategy to be physically active.

5 FALLS PREVENTION

Falling is not always just because of the old age. There are more than one factor contributing that means identifying and adapting to those factors will help to reduce the number of falls and injuries sustained. (Harries et al. 2009, 4. Kendrick et al. 2015. 10) Health care providers should discuss fall prevention with their patients because approximately half of older adults who fall do not discuss it with their health care provider, often because they fear this will lead to a loss of independence. (Bergen, Stevens & Burns 2016, 998) There was made systematic review by Gillespie et al. (2012) to determine efficient fall prevention interventions and in the study it was included 159 trials with 79,193 participants dating back as far as year 1947. Another report made by Todd et al. (2004) for WHO were prevention methods were listed both works combined results are presented in Table 4.

Table 4. Main results from the Interventions for preventing falls in older people living in the community. (Gillespie et al. 2012; Todd & Skelton 2004. 11-14.)

- Multi-dimensional group exercise considerably diminished the number of falls and risk of falling as did multi-dimensional home centred exercises. Also, Tai-Chi considerably diminished the risk of falling. In general, exercise interventions considerably diminished the risk of fall associated fractures.
- Multifactorial interventions containing risk evaluation diminished number of falls.
- Vitamin D supplementation did not diminish the amount nor risk of falls. It was noted that it might help individuals who had low vitamin D level beforehand.
- Living conditions assessment and needed changes diminished the number of falls and risk of falling. Additional benefits were noted with individuals in elevated risk group

- Taking in visually impaired. It was noted that living conditions changes were more effective when done by occupational therapist.
- In treatment of vision difficulties and vision alterations considerable rise in the number of falls and risk of falls. Interestingly, changing multifocal class, in regularly outdoor activity group, to single lens classes the outdoors falls were reduced but in group of mediocre outdoors activity falls amount rose.
- Pacemakers diminished the number of falls but not risk amongst individuals with carotid sinus hypersensitivity. Also, first eye cataract operation diminished number of the falls but second operation did not have any additional effect.
- Reducing the dosage of psychotropic medication diminished the number of falls bot not the risk of falls.
- Footwear anti-slip equipment diminished the number of falls in slippery(ice) environment. In multifactorial foot and ankle podiatry exercising group compared with regular number of falls was diminished but not risk of falls.
- Evidence on cognitive behavioural intervention was inconclusive.
- Applying only knowledge and educational interventions to prevent falls did not diminish the number of falls or risk of falling considerably.

6 EXERCISE

By English Oxford dictionary (2018) the word exercise defines as “Activity requiring physical effort, carried out to sustain or improve health and fitness”. Kendrick et.al (2015) have defined exercise as: “Planned, structured, repetitive, and purposive physical activity aimed at improving physical fitness”. Author also would like to add another definition of word train: “Teach (a person or animal) a particular skill or type of behaviour through sustained practice and instruction”. (Website of Oxford Dictionaries, 2018) In this case the skill and sustained practise and instructions can be well studied benefits of prolonged exercise stimuli, dosage and instructions. Those definitions should be the leading concepts in the gerontology definition on increase the health span, which was mentioned previously. (Katch, McArdle & Katch, 2011, 596)

Because by training elderly to exercise regularly we great the possibility to prevent or postpone life hindering conditions and as a side effect we great a behavioural change in the individual which can help to increase the behavioural change in the hole elderly community which lead towards longer health span. (Garber et al. 2011, 1337) As we know the exercise program should be created according to the individuals. (Larson, 2017, 1659)

6.1 Purpose of exercise

According to Pohjolainen et al. (2013) physical function consists of those five physiological indicators: endurance (oxygen uptake, heart and blood vessels efficiency, muscles ability to use oxygen), muscle strength (hand grip strength etc.), joint mobility (given joint range of motion), motor skills of observation (reaction, movement time, balance), body composition (height, weight, muscle mass, fat mass).

