Training Concepts Report

General Approach

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1 Preamble

1.1 Aim of this document

This document is the official deliverable D5 of the project „CiM“. It contains all information about the content of the of the motion-promotion service, i.e. the multi-component program and the engagement of PLUS within this certain part of the project.

1.2 Definitions and Abbreviations

CiM.....CareInMovement

CR.....Care Recipient (= primary end users, PEU

FC = Formal carer .....health care professionals at Hilfswerk or Aldia, as nurses

IC = Informal carer .....carers without professional background (relative, friend etc...)

BMI.....body mass index

EWGSOP.....European Working Group on Sarcopenia in Older People

HR.....Heart Rate

iADL .....instrumental activities of daily living

ADL .....activities of daily living

ICF .....international classification of impairments

ICD.....international classification of diseases

BIA .....Bioelectrical Impedance Analysis

WU.....waist circumference

HU.....hip circumference

MET .....Metabolic equivalent, 1 MET = $1 kcal \cdot kg^{-1} \cdot h^{-1}$

1.3 Connection to other documents/deliverables

As this document contains information about the concept of the multi-component exercise program, it addresses aspects that are related to contents addressed in the deliverables “User Requirements (D 4.1) and Use Cases (D 4.2)”, “System Requirements (D7)”, “Care Guidelines (D 6)” and “System Architecture (D10)”, drafted by other partners of the consortium.

2 Definition of the target-groups

As the CiM projects deals with several target groups that are connected but stand alone for themselves, we will have to define different target groups and draft this training concept accordingly.

In the process of care three groups are identified in CiM:

a) Care recipient
b) Informal carers (= relatives, friends, neighbours)
c) Formal carers (= care professionals, workers of ALDIA & Hilfswerk Salzburg)

2.1 Care recipients

A total of 450.000 people (+ 10% as estimated number of unreported cases) obtain care allowances in Austria. (Schmidt, 2015)

In Austria there are seven stages of care allowance. Stages 1 to 4 are assigned to people with low or mediocre nursing needs (time budget: monthly hours from 60 up to 180h) without the need of stationary care. Stages 5 to 7 are used for people who need 24h care or stationary care. (Schmidt, 2014)

Mental illnesses such as dementia are being noticed to be common in people with mediocre to high nursing needs within the Hilfswerk Salzburg.

In CiM we want to provide help for care recipients via smart technologies that require a certain minimum of mobility and brain agility, therefore people with low to mediocre nursing needs (stage 0 to 3) without mental illnesses such as dementia are included.

As Hilfswerk Salzburg and ALDIA are the end user partners of this project, people who fit into the criteria mentioned above and receive care via Hilfswerk Salzburg or ALDIA are defined as the target group “care recipients” (= CR). Care recipients are 55 years and older, without mental illnesses such as dementia, without severe visual or acustic impairments and who obtain care allowances from 0 to stage 3.

2.2 Informal carers

Informal carers (= IC) are a huge part of Austria´s care system. About 425.000 relatives take care for their family members and friends. (Schmidt, 2014)

IC´s build a very heterogeneous group as they can be friends, neighbors, siblings, kids or any other relative. Their common denominator is that domestic care produces measurable stress and that especially close family members who are taking care are facing a significant change in their personal lives. (Posch-Eliskases, 2015)

Accordingly informal carers are aged 15 years and older with no or very low nursing needs. Some of them will be digital natives, others will have moderate or large experiences with electronic devices such as a tablet.

2.3 Formal carers

The group called formal carers includes all health-care professionals that work at Hilfswerk in Salzburg or ALDIA in Pavia.

Both organizations work with trained individuals that are used to work with care recipients. They face an enormous workload (physically and mentally) and have very little time to fulfill their tasks, so they need tools that smoothens their work processes. As their work is also physically challenging they might be pleased to have some information about exercising/positive effects of exercise for their own good as well.

3 Training with older adults

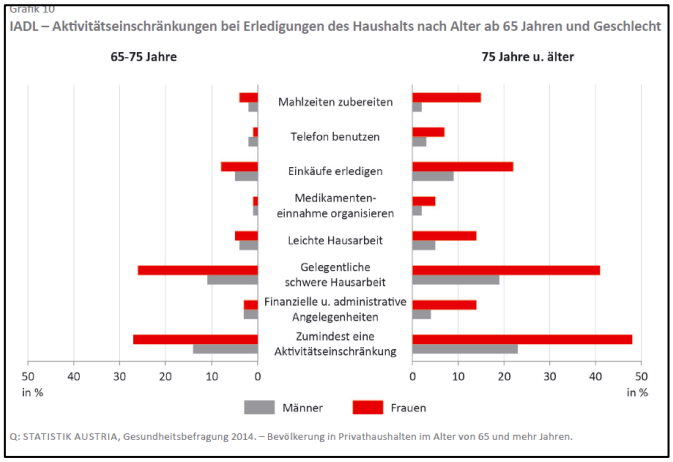
3.1 Rationale and implications for exercise

The increase in life-expectancy points towards an improved health-care system especially in high-income countries as Austria. Accordingly stabilization or better the reduction of disability-adjusted life years (DALYs) becomes a challenge even for rich economies.