It has noted in several studies that exercise is crucial in elderly with sedentary life style or prolonged illness to prevent falls. Attention should be focused on those with the highest risk to fall but nearly all elderly can and should exercise regularly. Exercise programs should be formed according to the individuals. (Larson, 2017, 1659)

Elderly who carry out regular exercise programs provided by community can reduce the risk of falls when using information and possibilities provided by community helps to keep the costs down and helps to great a long-term health intervention. (Barnetti, Smith, Lord, Williams & Baumand 2003, 413; Garber et al. 2011, 1337; Royall, Troiano, Johnson., Kohl, & Fulton. 2008) Conventional exercise like aerobic and local exercise have been shown to have reducing effect on the pain levels and increased the physical function levels. (Ageberg, Link & Roos, 2010. 1; Royall, Troiano, Johnson., Kohl, & Fulton. 2008)

6.2 Exercise intensity

Intensity while exercising is crucial factor to the physiological reactions in the body. Evidence supports that more vigorous exercise, were amount of the work is kept same has a greatest physiological reaction in the body. Although the amount of work needed to be done to improve physiological parameter is greatly affected by the individual's fitness level. But when referring to the overload principle to induce physiological adaptation one needs to exercise above the current level of fitness. (Garber et al. 2011, 1339; Royall, Troiano, Johnson., Kohl, & Fulton. 2008)

It is recommended to have a 30 min of moderate to vigorous physical activity in day which can be divided into short 10 min long exercise sessions in a day and when doing so it also helps to prevent the sedentary life style. (Garber et al. 2011, 1340; Royall, Troiano, Johnson., Kohl, & Fulton. 2008)

There are number of widely used formulas for prescribing exercise intensity. Most commonly is used percentage from heart rate (HR) maximum and percentage from one repetition max (1RM) or rating of perceived exertion (RPE). Table 5 shows estimated ranges of intensities when exercising. (Garber et al. 2011, 1342)

It is possible to calculate your estimated HR maximum with formula HR max =220-age. For example, if a person is 65 years old he´s estimated HR max would be 220-65=155 beats per minute. Now he or she can take percentage from the table and calculate the heart rate level for moderate intensity cardiorespiratory exercise which is 64-76 % from the HR max which is 155*0,64=99,2 beats per minute for 65-year-old person to exercise in the moderate intensity level. (Website of Centers for Disease Control and Prevention. 2015)

Percentage from 1RM is calculated from the maximum load person can lift or move. For example, if individual can do only 1 repetition with a certain load then that is he´s 1RM max. When individual is planning to do moderate intensity strength exercise and he´s 1RM max in back squat is 100kg then the moderate intensity training load from

Table 5 is 50-69% and from calculation 100*0.5=50 which means he´s training load for that session is 50Kg. (Shimano et al. 2006)

Last in the Table 5 is perceived exertion (RPE). It is a way of numerically assessing the physical activity intensity level. Were 0 - 6 should feel like no effort at all, 6 – 9 is like walk at persons everyday walking speed for several minutes, 9 – 13 is little bit strenuous but can carry on exercising, 14 – 17 is a strenuous exercise were person has to push him or herself hard, 18 – 20 is maximal effort for most persons and they can keep it up only short amount of time. It is a subjective assessment of how hard individual feels him or her body is working. Individual has to numerically asses physical sensations during the exercise including heart rate level, breathing rate, sweating and muscle tiredness. Even if it is subjective assessment there has been found correlation between the RPE score times 10 and real heart rate. It must be kept in mind that this is estimation which means there can be variability. (Website of Centres for Disease Control and Prevention. 2015; Garber et al. 2011, 1341)

Table 5. Intensity ranges for cardiorespiratory exercise and resistance exercise. (%HR max - percent of maximal HR. %1RM – percent from one repetition max. RPE - ratings of perceived exertion.) Modified from Classification of exercise intensity: relative and absolute exercise intensity for cardiorespiratory endurance and resistance exercise. (Garber et al. 2011, 1341)

	Cardiorespiratory training	Strength training	Perceived exertion (6-20 RPE scale)
Intensity/ Effort	%HR max	% 1RM	
Very light	<57	<30	<9
Light	57-63	30-49	´9-11
Moderate	64-76	50-69	´12-13
Vigorous	77-95	70-84	´14-17
Near max. to max	´=/>96	´=/>85	´=/>18

6.3 Exercise to improve muscle strength

Review by Garber et al. (2011) claim that by developing muscle fitness has many health enhancing properties. Report by Artero et al. (2012) claim that greater muscle strength has been also related to positive improvements in decreasing cardiometabolic risk factors, decreased cardiovascular disease incidents, lowering the nonfatal disease incidents and increasing the functional ability and life span.

By increasing muscle strength and hypertrophy which means increase in skeletal muscle size, we inadvertently effect positively on the bone mineral density and content which improves bone strength, slowing down or preventing evolving osteoporosis. Also, diminishing muscle strength has been noted as one factor evolving osteoarthritis by doing strength exercises it is possible to effect positively on pain and disability. (Garber et al. 2011, 1342)

Capability to produce force is essential to carry out any type of movement. (Ratamess et al. 2009, 687) There are 2 types of strength exercises isometric and dynamic. Isometric exercise is were person contracts muscles, but no movement is produced, for example when person closes hand into fist and tightly squeezes then it is an isometric muscle contraction. Dynamic exercise consists of concentric and eccentric muscle action involving more than one joint and movement is present. Single joint exercises are also suggested to target certain muscles. To avoid inequity both agonist and antagonist muscles must be trained, for example hamstring and quadricep muscle groups. All exercises should be performed with right intention in mind, technique, form, using all available range of motion and avoiding the Valsalva maneuver (holding breath) during the exercise meaning exhale in concentric(contraction) phase and inhale in eccentric(relaxation) phase. Solely training in eccentric phase should be avoided to prevent serious muscle damage. (Garber et al. 2011, 1343)

To promote adaptation in training, progressive strength exercise programs are needed. (Ratamess et al. 2009, 687) It is recommended to do strength program 2 – 3 times a week, doing one exercise 2 – 4 sets using 60 – 80% of the 1 RM and for beginners it is recommended to start in the 60 – 70% range and frail older people can start in the 40 – 50% range to promote optimal hypertrophy and strength. The load should allow

8 – 12 repetitions or amount of repetitions that gives feeling of muscle tiredness not exhaustion. Rest intervals should stay in the range of 2 – 3 min. These guidelines are suitable for men and woman in all age groups. (Garber et al. 2011, 1343; Ratamess et al. 2009, 687 - 693)

When physiological change to the strength exercises occurs, the greater force can be generated by the neuromuscular units. It has been noted the greatest increase in strength may happen with first week which means that long term strength exercise will recruit more and more neuromuscular units increasing the ability to produce more force and faster. Load required to promote strength increase in individual can be only 45 – 50% from 1 repetition maximum. (Ratamess et al. 2009, 689-690)

6.4 Flexibility exercises

With age flexibility reduces as many other physical abilities. It has been studied that taking care of the flexibility in older age improves postural stability and balance especial when combined with resistance exercises. Most commonly used technique is static stretching were the stretch is hold for 10 – 30 seconds in slight discomfort, for elderly it might be recommended to keep the stretch 30 – 60 seconds, 2 – 4 sets, 2 – 3 times a week is minimum and greater gains are seen when doing daily. (Garber et al. 2011. 1344-1345)

6.5 Neuromotor exercise

Neuromotor exercise in another words is functional fitness training which integrates motor skills like balance, coordination, gait, agility and proprioceptive exercises into the program. Which have been found to reduce the risk and fear of falling amongst elderly and might have positive effect on the number of falls amongst elderly. Exercise sessions recommended dosage is 2 – 3 times a week 20 – 30 min per session. (Garber et al. 2011. 1345)

6.6 NEMEX – TJR exercise protocol

NEMEX – TJR is a neuromuscular exercise (NEMEX) protocol. Which is initially intended for individuals with mild to severe hip or knee osteo – arthritis, admitted to the total joint replacement (TJR). Protocol emphasises neuromuscular training where goal is to improve sensorimotor control and eliminating compensatory movements and regaining stability in the affected joint. (Ageberg, Nilsdotter, Kosek & Roos, 2013, 4.) Where´s sensorimotor control ables individual to generate controlled movement through synchronized muscle action and providing dynamic stability throughout physical activity. Modified NEMEX exercise program is presented in Appendix 2. (Ageberg, Link & Roos. 2010, 2)

Protocol incorporates exercises which are like everyday life activities (lying, siting and standing) were various features of sensorimotor tasks like strength, coordination, balance and proprioception are addressed, but emphasis in each exercise is different, for example balance in one and strength in another. (Ageberg, Nilsdotter, Kosek & Roos, 2013, 4.)

Progression is addressed by number of directions, velocity in the movements, load and by support surface. Protocol is based on the circuit training model were exercises are addressing crucial components like core stability, postural function, postural orientation, lower extremity muscle strength and functional exercise. Purpose in the exercises is to improve right muscle activation to gain functional joint stability to decrease joint load, increase quality and efficiency of the movement which improves individuals overall functional ability. In each exercise the proper technique and form is addressed, for example the loading line in hip, knee and foot. (Ageberg, Nilsdotter, Kosek & Roos, 2013, 4.)