The last Austrian health-survey showed that 34% of males and 39% of females over 15 years suffer from chronic health disorders, whereby with age the percentage increased to 50% in 74 year old subjects. With age the metabolic disorder diabetes mellitus becomes prevalent and accounts for 10%/14% in 60 year old women/men in Austria and 14% (both sexes) in Italy (Statistik Austria, 2015; International Diabetes Federation, 2016). Every second adult of the Austrian population is characterized as overweight, whereby about 15% of women and 20% of men over 45 years are obese; obesity is a risk factor for diabetes mellitus.

Moreover chronic pain of back, shoulder, hips or spinal cord are most prevalent in the adult population and lower the physical mobility, a sub-domain of the quality of life (QoL). As indicated in Figure 2 more women than men suffer from physical limitations and are impaired to complete instrumental activities of daily living (iADLs) in the age strata 65 to 75 years, with an increase in sex-difference from the age of 75 years on (Statistik Austria 2015).

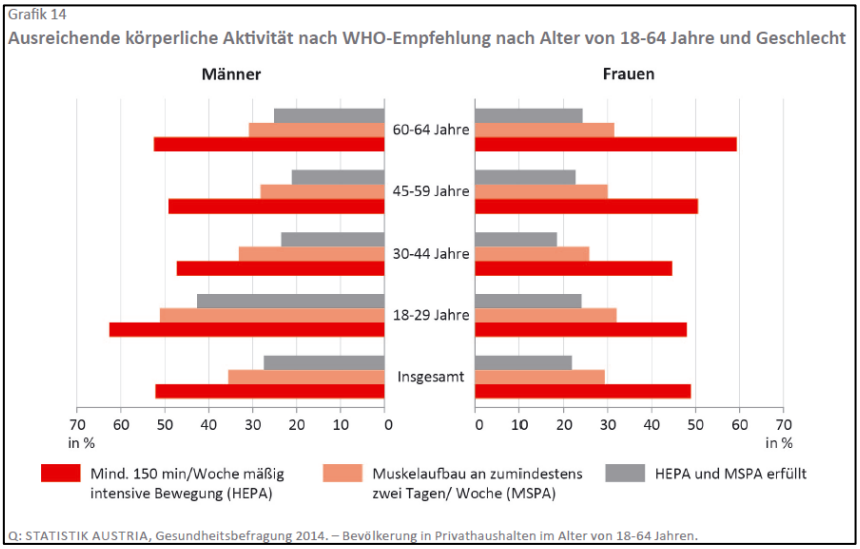
Figure 1. Prevalence of disabilities in males (grey) and females (red) in the Austrian population (Statistik Austria, 2015).



About 22% of males and 32% of females aged 65 years and older need additional help to complete iADLs. Almost half of the adult population is overweight, with 15% to 20% of people aged 65 years and older being obese (Statistik Austria 2015).

Accordingly metabolic disorders combined with pain and a low execution level of iADL induces a vicious cycle of inactivity and a loss of participation in daily life of our primary target group (care recipients 55+). Hereby health-enhancing physical activity (HEPA), i.e. moderate-to-vigorous exercise 150 minutes per week and two times muscle strengthening exercises, serves as an important resource of QoL, of a healthy aging and the lowering of the economic burden (Titze et al., 2015). As depicted in Figure 2, only 30% of men and 20% of women reach the recommended physical activity volume, i.e. two third of the adult population are not sufficiently active (Statistik Austria, 2015). This is in line with the Eurobarometer Study revealing that only 33% of Austrians and 14% of Italians met the recommendations (Special Eurobarometer 412, 2014).

Figure 2. Health-enhancing physical activity in Austria (Statistik Austria, 2015; grey).