For every exercise there is three progression levels. Step to next level is done when previous exercise is performed correctly and effortlessly and inspected by physiotherapist. The protocol should be done 2 time a week as a group training supervised by the physiotherapist until they went to surgery. As the pain is one of the biggest symptoms they also added self-reported VAS scale (visual analogue scale) from 0 (no pain) to 10

(worst pain ever) to monitor the pain. It was told that pain until 5 was allowed while training and after session and that next day the pain should reduce to the normal level, when it stayed above 5 then the load was reduced. (Ageberg, Nilsdotter, Kosek & Roos, 2013, 4.)

7 IMPLEMENTATION

Strength in old age (Voimaa Vanhuuteen) is a nation-wide program that has started in year 2005. It is coordinated by The Age Institute whose mission is to create and propagate know-how which could be used for increasing health span. The purpose is to promote physical exercise, functional capacity and health. Also, social inclusion and mental health. (Website of The Age Institute, 2016)

Närpes city applied and was chosen to the Strength in old age mentoring program in 2016 alongside with 17 other communities. Strength in old age purpose is to promote exercising possibilities and solutions through mentoring and workshops. In the mentoring and workshops take part The Age Institute, community rehabilitation coordinators, city`s sports secretary and different non-governmental associations (example: rheumatoid arthritis association etc). There it is discussed how the associations can increase collaboration between city and vice versa. How to improve and promote fitness consulting and supervised exercising with the main idea of increasing muscle strength and improving balance, creating possibilities for every-day exercising and outdoor activities which in turn promote social interaction. By creating long lasting intervention in the community it increases the healthspan, increases functional capacity so that elderly could stay longer independent and live at their natural environment. (Website of Strength in Old age, 2015; Garber et al. 1347) Through a workshop discussion Närpes city commune came up with the idea to start making exercising videos and show them on the community tv which is a way of creating instructed exercise interventions for the community dwelling elderly. From there the author of this thesis got the initial idea to help the Närpes city to great exercise program to show on the community tv.

Author introduced the NEMEX-TJR program to the Närpes city health promotion group. As a joint discussion it was decided to make modifications to the protocol to make it more suitable to the community and user friendly. Since the program is intended for community dwelling elderly not for a specific patient group the VAS scale was not introduced in the video. As well the physiotherapist approval for moving to the next level is discarded due to the nature of the project. The general rule of 4-week

physical adaptation period is used to be sure that elderly have adapted to the previous training load and are safe to continue on the next level to enhance functional ability and exercising is recommended essentially to all elderly as described in previous chapter.

Video was filmed in Närpes Folkhälsans rooms on 20.03.2018. There was present Närpes city elderly health promotion work group of 2 physiotherapists, Närpes city sports secretary, operator from the När TV, 4 persons who were models were from rheumatoid-arthritis association and author. Filming started 8:30 and ended at 11.35. During that time all the material was filmed for the 30-minute-long exercise vide. Author and the sports secretary also were present when the rough cut of film material was made. Finalising of the video was made by the När TV operators by the guidelines given to them. Material for the levels 2 and 3 was filmed later. All video material was filmed in Swedish since 81.4% of the Närpes community is Swedish speaking where´s only 5.4% is Finnish speaking and 13.2% some other language. (Website of Pohjanmaa Lukuina, 2018) The issue was discussed, and it was decided that the videos stay in Swedish and translation was not needed.

Video was based on the exercises from NEMEX-TJR protocol, explained before. Protocol was presented to the physiotherapists beforehand, via email, to decide if the program would be suitable and does it go together with their idea what they are trying to. achieve, which is to promote exercising and being active. After that author met the physiotherapists to present and explain the exercise to them.

Exercise were introduced to the models on the same day, everybody tried the exercises on spot with guidance. Every model had 2 exercises that they did with the instructions while filmed. Idea was to show as true situation as possible to the people watching and creating the feeling if they can then I can also. Exercise was filmed separately, doing every exercise for 2 rounds of 10 repetitions. For equipment it was needed a chair, floor mat, rubber exercise band, exercise ball, a towel, a step stool and books. Equipment for the filming was brought by the När TV.

8 THESIS PROCESS

Thesis process preparation and planning started in the 2015 study year. Participating in the research classes and thesis seminars. Finding the possible theme of thesis in autumn of 2015 after that meeting was arranged with the possible client in the 2015 October. Theme finalizing and presenting the study plan was presented in February of 2016. First thesis contract between the client was signed in 2016 April, due to the unfortunate circumstances first contract got lost and new contract was signed in 2018 February. Research on literature started in 2017 November. Filming of the 1. part of the video was arranged in 2018 March, part 2. and part 3. were filmed in the 2018 June. Finalising the theses in 2018 June and presenting the final work in the 2018 August.

Author feels that this theses process has been difficult to manage because it has been stretching over a long period of the time. Personally, author recommends keeping to the timeline and set goals in near future, take the work into small parts and work calmly on one goal until that goal is achieved and then tackle the second goal. Doing that author can gain confidence and hole project is under control.

Author also has received lots of help during this theses process and would like to thank people who have helped this project to conclude Närpes city physiotherapists, down´s sport secretary, När Tv, the elderly organizations who were outmost cooperative during the filming and the theses supervisor and teachers from school.

9 DISCUSSION

NEMEX exercise protocol was chosen because it is integrating strength, coordination, balance and proprioception into one program with clear instructions on technique and dosage. Program has been shown improvement amongst the osteoarthritis group in pain and functional ability. Were participants being between 60 – 77 years and literature research showed that for elderly it is highly beneficial to take part in physical exercise regimens that include strength, coordination, balance and proprioception.

Author finds that topic in hand is imperative in the future as the elderly population is increasing in the world and in Finland. By providing means and using all the possible options to offer different possibilities to keep up the physical condition and physical activity levels amongst community dwelling elderly might help to increase the healthy life span. Authors experience working with elderly has helped to understand the importance of the problem as more and more elderly patients are in the hospital due to a fall. Most of the patients have admitted that there has been falls prior to the one that took them to the hospital.

From here we can post number of theses topic questions for the future: Can NEMEX exercises program improve physical and functional ability amongst the community dwelling elderly? Can NEMEX exercise program reduce the fear of falls, number of falls and reduce the risk of falls amongst community dwelling elderly? Can NEMEX exercise program serve as a mean of prevention for falls in community dwelling elderly?

Keeping in mind the questions for the future theses, it would have been beneficial for the author to establish the physical condition level, physical activity level and fear of falling amongst the elderly in the beginning of the project to see the possible effects of the NEMEX exercise program. Also, how many emergency calls were made due to the fall before the program started and how many calls were made after for example 3 months, 6months and 12 months. By doing so it can be possible to measure the effects of showing the NEMEX exercises program on community tv as a follow up of the project. It would show if the NEMEX exercise program has reduced the falls incidents

needing medical attention or emergency calls made because of the falling, since the program started in the community. If there has been an effect on the number of emergency calls made and medical attention needed due to falls it would be possible to calculate the cost effectiveness of the program.

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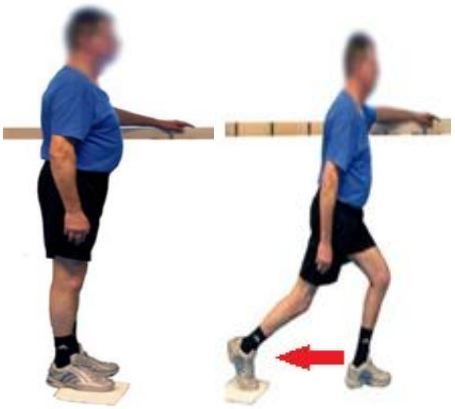
APPENDIX 1

Table 2. NEMEX exercise program. Modified from NEMEX-TJR training program: Feasibility of neuromuscular training in patients with severe hip or knee OA: The individualized goal-based NEMEX-TJR training program. BMC Musculoskeletal Disorders, 2010. (Ageberg et al, 2010)

<table>
<tr><td colspan="2">Exercise part 1.
Part 1 exercises aim is to increase core strengthen and postural function.</td></tr>
<tr><td colspan="2">Level 1.</td></tr>
<tr><td>A. Pelvic-lift with flexed knees and ball close to thighs (short lever arm), putting load on both legs as in Figure 1.
 
Figure 1. Pelvic lift, short lever arm.</td><td>B. Sit-ups with flexed knees, both legs on ball, arms on the thighs (short lever arm) as in Figure 2.
 