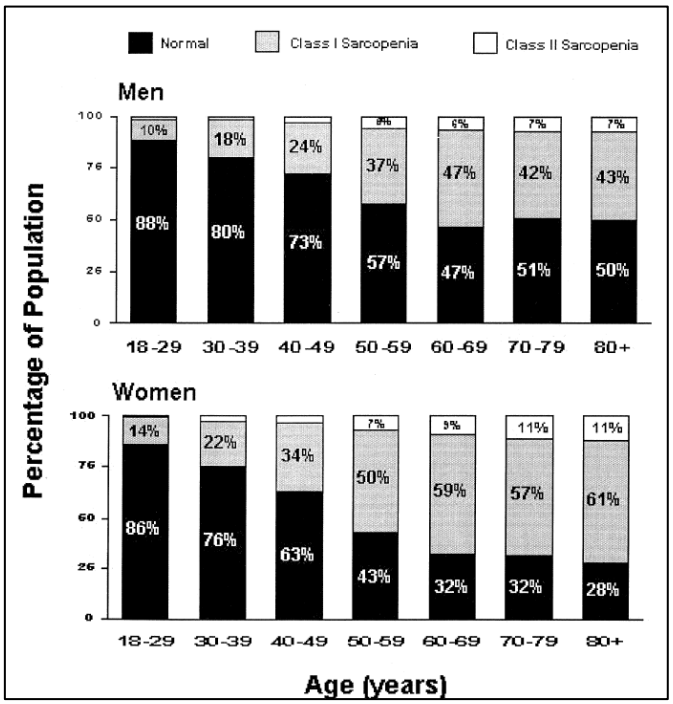
With ageing changes of daily activities occur over the lifespan. Hence alterations of physical and mental functions are commonly expected. However, these alterations can be negatively amplified by low levels of physical activity (Cruz-Jentoft et al., 2014; Janssen, Heymsfield & Ross, 2002). A recent study has shown that sitting can be counterbalanced (i.e. reduce mortality) by an increase in physical activity time, but this is not true for TV-viewing (Ekelund et al., 2016). This indicates that beside an increase in daily physical activity level ("introducing sitting-breaks") the sedentary time involved into TV-watching shall be reduced additionally. Data from the United States reveal that modern adults complete around 6,000 steps per day, which is below the recommended physical activity level (Tudor-Locke 2010).

Physiologically, the increase of inactive time with age, lead to a loss of skeletal muscle mass and shifts the muscle fiber type from an oxidative to a more glycolytic fiber type, that promotes the accumulation of glucose and lipids in the skeletal muscle cell by reducing the oxidation rate of fatty acids. This change in skeletal muscle characteristics is associated to metabolic disorders as insulin resistance or type-2-diabetes mellitus (Park et al., 2009). A further increase of sedentary time and immobility will promote the process of senescence that is characterized by a loss of motor units especially in fast twitch glycolytic fibers, inducing a loss of contractile and metabolic function over the whole fiber-type spectrum

(Narici & deBoer, 2011). Such a skeletal muscle is characterized by high intramuscular fat that will be incorporated by highly available circulating lipids and result in “sacropenic obesity”, that affect 18% of women and 43% of men as detected by the NHANESIII-study (Goisser et al., 2015).

This loss of muscle mass increases detrimentally from 50 years on especially in women as presented in Figure 3, where especially 50% of an north-American cohort (NHANES III) where characterized by class I sarcopenia (Janssen, Heymsfield & Ross, 2002).

Figure 3: Prevalence of sarcopenia by age (Janssen et al., 2000)



Altogether this bodily changes lead to a reduction in motor skills, i.e. the ability to walk steadily, to change posture rapidly, to carry loads and to communicate via engagement in physical activities like dancing or hiking with others. The trait behind this is “functional fitness” and is the main target of the CARIMO-Motion Promotion Program.

Beside the individual burden a recent economic analysis revealed that the health-care costs attributable to physical *in*-activity, i.e. sedentary behavior or activities that are below an energy expenditure of four $kcal \cdot kg^{-1} \cdot h^{-1}$ (4 METs), accounted for about 256 billion dollar in total (direct + indirect costs) in Austria. These costs are covered to 75.5% by the public sector, 8.5% by the private/third party sector and 15.8% by Austrian households (Ding et al., 2016).

Therefore solutions are warranted that support people to become regularly active and involving large skeletal muscle groups. Information-communication-technology (ICT) solutions are introduced to support individuals by adopting an active lifestyle (active assisted living) for improving functional fitness. These smart applications serve as “social support” to improve interpersonal communication and to motivate people to become active by providing exercises with the help of a fitness application. These “health-applications” include a reminding, monitoring and evaluating function that support the self-control and self-management abilities of the individual. Especially over the first time of an intervention

program such an ICT guided program can help to improve extrinsic motivation, the first step to change behavior. For implementing exercise as a routine into daily life over time intrinsic motivation is important and needs interpersonal interaction. To date, most of the studies reported that mobile health technologies are effective when accompanied by a personal support (empowerment) like a formal carer, practitioners, family members, volunteers or peers (see in Meister, Becker, & Simon, 2016; Kumar et al., 2016).

Accordingly the following prescription of a low-threshold exercise training program will be provided via tablet and an activity tracker as part of the "CARIMO" system, to be used by our primary target group, the care recipients. However, the content is designed to engage relatives of the care recipient or other person related to the care of the end user as well.

3.2 Recommendations of exercise training 55+

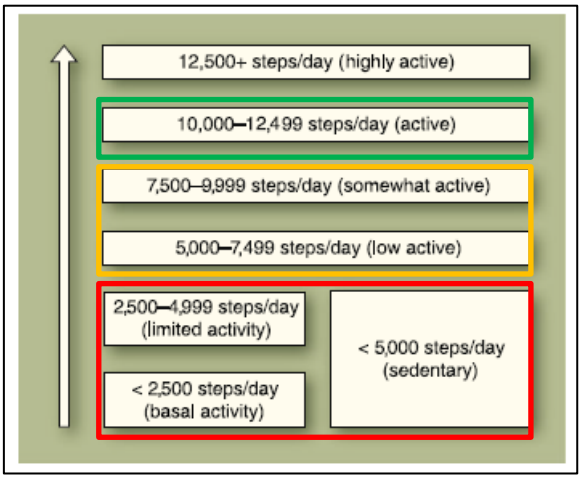
Based on international and national recommendations older people should be engaged 150 minutes per week into moderate-to-vigorous physical activity (4 to 6 MET equaling 100 to 130 steps/min, pedometer assessment; Tudor-Locke, 2010). The activity volume can be separated into 10 min bouts to achieve health-enhancing physical responses. Increasing the exercise intensity to more than 6 MET leads to a reduction of 75min/week exercise with beneficial effects on health (Titze et al., 2010).

Translating the recommendation to steps, adults in general shall consume additionally 3000 to 4000 steps per day to achieve the recommended health-enhancing level of 10,000 to 12,500 steps per day. On a weekly basis this is about15,000 moderate or 9,750 vigorous additional steps to maintain or enhance health. (see However as introduced in chapter 3.1, improving muscle strength and functional fitness is important to lower physical impairments.

Figure 4 and Tudor-Locke, 2010).

However as introduced in chapter 3.1, improving muscle strength and functional fitness is important to lower physical impairments.

Figure 4. Health enhancing physical activity recommendations translated to steps / day (Tudor-Locke, 2010, p. 274)



Therefore a multicomponent training program prescribed by the following characteristics as depicted in Table 1 was developed for CARIMO (Becker & Blessing-Kapelke, 2011; Bouaziz et al., 2016; Kumar et al., 2016; Titze et al., 2010; Zaleski et al., 2016).

Table 1. Recommendations to create a health-enhancing workout

Item	Prescription
Total Duration per week	150min/wk moderate-to-vigorous physical activity (MVPA) or 75min/wk vigorous physical activity (VPA), including all physical activities in the household, in transport (walking, cycling), in occupation or in leisure time. The multicomponent exercise training program is part of that volume.
Duration per Session	10min bouts/training sessions; at least 5 minutes
Intensity	Moderate-to-vigorous (MPA) = 4-6 kcal/kg/min (MET); Progressive
Frequency	At least 2x/week; on most days
Mode to complete the session	Continuous for 10 minutes (at least 5 min), i.e. not interrupted by longer rest periods (more than 2 minutes); Intermittent over the long run (2x 5min /d; 7x 10min /wk)
Type of exercise training (components)	Strength, balance/coordination, endurance; flexibility/stretching; Involvement of large skeletal muscle groups
Session Structure	Warm-up, main topic, cool-down
Order of exercise over time	Muscle strengthening > Balance and coordination tasks > Endurance (walking)
Guidance	For a better outcome: semi-supervised, i.e. PEU complete the program sometimes with the support of the formal or informal carer

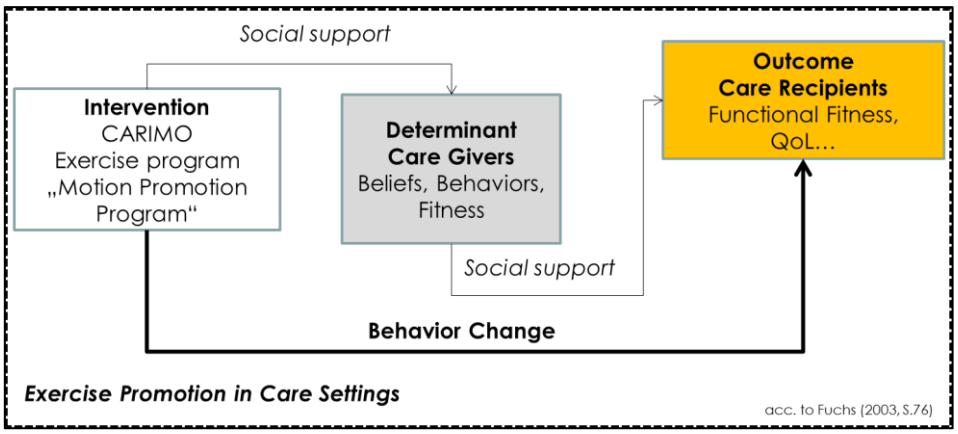
3.3 Participatory approach for carers and care recipients