Figure 2. Sit-up, short lever arm.</td></tr>
<tr><td colspan="2">Level 2.</td></tr>
<tr><td>A. Pelvic-lift with semi-flexed knees and ball under the calf muscles (medium lever arm), putting load on both legs.</td><td>B. Sit-ups with flexed knees, both legs on ball, arms crossed over chest (medium lever arm).</td></tr>
<tr><td colspan="2">Level 3</td></tr>
<tr><td>A. Pelvic-lift as above, knees straight as possible, ball under the heals (long leaver arm).</td><td>B. Sit-ups with flexed knees, both legs on ball, hands behind neck (long lever arm).</td></tr>
<tr><td colspan="2">Exercise part 2.
Part 2 exercises focus on the alignment of the joints in relation to each other. More precisely hip, knee and foot great toe on vertical line.</td></tr>
<tr><td colspan="2">Level 1.</td></tr>
</table>

A. Slide-exercise backward: Standing, weight-bearing on one leg, other leg o sliding surface as in Figure 3.  Figure 3. Slide backward.	B. Slide-exercise sideways: Standing, weight-bearing on one leg, other leg on sliding surface as in Figure 4.  Figure 4. Slide sideways.
Level 2.	
A. Slide-exercise backwards: weight bearing leg on uneven surface, with support (e.g., foam pillow or thick mattress) as in Figure 5  Figure 5. Slide backwards, weight bearing leg on uneven surface.	B. Slide-exercise sideways: weight bearing leg on uneven surface, with support (e.g., foam pillow or thick mattress) as in Figure 6.  Figure 6. Slide sideways, weight bearing leg on uneven surface.
Level 3.	
A. Slide-exercise backwards: as above, with out support.	B. Slide-exercise sideways: as above, without support.

<table>
<tr><td colspan="2">Exercise part 3.
Part 3 exercise are focused on increasin streangth of hip amd knee muscles.</td></tr>
<tr><td colspan="2">Level 1. Light rubber band.</td></tr>
<tr><td>A. Hip abductors/hip adductors: Weight bearing on one leg and rubber band on free leg. Move straight leg from hip out (hip abductors) an in (hip adductors) as Figure 7.
 
Figure 7. Hip adduction.
 
Figure 8. Hip abduction.</td><td>B. Knee extensors/knee flexors: Sitting position. Rubber band around one foot. Pull rubber band forward (knee extensors) as Figure 8 and backwards (knee flexors) as in Figure 9.
 
Figure 8. Knee extension.
 
Figure 9. Knee flexion.</td></tr>
<tr><td colspan="2">Level 2. Medium rubber band.</td></tr>
<tr><td>A. Hip abductors/hip adductors: as above.</td><td>B. Knee extensors/knee flexors: as above.</td></tr>
</table>

<table>
<tr><td colspan="2">Level 3. Strong/hard rubber band.</td></tr>
<tr><td>A. Hip abductors/hip adductors: as above.</td><td>B. Knee extensors/knee flexors: as above.</td></tr>
<tr><td colspan="2">Exercise part 4.
This circle includes exercises resembling activities of daily life.</td></tr>
<tr><td colspan="2">Level 1.</td></tr>
<tr><td>A. Chair stands: Start in a seated position, feet parallel, putting load on both legs, hands on thighs for slight support and stand up and sit back down as in Figure 10.
 
Figure 10. Chair stands.</td><td>B. Stair climbing: Step-up (concentric muscle activation) and step-down (eccentric muscle activation) on low step-board, with or without slight hand support for balance as in Figure 11.
 
Figure 11. Step up. Low high.</td></tr>
<tr><td colspan="2">Level 2.</td></tr>
<tr><td>A. Chair stands: as above but without hand support .</td><td>B. Stair climbing: as above, higher or medium high step-board as in Figure 12.</td></tr>
</table>

<table>
<tr><td></td><td> 
Figure 12. Step up. Medium high.</td></tr>
<tr><td colspan="2">Level 3.</td></tr>
<tr><td>A. Chair stands: Start in a seated position, one foot in front of the other without hand support as in Figure 13.
 
Figure 13. Chair stands.</td><td>B. Stair climbing: Step-up and step-down on high step-board as in Figure 14.
 
Figure 14. Step up. High step board.</td></tr>
</table>