To reach the target group with CARIMO we suggest a participatory approach where care givers are involved to support care recipients, i.e. primary end users (PEU) to adopt an active lifestyle. As depicted in According to Fuchs (2003) it is important to identify the determinants that affect the efficiency of an intervention by initiating a behavior change, i.e. to improve physical activity. Providing an exercise program alone will not lead to a change.

Figure 5 the intervention, the CARIMO exercise training program, will be delivered to the care recipients with the support of care givers.

According to Fuchs (2003) it is important to identify the determinants that affect the efficiency of an intervention by initiating a behavior change, i.e. to improve physical activity. Providing an exercise program alone will not lead to a change.

Figure 5. Action cycle of exercise promotion in care settings



Beside the low-threshold design of the exercise program itself the role of care givers to support the care recipient to become active in daily life is important and one of the determinants in the action-change model. Another determinant will be the usability of the IKT solutions and the built environment in the areas of living of our target groups as green parks and save pathways to walk and cycle. In this deliverable we focus on the determinant “care givers”.

3.3.1 Role of the formal carers

Formal carers are involved in many operative tasks and therefore their involvement in providing the exercise training program is limited. Furthermore it is important that the PEU will be empowered to execute and control the tablet-delivered training by their selves to increase intrinsic motivation, a precursor of behavior change. Formal carers encourage the PEU to use CARIMO to improve functional fitness and control that by testing the PEU. This involvement is an occasion for interpersonal communication via social support.

Accordingly the following tasks will be executed by formal carers

- Create workout reminders -> Motivation service
- Encouraging / remind PEU to use CARIMO / execute workouts -> Motivation service
- Show daily tipps to be active to the primary end-user (CR = PEU) -> Motivation service
- Familiarization with the CARIMO-training program, i.e. how to open the CARIMO-fitness function, what kind of exercises are included and why -> education service (inputs from other partners regarding use cases are warranted)
- Familiarization with the CARIMO-fitness tracker, i.e. how to initialize and what will be tracked (steps) -> education service (inputs from other partners regarding use cases are warranted)
- Testing functional fitness of CR -> test Instructor course of education services (inputs from other partners regarding use cases are warranted)
- Arrange test meetings -> community service

3.3.2 Role of the informal carers

Informal carers are family members and volunteers that serve as social support to improve functional fitness and adopt an active lifestyle regarding the motion promotion service.

Accordingly the following tasks will be executed by informal carers:

- Encouraging CR by monitoring the workouts -> motivation service
- Communicating with each other via web or tablet (volunteers, family)
- Give social support to the CR to complete workouts via tablet or via fitness tracker -> motivation services (family) and collaboration service (family, volunteers)
- Arrange meetings (volunteers)

4 Training concept – general information

Our training concept is embedded as the motion promotion service. This service should give ideas for daily activities as well as exercise regimens for daily use.

Care recipients shall see it as a pool of ideas full of healthy choices for them. They should feel encouraged to move more. Therefore it has to be built up very simple and provide the CR with easy to follow routines and exercises.

4.1 Training Concept – perspective care recipients

Care recipients should be motivated to move more often. Additional 10 minutes of movement per day have beneficial effects on their abilities in everyday life as well as their mental state.

In order to make it very easy the care recipients are provided with one training session per day. The exercises within this session are very easy to reproduce (even unsupervised.)

A session consists of three basic-exercises such as easy stretches, mobilisations, strengthening exercises or easy everyday movements such as “move through your flat/your room as quick as possible” and three bonus-exercises for those who want to work more.

It takes about 5 minutes to execute the basic-exercises and an additional 5 minutes are needed for the bonus-exercises. It is a goal that the CR exercises the whole 10 minutes per day.

After completing the session the care recipient gets feedback about several facts such as training duration, calories burned etc. The CR can then repeat the given session or end the motion-promotion service. The bonus points are saved and added to a weekly movement diary. At the end of the week, the CR can look up the bonus points and gets feedback.

The System provides a new training session every day, so that at the end of the week the CR has trained the majority of motor skills and abilities if he/she stuck to the plan.

4.2 Training Concept – perspective informal carers

Informal carers, as volunteers, relatives or other related persons of the CR can exercise with the care recipients. They can motivate them and talk about their goals.

(In the Education Service, there´s a chapter about setting movement goals, so that the IC´s can educate themselves about how to do that. Health enhancing movement goals are prescribed in chapter 3.2 and serve as an input for the content of the education services.)

4.3 Training Concept – perspective formal carers

Formal carers do have the same authorization as informal carers and could also train with the CR and can assess the functional fitness of the CR. Regarding their role and attributed tasks, in CiM it is expected that formal carers use the CARIMO motion promotion services as a weekly feedback regarding the volume of physical activity and to use this tool to motivate the client achieve the recommendations of 150 min/week or 10.000 steps per week (3500 additional steps/wk).

5 Program-Description

5.1 Multi-Component Training

Multi-component-training programs applied over longer periods seem to have positive effects on ADL as well as iADL in the elderly. It can be assumed that individualised multi-component-training-programs can achieve even better effects (Binder et al. 2002; Daniels et al., 2008; Illig & Pfeffer, 2010; Theou et al., 2011).

Physical training, especially functional strength training with sensomotor stimuli (Granacher et al 2007) was able to show significant improvements in parameters that are associated with ADLs and iADLs. (e.g. postural control - Granacher et al 2009)

Thus the motion-promotion service has to aim for incorporating exercises that train more than just one ability like flexibility or for example. It has to focus on task-oriented movements which address several combinations of skill and abilities.

5.1.1 Coordination

It is paramount to have precise and good coordination of movement to achieve efficient everyday motor control. The ability to coordinate different parts of various movements tends to decrease with age. (Rinkenauer, 2008)

Most exercises that address this ability are summed up under the umbrella term “sensomotor training” and are recommended for the elderly because of their positive effect to neuromuscular actions. (Granacher et al, 2007)

5.1.2 Strength

There is evidence for a big number of methods and intensities to be effective in fighting against age-related loss of strength. (Adams et al., 2001; Granacher & Borde, 2015; Littbrand et al., 2006; Liu & Latham, 2009)

5.1.3 Flexibility

Flexibility is the terminus technicus for the degree of movement in a certain joint. This range of motion (= ROM) is determined by multiple factors such as activity level, sex and age. (Baechle & Earle, 2008)

As everyday procedures require a certain degree of flexibility e.g. putting on a jacket, it is important to keep the ROM in a sufficient range.

5.1.4 Endurance

Endurance training bouts should be of at least 10 minutes in a continuous fashion. (Nelson et al., 2007) CiM tries to engage PEU´s in exercises that are about 10 minutes per day but it is highly unlikely that PEU´s with care allowances will start to move in an adequate intensity from day 1. As the PEU´s continue to use the program, they will receive exercises that will, whilst train their strength, also address their aerobic capabilities.

5.2 Exercise training goals and program prescription

5.2.1 Aims of the training program / motion promotion program

People at Level 0 has to be prepared for strengthening and therefore will receive exercises in order to experience (feel) their range of motion and regarding the low-threshold principle to smoothly adopt to regularly exercise training / physical activity.

People at Level 1 are targeted to receive and create more stability at their joints by completing exercises of mobilization, strengthening and flexibility.

Beside the completion of the order of exercises during a training session, the aims of the motion promotion service for CR are

- to improve (Level 0 to Level 1) or to maintain (Level 1) the fitness level,
- to consume a minimum of 10 minutes per day of fitness training,
- and additionally to complete 3000 to 4000 steps on a daily basis.

The structure of the program uses the following scheme as depicted in Figure 6.

Figure 6. Goals of multi-component training program

Coordination

Without proper coordination every move is impossible. Regarding the neuro-muscular regulation process, a dynamic engram has to be established by repeating movement patterns and by generating motor programs and motor competence (skill level) through

exercise training (= motor learning). It is paramount to keep in mind, that proper movement competence lays the groundwork for success in every advanced exercise or everyday activity. It is absolutely important to supervise movements when they are new ones, that mean: at the beginning of our program it is essential that the execution of exercises is guided and corrected by the formal carer.

Mobilization

It means that a person´s reaches the anatomical range of motion (ROM) of the joint when exercising. Especially with age the ROM decreases, because of age-related changes in joint structure. However, the ROM can be beneficially altered through exercise training if not restricted to bone deformations or skeletal muscle dysfunctions.

Stabilization

It means that a person can move within the expected ROM and has the ability to stabilize the joint through coordinated inter- and intramuscular contraction. Subjects with “good stabilization ability” can hold different positions without excess moving actions in static or dynamic positions.

Strengthening

Strength is the ability of a subject to generate force against resistance over a certain distance (space) and in a certain time by an interaction of the musculo-skeletal system. There are different strategies that can positively influence strength levels of the elderly which again may alter the abilities to fulfill activities of daily living (ADL) as well as the iADL (instrumental activities of daily living) towards being more capable of dealing with everyday life.

Order of types of exercises

Our motion promotion service consists of a training program that always starts with mobilizations as a warm-up, followed by easy stretches for the big joints. Thereafter, exercises that enhance stabilization of all big joints will be executed as the main exercise training part (Level 0).

To strengthen the body is a very powerful way to ensure mobility in older ages, but it is essential to build a stable base beforehand. Thus the strengthening exercises are the last step in our program and therefore reserved for people at level 1 who have already attained or still kept some movement competence via their capability to stabilize their joints (see Table 2).

Table 2. Order of Exercises per training session regarding fitness level

Level 0	Level 1
Mobilization exercises	Mobilization exercises
Flexibility exercises	Flexibility exercises
Stabilization	Stabilization exercises
	Strengthening exercises

Exercise Modality

Based on the low-threshold principle it is recommended to prescribe the training session by an intermittent mode to motivate our CR. Therefore we divide the full 10minutes into two 5-minute-bouts (intermittent modality). The first 5-minute-bout is called the basic training session and the second is the bonus part.

The first bout will include 3 exercises. Each exercise has to be done for 1 minute. As we deal with older adults in a care-situation, we expect slow movements. Therefore the 1-minute-timeframe should be long enough to produce 8 to 10 reps which is said to be a good start for a training set for this target group. (Baechle & Earle, 2008)

The first two exercises are done twice, the third just once, as it will be the most strenuous one.

Example for a basic-training-session:

1. Training set: Sit on a chair and roll your shoulders back for 1 minute
2. Training set: Sit on a chair - your heels are in contact with the floor. Bring your toes up and down for 1 minute.
3. Training set: repeat 1. & 2.
4. Training set: Sit on a chair, raise your arms to shoulder level and try to paint small circles with your hands.

After this 5 minute-bout, the CR can decide to exercise for another 5 minutes via the bonus part of the training session. The fact, that the PEU reached a bonus-part should help to develop some motivation via self-efficacy.

Example for a bonus-part:

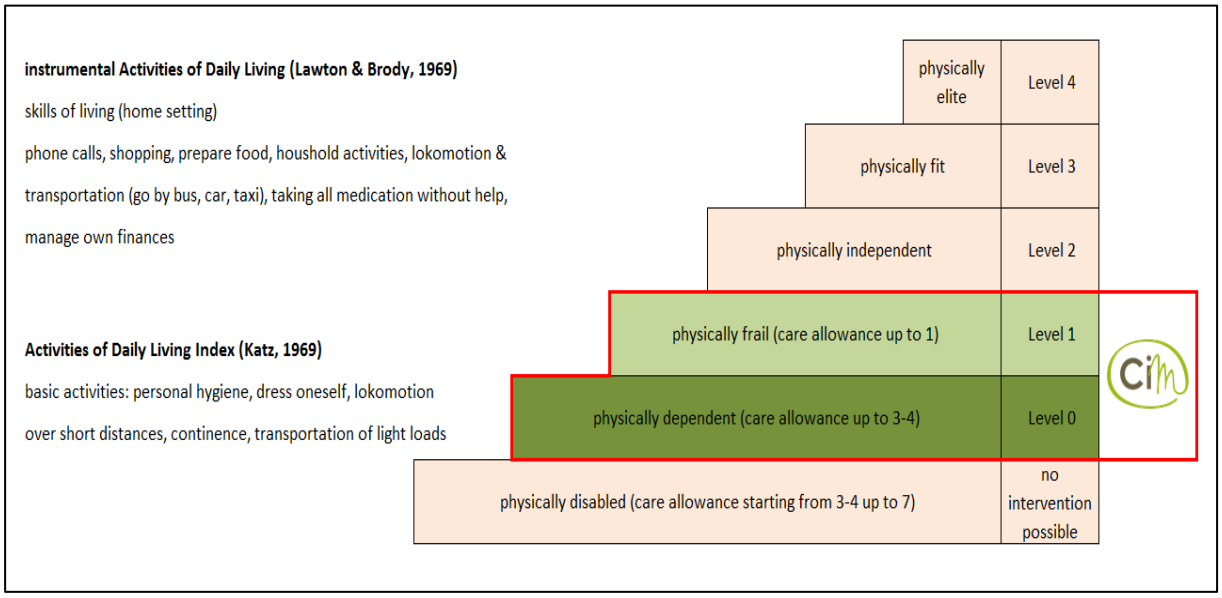
5. Training set: Sit on a chair and straighten your left leg, squeeze your thighs as much as you can. Then put it down again. Now do the same with the right leg. Exercise for 1 minute
6. Repeat Training set no. 5
7. Repeat training set no. 6
8. Sit on a chair, try to sit straight. Now slowly turn your head and look over your right shoulder. Then move to the other side. Repeat in a slow fashion for 1 minute
9. Stand up and stretch your body as good as you can as you breathe in. Return to your normal upright body posture when you breathe out. Repeat for 1 minute.

6 Assessment of Functional Fitness Level

In this study, formal carers will execute the assessments after completing the assessment education program. As indicated in Figure 7 we expect that our CR can be attributed to older adults characterized as physically frail (level 1) or dependent (level 0), indicating that they

are able to complete activities of daily living. Accordingly the training program and functional fitness testing rely on that presumption.

Figure 7: Hierarchy of functional fitness levels based on Spirduso (1995), Katz (1969) and Lawton&Brody (1969)



The whole assessment consists of 2 functional tests as well as 3 anthropometric assessments that are all very feasible and often used in clinical settings. They will receive instructions and tools to do the testing with their care recipients. Formal carers can decide, whether they take all measurements at one point of time or to divide them into several "events". They will be given an exact time frame to test their care recipient and a deadline when to deliver the results to PLUS.

The timeline is being coordinated with the questionnaires and will look like as the following.

PRE-Testing		INTER-Testing		POST-Testing
April/May 2017		August/September 2017		December ´17 / January 2018

6.1 Testing procedures

The effects of the CARIMO multicomponent exercise training program will be measured by indicators regarding body composition and functional fitness. The procedures, i.e. the test protocols, will be reported in detail in the assessment manual. Here we give a short overview about the relevant measures.

6.1.1 Anthropometric measures

To describe our sample regarding health indicators we measure body mass and body height as well as regional body fat with a surrogate measure.

Height/Weight

Body weight and height were measured to the nearest 0.1kg and 0.1cm by using standardized equipment (SECA) and procedures. From these measures the body mass index (BMI = kg/m²) will be calculated to determine the body weight category.

Regional Body Fat

According to the WHO STEPwise approach to Surveillance (STEPS) waist circumference will be measured (WHO, 2005). It is a surrogate measure for regional fat distribution and it has been identified as an important predictor of the metabolic and cardiovascular risk of people.

6.1.2 Functional Fitness Testing

Beside morphological indicators the effect of the multicomponent exercise program will be assessed by testing well elaborated indicators of functional fitness.

Grip Strength

Measurement of grip strength is paramount in evaluating the physical abilities of older adults. Grip strength is associated with limitations in ADL is a feasible replacement for more complex assessments of strength and is often used to get reliable information about general ability to produce force. It is also one of three parameters that are used to diagnose stages of sarcopenia. (Cruz-Jentoft et al. 2010)

The EWGSOP (European Working Group on Sarcopenia in Older People) recommends the following cut-offs for diagnosing frailty by grip-strength:

M: 30 kg W: 20 kg
(Cruz-Jentoft et al. 2010)

Women and men can be further classified according to Onder et al. (2002) and Cruz-Jentoft et al. (2010).

On the basis of those findings CiM uses this scaling:

Women

Grip strength (kg)	Classification	Intervention Level
> 30	Physically elite	Level 4
30 – 24,1	Physically fit	Level 3
24,0 – 20,1	Physically independent	Level 2
20 – 16,1	Physically frail	Level 1
< 16	Physically disabled	Level 0

Men

Grip strength (kg)	Classification	Intervention Level
> 40	Physically elite	Level 4
40 – 36,1	Physically fit	Level 3
36,0 – 30,1	Physically independent	Level 2
30 – 26,1	Physically frail	Level 1
< 26	Physically disabled	Level 0

30 sec chair rise test

The 30sec chair rise test is associated with lower body strength (Rikli, 2013) as well as lower body power (Smith et al, 2010)

Rikli & Jones (2013) defined cut-off values for moderate to fit persons with respect on their age. On base of those findings we define the following cut-off values:

Repetitions in 30”	Classification	Intervention Level
> 16,5	Physically elite	Level 4
16 – 14,5	Physically fit	Level 3
14,0 – 12,0	Physically independent	Level 2
11,5 – 9	Physically frail	Level 1
< 9	Physically disabled	Level 0

(For detailed description please see Assessment Manual.)

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